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Education Quarterly Review

2001, Vol. 7, no. 4

- Participation in job-related training
- What motivates graduates to change jobs?
- Grade 3 performance in Ontario
- TIMSS: Canada report

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Culture, Tourism and the Centre for Education Statistics

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Mission

Education Quarterly Review analyses and reports on current issues and trends in education using information from a variety of statistical sources. It serves as a focal point for education statistics and provides a forum for communication with stakeholders and the public. Our goal is to present information and analysis that are relevant, authoritative, timely and accessible.

This issue includes a broad cross-section of articles, ranging from research on the performance of Grade 3 students in Ontario to the achievement of Grade 8 science and math students in 38 countries, and from participation in adult education and training to the school-to-work transition of postsecondary graduates.

The key findings of these research papers include the following:

- To be most effective, research into early school achievement should look at student-, school- and class-level characteristics simultaneously.
- Canadian Grade 8 students had very good scores in both mathematics and science—only 6 of 38 countries scored higher than Canadian students.
- Changes in socio-economic characteristics, such as age, profession and category of worker, may mask positive changes in the rate of participation in training among different groups of workers.
- Major variations exist in the transition of postsecondary graduates to the labour force.

In addition to these papers, please refer to the **Cumulative index** at the back of the report, where we list by title all articles that have appeared in *EQR* since 1994. These articles have been grouped under 11 categories, including 'Education funding,' 'Technology and learning' and 'Accessibility.' These categories are based on education policy issues that were identified in the Centre for Education Statistics' *Strategic Plan*, which reviews the Centre's statistical program and identifies objectives and priorities required to strengthen the program to better address information needs. The *Strategic Plan* is available free of charge at www.statcan.ca/cgi-bin/downpub/freepub.cgi on the Internet.

Highlights

Participation in job-related training

- This study investigates how changes in the composition of the population—in its socio-economic characteristics such as age, occupation and class of worker—could have masked positive changes in the participation rate for training of different groups of workers during the last three cycles of the Adult Education and Training Survey.

- On the whole for 1991 to 1993, the effect of the change in population distribution on the total participation rate was positive for women and slightly negative for men. From 1993 to 1997, there was a positive composition effect, especially for women.

What motivates graduates to change jobs?

- Two years after graduation, some of the graduates who were holding down a job were looking for a new one. The job search rate was affected by two variables: dependent children and level of education. Specifically, the rates for graduates without dependent children and for doctoral graduates were higher than for other graduates.

- The decision to look for a new job was frequently motivated by dissatisfaction with working conditions. For example, graduates felt their current job did not provide them with enough hours; they felt they were overqualified; the job was not permanent; or they were dissatisfied with the work or the pay.

Grade 3 performance in Ontario

- The most surprising finding was the large amount of variation in Grade 3 academic achievement associated with classes and schools. This suggests that elementary classes and schools in Ontario are fairly homogeneous, with a reasonably high correlation in test scores within classes and within schools.

- The degree of variation in achievement associated with classes and schools in this study is similar to class/school variation in U.S. academic achievement. This finding contradicts conventional wisdom about the nature of schools and neighbourhoods in Ontario vis-à-vis those in the United States.

TIMSS: Canada report

- Almost all Canadian students—96% in mathematics and 94% in science—score at or above the 25th percentile. This is considerably higher than in some other industrialized countries, indicating that Canadian schools deal equitably with students from every socio-economic level.
- There is no 'magic bullet' in education, no single variable that accounts for the wide variation in achievement among countries or provinces. Every factor such as class size, hours of instruction, or days in the school year work somewhat differently in different countries. Thus, large class sizes are associated with higher levels of achievement in some countries and with lower levels of achievement in others. EQR

Articles

Socio-economic changes in the population and participation in job-related training

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Introduction

During the last two decades, the labour market has been affected by the accelerated introduction of new technologies and marked changes in how work is organized. Work organization includes human resources management and different practices such as flexible job design and variable pay. High-technology sectors and, more generally, those based on knowledge are assuming increasing importance in the economy. Moreover, companies have adopted more flexible management practices that require greater versatility on the part of their employees. Many decision makers and analysts believe that such a context requires increased training for Canadian workers. Yet the Adult Education and Training Survey (AETS) shows that the opposite occurred in Canada in the 1990s. In this study, we looked at job-related, employer-sponsored training, because the majority of training related to employment is sponsored by the employer in some way and also because we were interested in employers' attitudes toward the training of their employees.

It is possible that changes in the composition of the employed population may give greater weight to groups of workers that usually take less training, thereby masking the increased participation in training of other groups. For instance, because older workers take less training than younger ones, it is possible that the overall rate did not show an increase during the 1990s as a result of the increase of the proportion of older workers in the employed population.

The purpose of this study is to find out whether the slight drop in the participation rate for training was due to a change in the composition of the population (insofar as various socio-economic characteristics are concerned) or to a change in behaviour among workers or among companies. To do this, we studied the variations in the overall participation rate for training by using a multivariate analysis. The independent variables of this multivariate analysis were respondents' socio-economic characteristics, such as age, size of the company they worked for, and province of residence. Because the evolution in the overall participation rate for men was different from

About the present study

The Adult Education and Training Survey (AETS) was conducted several times in the 1980s and 1990s to establish a portrait of formal activities in adult training. The last three survey cycles (1991, 1993 and 1997) are comparable with respect to methods and content. Within the framework of the AETS, which is a supplement to the Labour Force Survey, researchers from Statistics Canada interviewed respondents about training they had taken during the previous year. Among other things, they wanted to know whether training was related to work (current or future) or was taken for personal interest. They also determined whether job-related training was sponsored by the employer, that is, whether the employer offered this training, reimbursed respondents for it, or facilitated it in some other way, such as by offering it during work hours or by reimbursing for transportation or shelter costs.

This study concentrated on training related to work (as opposed to that taken for personal interest). Most training related to employment is sponsored by the employer, and so the research focussed on job-related, employer-sponsored training. In order to examine changes related to a work environment, the population studied was employed and self-employed Canadians. The study, which viewed the way in which workers trained while working, did not include people who had withdrawn from the labour force or who were unemployed. In addition, it was restricted to workers aged 25 to 54. Most workers older than this are about to leave the labour force and job-related training is of less interest or use to them. Similarly, the population of workers aged 24 and younger includes students who are completing their initial education on a part-time basis.

This article is an adaptation of *Analyse des taux de participation aux activités de formation au Canada* (Léonard forthcoming). The longer document includes a shift-share analysis, which examines the effect of the change in population distribution associated with each socio-economic characteristic taken separately. Unlike the multivariate analysis presented in this article, shift-share analysis does not control for the effect of change in the other variables. In addition, it does not present men and women separately; rather, it presents the entire employed population as a single group. However, it allowed us to conclude from the following observations that the drop in the participation rate was primarily the result of a change in behaviour; the population distribution did not change very much from 1991 to 1997 for most of the characteristics studied. On one hand, the changes that occurred in the distribution of workers for type of work (full-time or part-time), industry, job tenure, union status and, especially, category of worker (employee or self-employed) lowered the participation rate. On the other hand, the changes observed in the population distribution for occupation, firm size and educational attainment tended to push the rate up. The most notable change was associated with educational attainment; when considered in isolation, it raised the participation rate by approximately 2 percentage points between 1991 and 1997.

that for women, we have presented a separate multivariate analysis for each sex. After using an equation to estimate the probability of taking training at each point in time (1991, 1993 and 1997), we applied the coefficients estimated with the data of a particular cycle to the independent variables of a previous cycle. This enabled us to predict what the participation rate would have been if the independent variables had remained unchanged. In this way, we could measure the impact of the change in the independent variables (composition effect) and the impact of the change in the estimated coefficients (behaviour effect) on the participation rates.

Definitions and evolution of training indicators

Examining the incidence of training can provide insights. To measure incidence, we calculate the participation rate of a specific population by dividing the number of participants in training by the total number of people in the population. The participation rate in job-related, employer-sponsored training of the employed population aged 25 to 54 dropped from 26.7% in 1991 to 26.1% in 1993, then to 24.8% in 1997—a somewhat surprising decrease, given the changes that have taken place in the labour force over the last two decades. It is possible, as well, that the characteristics studied (such as class of worker, occupation, and industry) changed between taking the training and filling out the survey; these characteristics provided information about the respondents at the time of the survey (for example, January 1992), not at the time of the training (during 1991).

Table 1 shows the participation rate from the last three cycles of the AETS for men and women. From 1991 to 1997, the rates increased slightly for women but decreased for men. In 1991, men had a higher rate than women; the opposite was the case in 1997. The decrease in the men's rate was so much greater than the increase in the women's rate that the overall rate decreased slightly.

Table 1
Rates of participation in job-related, employer-sponsored training among workers aged 25 to 54, by sex

Population of workers	1991	1993	1997
		%	
Men	27.9	26.3	23.9
Women	25.4	25.9	25.7
Total employed population	26.7	26.1	24.8

Source: *Adult Education and Training Survey, Statistics Canada.*

Results of multivariate analysis for men

Table A1 in Appendix A presents detailed results of logistic regressions performed on the 1991, 1993 and 1997 data for men. For each year and for each variable, we found the average, the estimated coefficient (with the standard deviation under the coefficient in parentheses), and then the odds-ratio. The average represents the proportion of all employed and self-employed Canadians aged 25 to 54 in the subgroup represented by each variable. The coefficient is more difficult to interpret. When it is positive,

Multivariate analysis

We used a multivariate analysis for each survey year in order to estimate, using an equation, the probability of participation in training according to characteristics of the employee (such as age, job tenure, sex and educational attainment) and those of the company where the employee worked (such as size and industry). Each equation yielded estimated coefficients for each variable. We then decomposed the difference between the total rates, according to certain characteristics, in two parts: the changes in the population distributions (1991 to 1993, and 1993 to 1997) of the samples (composition effect); and the differences in the way each variable affected the samples (behaviour effect). For example, firm size had a smaller effect in 1997 than in 1991.

Because men's behaviour could be different from women's for each independent variable (for example, part-time female workers are less likely than part-time male workers to take training), we felt that including a dichotomous variable for women in an equation that combines the two sexes might be insufficient. Therefore, for each sample year, we developed separate equations, accounting for different composition and behaviour effects for men and women.

A similar analysis was used by Oaxaca (1973) to explain the role of discrimination in the difference in salary between men and women. Oaxaca developed separate equations for men's and women's salaries. According to his analysis, part of the difference found in average salaries sprang from differences in the independent variables (such as hours worked, industry and occupation) and part from the different coefficients related to each characteristic by sex. It was this latter part that represented the effects of discrimination.

Because participation in training is a dichotomous variable (takes training/does not take training), we made our estimates by logit (logistic regression). Logit is similar to probit (probability regression); only the distribution of the error term is different. The two methods are equivalent, but logit allows us to quickly calculate odds-ratios that are easy to interpret. The principle of logit is to evaluate the probability that a dependent variable (Y) will take a value of 0 or 1 as a result of independent variables. (For example, variable Y is equal to 1 when the worker has taken training and 0 when he has not.) Logit evaluates the probability that the dichotomous variable Y takes the value of 1 at time i (1991, 1993 or 1997) in the following way:

$$\text{(equation 1)} \quad \text{Prob}(Y=1) = \frac{e^{BiXi}}{1+e^{BiXi}}$$

X_i and B_i represent, respectively, the matrix of independent variables and the coefficients estimated at time i. Thus, each worker is attributed a probability of taking training according to his socio-economic characteristics. For each characteristic, one or more dichotomous variables are created as inclusive subgroups. For example, the present study uses three age variables: 25 to 34, 35 to 44 and 45 to 54 years of age. Each of these variables is equal to 1 when the worker is part of that group and 0 when the worker is not. In the estimate, one must always exclude a reference group for each of the characteristics to serve as a comparison with the other groups. For each of the characteristics in this study, the variable that included the greatest proportion of the population (in terms of observations) was chosen as the reference group.

The characteristics included in the equations are age group, educational attainment, marital status, province of residence, class of worker (employee or self-employed), type of work (full-time or part-time), firm size, industry, occupation, union status and job tenure. We are interested in these characteristics because changes associated with them occurred in the distribution of the population in the last decade and could have masked certain changes in the behaviour of workers and of companies in terms of their investment in training. We also developed our equations according to two other variables that have not been retained because they were not significant: the presence of preschool children in the respondent's household, and the location (rural or urban) of the residence.

it means that the fact of being part of this group increases the probability of taking training relative to the appropriate reference group (for age, for example, the reference group is 25- to 34-year-olds). A negative coefficient indicates decreasing probability. Thus the size of the coefficient is only important relative to the other coefficients. Finally, the odds-ratio indicates the probability of taking training for workers in the group under consideration compared with the reference group. For instance, in 1991, living in Quebec reduced the probability of taking training by 15% (0.85 – 1.00 = -0.15) compared with residents of Ontario; however, living in Alberta increased this probability by 67% (1.67 – 1.00 = 0.67). To judge whether the coefficient is significant or not, we use the likelihood ratio, which follows a distribution of chi square. A significant coefficient means that belonging to this group significantly changes the probability of taking training, compared with the reference group.

If we examine the age group variables, we see that there is no significant difference in the probability of taking training between the two youngest groups (25 to 34 and 35 to 44 years of age) in the 1993 and 1997 cycles of the survey. However, the oldest group (45 to 54 years) is less likely to take training than the others. This result is frequently ascribed to older workers having fewer years in which to benefit from the positive results of training. On the other hand, this effect seems to have decreased with time. In fact, compared with the 25- to 34-year-old group, being 45 to 54 years old decreased the probability of taking training by 42% in 1991, 28% in 1993 and 27% in 1997. We must also note that the two older groups increased their share of employed Canadians between 1991 and 1997.

For all three AETS cycles, we observed that the probability of taking training increased with educational attainment. Workers who had not finished high school were at a clear disadvantage compared with those who had a high school diploma. Education level may reflect the interest or capabilities of workers as far as training is concerned. Companies probably take this indicator into consideration when selecting employees who are most likely to benefit from training. We must note that the average educational attainment in the population also increased between 1991 and 1997. In fact, the two most educated groups increased their share of the working population by more than 3 percentage points each.

In 1997, single men (single, separated, divorced or widowed) had approximately 34% less probability of taking training than married men or those living common law. It is difficult to interpret this result. Single people may differ in unobserved characteristics, such as tastes and aptitudes. Quebec residents were less likely than Ontario residents to take training and this difference has grown over the years. By comparison, residents of the Western provinces (Manitoba, Saskatchewan, Alberta and British Columbia) were more likely to take training, especially in 1991 and 1993. Self-employed people had a lower participation rate than employees. This difference was greater in 1991 and 1993; when the effect of the other variables was kept constant, the difference between the self-employed and the salaried was no longer significant in 1997. It is possible that the growth in the number of self-employed people in the employed population has led them to get more organized (for example, into groups) or that providers of training have adapted their services to these workers' needs. Part-time workers were less likely to take training than full-time workers, but this gap seems to have decreased between 1993 and 1997.[1]

During all three survey cycles, the probability of taking training increased with the size of the company. For example, in 1997, workers in companies with fewer than 20 employees were 63% less likely to take training than their counterparts in companies with 500 or more employees, all other things being equal. One of the main arguments put forward to explain this is that large companies can provide more training because they benefit from economies of scale.

When we analyse the data by industry,[2] we see that employees in public administration or the finance and transportation sectors had a greater probability of taking training than employees in the services industries. From a perspective of occupations, workers in management, administration, natural and social sciences, and education and health were more likely to take training, compared with those in sales, the arts and services. It is normal for certain industries or occupations to require more training than others, depending on the extent of technological change or the speed of the development of knowledge.

The probability of taking training was also less for unionized workers, especially in 1993 and 1997. The group of workers covered by a collective agreement without being unionized is so small that it is difficult to determine whether this group has a greater probability than unionized workers of taking training.

Finally, in all three survey cycles, we found that the probability of taking training increased with job tenure. It seems that employers tend to train employees whom they believe to be loyal to the company, and greater job tenure suggests a smaller risk that the employee will quit to work elsewhere.

Gap between men's and women's participation

For several of the characteristics studied, women had a different population distribution from men (Table A2). Compared with men, fewer women were self-employed and more worked part time. Women also had less job tenure than men. In 1991, women had a lower educational attainment than men, but they were similar to men in 1997. Distribution by industry and occupation remained very different: there were more women in the services and financial sectors and fewer in the primary, manufacturing and transportation sectors. Women were also proportionally more numerous in occupations related to teaching, health and office work, and a greater proportion of them was not married. The distribution of women by age, province of residence, firm size and union status was similar to that of men.

As for age group, we saw earlier that the probability of taking training was lower for men aged 45 to 54 than for those aged 25 to 34. Yet, in 1997, women aged 45 to 54 had a 15% higher probability of taking training than those aged 25 to 34.

The data from the last survey cycle show that educational attainment seems to be a more important characteristic for women than for men. The odds-ratio of participating in training for university graduates compared with people not having finished high school was 4 for women and 2.7 for men.[3] As for marital status, the fact of being single greatly reduced the probability of taking training only for men (-34% in 1997). This effect was nil (not significant) for women in 1997. Self-employed and employed women had a similar probability of taking training; however, self-employed men were less likely to take training in 1991 and 1993.

Working in the finance or public administration sectors increased the probability of taking training even more for men than for women. We noted a similar probability of participation among men working in the trade sector and in the services sector (reference group); however, employed women in the trade sector had a 25% to 40% lower probability of taking training than those in the services sector. In terms of occupations, the differences between the most and the least likely to receive training is greater among women than among men. For example, in 1997, women in the social and natural sciences group had a 5.7 times greater probability of taking training than employees in construction, transportation and handling; for men this ratio was 2.4. In other respects, unionized women were as likely to take training as non-unionized women, but unionized men were less so.

Finally, job tenure is a more important factor among men than among women. For women, the gap between those with few years of service and those with many is less prominent. For example, in 1997, the probability of taking training was 37% higher for men with 20 or more years of job tenure than for those who had between 1 and 5 years of service. For women, this probability was positive but not significant.

Predicted values of participation rates

Table 2 shows the predicted rates of participation for women and men. These rates were calculated by combining the independent variables and the coefficients of the various years. The figures in bold give the actual rates of participation that can be obtained by taking the average of the probabilities of each worker for a given year because, on average, the error terms are nil. For example, row X_{1991} B_{1991} shows the rates of participation in 1991. The other rows show the figures obtained by combining the coefficients and the independent variables for other years. Row X_{1991} B_{1993} gives the average of probabilities calculated using the independent variables of 1991 but according to the coefficients obtained in the estimated equation using 1993 data. When this is compared with the actual rate of 1991, the difference is attributed to a change in behaviour.

Table 2
Predicted values of participation rates

Independent variables	Coefficients	Men	Women
X_{1991}	**B1991**	**27.9**	**25.4**
	B1993	26.6	24.5
	B1997	24.2	23.5
X_{1993}	B1991	27.4	26.4
	B1993	**26.3**	**25.9**
	B1997	23.7	25.0
X_{1997}	B1991	28.0	27.4
	B1993	27.2	27.0
	B1997	**23.9**	**25.7**

Source: *Adult Education and Training Survey, Statistics Canada.*

Decomposing changes between behaviour and composition effects was fairly simple. For the composition effect, we postulated what would have happened to the participation rate if all the independent variables had changed but the estimated coefficients had remained the same. For the behaviour effect, we varied the coefficients associated with each variable and left the independent variables unchanged. For example, men's participation rate was 27.9% in 1991 and 26.3% in 1993. To measure the composition effect between these two years, we evaluated the rate obtained by combining the estimated 1991

coefficients (B_{1991}) with the independent variables from 1993, arriving at the predicted participation rate of 27.4%. The composition effect is, therefore, -0.5 (27.4-27.9). To evaluate the behaviour effect, we kept the independent variables at their 1991 values (X_{1991}) and used the estimated coefficients from the 1993 data (B_{1993}). We arrived at a predicted rate of 26.6% and a resulting behaviour effect of -1.3. The residue—the part of the change in the total rate that cannot be attributed to composition or behaviour effects—is +0.2.[4]

For the period 1991 to 1993, changes in the composition of the working population put a slight downward pressure (-0.5) on the total participation rate for men and an upward pressure (+1.0) on that of women (Table 3). The difference between the two sexes may be due to the distribution of the population by level of educational achievement, which improved more among women than among men. The drop in the total rate from 1991 to 1993 among men can be attributed entirely to a negative behaviour effect, that is, a change in the effect of the various variables considered on the probability of taking training. The negative behaviour effect was less among women than among men. The positive composition effect dominated to the extent that the participation rate among women increased slightly.

Table 3
Composition and behaviour effects

	Men	Women
Total – 1991 to 1993	-1.6	+0.5
Composition	-0.5	+1.0
Behaviour	-1.3	-0.9
Residual	+0.2	+0.4
Total – 1993 to 1997	-2.4	-0.2
Composition	+0.9	+1.1
Behaviour	-2.6	-0.9
Residual	-0.7	-0.4

Source: *Adult Education and Training Survey, Statistics Canada.*

For the period 1993 to 1997, the composition effect was positive, preponderant and similar for men and women. The behaviour effect was negative and higher for men than for women. As a result, the participation rate tended downward for men whereas it remained almost unchanged for women.

For the entire period (1991 to 1997), we noted a marked difference in behaviour between men and women. For men, a change in the composition of the population should have caused a slight increase in the participation rate. In spite of this, it tended downward because of a change in the effect of independent variables on the probability of taking training. In this case, this is considered as a change in the behaviour of the workers (or of their employers). For women, the composition effect was stronger than the behaviour. This explains the slightly increased participation rate.

Conclusion

In this study, we investigated how changes in the composition of the population—in its socio-economic characteristics such as age, occupation and class of worker—could have masked positive changes in the participation rate for training of different groups of workers during the last three cycles of the AETS.

Using estimates, we divided the total change in participation rates into, on the one hand, a change in the influence of independent variables on participation and, on the other, a change in the independent variables themselves. From 1991 to 1993, the change in independent variables (composition effects) affected the rates of participation of men and women differently. Changes in the population distribution for certain characteristics (educational attainment and occupation) had a positive effect on participation rates. Other characteristics (class of worker and firm size) had a negative effect. On the whole for 1991 to 1993, the effect of the change in population distribution on the total participation rate was positive for women and slightly negative for men. From 1993 to 1997, there was a positive composition effect, especially for women. One might think that this effect was the result in the distribution change by occupation and, primarily, by educational attainment. In fact, the groups that showed the highest probability of taking training (workers in scientific occupations or in management and those with higher levels of education) increased in the working population. This positive composition effect was counterbalanced by a marked negative behaviour effect, especially among men.

It would, therefore, be interesting to know what factors contributed to the appearance of this negative behaviour effect in a context that requires greater participation in training. An initial hypothesis is that informal training—which is completely ignored by the AETS—is on the rise as a means of acquiring knowledge. Changes in the economic climate may also serve to explain this negative behaviour effect. For both employees and companies, the opportunity cost of training can be higher in times of growth than during recessions. One might also think that the relative cost of training has increased in the last decade.[5] It is also possible that the training that is offered does not adequately meet the new training needs of employees and companies.

Finally, it would be useful to undertake a similar analysis to examine the intensity of the training taken. As Jennings (1996) mentioned, it is possible that there is an inverse relationship between the intensity and the incidence, that is, that groups that do not train frequently take courses that are longer. Data from the last three cycles of the survey show a considerable increase in the number of hours of training taken per participant. If the reverse relation between incidence and intensity is true, then the positive composition effect associated with incidence should have translated into a decrease in the average number of hours of training. However, the opposite occurred, clearly demonstrating that there was a change in behaviour. In fact, the number of hours of training per worker has increased in spite of the decrease in the participation rate. This observation leads us to presume that the problem of employee training, if such a problem exists, should not be looked at from the point of view of quantity but rather from its distribution among the various groups. EQR

Notes

1. We are interested here in employer-sponsored training. Part-time employees have a higher participation rate than full-time employees for training that is not sponsored.

2. We have regrouped the industries and the occupations into 7 major groups. The AETS classifies industries and occupations into 13 groups. Some of these groups have too few observations for the resulting analysis to be reliable, and they have been linked to groups similar in both nature and participation rate (for example, the durable manufacturing sector with the non-durable manufacturing sector).

3. We obtained these results by dividing the odds-ratio of the group that has a university degree by that of the group that does not have a high school diploma—for men: 1.02/0.38 = 2.7; for women: 1.32/0.33 = 4.0.

4. It is worth noting that we could have done the opposite: starting from the 1997 rate and backtracking to 1991. Both calculations are valid and provide similar results. This dilemma is tantamount to choosing, in a decomposition that is more traditional than the Oaxaca, which is the basic salary structure (the men's or the women's) to determine which part of the differences in salary is due to discrimination.

5. An indicator of the increased cost of training is the fact that the education/training component of the Consumer's Price Index (CPI) has increased much more rapidly between 1991 and 1997 than the CPI altogether. According to these data, the relative price of education and training increased by about 50% during this period, primarily because of an increase in tuition fees (author's opinion).

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Appendix A

Results of logistic regressions

Table A1
Results of estimates, by logit, for men's job-related, employer-sponsored training

Variable	1991 Average (%)	1991 Coefficient (standard deviation)	1991 Odds-ratio	1993 Average (%)	1993 Coefficient (standard deviation)	1993 Odds-ratio	1997 Average (%)	1997 Coefficient (standard deviation)	1997 Odds-ratio
Constant	100.0	-0.51*** (0.11)	100.0	-0.27	***100.0 (0.12)	-0.70	***	(0.14)	
Age group									
25 to 34 years	*37.3*	*1.00*	*35.9*	*1.00*	*33.0*	*1.00*			
35 to 44 years	37.1	-0.15** (0.06)	0.86	37.3	-0.09 (0.07)	0.91	38.1	-0.11 (0.08)	0.89
45 to 54 years	25.6	-0.55*** (0.08)	0.58	26.8	-0.33*** (0.08)	0.72	28.9	-0.32*** (0.09)	0.73
Educational attainment									
High school not completed	21.1	-0.89*** (0.08)	0.41	18.4	-0.86*** (0.09)	0.42	14.8	-0.98*** (0.12)	0.38
High school diploma	21.2	-0.32*** (0.07)	0.73	21.1	-0.55*** (0.08)	0.58	20.0	-0.53*** (0.09)	0.59
Partial postsecondary	8.5	0.10 (0.09)	1.11	7.1	-0.28*** (0.11)	0.75	7.8	0.03 (0.11)	1.03
Postsecondary diploma	*29.6*	*1.00*	*32.1*	*1.00*	*34.0*	*1.00*			
University degree	19.6	0.23*** (0.07)	1.26	21.3	0.00 (0.08)	1.00	23.4	0.02 (0.08)	1.02
Marital status									
Married or living common law	*79.9*	*1.00*	*78.0*	*1.00*	*75.5*	*1.00*			
Single, separated, divorced or widowed	20.1	-0.43*** (0.07)	0.65	22.0	-0.28*** (0.07)	0.76	24.5	-0.42*** (0.08)	0.66
Province of residence									
Newfoundland	1.6	0.01 (0.20)	1.01	1.5	-0.03 (0.23)	0.97	1.3	-0.48* (0.28)	0.62
Prince Edward Island	0.4	0.17 (0.42)	1.19	0.4	-0.01 (0.43)	0.99	0.4	-0.02 (0.53)	0.98
Nova Scotia	3.0	-0.08 (0.15)	0.93	2.9	0.26* (0.15)	1.30	2.8	0.24 (0.17)	1.27
New Brunswick	2.3	0.03 (0.17)	1.03	2.2	0.07 (0.18)	1.07	2.1	-0.19 (0.21)	0.83
Quebec	24.9	-0.16** (0.06)	0.85	24.6	-0.30*** (0.07)	0.74	24.0	-0.69*** (0.08)	0.50
Ontario	*39.4*	*1.00*	*39.3*	*1.00*	*40.1*	*1.00*			
Manitoba	3.7	0.30** (0.13)	1.36	3.8	0.33** (0.14)	1.39	3.8	0.01 (0.15)	1.01
Saskatchewan	3.4	0.39*** (0.14)	1.47	3.3	0.35** (0.15)	1.43	3.1	0.25 (0.16)	1.28
Alberta	10.0	0.51*** (0.08)	1.67	10.2	0.18* (0.09)	1.19	10.5	0.09 (0.10)	1.10
British Columbia	12.3	0.38*** (0.08)	1.47	12.8	0.21** (0.08)	1.23	12.9	-0.04 (0.09)	0.96
Class of worker									
Self-employed	11.2	-0.38*** (0.11)	0.69	12.0	-0.41*** (0.12)	0.67	20.5	-0.05 (0.11)	0.95
Employee	*88.8*	*1.00*	*88.0*	*1.00*	*79.5*	*1.00*			
Type of work									
Part-time	3.6	-0.55*** (0.19)	0.58	3.4	-0.78*** (0.21)	0.46	5.1	-0.35** (0.17)	0.70
Full-time	*96.4*	*1.00*	*96.6*	*1.00*	*94.9*	*1.00*			
Firm size									
Fewer than 20 employees	26.4	-0.98*** (0.08)	0.38	30.3	-1.38*** (0.09)	0.25	32.2	-1.01*** (0.11)	0.37
20 to 99 employees	12.7	-0.65*** (0.08)	0.52	13.4	-0.90*** (0.09)	0.41	15.0	-0.59*** (0.10)	0.56
100 to 499 employees	11.9	-0.16** (0.07)	0.85	12.2	-0.69*** (0.08)	0.50	13.6	-0.06 (0.09)	0.94
500 employees or more	*38.4*	*1.00*	*35.2*	*1.00*	*37.7*	*1.00*			
Does not know/refuses to answer	10.6	-0.87*** (0.12)	0.42	8.9	-1.70*** (0.14)	0.18	1.5	-1.01*** (0.31)	0.36

Table A1
Results of estimates, by logit, for men's job-related, employer-sponsored training (concluded)

Variable	1991 Average (%)	1991 Coefficient (standard deviation)	1991 Odds-ratio	1993 Average (%)	1993 Coefficient (standard deviation)	1993 Odds-ratio	1997 Average (%)	1997 Coefficient (standard deviation)	1997 Odds-ratio
Industry									
Primary industry and construction	14.5	0.10	1.10	14.5	-0.03	0.97	13.1	0.30***	1.36
		(0.11)			(0.12)			(0.13)	
Manufacturing industry	21.2	0.13	1.14	20.8	0.13	1.14	22.8	0.04	1.04
		(0.09)			(0.10)			(0.11)	
Transport	11.5	0.48***	1.62	11.9	0.24**	1.28	10.9	0.63***	1.87
		(0.10)			(0.11)			(0.12)	
Trade	16.1	0.13	1.13	16.3	0.02	1.02	15.5	0.10	1.10
		(0.09)			(0.10)			(0.11)	
Finance	5.1	0.47***	1.60	4.7	0.80***	2.23	4.3	0.71***	2.04
		(0.12)			(0.13)			(0.15)	
Services	*23.1*	-	*1.00*	*24.4*	-	*1.00*	*25.9*	-	*1.00*
Public administration	8.5	0.76***	2.13	7.4	0.81***	2.25	7.5	1.09***	2.98
		(0.10)			(0.11)			(0.12)	
Occupation									
Management and administration	17.3	0.41***	1.51	17.1	0.60***	1.82	16.1	0.52***	1.67
		(0.08)			(0.09)			(0.11)	
Natural and social sciences	8.3	0.76***	2.14	9.0	0.87***	2.39	10.7	0.81***	2.25
		(0.10)			(0.11)			(0.12)	
Teaching and health	6.6	0.55***	1.74	5.8	0.52***	1.68	6.0	0.69***	1.98
		(0.12)			(0.13)			(0.15)	
Sales, arts and services	*19.4*	-	*1.00*	*20.4*	-	*1.00*	*19.2*	-	*1.00*
Office work	5.1	-0.16	0.85	5.3	-0.08	0.92	5.4	0.03	1.03
		(0.12)			(0.13)			(0.15)	
Primary industry and processing	17.2	-0.10	0.90	17.4	0.09	1.10	24.5	0.15	1.17
		(0.10)			(0.11)			(0.11)	
Construction, transportation and handling	26.1	-0.15*	0.86	25.0	0.23**	1.26	18.1	-0.07	0.93
		(0.09)			(0.10)			(0.12)	
Union status									
Unionized	33.6	-0.15**	0.86	31.7	-0.42***	0.66	30.3	-0.27***	0.77
		(0.07)			(0.07)			(0.08)	
Covered by collective agreement	3.5	-0.11	0.89	3.9	-0.17	0.85	2.8	0.28*	1.32
		(0.13)			(0.13)			(0.17)	
Non-unionized	*54.2*	-	*1.00*	*56.9*	-	*1.00*	*66.4*	-	*1.00*
Does not know/refuses to answer	8.7	-0.86***	0.42	7.5	-0.68***	0.51	0.5	0.50	1.65
		(0.13)			(0.14)			(0.45)	
Job tenure									
1 to 6 months	8.7	-0.52***	0.59	8.9	-0.38***	0.68	8.6	-0.89***	0.41
		(0.11)			(0.12)			(0.14)	
7 to 12 months	5.0	-0.46***	0.63	5.3	-0.65***	0.52	7.0	-0.34***	0.71
		(0.13)			(0.16)			(0.14)	
1 to 5 years	*28.8*	-	*1.00*	*26.9*	-	*1.00*	*33.4*	-	*1.00*
6 to 10 years	18.5	0.04	1.04	20.5	0.17**	1.19	18.8	0.11	1.12
		(0.07)			(0.08)			(0.09)	
11 to 20 years	27.3	0.30***	1.35	24.5	0.14*	1.16	18.4	0.19**	1.21
		(0.07)			(0.08)			(0.09)	
More than 20 years	11.7	0.32***	1.37	13.9	0.44***	1.55	13.8	0.31***	1.37
		(0.10)			(0.10)			(0.11)	

Notes:
Standard deviations appear in parentheses.
Variables in italics represent reference groups.
* *Significant to 90%.*
** *Significant to 95%.*
*** *Significant to 99%.*
\- *Nil or zero.*

Table A2
Results of estimates, by logit, for women's job-related, employer-sponsored training

Variable	1991 Average (%)	1991 Coefficient (standard deviation)	1991 Odds-ratio	1993 Average (%)	1993 Coefficient (standard deviation)	1993 Odds-ratio	1997 Average (%)	1997 Coefficient (standard deviation)	1997 Odds-ratio
Constant	100.0	-0.73*** (0.12)	-	100.0	-0.92*** (0.12)	-	100.0	-1.01*** (0.12)	-
Age group									
25 to 34 years	*38.2*	-	*1.00*	*36.4*	-	*1.00*	*33.2*	-	*1.00*
35 to 44 years	37.3	-0.05 (0.06)	0.95	38.1	0.14** (0.07)	1.15	38.2	0.09 (0.07)	1.10
45 to 54 years	24.5	-0.35*** (0.08)	0.71	25.5	0.03 (0.08)	1.03	28.6	0.14* (0.08)	1.15
Educational attainment									
High school not completed	17.0	-1.01*** (0.12)	0.36	14.1	-0.87*** (0.12)	0.42	10.9	-1.11*** (0.15)	0.33
High school diploma	27.6	-0.14* (0.07)	0.87	23.8	-0.27*** (0.08)	0.76	20.6	-0.38*** (0.09)	0.68
Partial postsecondary	8.8	0.13 (0.10)	1.14	9.5	0.13 (0.10)	1.14	8.3	-0.11 (0.11)	0.90
Postsecondary diploma	*28.9*	-	*1.00*	*31.2*	-	*1.00*	*37.6*	-	*1.00*
University degree	17.7	0.12 (0.08)	1.13	21.4	-0.02 (0.07)	0.98	22.6	0.28*** (0.07)	1.32
Marital status									
Married or living common law	*74.5*	-	*1.00*	*75.0*	-	*1.00*	*73.8*	-	*1.00*
Single, separated, divorced or widowed	25.5	-0.17*** (0.06)	0.84	25.0	-0.11* (0.06)	0.90	26.2	0.08 (0.06)	1.09
Province of residence									
Newfoundland	1.4	0.07 (0.24)	1.07	1.4	-0.38 (0.25)	0.68	1.4	-0.10 (0.27)	0.90
Prince Edward Island	0.4	0.12 (0.45)	1.13	0.4	0.83** (0.40)	2.30	0.4	0.24 (0.44)	1.28
Nova Scotia	2.9	-0.01 (0.17)	0.99	2.9	0.01 (0.17)	1.01	2.9	0.21 (0.17)	1.24
New Brunswick	2.3	-0.33* (0.20)	0.72	2.2	-0.41* (0.21)	0.66	2.1	-0.12 (0.21)	0.89
Quebec	24.7	-0.18** (0.07)	0.83	23.1	-0.53*** (0.08)	0.59	23.7	-0.68*** (0.08)	0.51
Ontario	*39.1*	-	*1.00*	*40.2*	-	*1.00*	*39.6*	-	*1.00*
Manitoba	3.9	0.41*** (0.14)	1.51	4.0	0.26* (0.14)	1.29	3.6	0.13 (0.16)	1.14
Saskatchewan	3.5	0.31** (0.15)	1.36	3.3	0.21 (0.15)	1.24	3.2	0.27 (0.16)	1.31
Alberta	10.0	0.72*** (0.09)	2.06	9.8	0.38*** (0.09)	1.47	10.2	0.17* (0.10)	1.19
British Columbia	11.8	0.33*** (0.09)	1.39	12.7	0.23*** (0.09)	1.26	12.9	0.12 (0.09)	1.13
Class of worker									
Self-employed	8.0	-0.16 (0.15)	0.86	8.7	-0.09 (0.14)	0.92	12.6	-0.13 (0.12)	0.88
Employee	*92.0*	-	*1.00*	*91.3*	-	*1.00*	*87.4*	-	*1.00*
Type of work									
Part-time	22.8	-0.59*** (0.08)	0.55	21.8	-0.57*** (0.08)	0.57	24.8	-0.27*** (0.08)	0.76
Full-time	*77.2*	-	*1.00*	*78.2*	-	*1.00*	*75.2*	-	*1.00*
Firm size									
Fewer than 20 employees	24.4	-1.03*** (0.09)	0.36	25.4	-0.83*** (0.09)	0.44	29.3	-0.89*** (0.10)	0.41
20 to 99 employees	11.3	-0.76*** (0.10)	0.47	11.3	-0.58*** (0.10)	0.56	13.5	-0.11 (0.09)	0.90
100 to 499 employees	12.5	-0.38*** (0.08)	0.68	12.8	-0.11 (0.08)	0.90	14.5	0.08 (0.08)	1.08
500 and more employees	*39.1*	-	*1.00*	*39.1*	-	*1.00*	*40.1*	-	*1.00*
Does not know/refuses to answer	12.7	-1.12*** (0.11)	0.33	11.4	-1.03*** (0.11)	0.36	2.6	-0.72*** (0.23)	0.49

Table A2
Results of estimates, by logit, for women's job-related, employer-sponsored training (concluded)

Variable	1991 Average (%)	1991 Coefficient (standard deviation)	1991 Odds-ratio	1993 Average (%)	1993 Coefficient (standard deviation)	1993 Odds-ratio	1997 Average (%)	1997 Coefficient (standard deviation)	1997 Odds-ratio
Industry									
Primary industry and construction	4.3	-0.09 (0.18)	0.91	3.3	-0.10 (0.20)	0.91	3.5	0.14 (0.21)	1.15
Manufacturing industry	9.7	0.02 (0.12)	1.02	8.5	0.06 (0.13)	1.07	10.0	0.14 (0.13)	1.16
Transport	5.2	0.21* (0.13)	1.23	4.9	0.06 (0.13)	1.05	5.7	0.67*** (0.13)	1.96
Trade	14.5	-0.57*** (0.11)	0.57	13.5	-0.37*** (0.10)	0.69	13.8	-0.27** (0.11)	0.76
Finance	9.6	0.38*** (0.10)	1.46	9.8	0.15 (0.10)	1.16	8.0	0.39*** (0.11)	1.48
Services	*48.8*	-	*1.00*	*52.6*	-	*1.00*	*52.5*	-	*1.00*
Public administration	7.9	0.56*** (0.10)	1.76	7.4	0.52*** (0.11)	1.68	6.5	0.43*** (0.12)	1.54
Occupation									
Management and administration	14.4	0.86*** (0.10)	2.37	14.9	1.04*** (0.10)	2.82	16.6	0.73*** (0.10)	2.08
Natural and social sciences	5.1	0.98*** (0.13)	2.66	5.4	1.25*** (0.13)	3.49	6.5	0.87*** (0.13)	2.40
Teaching and health	18.1	0.76*** (0.11)	2.14	20.2	0.70*** (0.10)	2.02	19.7	0.36*** (0.11)	1.44
Sales, arts and services	*23.9*	-	*1.00*	*23.3*	-	*1.00*	*23.7*	-	*1.00*
Office work	29.5	0.12 (0.09)	1.13	28.4	0.17* (0.09)	1.18	23.6	0.00 (0.10)	1.00
Primary industry and processing	6.3	-0.51*** (0.19)	0.60	5.4	-0.53** (0.21)	0.59	7.3	-0.69*** (0.19)	0.50
Construction, transportation and handli	2.7	-0.35 (0.24)	0.70	2.4	-0.27 (0.25)	0.76	2.6	-0.87*** (0.27)	0.42
Union status									
Unionized	30.9	0.08 (0.08)	1.09	32.8	-0.10 (0.08)	0.90	31.1	-0.03 (0.08)	0.97
Covered by collective agreement	4.7	0.27** (0.12)	1.32	4.2	-0.16 (0.14)	0.85	2.8	0.38** (0.16)	1.47
Non-unionized	*54.5*	-	*1.00*	*53.2*	-	*1.00*	*65.6*	-	*1.00*
Does not know/refuses to answer	9.9	-0.74*** (0.14)	0.48	9.8	-0.45*** (0.12)	0.64	0.5	0.21 (0.41)	1.24
Job tenure									
1 to 6 months	13.2	-0.46*** (0.10)	0.63	11.7	-0.67*** (0.12)	0.51	10.8	-0.61*** (0.12)	0.55
7 to 12 months	5.4	-0.05 (0.13)	0.95	5.5	-0.80*** (0.16)	0.45	6.6	-0.34** (0.14)	0.71
1 to 5 years	*35.3*	-	*1.00*	*32.0*	-	*1.00*	*34.6*	-	*1.00*
6 to 10 years	19.4	0.06 (0.07)	1.06	22.8	0.28*** (0.07)	1.33	22.7	0.22*** (0.08)	1.24
11 to 20 years	20.7	0.02 (0.07)	1.02	21.9	0.37*** (0.08)	1.44	16.1	0.03 (0.09)	1.04
More than 20 years	6.0	-0.01 (0.12)	0.99	6.1	0.04 (0.12)	1.04	9.2	0.07 (0.12)	1.07

Notes:
Standard deviations appear in parentheses.
Variables in italics represent reference groups.
* *Significant to 90%.*
** *Significant to 95%.*
*** *Significant to 99%.*
\- *Nil or zero.*

The school-to-work transition: What motivates graduates to change jobs?

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Introduction

The school-to-work transition of new graduates occurs within a global economy, a context where Canada must remain competitive. To meet this challenge, the government invests in education to encourage the development of human resources while stimulating the Canadian economy. In addition, successful businesses depend upon the availability of a specialized and flexible labour force. When postsecondary graduates possess the skills that employers need, they can expect to find suitable employment and thus be rewarded for the efforts they have put into their education.

The school-to-work transition of postsecondary graduates has been the subject of several studies. These studies show that five years after graduation, the majority of graduates had found and kept 'interesting' and well-paid jobs related to their field of study (Finnie 1999).

Several studies have shown that young men and women tend to have greater mobility (that is, change jobs more frequently) than older workers (Booth, Francesconi and Garcia-Serrano 1999; Boothby 1992; Loprest 1992). Furthermore, voluntary mobility has advantages because it enables employees to increase their income (Bartel and Borjas 1981; Keith 1993; Keith and McWilliams 1995). In June 1997, some three-quarters of 1995 graduates held paid jobs. About a quarter of these employed graduates were looking for another job two years after graduation, confirming that the transition is ongoing.

The current study looks at why graduates decide to change jobs. We used three components—sociodemographic characteristics, working conditions and job satisfaction—to create a profile of graduates who are paid workers and are looking for another job. Next, we attempted to establish the variables associated with these three components that might best explain the graduates' reasons for wanting to change jobs.

1997 National Survey of 1995 Graduates

In June 1997, in co-operation with Human Resources Development Canada, Statistics Canada interviewed nearly 43,000 individuals in the context of the National Survey of Graduates. This sample represented almost 300,000 Canadians who had graduated from college, vocational/trade school or university in 1995. The survey focussed mainly on their studies, training and work experience in the two years after graduation. The survey specifically covered the principal activity in the four weeks preceding the survey interview. The survey asked paid workers about the nature of their current job, their level of job satisfaction, and whether they felt they were overqualified.

During the week of the interview, the work activities of all graduates were distributed as follows:

Working part time or full time	82%
Unemployed and looking for work	10%
Unemployed and not looking for work	8%

Paid workers represented 76% of the graduates, and 24% of these had been looking for another job during the four weeks preceding the interview. The current analysis deals with paid workers, whether or not they were looking for another job during the four weeks preceding the interview. Some of the workers may have still been in school. Graduates who were back in school full time two years after graduation were excluded from the results. From a statistical viewpoint, however, the results did not differ from analyses that included this group of students.

Job search rate affected by marital status and dependent children

The job search rate among employed graduates was 24% for both men and women (Table 1).[1] This rate is consistent with the results obtained by Boothby (1992) and Loprest (1992). Graduates who were looking for another job were slightly younger than those who were not—29 on average, compared with 30. This outcome is statistically significant in spite of the minor difference, and consistent with previous surveys (Booth, Francesconi and Garcia-Serrano 1999).

The job search rate was higher for single graduates than for married graduates—26% versus 20%. The rates for graduates who were separated, divorced or living common law were the same at 23%. In addition, because job mobility is frequently associated with geographical mobility, it is possible that a double career change makes looking for a job less attractive.

Whether or not graduates had dependent children affected their job search rate. In fact, 19% of graduates with one or more dependent children were looking for a job, compared with 25% of graduates without dependent children. Furthermore, women and men whose family situations were similar were equally likely to be looking for another job.

Job search rate affected by place, field and level of education

The job search rate was affected by the graduate's province or territory of study in 1995. The lowest rate (16%) was for employed postsecondary graduates who had studied in the Northwest Territories.[2] The highest rate (31%) was for those who had studied in Newfoundland, followed by 28% in Prince Edward Island, and 27% each in New Brunswick and Ontario. This distribution was fairly consistent with that of the graduates' province or territory of residence at the time of the interview. In 1997, Yukon residents, regardless of their province or territory of study, were an exception with 39% of employed graduates looking for a job during the four weeks preceding the interview.

The job search rate also varied by level of education, from a low of 20% for vocational/trade school graduates to a high of 30% for doctoral graduates who were seeking another job. Arts and science graduates had the highest job search rate in community colleges and vocational/trade schools (41%).

Among university graduates, those in fine and applied arts had the highest rate (32%). Interestingly, this same group also had the lowest median salaries (Taillon and Paju 1999). In contrast, health science graduates experienced the highest median salaries, followed by engineering and applied science graduates (Taillon and Paju 1999). These two groups of graduates also had the lowest job search rates.

Table 1
Job search rate, by sociodemographic characteristics, 1997

	Looking for a job
	%
Sex	
Men	24
Women	24
Marital status	
Single (never married)	26
Living common-law	23
Separated	23
Divorced	23
Married	20
Widowed	19
Dependent children	
None	25
One or more	19
Level of education in 1995	
Vocational or trade school diploma	20
College diploma	25
Bachelor's degree	25
Master's degree	23
Doctorate	30
Province or territory of study in 1995	
Newfoundland	31
Prince Edward Island	28
Nova Scotia	25
New Brunswick	27
Quebec	19
Ontario	27
Manitoba	25
Saskatchewan	24
Alberta	25
British Columbia	22
Northwest Territory	16
Yukon	26
Province or territory of interview in 1997	
Newfoundland	32
Prince Edward Island	30
Nova Scotia	26
New Brunswick	27
Quebec	19
Ontario	27
Manitoba	26
Saskatchewan	23
Alberta	25
British Columbia	22
Northwest Territory	15
Yukon	39
Field of study (college, vocational/trade school graduates)	
Arts and sciences	41
Arts	28
Humanities and related fields	27
Social sciences and services	25
Health sciences and related fields	24
Business and commerce	23
Natural sciences and primary industries	21
Engineering and applied science	20
Other	8
Field of study (university graduates)	
Fine and applied arts	32
Agriculture and biology	28
Social sciences	28
Humanities	26
Education	25
Arts and sciences, general	24
Mathematics and physical sciences	22
Commerce, management and administration	21
Engineering and applied science	19
Health	18

Source: *The 1997 National Survey of 1995 Graduates.*

Job search rate affected by working conditions

For graduates working part time, the job search rate was 37%, compare with 21% of graduates working full time. Furthermore, 45% of those working part time and looking for another job would prefer to work full time.

More graduates with temporary or seasonal jobs were looking for jobs than were those with permanent jobs. In fact, about one in five graduates with permanent jobs was looking for another one, whereas one in three with seasonal or temporary jobs was job seeking. These results indicate that less stable employment increases the incentive for graduates to seek work elsewhere.

The job search rate was higher for graduates who considered themselves overqualified than for those who did not feel overqualified (38% compared with 16%). Graduates who were looking for a job were making less money than those who were not. This was true whether they were working full time or part time. Full-time workers looking for another job earned an average of $28,000 annually; graduates not looking for work earned $32,300. Graduates working part time who were looking for a new job earned $11,900 annually, compared with $15,300 for those who were not looking. Factors such as field of study, income level and perception of overqualification were closely linked to the decision to seek a new job. Furthermore, graduates in positions with good benefits were less likely to be job hunting than those without benefits.

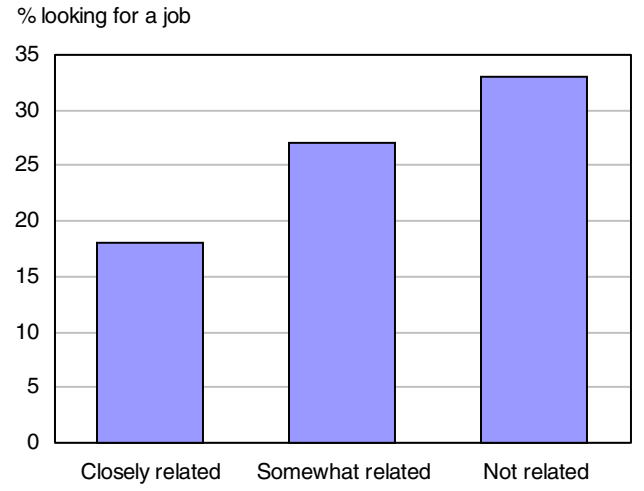
Job search rate affected by relatedness of job and studies and by mobility

The more closely work was related to the field of study, the lower the job search rate in the four weeks preceding the interview (See Graph 1). About 33% of employed graduates who were looking for work reported that their work was unrelated to their field of study. This rate fell to 27% for those whose work was somewhat related, dropping again to 18% for those whose work was closely related to their studies. With respect to mobility, graduates looking for another job had held 2.3 jobs on average since graduation, compared with 1.9 jobs for those who were not looking.

Job search rate affected by job and pay satisfaction

Generally, the lower the job satisfaction that graduates reported, the higher the job search rate (Graph 2). Only 12% of graduates who were very satisfied with their job were looking for another job. Among satisfied graduates, the job search rate was 27%. However, 56% of dissatisfied graduates and about 63% of very dissatisfied graduates were looking for a new job.

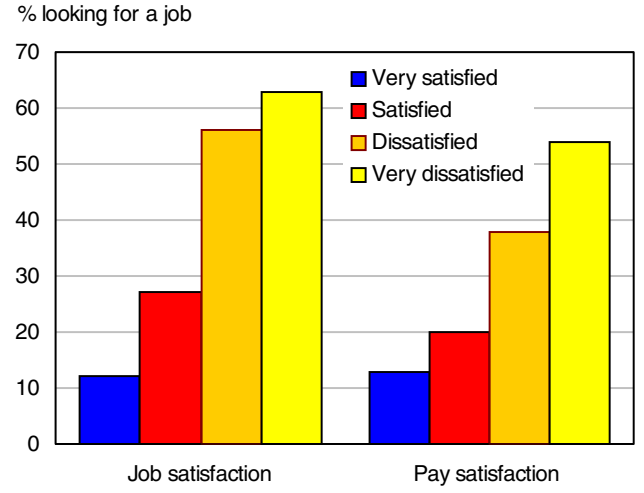
Graph 1
Job search rate, by relatedness of work and field of study, 1997



Source: *The 1997 National Survey of 1995 Graduates.*

The level of job satisfaction and income were important factors in the decision to look for another job. However, job satisfaction was more important than satisfaction with pay level. Consequently, the job search rate was higher among graduates who were dissatisfied or very dissatisfied with their job.

Graph 2
Job search rate, by satisfaction with job and pay, 1997



Source: *The 1997 National Survey of 1995 Graduates.*

Table 2
Job search rate, by working conditions, 1997

	Looking for a job
	%
Hours worked	
Full-time (30 hours or more)	21
Part-time (fewer than 30 hours)	37
Part-time work — involuntary	45
Part-time work — voluntary	29
Temporary, seasonal or permanent work	
Temporary	33
Seasonal	31
Permanent	21
Supervisory work	
No	24
Yes	23
Relatedness of work to field of study	
Not related	33
Somewhat related	27
Closely related	18
Overqualified	
No	16
Yes	38
Health insurance	
No	31
Yes	19
Dental plan	
No	29
Yes	19
Retirement plan benefits	
No	30
Yes	18
Paid vacation	
No	32
Yes	21
Sick leave benefits	
No	32
Yes	18

Source: *The 1997 National Survey of 1995 Graduates.*

The most important factors

A logistical regression established which variables were most important in an employed graduate's decision to look for another job.[3] In terms of academic level, the results confirmed that the job search rate for doctoral graduates was proportionately higher than for other graduates. Among doctoral graduates, all things being equal, the job search rate was 29%. For graduates with master's degrees, it was 21%. Generally, the trend in the job search rate increased by level of education. However, the results were reversed for graduates with a college diploma or bachelor's degree.

The job search rate was higher for graduates who worked part time, as well as for those who held a temporary job, saw themselves as overqualified for their current job, had not been in their current job for very long, and had been the most mobile since graduation.

In addition, the logistical regression confirmed that the job search rate fell when job and pay satisfaction rose. About 43% of the graduates who said they intended to change jobs were also very dissatisfied with their work. The rate fell to 34% for graduates who said they were very dissatisfied with their pay level.

Table 3
Job search rate, by the predictive variables used in the analytical model, 1997

	Looking for a job
	%
Total	**18**
Sociodemographic characteristics	
Dependent children	
None	19
One or more	16
Level of education in 1995	
Vocational/trade school diploma	16
College diploma	19
Bachelor's degree	18
Master's degree	21
Doctorate	29
Working conditions	
Hours worked	
Part-time (less than 30 hours)	26
Full-time (30 hours or more)	17
Temporary, seasonal or permanent work	
Temporary	24
Seasonal	20
Permanent	17
Overqualified	
No	15
Yes	24
Time worked in current job	
Less than 16 months	19
16 to 38 months	18
39 to 62 months	17
63 to 87 months	16
88 to 113 months	15
114 to 141 months	14
142 to 171 months	13
Number of jobs held since graduation	
1	17
2	18
3	19
4	21
5	23
Satisfaction	
Job satisfaction	
Very dissatisfied	43
Dissatisfied	38
Satisfied	21
Very satisfied	12
Pay satisfaction	
Very dissatisfied	34
Dissatisfied	29
Satisfied	19
Very satisfied	15

Source: *The 1997 National Survey of 1995 Graduates.*

Summary

Two years after graduation, some of the graduates who were holding down a job were looking for a new one. The job search rate was affected by two variables: dependent children and level of education. Specifically, the rates for graduates without dependent children and for doctoral graduates were higher than for other graduates.

The decision to look for a new job was frequently motivated by dissatisfaction with working conditions. For example, graduates felt their current job did not provide them with enough hours; they felt they were overqualified; the job was not permanent; or they were dissatisfied with the work or the pay.

Finally, the more mobile graduates were in the two years after graduation, the more likely they were to be looking for another job two years after graduation. These results show that there were major variations in the school-to-work transition of postsecondary graduates. EQR

Notes

1. The statistical analyses used in this study are explained in Appendix 1.

2. At the time of the interview, the Northwest Territories included Nunavut.

3. For a detailed explanation of the analysis, please consult Appendix 2.

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Appendix 1

Statistical analyses used to develop graduate profiles

The primary focus of our analysis was to develop a profile of graduates based on three components: sociodemographic characteristics, working conditions and job satisfaction. We wanted to determine whether differences in these variables would enable us to compare the responses of graduates who were looking for another job with the responses of graduates who were not. Accordingly, for the variables whose values could not be ranked (such as sex and province of study), the differences between the two groups were tested for significance using chi square. This test indicated whether or not the differences obtained by cross-tabulation were statistically significant. If statistical analysis provided a result over the 5% threshold for sampling error (alpha), then a significant difference rather than a sampling error emerged.

We performed a Mann-Whitney statistical analysis to reveal differences between the two groups for variables whose values could be ranked, such as level of education, satisfaction variables and relatedness of work to field of study. The test for measuring significance hinged on the value of U.

A *t*-test revealed differences between the two groups for continuous variables such as age and income. Variance was first determined using the statistic F, and the significant difference (difference not related to a sampling error) was evaluated using the statistic t.

Finally, a logistical regression analysis using a multinomial model shed light on which of the variables best explained the decision to look for another job. The variables were introduced and then excluded from the logistical regression model in order to discern the most suitable model in relation to the degree of freedom.

Appendix 2

Examination of the results of the logistical regression analysis

We determined which of the variables best explained the decision to look for another job, noting significant differences between the variables introduced in this model and the reference variable. In most cases, eliminating non-significant variables did not create any problems. This did not hold true for the benefits variables. All benefits were significant, except for paid vacations. However, including these variables in the model greatly reduced its explanatory value. Furthermore, when these variables were added to the model, there was no statistical difference between a bachelor's degree and a college diploma. The benefits variables were therefore excluded from the model.

Another variable that created a problem was pay level. This variable included the pay received by graduates who worked part time and whose annual income was consequently much lower. Nevertheless, this variable was included in the analytical model because it improved the explanatory value of the job search model. Excluding the pay variable seriously reduced the model's explanatory value. The results of the model are found in Table A1.

Table A1
Probability ratios in the multinomial logistical regression model, by the predictive variables, 1997

	Probability rating	p <
Sociodemographic characteristics		
Dependent children		
None	1.210	<0.01
One or more	1.000	...
Level of education in 1995		
Vocational/trade school diploma	0.852	<0.01
College diploma	1.000	...
Bachelor's degree	0.932	<0.05
Master's degree	1.172	<0.05
Doctorate	1.784	<0.01
Working conditions		
Hours worked		
Part-time (less than 30 hours)	1.000	...
Full-time (30 hours or more)	0.569	<0.01
Temporary, seasonal or permanent work		
Temporary	1.624	<0.01
Seasonal	1.265	<0.01
Permanent	1.000	...
Overqualified		
No	1.000	...
Yes	1.754	<0.01
Time worked in current job	0.997	<0.01
Number of jobs since graduation	1.101	<0.01
Pay	1.000	<0.01
Satisfaction		
Job satisfaction		
Very dissatisfied	2.840	<0.01
Dissatisfied	2.266	<0.01
Satisfied	1.000	...
Very satisfied	0.513	<0.01
Pay satisfaction		
Very dissatisfied	2.185	<0.01
Dissatisfied	1.733	<0.01
Satisfied	1.000	...
Very satisfied	0.733	<0.01

Note:
… Value not significant.
Source: *The 1997 National Survey of 1995 Graduates.*

Factors affecting Grade 3 student performance in Ontario: A multilevel analysis

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Abstract

This study uses an ecological conceptual approach to examine factors influencing academic performance of Grade 3 students in Ontario. The data come from Ontario's Education Quality and Accountability Office (EQAO), which administered Ontario-wide standardized tests to some 115,000 English-speaking Grade 3 students from more than 3,200 schools in 1997. The EQAO also administered surveys that provided information about students, their classrooms, their schools and their families. Information about neighbourhoods was obtained by linking school catchment areas with census socio-economic status (SES) characteristics. Multilevel regression analyses were used because of the nested structure of the data. While individual student characteristics accounted for the majority of the variation in test scores, a surprising 33% of the total variation was associated with the classrooms and schools. This suggests that teachers, classrooms, schools and neighbourhoods are important for student achievement. At the student level, girls outperformed boys, students from higher-SES backgrounds performed better than those from lower-SES backgrounds, and those with parents involved at school performed better than those with non-involved parents. Class-level variables that positively affected performance included lower numbers of students in the classroom and experienced teachers who were comfortable with the curriculum. At the school level, achievement was higher in schools located in higher-SES neighbourhoods, and students in urban schools outperformed those in rural schools. These results suggest that policies aimed at improving elementary school achievement should be informed by an understanding that school contextual factors make a difference for educational outcomes.

Introduction

The development and well-being of Canada's children have been the focus of much recent investigation and discussion in both policy and academic circles (Corak 1998; McCain and Mustard 1999). An

important measure of children's well-being is their academic performance. Poor achievement, even at the elementary school level, increases the chances that a child will not have the skills and opportunities to participate fully in and contribute to Canadian society as an adult. Furthermore, one of the most important factors for building resiliency in children is ensuring that they achieve success in school (Connolly et al. 1999). This study seeks to identify factors that influence academic achievement in elementary school children in Ontario.

The conceptual approach we take here may be broadly termed 'ecological' because student achievement is determined by a combination of neighbourhood, school, classroom, and family influences as well as individual characteristics of the student (Willms 1992). Thus student competency is influenced by such varied factors as teaching practices and family and neighbourhood environments. We pair this theoretical understanding with multilevel regression modelling, an analytical technique that allows for the simultaneous interpretation of various levels of influence on student achievement.

We hypothesize that certain pre-existing factors (such as individual socio-economic status (SES) and home environment) have a large impact on students' academic achievement. We also hypothesize that factors in the classroom (such as teaching practices and number of students) and in the neighbourhood surrounding the school (such as neighbourhood SES) exert independent incremental effects on school performance. The inclusion of variables describing features of family life such as parental involvement with the school presupposes that social relationships within the family—called 'family social capital' by Coleman (1988)—can enhance children's academic achievement. Indeed, past research supports this view (Ryan and Adams 1999; Sun 1999; Valenzuela and Dornbusch 1994).

By including neighbourhood measures, we are inferring the existence of 'community social capital'—community social processes that have been shown to have a substantial connection to general child health and development (Brooks-Gunn et al. 1993) and, more specifically, to academic achievement (Kohen et al. 1999; Leventhal and Brooks-Gunn, 2000; Pong 1997; Shumow et al. 1999; Sun 1999). Collectively, these concepts of family and community social capital suggest that there are both tangible and intangible resources in families and communities that have a bearing on how well children perform in school. The influences of schools and neighbourhoods on child outcomes like school performance are particularly important from a policy perspective, given that school resources and, to some degree, neighbourhoods are amenable to change through policy intervention.

Methods

Data sources

We used two data sources for the analysis of student performance. The first was the 1997 Education Quality and Accountability Office (EQAO) database. The Government of Ontario established the EQAO in 1996 to respond to requests for information about the quality of education in Ontario. The primary mandate of the EQAO is to administer province-wide standardized tests. The EQAO data used in this study consists of individual 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 provided information on student, family, teacher, class and school factors thought to have a bearing on student performance.

The second data source was a specially prepared file from the microdata file of Statistics Canada's 1996 Census of Population. This aggregated file provided information about community factors that could also influence student performance. Our definition of 'neighbourhood' in urban areas was the collection of census enumeration areas (see Appendix 3) contained within a 1.6-kilometre radius of a school. This boundary was intended to represent the area within walking distance of the school. In rural areas, 'neighbourhood' was defined as the census subdivision (see Appendix 3) in which the school was located.

Target population and sample size

The target population consisted of all Grade 3 students in Ontario in the 1997–1998 school year, with the exception of pupils in French schools and those exempted[1] from the testing. Of the original 129,448 Grade 3 students in English schools, 7.1% were exempted; 3.8% had missing information. The resulting analytical sample size was 115,712 students within 6,929 classrooms and 3,285 schools.

Achievement measure

The standardized test scores consisted of 14 performance assessments: 8 in mathematics; 3 in writing; and 3 in reading. Each performance was assessed on a scale of 1 to 4. A score of 2 or 3 meant that a student was performing at provincial standards; a score of 1 indicated performance below provincial standards; and a score of 4 indicated performance above provincial standards. Before calculating the arithmetic mean of the performance assessments into an overall achievement measure, the performance assessments were scaled using a logit transformation for re-expressing grades (Mosteller and Tukey 1977; Willms 1986; Garner and Raudenbush 1991). The resulting distribution of the

overall achievement measure was roughly normal, with a mean of –0.02 and a standard deviation of 1.29. For analysis purposes, this outcome measure was standardized using an 'empty' multilevel model (see Appendix 2) to a mean of 0 and a standard deviation of 1 (see Table 1).

Explanatory measures

We derived explanatory measures from additional questionnaires administered by EQAO. The Student Questionnaire and the Home Questionnaire provided the following information about students: sex; enrolment in

Table 1
Descriptive statistics for Grade 3 student achievement and explanatory measures

	Sample size	Mean (%)	Standard deviation	Minimum value	Maximum value
Student-level	115,712				
Outcome					
Achievement[c]		0	1	-2.473	2.919
Control					
Gifted intellectually		0.4	0.059	0	1
Special support–not identified		9.6	0.295	0	1
Special support–identified		3.0	0.171	0	1
Accommodation–exceptional		0.2	0.042	0	1
Accommodation–typical		17.7	0.382	0	1
Background					
Sex		49.7	0.500	0	1
English as a second language		5.4	0.227	0	1
French immersion		4.0	0.196	0	1
Proxy SES					
Computer at home		53.6	0.499	0	1
More than 100 books at home		58.8	0.492	0	1
Home environment					
Other language than English (OLE)		24.1	0.428	0	1
Missing control for OLE		1.7	0.129	0	1
Parental involvement with school		50.9	0.500	0	1
Class-level	6,929				
Teacher characteristics					
≤10 years' experience		63.2	0.482	0	1
Not comfortable with curriculum		25.4	0.435	0	1
Teaching practice[c]		0	1	-3.019	5.871
Class environment					
Number of Grade 3 students in class[c]		17.3	7.736	1	37
Split grade with Grade 2		21.8	0.413	0	1
Split grade with Grade 4		22.3	0.416	0	1
Other split grade		3.3	0.178	0	1
Access to computer (limited)		69.0	0.462	0	1
Access to computer (none)		1.6	0.124	0	1
School-level	3,285				
School environment					
Public		69.3	0.461	0	1
School size <230		23.8	0.426	0	1
School size >471		25.3	0.435	0	1
School neighbourhood					
Urban		83.4	0.372	0	1
% of population with less than high school[c]		31.2	0.100	4.1	69.8
Population <0.6% immigrants		24.4	0.430	0	1
Population >8.2% immigrants		24.6	0.431	0	1
Median age <33		22.9	0.420	0	1
Median age >37		20.8	0.406	0	1
Youth unemployment <15%		24.0	0.427	0	1
Youth unemployment >22%		24.5	0.430	0	1
				$'000	
Median income[c]		42.5[M]	13.9	11.9	114.0

Notes:
[c] *Considered as continuous variables in the analysis.*
[M] *Median.*
Sources: *Education Quality and Accountability Office and Census of Population, 1996.*

English as a second language or French immersion; cognitive resources (books and computer) available at home, which were used as a proxy indicator for student-level SES; and some details about their home environment (language spoken at home and parental involvement in the school). Information available on the Student Questionnaire also made it possible to control in the regression models for students receiving special support or requiring help during the performance assessments.

At the class level, teachers provided information on their years of experience, the closeness with which they followed the curriculum and their degree of comfort with it (see Appendix A), and the class environment (such as how many Grade 3 students were in the class, whether the class is a split grade, and what access the class has to a computer). The split grade variable was used as a control in the regression models because placement of students in split-grade classes is often based on their age and abilities.

At the school level, school demographics were provided by school principals, and socio-economic profiles of school neighbourhoods were derived from the census. School type (public or Catholic) and the median age of the neighbourhood (a measure of neighbourhood stability) were entered as control variables. Variable details are described in Appendix A, and their descriptive statistics are provided in Table 1.

Multilevel models

The multilevel model (MlwiN) package (Goldstein et al. 1998) was used to fit the models of Grade 3 academic achievement. We developed incrementally two three-level models that offered simultaneous consideration of *i* students nested within *j* classes nested within *k* schools. The first model, usually called the 'empty' or 'null' model, was estimated with no explanatory variables. The empty model measures the relative importance of individual and contextual (class- and school-level) effects in accounting for variation in the outcome. The second or 'final' model includes those explanatory variables at the individual and contextual levels that are significantly ($p \leq 0.01$) associated with the achievement outcome. The model has been adjusted for Grade 3 students receiving special education support or needing help during the performance assessments, as well as for split-grade classrooms, for public schools and for median age of the school neighbourhood.

The findings

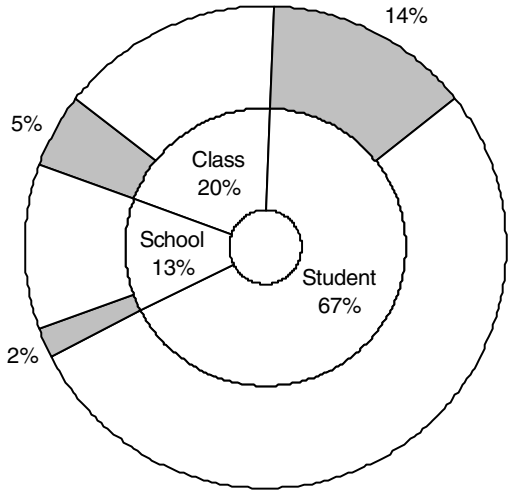
Descriptive statistics

The analysis covers 115,712 students in 6,929 classrooms in 3,285 schools (and neighbourhoods). In terms of individual student characteristics, roughly 5% of Grade 3 students were enrolled in English as second language programs and about 4% in French immersion. More than half the students (53.6%) had home computers, and 58.8% had more than 100 books available to them in the home environment. As for classroom characteristics, a full 47% of students were in split-grade classrooms and most (64.7%) were taught by teachers with 10 years or less of teaching experience. More than 70% of teachers indicated that their students had either limited access or no access to a computer at school. As for school-level characteristics, almost 70% of schools were public and over 80% were located in urban environments. The neighbourhoods in which schools were located had a median income of $42,500.

Breaking down the total variance in school achievement

The empty model allows us to break down (decompose) the total variance of student achievement in Ontario and thereby quantify the heterogeneity within the school system.[2] The sources of variation in the model are best represented graphically (Graph 1). While most (67%) of the variation in student achievement was accounted for by individual student differences, the balance was associated with classes (20%) and schools (13%). As can be seen from the shading in Graph 1, rather little of that variation (14%, 5% and 2%, respectively) is explained by the variables in the model. That 33% of the variation in student achievement was attributable to classes and schools is surprising in a Canadian school system setting where students are not systematically selected for specific classes

Graph 1
Breakdown of the total variance of the achievement and percentage of the explained variation per level



Note:
The shaded areas represent the portion of variation explained by the final model.
Sources: *Education Quality and Accountability Office and Census of Population, 1996.*

or schools by their ability. The amount of variation in achievement associated with classes and schools in this study is strikingly similar to class/school variation in U.S. academic achievement (OECD 1998).

Student factors associated with achievement

Table 2 presents the results of the empty and final multilevel models for student achievement. The last column of the table shows the impact of each of the significant explanatory variables (factors) expressed as the departure in percentage points from the typical student (see Appendix 3). This transformation implies that students with the lowest achievement have a score of 0 and those with the highest achievement have a score of 100. A score of 51 goes to the typical student, or the reference group, defined as having the most prevalent (probable) characteristics: the average if the characteristic is a continuous variable, and the mode otherwise (see Table 1 for descriptive statistics). Thus, among other characteristics, the typical student is an English-speaking girl, who is not in a split-grade class,

Table 2
Multilevel models of Grade 3 student achievement and the impact of the main influencing factors

	Empty model	Final model*	Factor impact
Fixed effects variance			
Student-level			
Intercept	0.000(0.009)	-0.181(0.032)	-
Background			
Sex		0.154(0.004)	3
English as a second language		-0.141(0.012)	-3
French immersion		-	-
Proxy SES			
Computer at home		0.146(0.005)	3
More than 100 books at home		0.177(0.005)	3
Home environment			
Other language than English (OLE)		-0.026(0.006)	-1
Parental involvement with school		0.059(0.005)	1
Class-level			
Teacher characteristics			
≤10 years' experience		-0.045(0.013)	-1
Not comfortable with curriculum		-0.051(0.015)	-1
Teaching practice		0.070(0.007)	1
Class environment			
Number of Grade 3 students in class		-0.007(0.001)	-1
Access to computer (limited)		-	-
Access to computer (none)		-	-
School-level			
School environment			
School size <230		-	-
School size >471		-	-
School neighbourhood			
Urban		0.087(0.024)	2
Median income		0.006(0.001)	1
% of population with less than high school		-0.004(0.001)	-1
Population <0.6% immigrants		-0.062(0.021)	-1
Population >8.2% immigrants		0.185(0.020)	3
Youth unemployment <15%		-	-
Youth unemployment >22%		-	-
Random effects variance			
Student-level			
σ_e^2	0.675(0.007)	0.536(0.002)	-
Class-level			
σ_v^2	0.205(0.006)	0.157(0.005)	-
School-level			
σ_k^2	0.123(0.007)	0.104(0.005)	-
Overall			
-2*log (likelihood)	296939.2	270302.8	-

Notes:
* *Control variables included.*
\- *Nil or zero.*
Values in parentheses represent the standard error of the estimated parameter.
Sources: *Education Quality and Accountability Office and Census of Population, 1996.*

and whose school is in an urban neighbourhood with a median household income of $42,500.

The final model results demonstrate that individual SES, sex and first language of the students were significantly associated with student achievement. The average gap in achievement between Grade 3 students whose parents or guardians reported having a computer and more than 100 books at home and those whose parents or guardians reported neither of these resources amounted to 6 points. Recall that we used these resources in the home as a proxy for student-level SES, as has been done in past international studies of school performance (OECD 1998).

Girls performed 3 points higher than boys, after we accounted for other variables in the model. These findings generally echo those of other researchers who have demonstrated that girls have higher academic success than boys in the lower elementary school grades (Connolly et al. 1999; Willms 1996).[3] Grade 3 students who were identified as speakers of English as a second language performed 3 points lower than students whose mother tongue was English. After controlling for all of the explanatory variables, the students enrolled in French immersion did not perform differently from other students.

The two variables characterizing a child's home environment—language spoken at home and parental involvement with school—had significant effects on Grade 3 student achievement. If English was not the dominant language spoken at home, the students performed about 1 point lower than average at school. Grade 3 students whose parents were involved with the school were stronger students (by 1 point) than the rest. 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 (Zellman and Waterman 1998; Brody et al. 1995). 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 a more complex construct that includes a wide variety of parent behaviours. Zellman and Waterman (1998) conclude that school involvement is really a manifestation of parental enthusiasm and positive parenting style.

Class factors associated with achievement

Students performed better at school when taught by teachers who had had more than 10 years' experience in the lower elementary school grades or who were comfortable with the curriculum. For each of these teacher characteristics, the difference in the students' scores from those of the typical student was 1 point. The more closely the teachers reported following the current curriculum, the better the students performed. For each standard deviation above the average teaching practice score, these students exceeded the typical student by 1 point.

Class size, as measured by the number of grade 3 students in the classroom, was inversely related to achievement. Students in classrooms with more than 8 students beyond the mean class size performed 1 point lower than students in classes of average size. The evidence about the relationship between class size and student performance in the United States has been mixed. Class size was shown to have a large influence on achievement, especially for children in the early grades, in an experiment in Tennessee (Finn and Achilles 1990; Mosteller 1995) and in other studies (e.g., Akerhielm 1995). Hanushek and Rivkin (1996), however, argue that as many studies demonstrate no effect and the debate in the United States is ongoing (Hanushek 1999; Finn and Achilles 1999). While class size was found to be important in this study, no relationship was found between the presence of a computer in the classroom and the achievement of the students. This corroborates a large U.S. study that found access to computers in the classroom had no effect on student achievement at the Grade 4 level (Johnson 2000).

School-level effects

The type of school and its socio-economic profile were associated with Grade 3 student achievement. Students attending urban schools achieved scores 2 points higher than students attending rural schools. This finding stands in stark contrast to U.S. research showing that elementary students in urban schools typically perform below their non-urban counterparts, even after accounting for the higher concentration of low-income students in urban U.S. schools (U.S. Department of Education 1996). Students attending schools located in neighbourhoods with affluent and well-educated populations outperformed those in neighbourhoods with populations that were less affluent and less educated. To get a sense of the magnitude of the effect, an increase of $8,000 in the median household income of $42,500 for the neighbourhood was associated with an increase of 1 point in student scores. One surprising finding was that, after taking account of all other variables in the model, students whose school was located in a neighbourhood with a high proportion of recent immigrants performed 3 points better than those in neighbourhoods not characterized by large immigrant populations. When additional variables such as SES are controlled for, other studies conducted at the individual level have found that immigrant students perform in school as well as or better than native-born students (Gibson 1987; Ogbu 1983), although we caution that we have no measure of immigrant status at the individual level in the study. Recall that individual students with non-English home environments did not perform as well as typical students in the study.

Finally, the school's neighbourhood youth unemployment rate did not have an association with Grade 3 achievement in this study.

The 21% of the variation in students' achievement (the shaded areas in Graph 1) explained by the final model falls within a typical range for this type of analysis (Gray 1988; OECD 1998). Thus important variables affecting academic performance have not been taken into account. For example, a model such as the one presented here would likely explain more variation in achievement if more details were available about students' academic performance, parents'/guardians' education levels, and students' use of cognitive resources in the home. Also, 'neighbourhood' was defined as the catchment area of the school because information about where students actually lived was unavailable. Refining the definition to capture details about the students' residential neighbourhood would likely improve model precision by more accurately reflecting the environment to which they are routinely exposed.

Discussion

The principal objective of this study was to isolate factors associated with Grade 3 student achievement in Ontario. We identified characteristics of individual students and their families, teachers, classrooms, schools and neighbourhoods that influenced student performance. The results reflect clearly the importance of using student-level, class-level and school-level factors simultaneously in order to understand the variation in student performance.

A major strength of this study is that its large sample of both individual students and schools allowed us to create fully specified multilevel models. The data requirements of such models are fairly stringent (Bryk and Raudenbush 1992) in terms of having sufficient sample sizes at each level of the analysis, and we easily met these requirements with this study. In addition, the diversity of information available about students, their classrooms and their schools allowed us to examine some factors not traditionally available in large standardized testing situations.

The most surprising finding was the large amount of variation in Grade 3 academic achievement associated with classes and schools. This suggests that elementary classes and schools in Ontario are fairly homogeneous, with a reasonably high correlation in test scores within classes and within schools. The degree of variation in achievement associated with classes and schools in this study is similar to class/school variation in U.S. academic achievement (OECD 1998). This finding contradicts conventional wisdom about the nature of schools and neighbourhoods in Ontario vis-à-vis those in the United States. A Minneapolis study, for example, demonstrated that unrestricted parental choice would ultimately lead to severe segregation by race and ethnicity (Glazerman 1998). While there has been research to suggest that residential choice can be based on school quality or characteristics of the student body in the United States, this has not been widely studied in Canada. In general, like individuals tend to live together in like neighbourhoods in both countries, but the degree of residential segregation has traditionally been much higher in the United States than in Canada (unpublished analyses, Health Analysis and Modelling Group, Statistics Canada).

The overwhelming majority of the variation in achievement is explained by individual-level characteristics. Girls, students with computers and books at home, and students whose first language was English outperformed their peers. Recall that we used resources in the home as a proxy for student-level SES. It may be, however, that what these resources measure is not SES. In a small longitudinal study of academic motivation, Gottfried et al. (1998) found that a cognitively stimulating home environment had significant effects above and beyond SES.

Our findings generally support other claims that teachers and public resources aimed at reducing class size can influence achievement (Alexander 1997; Ravitch 1999). Students of teachers who reported more experience and a higher comfort level with the curriculum outperformed other students, after we accounted for individual, school and other class characteristics. While having access to a computer in the classroom did not affect test outcomes, the number of students in the classroom was shown to have a significant effect on test scores. Prior research suggests that teachers do not tend to change their teaching strategies in smaller classrooms; rather, the key benefit of smaller classes is increased student engagement in the learning process (Finn and Achilles 1999).

We have labelled as 'ecological' the theoretical approach we take in this paper because we consider student achievement to be influenced by family, class and school environment factors in addition to characteristics of the students themselves. We have suggested that family and neighbourhood 'social capital'—those tangible and intangible resources in families and neighbourhoods—can influence how well even a young (Grade 3) student performs in school. The modelling results generally support our approach. However, the degree to which the explanatory variables capture details of family and neighbourhood social capital was limited. Smith et al. (1995) suggest that social capital includes both structural and process components. The variables used to describe families and neighbourhoods in this study predominantly represent the structural dimensions (such as SES) rather than the process dimensions (such as general family functioning, school-related parent–child interactions, and strength of social ties among neighbourhood residents) of social capital. Future

research on school performance might focus on the more subtle process dimensions of neighbourhood social capital, but this would require going beyond census data to include administrative data on crime or community-based surveys of social networks and social control.

It may be that the more distal variables we have included here to help explain student achievement are mediated through a latent variable such as individual student motivation for learning. That is, it is possible that our model better captures variation in students' intrinsic motivation and that this motivation predicts how well a student will perform on the standardized performance assessments. Indeed, preliminary analyses of the motivation questions on the EQAO student questionnaire suggest that motivation and achievement are highly correlated. This hypothesis can be tested more thoroughly in subsequent analyses. EQR

Notes

1. These were students who were unable to respond in any way to more than seven performance assessments or students who would be adversely affected by participating.

2. It also shows the importance of using a multilevel model that takes simultaneous account of student-level, class-level and school-level effects in studies of student achievement. If the class-level effects were not used in the model, the variation among schools and among students would be overestimated. Moreover, Snijders and Bosker (1999) suggest that using class level in such studies improves the validity of hypothesis tests for added fixed effects.

3. In national assessments of U.S. 9-year-olds, girls consistently had higher reading scores than boys but there was no significant difference between the sexes for mathematics (Federal Interagency Forum on Child and Family Statistics 1998). The outcome measure here is a composite score of reading, writing and mathematics examination results.

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Appendix 1

Description of explanatory measures

Student-level measures

The 12 measures within student-level characteristics were derived from the student questionnaire, the student information form and the home questionnaire. Sex and language spoken at home were derived from the student questionnaire. Sex was coded 0 for boys and 1 for girls. Language spoken at home was coded 0 for English as the primary language and 1 for any other language.

The teacher completed the student information form. It provided five binary measures (coded 0 or 1) on the background of the student and two on the type of accommodations required during the performance assessments. These seven variables, which flagged students receiving special education support or needing help during the performance assessments, were used as control variables in the models.

Three of the family characteristics derived from the home questionnaire were in fact student characteristics. Two variables were used separately as a proxy for SES: the presence in the home of a computer and of more than 100 books. Both were coded 1 for the presence and 0 for the absence of the resource in the home. The last family characteristic, parental involvement with the school, was coded 1 if the parents were actively or somewhat involved and 0 otherwise.

Class-level measures

Teachers' characteristics and class environment were the two categories of class-level measures. A dummy variable representing teacher experience was coded 1 for teachers with 10 years or less of experience in primary (low elementary) grades and 0 for those with more than 10 years of experience. The reference group was teachers with more than 10 years of experience. The level of teachers' comfort with the curriculum was coded 1 for teachers who were least comfortable with the current curriculum and 0 for all the others. The level of teachers' comfort was a continuous measure, with the teachers least comfortable with the curriculum represented by the first quartile of that measure. Teaching practice was a standardized measure of 68 items representing how closely the teacher followed the suggested curriculum. There were 27 items directed at teaching practices for reading, 20 for writing and 21 for mathematics. Sample items included "How often do you have your Grade 3 students define words in context in their reading?" and "How often do you have your Grade 3 students apply mathematical rules within real-life or authentic contexts?" (A complete copy of the questionnaire is available in EQAO 1997).

The class environment consisted of the number of Grade 3 students in the classroom, three dummy variables for split-grade classes, and two dummy variables for access to a computer at school. A class was considered to be a split grade when it contained students from grades other than Grade 3. For each of these three dummy variables, the reference group—classrooms with a majority of Grade 3 students—was coded 0. These variables were coded 1 for classrooms with a majority of Grade 2 students, of Grade 4 students, or of students from other grades. The two dummy variables for access to a computer at school were coded 1 for limited access or no access, and 0 otherwise.

School-level measures

The environment of the school was measured with three variables derived from the information provided by EQAO. A continuum of the student enrolments of all schools in Ontario was divided into quartiles, with the first quartile representing the smallest schools and the fourth the largest schools. Two dummy variables used in the model were coded 1 for schools whose total enrolment fell in the first or fourth quartile and 0 otherwise. The type of school, derived from the school name, was coded 0 for Catholic schools and 1 for public schools.

The neighbourhood around an urban school was defined as all census enumeration areas (EAs)[1] that were fully contained within a 1.6-kilometre radius of the school. The neighbourhood of a rural school was defined as the census subdivision (CSD)[2] in which it was located.

From EA-level census data, we could create a profile for each school neighbourhood, including median household income; education level of adults (measured as the proportion of adults with less than a high school diploma); median age of the neighbourhood; the proportion of recent immigrants (people indicating that they had immigrated to Canada since 1990); and the youth unemployment rate. The distribution of median household income and rates of less than high school education were roughly normal and then centred with the Ontario schools' neighbourhood mean. Based on their distribution, youth unemployment rates, recent immigrant rates and median age were all categorized with two dummy variables.

Notes

1. An EA is a small geographic area in which the number of dwellings generally varies between a maximum of 440 in large urban areas and a minimum of 125 in rural areas (Statistics Canada 1999).

2. A CSD is the general term for a municipality or its equivalent, such as an Indian reserve, an Indian settlement or an unorganized territory (Statistics Canada 1999).

Appendix 2

Multilevel models

Empty model

The first multilevel model used in the analysis was the following:

$$Y_{ijk} = \beta_0 + v_{0k} + u_{0jk} + e_{0ijk} \quad (1)$$

This type of multilevel model is a 'null' or 'empty' three-level model. The empty model is used for three different purposes: 1) to decompose the total variance; 2) to estimate the intra-class correlation; and 3) as a base line, to measure how much of the variation is explained by the model. The empty model contains only an outcome variable y, the achievement measure; a fixed intercept term, β_0, interpreted as the provincial average; and three random effects associated with the intercept—at the school level (v_{0k}), the class level (u_{0jk}), and the student level (e_{0ijk}). These random effects are assumed to have a mean of 0 with variances $\mathrm{Var}(v_{0k}) = \sigma_v^2$, $\mathrm{Var}(u_{0jk}) = \sigma_u^2$ and $\mathrm{Var}(v_{0ijk}) = \sigma_e^2$ and to be mutually independent (see inner circle in Graph 1).

The total variance of Grade 3 student achievement is decomposed as the sum of the school-level, class-level and student-level variances:

$$\mathrm{Var}(y_{ijk}) = \mathrm{Var}(v_{0k}) + \mathrm{Var}(u_{0jk}) + \mathrm{Var}(e_{0ijk}) = \sigma_v^2 + \sigma_u^2 + \sigma_e^2. \quad (2)$$

The variances σ_v^2, σ_u^2 and σ_e^2 estimate the variation among schools, among classes and among students, respectively. It is, therefore, possible to decompose the variance at various levels to assess how much of the variation is due to students themselves and how much is due to classes and schools. Also, the empty model provides an initial estimate for the intra-class correlation in the school achievement. It is calculated as the sum of the class-level and school-level variances divided by the total variance of Grade 3 student achievement:

$$\rho(y_{ijk}, y_{i'jk}) = \frac{\sigma_v^2 + \sigma_u^2}{\sigma_v^2 + \sigma_u^2 + \sigma_e^2}, \quad (3)$$

where ρ is the intra-class correlation parameter representing the correlation between two students randomly selected from the same classroom. It could also be interpreted as the fraction of the total variance of Grade 3 student achievement that is due to contextual effects. The intra-class correlation is an important measure to justify the use of multilevel models and higher-level (class-level and school-level) factors in identifying more precisely the main factors influencing Grade 3 student achievement (Kreft and de Leeuw 1998, p.10). Finally, the empty model is used as a base line to estimate the variance reduction after factors are included in the model. In regression analysis, this variance reduction is also known as the difference between the unexplained and the explained variances.

Final model

The final three-level model expands the empty model by including control variables and statistically significant explanatory variables ($p \leq 0.01$) as fixed effects. The new model can be written as

$$y_{ijk} = \beta_0 + \beta_1 x_{1ijk} + \cdots + \beta_m x_{mijk} + \beta_{m+1} x_{m+1jk} + \cdots + \beta_n x_{njk} + \beta_{n+1} x_{n+1k} + \cdots + \beta_p x_{pk} + v_{0k} + u_{0jk} + e_{0ijk} \quad (4)$$

with m student-level explanatory variables (x_{ijk}), n-m class-level explanatory variables (x_{jk}), and p-n school-level explanatory variables (x_k). It is possible, therefore, from this model to identify and quantify the factors influencing Grade 3 student achievement.

In this type of model, the variance of the random terms can be interpreted as the remaining unexplained variances after controlling for the factors. In the three-level model, the three potential sources of variation—student-level, class-level and school-level—may be accounted for by the explanatory variables at their level or at a lower level. These variations can result from the socio-economic background of the students (student level), the way in which the teaching is organized and delivered (class level) or the profile of the community around the school (school level). The proportion of total explained variance proposed by Snijders and Bosker (1999) is calculated as

$$1 - \frac{\mathrm{Var}(y_{ijk} \mid \beta_0, \beta_1, \cdots, \beta_p, x_{1ijk}, \cdots, x_{mijk}, x_{m+1jk}, \cdots, x_{njk}, x_{n+1k}, \cdots, x_{pk})}{\mathrm{Var}(y_{ijk} \mid \beta_0)} \quad (5)$$

Using the above approach, the total variance of the fitted Grade 3 student achievement can be decomposed and the proportion of explained variation for each level can be estimated (see outer circle in Graph 1).

Appendix 3

Definitions

Enumeration area (EA): a small geographic area. The number of dwellings in an EA generally varies between a maximum of 440 in large urban areas and a minimum of 125 in rural areas (Statistics Canada 1999).

Census subdivision (CSD): a geographic area representing a municipality or its equivalent, such as an Indian reserve, an Indian settlement or an unorganized territory (Statistics Canada 1999).

Departure in point (or factor impact): the difference between the mark predicted with the multilevel model and the mark of the typical student, with both expressed as points between 0 and 100.

Dummy variable: A variable coded into 0 or 1 to reflect group membership. This coding permits comparison of mean scores of one group with those of another.

Multilevel model: A multilevel model is a formalized statistical expression enabling, in this case, the study of simultaneous effects of factors from different levels—student, classroom and school—on student achievement.

Neighbourhood: A neighbourhood is defined as the geographical area surrounding a school. For urban schools, it was defined as all census enumeration areas that were fully contained within a 1.6-kilometre radius of the school. For rural schools, it was defined as the census subdivision in which the school was located.

Social capital: At its most basic level, the term refers to the notion that how we associate with others has important implications for our well-being (Woolcock 2001). Individuals can posses social capital by having a large network of friends and acquaintances but social capital at the individual level can also be thought of as a type of social savvy, something akin to the concept of a high emotional quotient. On the other hand, many researchers consider social capital to be a property of a community, school or family (see discussion in Portes 1988). The place-based concept refers to the efficiencies and benefits (e.g., in school achievement, health, or the marketplace) gained by smooth social relationships based on trust and reciprocity.

Third International Mathematics and Science Study: Canada report[1]

The *Third International Mathematics and Science Study* (TIMSS) was designed to compare and contrast the teaching and learning of mathematics and science in elementary and secondary schools around the world. The study allows countries worldwide to learn from one another about the kinds of learning environments which are associated with high levels of student achievement. The goal of the study is to contribute to the improvement of the education of young people in these two major areas of the elementary and secondary school curriculum.

The first round of data collection for TIMSS occurred in 1995 (TIMSS-95) for grades 3, 4, 7, 8 and 12. Four reports were published on TIMMS-95 data that analysed the performance of Canadian students between 1996 and 1998. In 1999, a partial replication of the 1995 study was conducted at the Grade 8 level only (TIMSS–99). In 2003, researchers will collect a third round of data focussing upon students in grades 4 and 8.

Participants in TIMSS-99

Thirty-eight countries took part in TIMSS-99, of which twenty-six were participants in TIMSS-95.[2] They are indicated by asterisk in Table 1 below. TIMSS–99 focussed on Grade 8 or the equivalent, the highest level of schooling in most countries when students are still studying mathematics and science.

Table 1
Countries participating in TIMSS-99

Australia*	Hungary*	Macedonia	Slovak Republic*
Belgium (Flemish)*	Indonesia	Malaysia	Slovenia*
Bulgaria*	Iran*	Moldova	South Africa*
Canada*	Israel*	Morocco	Taiwan
Chile	Italy*	Netherlands*	Thailand*
Cyprus*	Japan*	New Zealand*	Tunisia
Czech Republic*	Jordan	Philippines	Turkey
England*	Korea*	Romania*	United States*
Finland	Latvia*	Russia*	
Hong Kong*	Lithuania*	Singapore*	

Note:
* *Countries that also participated in TIMSS-95.*

This article is adapted from a series of monographs based on the Third International Mathematics and Science Study *(TIMSS) by David Robitaille and Alan Taylor.*

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Statistics Canada selected a nationally representative sample of schools and classrooms. The sample included French and English public, private and separate schools. Newfoundland, Quebec, Ontario, Alberta and British Columbia elected to over-sample so that comparisons could be made at the provincial level.

The co-operation rates from Canadian schools were extremely high. About 8,800 Canadian students from 385 schools participated in TIMSS-99. Students wrote a 90-minute test in mathematics and science. They also completed a questionnaire about their opinions, attitudes and interests. The teachers and principals completed questionnaires, and specialists provided information about mathematics and science curricula.

Quality control

A rigorous quality control program ensured that the samples were nationally representative, the samples were gathered from comparable populations, the test items were unbiased, and the standards for data collection and data processing were high quality. Approximately one-third of the achievement test items used in TIMSS-99 were items that were used but unreleased from TIMSS-95. The remaining test items that were developed for the 1999 study were parallel in form and content to the released items they replaced. The pool of test items included multiple-choice items as well as items to which students had to construct responses. Translation of the test items and questionnaires was supervised and verified centrally.

Achievement highlights

- Canadian students had extremely good results in both mathematics and science; out of 38 countries, only 6 scored significantly higher than Canada. In science, only 5 countries had science scores that were significantly higher.

- Results for Canada and each of the provinces were significantly higher than the international average in both mathematics and science.

- Scores for Canadian students in both mathematics and science improved significantly between 1995 and 1999. Canada was one of two countries that showed a statistically significant improvement in both subjects.

- In 1999, students from Japan, Korea, Singapore and Taiwan had significantly higher scores than Canadian students in both mathematics and science.

- Canadian students had significantly higher scores in both mathematics and science than students from more than half the participating countries including Chile, Israel, Italy, New Zealand and the United States.

- In Canada, no gender differences were found among Grade 8 students in mathematics in either the 1995 or the 1999 studies. In science, an achievement gap was found in favour of boys in the TIMSS-99 results, and there was no such gap in TIMSS-95.

- Canadian science scores improved significantly in Quebec and Ontario, and for mathematics in Ontario between 1995 and 1999.

- Quebec students excelled in mathematics, placing among the top six countries, with scores significantly higher than the Canadian average. Scores from Alberta, British Columbia and Ontario were not significantly different from the Canadian average. The average mathematics score in Newfoundland was significantly lower than the Canadian average.

- Alberta students scored well in science, placing among the top five countries with scores significantly higher than the Canadian average. Averages for British Columbia, Ontario and Quebec were not significantly different from the Canadian average. Results from Newfoundland were significantly lower than the Canadian average.

- Canadian students had scores that were significantly higher than the international average on all five sub-tests in mathematics and on all six sub-tests in science.

- Generally, Canadian students felt more positive towards mathematics and science than their counterparts in other countries. Within the country, however, students in Quebec were less positive toward these subjects than those in other provinces.

- The age cohort of Grade 4 students tested in TIMSS-95 is the same cohort of students that was in Grade 8 for TIMSS-99. The achievement of this cohort of Canadian students improved by two scale points between the two studies.

Mathematics overview

Table 2 contains a summary of the results on the mathematics portion of TIMSS-99. For each participating country or province, the table shows the mean scale score, the

Table 2
Results of the mathematics test, TIMSS–99

Significantly higher than Canada				Similar to Canada				Significantly lower than Canada			
Country	Mean	Standard error	Age	Country	Mean	Standard error	Age	Country	Mean	Standard error	Age
Singapore	60	(0.6)	14.4	Netherlands	54	(0.7)	14.2	Latvia	51	(0.3)	14.5
Korea	59	(0.2)	14.4	Slovak Republic	53	(0.4)	14.3	**Newfoundland**	**50**	**(0.6)**	**14.0**
Taiwan	59	(0.4)	14.2	Hungary	53	(0.4)	14.4	United States	50	(0.4)	14.2
Hong Kong	58	(0.4)	14.2	**CANADA**	**53**	**(0.3)**	**14.0**	England	50	(0.4)	14.2
Japan	58	(0.2)	14.4	Slovenia	53	(0.3)	14.8	New Zealand	49	(0.5)	14.0
Quebec	**57**	**(0.5)**	**14.3**	**Alberta**	**53**	**(0.4)**	**13.9**	Lithuania	48	(0.4)	15.2
Belgium (Flemish)	56	(0.3)	14.1	Russia	53	(0.6)	14.1	Italy	48	(0.4)	14.0
				Australia	53	(0.5)	14.3	Cyprus	48	(0.2)	13.8
				British Columbia	**52**	**(0.6)**	**13.9**	Romania	47	(0.6)	14.8
				Finland	52	(0.3)	13.8	Moldova	47	(0.4)	14.4
				Czech Republic	52	(0.4)	14.4	Thailand	47	(0.5)	14.5
				Malaysia	52	(0.4)	14.4	Israel	47	(0.4)	14.1
				Ontario	**52**	**(0.3)**	**13.9**	Tunisia	45	(0.2)	14.8
				Bulgaria	51	(0.6)	14.8	Macedonia	45	(0.4)	14.6
								Turkey	43	(0.4)	14.2
								Jordan	43	(0.4)	14.0
								Iran	42	(0.3)	14.6
								Indonesia	40	(0.5)	14.6
								Chile	39	(0.4)	14.4
								Philippines	35	(0.6)	14.1
								Morocco	34	(0.3)	14.2
								South Africa	28	(0.7)	15.5

The Quebec mathematics mean was significantly higher than the Canadian mean. Means for Alberta, British Columbia and Ontario were not significantly different from the Canadian mean. The mean for Newfoundland was significantly lower than the Canadian mean.

standard error of the mean and the average age of the students in that country or province at the time they wrote the test.

National scale scores ranged from a high of 60 in Singapore to a low of 28 in South Africa. The Canadian mean was 53, and the international mean was 49. Out of 38 countries, only 6 had mathematics scores that were significantly higher than Canada. Canada's science score was significantly higher than those from 21 countries, and essentially the same as the scores from the other 10 countries.

Science overview

Table 3 contains a summary of the results on the science portion of TIMSS-99. For each participating country or province, the table shows the mean scale score, the standard error of the mean and the average age of the students in that country or province at the time they wrote the test.

National scale scores ranged from a high of 57 in Taiwan to a low of 24 in South Africa. The Canadian mean was 53, and the international mean was 49. Out of 38 countries, only 5 scored significantly higher than Canada in science. Overall, Canada's score was significantly higher than the scores from 21 countries, and similar to the scores of the other 11 countries.

Curriculum and instruction

- The average size of a Grade 8 class in Canada in either mathematics or science is around 27 pupils, somewhat lower than the international average of 31.

- There does not appear to be any simple relationship between class size and student achievement. Some high-scoring countries have large class sizes, while others have small class sizes.

- Calculators are used extensively in mathematics instruction in Canada. This usage is much higher than in most countries, with only four countries reporting higher rates. Very little use of calculators is reported in Japan, Korea and Taiwan.

- The percentage of Canadian students who have access to the Internet from home is 57%, second only to the United States at 59%. The vast majority of Canadian Grade 8 students—almost 90%—report they have access to the Internet from school. However, students also reported that very little use is made of computers or of Internet access in mathematics and science classrooms.

Table 3
Results of the science test, TIMSS–99

Significantly higher than Canada				Similar to Canada				Significantly lower than Canada			
Country	Mean	Standard error	Age	Country	Mean	Standard error	Age	Country	Mean	Standard error	Age
Taiwan	57	(0.4)	14.2	Netherlands	55	(0.7)	14.2	United States	52	(0.5)	14.2
Singapore	57	(0.8)	14.4	**British Columbia**	**54**	**(0.5)**	**13.9**	**Newfoundland**	**51**	**(0.6)**	14.0
Alberta	**56**	**(0.5)**	**13.9**	Australia	54	(0.4)	14.3	New Zealand	51	(0.5)	14.0
Hungary	55	(0.4)	14.4	**Quebec**	**54**	**(0.5)**	**14.3**	Latvia	50	(0.5)	14.5
Japan	55	(0.2)	14.4	Czech Republic	54	(0.4)	14.4	Italy	49	(0.4)	14.0
Korea	55	(0.3)	14.4	England	54	(0.5)	14.2	Malaysia	49	(0.4)	14.4
				Finland	54	(0.4)	13.8	Lithuania	49	(0.4)	15.2
				Slovak Republic	54	(0.3)	14.3	Thailand	48	(0.4)	14.5
				Belgium (Flemish)	54	(0.3)	14.1	Romania	47	(0.6)	14.8
				Slovenia	53	(0.3)	14.8	Israel	47	(0.5)	14.1
				CANADA	**53**	**(0.2)**	**14.0**	Cyprus	46	(0.2)	13.8
				Hong Kong	53	(0.4)	14.2	Moldova	46	(0.4)	14.4
				Russia	53	(0.6)	14.1	Macedonia	46	(0.5)	14.6
				Ontario	**52**	**(0.3)**	**13.9**	Jordan	45	(0.4)	14.0
				Bulgaria	52	(0.5)	14.8	Iran	45	(0.4)	14.6
								Indonesia	44	(0.5)	14.6
								Turkey	43	(0.4)	14.2
								Tunisia	43	(0.3)	14.8
								Chile	42	(0.4)	14.4
								Philippines	35	(0.8)	14.1
								Morocco	32	(0.4)	14.2
								South Africa	24	(0.8)	15.5

The science mean for Alberta was significantly higher than the Canadian mean. The means for British Columbia, Ontario and Quebec were not significantly different from the Canadian mean. The mean for Newfoundland was significantly lower than the Canadian mean.

- The length of the school year varies among countries from a low of about 160 days to a high of 251. The median across countries is 193. The average length of the school year in Canada is 188 days.

- The median number of hours spent in mathematics instruction per year at this grade level is 129. The average for Canada is 150 hours per year, with a low of 132 hours in British Columbia and a high of 174 in Newfoundland.

Some implications

The primary goal of studies such as TIMSS is to contribute to the development of a better understanding of what 'works' in the teaching and learning of mathematics and science. What can we learn from other countries about matters related to curriculum and methods of instruction? What kinds of instructional practices and what kinds of curricular arrangements are associated with higher levels of student achievement? How can we use this information to improve the educational experience of students in Canada and elsewhere? The TIMSS findings point to future areas of research. A number of these findings are listed below.

- The findings show that it is possible to have high expectations for student achievement. If students in countries such as Japan, Korea and Singapore can consistently achieve high levels of performance, then so can Canadian students. Results for Quebec in mathematics and for Alberta in science show that this is already happening in Canada.

- Generally, computers and Internet-based resources remain unused, despite their prevalence in Canadian schools. Similarly, there is an increasing supply of good instructional software and websites available to students and teachers.

- Almost all Canadian students—96% in mathematics and 94% in science—score at or above the 25th percentile. This is considerably higher than in some other industrialized countries, indicating that Canadian schools deal equitably with students from every socio-economic level.

- There is no 'magic bullet' in education, no single variable that accounts for the wide variation in achievement among countries or provinces. Every factor

such as class size, hours of instruction, or days in the school year work somewhat differently in different countries. Thus, large class sizes are associated with higher levels of achievement in some countries and with lower levels of achievement in others.

Current and future activities

The TIMSS data may identify directions that researchers should pursue in order to continue our national quest for excellence in education. Researchers need to carry out more sophisticated and multivariate analyses of these data. Funding needs to be provided at both the provincial and national levels to permit researchers to achieve these goals.

The TIMSS data sets from 1995 and 1999 are the kind of high quality data sets that researchers in many fields need in their work. Researchers from within the field of education, labour, economics and health have shown great interest in the data.

Within the field of education, the TIMSS data can be used to investigate important areas of interest to policy makers. These areas include teacher education programs, streaming and tracking of students, gender differences, the importance of out-of-school learning (especially in science), students' interests and future plans, as well as the relationship between a variety of instructional practices and students' achievement.

TIMSS-related activities that are currently in progress include papers dealing with the findings and their implications that are presented at academic and professional conferences around the world; articles published in a wide variety of journals; and application of the TIMSS findings by educators involved in curriculum revision, textbook writing and assessment. Policy makers in a number of countries have made extensive use of the TIMSS findings as part of the process leading to major changes in curriculum, testing practices, school organization and the like.

The most extensive use of the TIMSS data has been undertaken in the United States. Both federal and state levels of government have supported a wide variety of activities to ensure that the findings of the study were investigated in depth and used to help improve the teaching and learning of mathematics and science in American schools. In addition, the National Science Foundation and National Center for Education Statistics have provided funding for many studies involving secondary analysis of the TIMSS data.

More of this kind of secondary analysis needs to be done in Canada. The Canadian data should be analysed in light of the corresponding information from other countries of interest to Canadians. Human Resources Development Canada and the Ontario Ministry of Education have supported such activity, but these have been relatively small-scale projects. Much more can and should be done to ensure that the data sets are used to provide as much information as possible.

Another round of TIMSS testing is scheduled for 2003, this time involving both Grade 4 and Grade 8. Canada should be represented in that study. The decision needs to be made soon if we are able to contribute to the study's design development and specifications.

Notes

1. In this report, references are made to differences being significant or statistically significant. The expression 'significantly different,' as used here, means that we are 95% certain that the difference is real and not attributable to chance.

2. For a summary of the Canada report for Grade 8, see "Third International Mathematics and Science Study: Canada report, Grade 8," *Education Quarterly Review* (1998, Vol. 4, no. 3).

Data availability

announcements

Data releases

In this section we provide the titles of data released by the Centre for Education Statistics since the publication of the previous issue of Education Quarterly Review. *Details on each release can be accessed free of charge from Statistics Canada's website* www.statcan.ca. *Click on "The Daily" and "Previous issues."*

- Registered Apprenticeship Training, 1999 (released August 15, 2001)
- University finances, 1999–2000 (released July 30, 2001)
- Trends in the use of private education, 1987–1988 to 1998–1999 (released July 4, 2001) EQR

Current data

Data series	Most recent data: Final[1]	Most recent data: Preliminary or estimate[2]
A. Elementary/secondary		
Enrolment in public schools	1998–1999	1999–2000[e] 2000–2001[e]
Enrolment in private schools	1998–1999	1999–2000[e]
Enrolment in minority and second language education programs	1998–1999	
Secondary school graduation	1998–1999	
Educators in public schools	1998–1999	1999–2000[e] 2000–2001[e]
Educators in private schools	1997–1998	1998–1999[e] 1999–2000[e]
Elementary/secondary school characteristics	1998–1999	1999–2000[e]
Financial statistics of school boards	1997–1998	
Financial statistics of private academic schools	1995–1996	1996–1997[p]
Federal government expenditures on elementary/secondary education	1997–1998	1998–1999[p] 1999-2000[e]
Consolidated expenditures on elementary/secondary education	1997–1998	1998–1999[p] 1999–2000[e]
Education Price Index	1998	
B. Postsecondary		
University enrolments	1998–1999	discontinued
University degrees granted	1998	discontinued
University continuing education enrolment	1996–1997	discontinued
Educators in universities	1998–1999	1999–2000[e]
Salaries and salary scales of full-time teaching staff at Canadian universities	1999–2000	
Tuition and living accommodation costs at Canadian universities	2000–2001	
University finance	1998–1999	1999–2000[p]
College finance	1997–1998	1998–1999[p] 1999–2000[e]
Federal government expenditures on postsecondary education	1997–1998	1998–1999[p] 1999–2000[e]
Consolidated expenditures on postsecondary education	1997–1998	1998–1999[p] 1999–2000[e]
Community colleges and related institutions: enrolment and graduates	1998–1999	1999–2000[e]
Trade/vocational enrolment	1998–1999	1999–2000[e]

See notes at end of this table.

Current data (concluded)

Data series	Most recent data: Final[1]	Most recent data: Preliminary or estimate[2]
College/trade teaching staff	1997–1998	1998–1999[p]
International student participation in Canadian universities	1998–1999	

C. Publications[3]

Education in Canada (2000)

South of the Border: Graduates from the class of '95 who moved to the United States (1999)

Leaving school (1993)

After High School, the First Years (1996)

Adult education and training survey (1995)

A report on adult education and training in Canada: Learning a living (1998)

International student participation in Canadian education (1993–1995)

Education Price Index – methodological report

Handbook of education terminology: elementary and secondary level (1994)

Guide to data on elementary secondary education in Canada (1995)

A Guide to Statistics Canada Information and Data Sources on Adult Education and Training (1996)

A Statistical Portrait of Elementary and Secondary Education in Canada – Third edition (1996)

A Statistical Portrait of Education at the University Level in Canada – First edition (1996)

The Class of '90: A compendium of findings (1996)

The Class of '90 Revisited (1997)

The Class of '95: Report of the 1997 National Survey of 1995 Graduates (1999)

Education indicators in Canada: Report of the Pan–Canadian Indicators Program (1999)

Education at a Glance: OECD Indicators (2000)

In Pursuit of Equity in Education: Using International Indicators to Compare Equity Policies (2001)

Literacy, Economy and Society (1995)

Literacy Skills for the Knowledge Society (1997)

Literacy in the Information Age (2000)

International Adult Literacy Survey Monograph Series

Benchmarking Adult Literacy in North America: An International Comparative Study (2001)

Growing Up in Canada: National Longitudinal Survey of Children and Youth (1996)

Children and youth at risk: Symposium report

Notes:

1. *Indicates the most recent calendar year (e.g., 1993) or academic/fiscal year (e.g., 1993–1994) for which final data are available for all provinces and territories.*
2. *Indicates the most recent calendar year (e.g., 1995) or academic/fiscal year (e.g., 1996–1997) for which any data are available. The data may be preliminary (e.g., 1995[p]), estimated (e.g., 1995[e]) or partial (e.g., data not available for all provinces and territories).*
3. *The year indicated in parentheses denotes the year of publication. Some of these publications are prepared in co-operation with other departments or organizations. For information on acquiring copies of these reports, please contact Client Services, Culture, Tourism and the Centre for Education Statistics. Telephone: (613) 951-7608, toll free 1 800 307-3382; Fax: (613) 951-9040) or E-mail: educationstats@statcan.ca.*

Education at a glance

This section provides a series of social, economic and education indicators for Canada and the provinces/territories. Included are key statistics on the characteristics of the student and staff populations, educational attainment, public expenditures on education, labour force employed in education, and educational outcomes.

Table 1
Education indicators, Canada, 1981 to 1999

Indicator[1]	1981	1986	1991	1992	1993	1994	1995	1996	1997	1998	1999
	thousands										
Social context											
Population aged 0–3	1,448.7	1,475.0	1,573.4	1,601.7	1,610.6	1,596.1	1,595.1	1,578.6	1,560.7	1,550.7	1,453.9
Population aged 4–17	5,480.3	5,204.7	5,395.4	5,437.7	5,484.7	5,536.4	5,620.7	5,691.4	5,754.0	5,795.7	5,725.6
Population aged 18–24	3,493.1	3,286.3	2,886.1	2,869.2	2,869.6	2,852.0	2,823.4	2,816.8	2,833.0	2,865.4	2,895.9
Total population	24,900.0	26,203.8	28,120.1	28,542.2	28,940.6	29,248.1	29,562.5	29,963.7	30,358.5	30,747.0	30,553.8
Youth immigration[r]	42.8	25.9	61.2	61.2	73.1	68.3	65.9	66.3	70.4	61.2	..
	%										
Lone-parent families	16.6	18.8	15.3	14.4	14.8	14.9	15.1	14.8	14.9	..	..
Economic context											
GDP: Real annual percentage change	4.0	3.1	-1.8	-0.6	2.2	4.1	2.3	1.5	..	..	..
CPI: Annual percentage change	12.4	4.2	5.6	1.5	1.8	0.2	2.2	1.7	1.7	1.0	1.9
Employment rate	60.0	59.6	59.7	58.4	58.0	58.4	58.8	58.5	59.0	59.7	60.6
Unemployment rate	7.6	9.7	10.3	11.2	11.4	10.4	9.4	9.7	9.1	8.3	7.6
Student employment rate	..	34.4	38.0	35.1	34.0	34.2	33.3	34.8	32.5[2]	..	..
Families below low income cut-offs:											
Two-parent families	10.2	10.9	10.8	10.6	12.2	11.5	12.8	11.8	12.0	..	..
Lone-parent families	48.4	52.5	55.4	52.3	55.0	53.0	53.0	56.8	51.1	..	..
Enrolments	thousands										
Elementary/secondary schools	5,024.2	4,938.0	5,218.2	5,284.1	5,327.8	5,362.8	5,441.4	5,414.6	5,386.3	5,483.9[e]	5,524.9[e]
	%										
Percentage in private schools	4.3	4.6	4.7	4.9	5.0	5.1	5.1	5.2	5.3	5.3[e]	..
	thousands										
College/trade/vocational, full-time[3]	..	238.1	275.9	266.7	306.5	298.5	269.1	266.4[e]	264.5[e]	..	..
College/postsecondary, full-time	273.4	321.5	349.1	364.6	369.2[r]	380.0[r]	391.3[r]	397.3[r]	398.6	403.5[r]	409.4[e]
College/postsecondary, part-time[4]	..	96.4[e]	125.7[e]	106.6[e]	98.4	90.8	87.7	87.1	91.6	91.4	..

See notes at end of this table.

Table 1
Education indicators, Canada, 1981 to 1999 (concluded)

Indicator[1]	1981	1986	1991	1992	1993	1994	1995	1996	1997	1998	1999
						thousands					
Full-time university	401.9	475.4	554.0	569.5	574.3	575.7	573.2	573.6	573.1[r]	580.4	..
Part-time university	251.9	287.5	313.3	316.2	300.3	283.3	273.2	256.1	249.7	246.0	..
Adult education and training	..	..	5,504	..	5,842	..	..	..	6,069	..	..
						%					
Participation rate	..	..	27	..	28	..	..	..	26	..	..
Graduates						thousands					
Secondary schools[5]	..	..	260.7	272.9	281.4	280.4	295.3	300.2[r]	296.4[r]	300.8[e]	..
College/trade/vocational[6]	..	145.0	159.7	158.8	163.9	151.1	144.2	141.5[e]	138.7[e]	..	..
College/postsecondary	71.8	82.4	85.9	92.5	95.2	97.2	100.9	105.0	105.9[e]	..	..
University/Bachelor's	84.9	101.7	114.8	120.7	123.2	126.5	127.3	128.0	125.8	124.9	..
University/Master's	12.9	15.9	18.0	19.4	20.8	21.3	21.4	21.6	21.3	22.0	..
University/Doctorate	1.8	2.2	2.9	3.1	3.4[e]	3.6	3.7	3.9	4.0	4.0	..
Full-time educators											
Elementary/secondary schools	274.6	269.9	302.6	301.8	295.4	295.7[e]	298.7[e]	294.4[e]	296.8[e]	295.9[e]	295.9[e]
College/postsecondary/trade/ vocational	26.8[7]	30.6[7]	31.7[7]	31.8[7]	32.2[7]	31.0[7]	30.9[r]	31.5[r]	31.0[r]	32.1[e]	..
University	33.6	35.4	36.8	37.3	36.9	36.4	36.0	34.6	33.7	33.7[e]	..
						ratio					
Elementary/secondary pupil–educator ratio	17.0	16.5	15.5	15.7[e]	16.1[e]	16.1[e]	16.1[e]	16.3[e]	16.3[e]	16.5[e]	16.6[e]
Education expenditures						$ millions					
Elementary/secondary	16,703.2	22,968.0	33,444.9	34,774.5	35,582.3	35,936.0	36,424.7	36,744.7	36,973.1[p]	37,453.8[e]	37,498.9[e]
Vocational	1,601.2	3,275.1	4,573.8	5,380.9	5,631.2	6,559.0	6,185.2	5,301.8	5,896.9[p]	5,903.4[e]	6,229.6[e]
College	2,088.1	2,999.0	3,870.7	4,075.3	4,105.9	4,207.1	4,531.8	4,477.9	4,642.0[p]	4,808.9[e]	5,261.7[e]
University	4,980.7	7,368.7	11,254.8	11,569.8	11,736.8	11,857.9	11,802.0	11,600.7	12,255.4[p]	12,660.5	12,874.9[e]
Total education expenditures	25,373.2	36,610.8	53,144.2	55,800.5	57,056.2	58,560.0	58,943.7	58,125.1	59,767.4[p]	60,826.6	61,865.1
						%					
As a percentage of GDP	7.1	7.3	7.9	8.1	8.0	7.8	7.6	7.1	6.9	6.8	..

Notes:

.. *Figures not available.*

[r] *Revised figures.*

[e] *Estimated figures.*

1. *See 'Definitions' following Table 2.*
2. *The figure is for April 1997.*
3. *The enrolments have all been reported as full-time based on a'full-day' program, even though the duration of the programs varies from 1 to 48 weeks.*
4. *Excludes enrolments in continuing education courses, which had previously been included.*
5. *Source: Canadian Education Statistics Council. (Excludes adults for Quebec, Ontario and Alberta equivalencies.)*
6. *The majority of trade and vocational programs, unlike graduate diploma programs which are generally two or three years' duration, are short programs or single courses that may require only several weeks. A person successfully completing these short-duration programs or courses is considered a completer, not a graduate. These completers do not include persons in part-time programs.*
7. *Figures have been revised to include a complete count of staff in trade programs.*

Table 2
Education indicators, provinces and territories

Indicator[1]	Canada	Newfound-land	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario
				%			
Social and economic context							
Educational attainment,[2] 1999:							
Less than secondary diploma	26.8	38.4	35.7	30.8	32.9	33.0	24.1
Graduated from high school	19.3	14.1	15.1	14.0	19.9	15.8	21.0
Some postsecondary	6.9	4.8	5.5	5.6	4.5	5.4	7.2
Postsecondary certificate, diploma or university degree	47.0	42.6	43.8	49.5	42.8	45.7	47.6
Labour force participation rates by educational attainment, 1999:							
Total	66.0	58.5	65.7	60.8	60.8	63.4	66.9
Less than secondary diploma	40.0	34.5	47.0	36.2	36.2	37.5	40.2
Graduated from high school	69.6	64.4	73.7	66.8	69.1	70.1	68.8
Some postsecondary	71.8	63.0	71.4	70.0	67.9	70.3	72.1
Postsecondary certificate, diploma or university degree	78.5	77.8	77.0	73.4	75.1	79.0	78.9
Unemployment rate, 1999	6.3	15.1	13.4	7.8	8.9	8.1	5.0
Costs							
Public and private expenditures on education as a percentage of GDP, 1994–1995	7.0	9.9	7.6	7.6	7.4	7.6	6.8
Public expenditures on education as a percentage of total public expenditures, 1994–1995	13.6	16.9	10.8	9.7	11.2	13.8	14.2
Elementary/secondary pupil–educator ratio, 1997–1998	16.4 r	14.6	17.2	17.5	17.6	14.6 r	16.7 r
Educational outcomes							
Secondary school graduation rates, 1996–1997	73.4	80.2	85.6	80.7	86.0	75.9[3,4]	72.0
University graduation rate, 1997–1998	35.2 r	31.4 r	21.0 r	53.5 r	32.9 r	41.8 r	36.7
Unemployment rate by level of educational attainment, 1999							
Less than secondary diploma	10.4	25.4	23.6	13.0	15.7	12.7	7.7
Graduated from high school	6.3	16.7	15.3	6.6	8.9	8.4	5.1
Some postsecondary	7.1	9.2	5.7	5.8	5.9	9.8	6.6
Postsecondary certificate, diploma or university degree	5.0	10.7	8.1	6.6	6.5	6.2	4.1

See notes at end of this table.

Table 2
Education indicators, provinces and territories (concluded)

Indicator[1]	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon	Northwest Territories
			%			
Social and economic context						
Educational attainment,[2] 1999:						
Less than secondary diploma	30.9	31.4	21.6	20.5	..	..
Graduated from high school	18.3	18.8	19.9	22.6	..	..
Some postsecondary	6.8	7.9	8.2	8.8	..	..
Postsecondary certificate, diploma or university degree	44.0	41.9	50.3	48.1	..	..
Labour force participation rates by educational attainment, 1999:						
Total	66.8	67.5	73.1	65.8	..	..
Less than secondary diploma	44.5	44.6	50.4	39.8	..	..
Graduated from high school	72.1	77.5	75.4	66.5	..	..
Some postsecondary	75.9	73.5	77.5	69.0	..	..
Postsecondary certificate, diploma or university degree	78.9	79.1	81.2	76.0	..	..
Unemployment rate, 1999	4.6	4.8	4.4	7.2	..	..
Costs						
Public and private expenditures on education as a percentage of GDP, 1994–1995	7.8	7.4	5.4	6.5	11.3	16.6
Public expenditures on education as a percentage of total public expenditures, 1994–1995	12.9	13.8	13.2	12.2	10.4	12.0
Elementary/secondary pupil–educator ratio, 1997–1998	16.3	17.3	17.8 r	17.5	13.2	13.1
Educational outcomes						
Secondary school graduation rates, 1996–1997	78.1	78.8	64.7	70.5	37.3	24.6
University graduation rate, 1997–1998	31.3 r	34.1 r	26.8 r	24.5 r	..	..
Unemployment rate by level of educational attainment, 1999						
Less than secondary diploma	6.8	7.9	5.6	12.8	..	..
Graduated from high school	4.2	3.9	3.9	8.1	..	..
Some postsecondary	4.7	5.6	5.2	7.3	..	..
Postsecondary certificate, diploma or university degree	3.8	3.7	3.9	5.6	..	..

Notes:
.. Figures not available.
r Revised figures.
1. See 'Definitions' following Table 2.
2. Parts may not add up to 100% due to rounding.
3. Starting in 1995, Quebec graduate data for regular day programs include individuals over the age of 20 who graduated from regular day programs.
4. Excludes "Formation professionnelle."

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Definitions

Education indicators, Canada

Table 1.
Year references are as follows: (1) *population* refers to July of the given year; (2) *enrolment* and *staff* refer to the academic year beginning in September of the given year; (3) *graduates* refers to number of persons graduating in the spring or summer of the given year; (4) *expenditures* refers to the fiscal year beginning in April of the given year.

1. **Youth immigration**
   The number of persons aged 0 to 19 who are, or have been, landed immigrants in Canada. A landed immigrant is a person who is not a Canadian citizen by birth, but who has been granted the right to live in Canada permanently by Canadian immigration authorities.

2. **Lone-parent families**
   The number of lone-parent families expressed as a percentage of the total number of families with children. A lone parent refers to a mother or a father, with no spouse or common-law partner present, living in a dwelling with one or more never-married sons and/or daughters. Sources: Statistics Canada, 1971 to 1986: *Lone-parent families in Canada*, Catalogue no. 89-522-XPE; 1991 to present: Small Area and Administrative Data Division.

3. **Gross domestic product**
   The unduplicated value of production originating within the boundaries of Canada, regardless of the ownership of the factors of production. GDP can be calculated three ways: as total incomes earned in current production; as total final sales of current production; or as total net values added in current production. It can be valued either at factor cost or at market prices. Source: Statistics Canada, Industry, Measures and Analysis Division.

4. **Consumer Price Index**
   The Consumer Price Index (CPI) is an indicator of changes in consumer prices. It is defined as a measure of price change obtained by comparing, over time, the cost of a specific basket of commodities. Figures are annual averages.

5. **Employment rate**
   The number of persons employed expressed as a percentage of the population 15 years of age and over, excluding institutional residents. Figures are annual averages.

6. **Unemployment rate**
   The number of unemployed persons expressed as a percentage of the labour force.

7. **Student employment rate**
   The number of persons aged 15 to 24 attending school on a full-time basis who were employed during the calendar year (excluding May through August), expressed as a percentage of the total number of full-time students 15 to 24 years of age.

8. **Families below low income cut-offs**
   Low income cut-offs are a relative measure of the income adequacy of families. A family that earns less than one-half of the median adjusted family unit income is considered to be in difficult circumstances. The set of low income cut-offs is adjusted for the size of the area of residence and for family size. Source: Statistics Canada, *Low Income Persons, 1980 to 1995*, December 1996, Catalogue no. 13-569-XPB/XIB.

9. **Adult education participation rate**
   The number of persons 17 years of age or over participating in adult education or training activities, expressed as a percentage of the total population 17 years of age or over. Excludes regular full-time students who are completing their initial schooling.

10. **Elementary/secondary pupil–educator ratio**
    Full-time equivalent enrolment (enrolment in grades 1 to 12 [including Ontario Academic Credits] and ungraded programs, pre-elementary enrolment in provinces where attendance is full time, and half of the pre-elementary enrolment in other provinces) divided by the full-time equivalent number of educators.

11. **Education expenditures**
    Includes expenditures of governments and of all institutions providing elementary/secondary and postsecondary education, and vocational training programs offered by public and private trade/vocational schools and community colleges.

Education indicators, provinces and territories

Table 2.
The methodologies used to derive the indicators in Table 2 may differ from those used in other statistical tables of this section.

12. Educational attainment and labour force participation rates
Refers to the population aged 25 and over. Source: Statistics Canada, Labour Statistics Division.

13. Secondary school graduation rate
Source: Statistics Canada, 2001, Centre for Education Statistics, *Education in Canada 2000,* Catalogue no. 81-229-XPB.

14. University graduation rate
Number of degrees awarded at the undergraduate level, as a percentage of the population aged 22.

15. Unemployment rate by level of educational attainment
The number unemployed with a given level of education expressed as a percentage of the labour force with the same education for the population aged 25 and over. Upper secondary includes the final grade of secondary school. EQR

In upcoming issues

The following articles are scheduled to appear in upcoming issues of *Education Quarterly Review:*

Determinants of science and technology skills

Using data from the *Third International Mathematics and Science Study* and the National Graduates Survey, this study looks at the development of science and technology skills, from Grade 4 to Grade 8, through high school and university, and into the work force. One important finding is that the greatest attrition from the science stream appears to occur in late primary school and continues into high school.

Labour market performance of liberal arts and sciences university graduates

The labour market experiences of liberal arts and sciences university graduates are examined using data from the Survey of Labour and Income Dynamics. The paper examines dynamic issues, including occupational mobility and wage growth. Evidence is offered to suggest that the skills of the liberal arts and sciences group are more portable across industrial and occupational sectors.

Family income and participation in postsecondary education

This analysis looks at family income and its impact on participation in postsecondary education. It suggests that parents' education has a stronger effect than income on the likelihood of children going on to postsecondary education. In addition to the involvement of parents in their children's education, other important factors include aspirations, values and motivations that facilitate educational attainment.

Income prospects of British Columbia university graduates

Using tax and administrative records of British Columbia bachelor's graduates, income of graduates is examined with a focus on changes in income over time, as well as differences across major fields of study.

Female engineering graduates in Ontario: Success in the labour market

Using data from Statistics Canada's University Student Information System and the T-1 Family File, this article examines a series of questions of interest to students preparing to enter postsecondary studies, as well as to teachers, counselors and companies in the technology sector: What is the potential for earnings and growth in engineering? How has the proportion of female graduates in engineering changed over time? How do engineering incomes compare to incomes in other fields of study?

EQR

Cumulative index

This index lists all analytical articles published in *Education Quarterly Review*. Included are descriptions of education and education-related surveys conducted by Statistics Canada, provincial governments and institutions. The categories under which the articles appear are based on policy issues identified in the report *Strategic Plan (1997),* released by the Centre for Education Statistics in November 1997 and available on the Internet at address www.statcan.ca/cgi-bin/downpub/freepub.cgi

Education funding

Student flows, student mobility and transitions

Relationships between education and the labour market

Technology and learning

Accessibility

Alternative forms of education delivery

Teacher issues

Student participation and performance

Foreign students and marketing of education internationally

Satisfaction

Education data sources