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International Adult Literacy Survey

Gaining and Losing Literacy Skills Over the Lifecourse

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Acronyms

ALL – Adult Literacy and Lifeskills Survey

GDP – Gross Domestic Product

IALS – International Adult Literacy Survey

OECD – Organization for Economic Cooperation and Development

PISA – Programme for International Student Assessment

UNESCO – United Nations Educational, Scientific and Cultural Organization

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Introduction

> The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes, and which consist always either in the immediate produce of that labour, or in what is purchased with that produce from other nations.
>
> According therefore as this produce, or what is purchased with it, bears a greater or smaller proportion to the number of those who are to consume it, the nation will be better or worse supplied with all the necessaries and conveniences for which it has occasion
>
> Adam Smith, 1776, Book One.

The policy community has for some time recognized that human capital – what workers know and can put to productive use – plays an important role in the social and economic development of nations (Becker, 1964; Schultz, 1963). As noted in the quote above Adam Smith, author and one of the world's first economists, was among the first to comment on the importance of human capital to the wealth of nations. More recently John Kenneth Galbraith, a noted Canadian-born economist, identified literacy as a key aspect of human capital and a central pillar of economic development:

> People are the common denominator of progress. So…no improvement is possible with unimproved people, and advance is certain when people are liberated and educated. It would be wrong to dismiss the importance of roads, railroads, power plants, mills and the other familiar furniture of economic development…But we are coming to realize…that there is a certain sterility in economic monuments that stand alone in a sea of illiteracy. Conquest of illiteracy comes first (Galbraith, 1958).

Smith and Galbraith's intuition has recently been confirmed by empirical evidence. Differences among 14 OECD countries in the stock of human capital, as reflected in average levels of adult literacy skills, explains over half (55%) of differences in long term growth rates in GDP per capita, one of the key measures of economic performance (Coulombe, Tremblay, and Marchand, 2005). In addition to this "level" effect, Coulombe also identifies a distributional effect in which the percentage of adults with very low literacy skills[1] appears to reduce the long-term growth rate of Gross Domestic Product (GDP) per capita as well as productivity in those countries with higher percentages of such adults.

Learning, including the acquisition of literacy skills, takes place over the life course in a diverse variety of contexts. Countries can influence the stock of human capital that is available to the economy and society by increasing the output of learning systems – the quantity and average quality of learning – at all ages. For example, learning output can be increased by improving the level of maternal health, the quality of early childhood experience, the quality of primary education, the quality and average duration of secondary education, the quality and average duration of post-secondary education, and the incidence and duration of formal and informal learning undertaken by adults.[2] Learning output can also be increased by increasing the efficiency of the learning process in each of these systems, either by increasing the incentives

to learn, the efficiency of markets that select and reward skill, the adoption of more productive instructional technologies and by providing individuals with the tools to be independent learners.

Canada is among a select group of countries that invested heavily in increasing its stock of human capital, expending an average of 7% of GDP on education in the post-war period. Much of this investment has gone to increasing the quality of the early childhood experience and the quality and quantity of initial formal education. As a result Canada now boasts one of the world's highest levels of educational attainment. Canada also ranks among the world's elite in terms of the quality of its secondary education system, consistently placing in the top tier of international comparisons of reading, mathematics and science (Beaton *et al.*, 1996; Willms, 2006).

However, the recent findings from the International Adult Literacy Survey (IALS) and the 2003 Adult Literacy and Life Skills Survey (ALL) suggest that Canada's stock of human capital may not be increasing as rapidly as expected, at least as measured by increases in the average levels of adult literacy (Willms, 2005). It seems that this lack of progress can be attributed to the fact that improvements in literacy skill flowing from the initial education system are being eroded by significant levels of literacy skill loss in adulthood. This is troubling given the relationships between literacy and overall economic performance, and between literacy and measures of individual success such as wages, health outcomes and social engagement. At a minimum, literacy skill loss erodes the public and private returns on investments in its acquisition and denies both individuals and the economy the benefits associated with strong literacy skills.

This study uses data from IALS and ALL to explore how Canada's stock of literacy skill evolved over the nine year period from 1994 to 2003. It employs a synthetic cohort analysis to document net skill change for various demographic groups for Canada and the provinces and to explore the individual characteristics that influence whether a particular group has gained or lost skill on average over the nine year reference period. The analysis reveals the presence of significant literacy skill loss in adulthood, loss that would seem to be concentrated in adults from lower socio- economic backgrounds. Given the influence that literacy skill appears to exert upon individual labour market success and the overall performance of the economy understanding what underlies the loss and what, if anything, should be done by individuals, institutions or governments to slow or reverse the process, should be a priority.

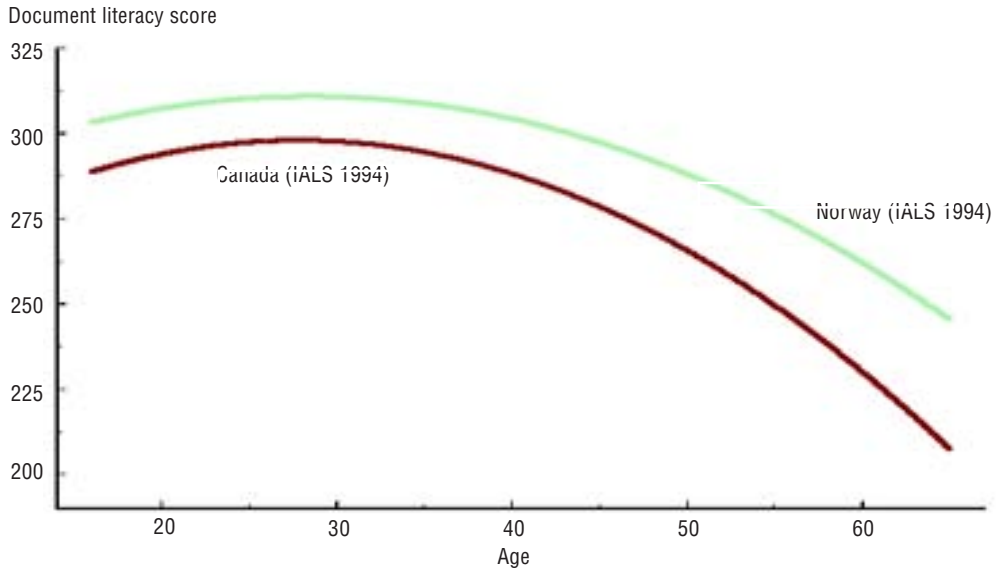
Skill loss and age

A plausible explanation for the skill loss in Canada is that, on average, people lose skills as they age, and Canada has an aging population. Chart 1 shows the relationship between document literacy skills and age for Canada and Norway, based on data from the 1994 IALS. The IALS and ALL studies measured slightly different sets of skill domains;[3] however, the prose literacy and document literacy measures were virtually identical for the two surveys, and therefore afforded data that can be compared across cohorts. We chose document literacy skills for these analyses because they generally have a stronger relationship than prose literacy with occupational attainment and earnings (Statistics Canada and the Organization for Economic Cooperation and Development, 2005).

The results show a marked decease in skills associated with age for individuals above the age of 30 in both countries. However, this relationship is stronger in Canada than in Norway. Some of the effects of age are associated with the level of education attained by adults in both countries, as well as other factors. Therefore, we pose the question: "Could the distribution of literacy skills in Canada be comparable to that of Norway?"

Chart 1

Average document literacy scores versus age for Norway and Canada, 1994



Why skill loss matters

The existence of significant levels of adult literacy skill loss is troubling in several respects. First, many observers argue that Canada's future economic and social development depends on our collective ability to compete in global markets. As citizens we share an interest in understanding what factors will influence our relative success, including those things over which we have some control, either as individuals or through the actions of our institutions or our governments.

The Canadian economy is much more dependent on trade than most other countries, a fact that implies that Canada's firms will feel any shift in the terms of trade more rapidly than others. Traditionally, Canada's wealth has depended on low skill resource extraction. Canada is, however, becoming far more reliant on knowledge and skill intensive output, a trend that is currently masked by high commodity prices (Kanagarajah, 2003; Statistics Canada, 2004; Yan, 2005). Even our primary industries – fishing, farming, forestry, and mining – have become much more skill, knowledge and capital intense as they struggle to become more productive and to compete on global markets.

This analysis documents skill loss that is large enough to offset the skill gain that should have resulted from increases in educational investment over the period of 1994 - 2003. Skill loss of this magnitude could stem from demand deficiencies, problems in the quality of skill supply or inefficiencies in markets for skill or some mix of the three. Governments need to understand the relative impact of each of these factors if they are to know if, or where, they have to intervene. The fact that some of Canada's economic peers have chosen to invest heavily in literacy – to raise levels of literacy skill demand, to increase the quantity, quality and equity of literacy skill supply and the efficiency of markets for literacy – suggests that Canadian public policy makers need to consider action of some sort.[4] Also there is growing evidence that inaction will incur a large penalty. The global supply of economically productive skills is growing rapidly, and, like any commodity, the price can be expected to fall (UNESCO, 2005; Murray, 2005). Thus, governments must devote increasing energy and resources to understanding and managing their human capital (Murray 2005). Understanding and managing the demand for skill, the adequacy of supply and the efficiency of markets for skill that match the two is simply a matter of economic self interest.

Second, skill loss erodes the return on investment in what is largely publicly funded education. Education absorbs a significant share of public expenditures and it is in our collective interest to see that we get a good return on this investment. Canadian's taxes also pay for the delivery of other public goods and services, including health and social services, the demand for which, and cost of, depend to a considerable extent on the literacy skill of those being served.

Third, previous analyses of the IALS and ALL data indicate youth and adults from lower socioeconomic backgrounds have significantly lower levels of educational attainment than those from higher socioeconomic backgrounds (Statistics Canada and Organisation for Economic Cooperation and Development, 2005; Organisation for Economic Cooperation and Development and Statistics Canada, 2000). If the skill loss associated with aging is greater for people from poorer economic circumstances, then it raises concerns about equity and the ability of different groups to compete fairly in markets that select upon and reward skill, including the labour market and adult education markets – a serious concern, since Canadians pride themselves on affording their citizens with equal opportunity (Human Resources Development Canada, 2002; Maxwell, 1995).

The link between literacy skill and outcomes in Canada's labour markets, health systems, educational systems, and social systems is among the strongest in the world. For example, analyses of the degree to which literacy skill explains wage differences has revealed that literacy skill explains a higher proportion of individual wage in Canada than all other countries for which IALS data are available, fully 33% (Organisation for Economic Cooperation and Development and Human Resources Development Canada, 1997). While it can be argued that this is economically efficient, such efficiency imposes huge costs upon those Canadians with low levels of literacy skill. Skill loss will only serve to increase already high levels of social inequality in key outcomes like employability and wage rates. Reducing inequality in skill would help to reduce inequality over a range of outcomes.

Finally, there is a significant amount of evidence that human capital will become an increasingly important input, one that allows Canadian firms to adopt the more knowledge and skill intense technologies and work organizations that will keep us competitive in the global economy (Brink, 2002; Krahn and Lowe, 1998). There is considerable evidence that the rate at which Canadian workers will be able to adopt productivity-enhancing information and communication technologies will depend upon their literacy levels (Statistics Canada and Organisation for Economic Cooperation and Development, 2005). The importance of lifelong learning to economic performance was summarized nicely by Marshal McLuhan, who wrote: "In the age of electricity and automation, the globe becomes a community of continuous learning, a single campus in which everybody, irrespective of age, is involved in learning a living" (McLuhan, 1969, p. 41). If McLuhan is right then literacy – the ability to solve problems using information gleaned from the printed word, to be an efficient independent learner and applier of technology – becomes a skill that no Canadian adult can afford to be without and a key foundation of our future economic prosperity.

Age, period, and cohort effects

Canadians share an interest in documenting the level and pace of change in key social and economic outcomes and in understanding processes that underlie the observed change. This knowledge allows both citizens and policy makers to make more informed choices about how and where to invest their scarce resources.

However, it is usually difficult to distinguish between age, cohort, and period effects. *Age* effects pertain to the effects associated with getting older. In the case of literacy skills, for example, we might expect people to increase their literacy skills rapidly during their childhood

and youth, and then to maintain them, increase them, or even lose them during early and late middle age, depending on their engagement in literacy activities. *Cohort* effects pertain to macro-level conditions of society that affect individuals of a particular cohort, that is, those born in a specific year. For example, the majority of those who were age 16 when ALL was conducted were born in 1987. This cohort would have experienced much different family and school conditions than, say, those born ten years previously because of changes in family structure, levels of parents' education, school expenditures, teaching methods, and so on. One of the most important secular changes affecting literacy skills is increased participation in formal schooling, which can affect literacy skills in two ways: people are likely to have higher literacy skills than the generation before them not only because they are more highly educated, but also because on average they will have grown up in families with more highly educated parents. *Period* effects stem from particular events that affect the trajectories of all people over a particular period. For example, the rapid increase in access and use of information and communication technology over the ten years prior to ALL is likely to have had a period effect on people's literacy skills.

Ideally one would use longitudinal data to track change at the individual level for multiple cohorts in order to isolate age, period and cohort effects, and to understand what factors influence or explain the observed changes over the full distribution of outcomes. Unfortunately, the collection of longitudinal data is expensive and time consuming, to the point that it often only yields its insights long after decisions have had to be taken.

The approach used in this study entails using "synthetic cohorts", which enables one to get more timely information. Rather than tracking change at the individual level, a synthetic cohort analysis tracks changes for different sub-groups of the population. This level of information is generally sufficient to inform social and economic policy. It can tell us whether the direction and level of change are as expected, and if not, it can provide direction for policy makers to consider what scope there is for influencing the pace of change over the short, medium and long terms, and what kinds of intervention may be most effective.

In the analyses that follow, the literacy scores of the same population groups observed at two time points nine years apart are compared. For example the average skills of adults aged 15to 24 years in 1994 are compared with adults aged 24 to 33 years old in 2003 and a difference is computed. This analysis also allows one to look at the magnitude of net skill gain or loss for different demographic groups. One can then extend the analysis by introducing additional characteristics that are believed to underlie skill loss or gain. The result is that one begins to approximate the underlying distribution of individual trajectories by showing the extent to which differing groups gained or lost literacy skills over the study period.

One of the confounding variables that may influence skill loss over the period is influx of immigrants. Thus, in comparing the synthetic cohorts, people who immigrated to Canada during the period spanned by the two studies are excluded from the analysis. This affords a relatively conservative estimate of skill loss, as those adults who were recent immigrants prior to 1994 were likely to have made skill gains on the literacy measures as they increased their knowledge of English or French. This is evident in the results in the next section.[5]

1. Skill gains and losses for Canada and the provinces

The overall levels of skill gain or loss by age for Canada are shown in Chart 2. The chart shows the average relationship between document literacy scores and the age of the respondent for adults participating in the 1994 IALS and the 2003 ALL.[6] The x-axis is scaled to include the "synthetic cohorts" of adults aged 16 to 65 in 1994 (IALS) and aged 25 to 74 in 2003. For example, adults who were born in 1954 were 40 years old in 1994, when IALS was conducted, and 49 years old in 2003 when ALL was conducted. For adults at this age, the ALL line is below the IALS line; the difference is 13.1 points, indicating a skill loss for 40-year old adults. Judged in educational terms, these are significant losses of skill, roughly equivalent to the average learning gain in literacy associated with an additional 3.5 months of schooling (Willms, 1999).

Chart 2

Document literacy scores versus age for Canada, 1994 and 2003

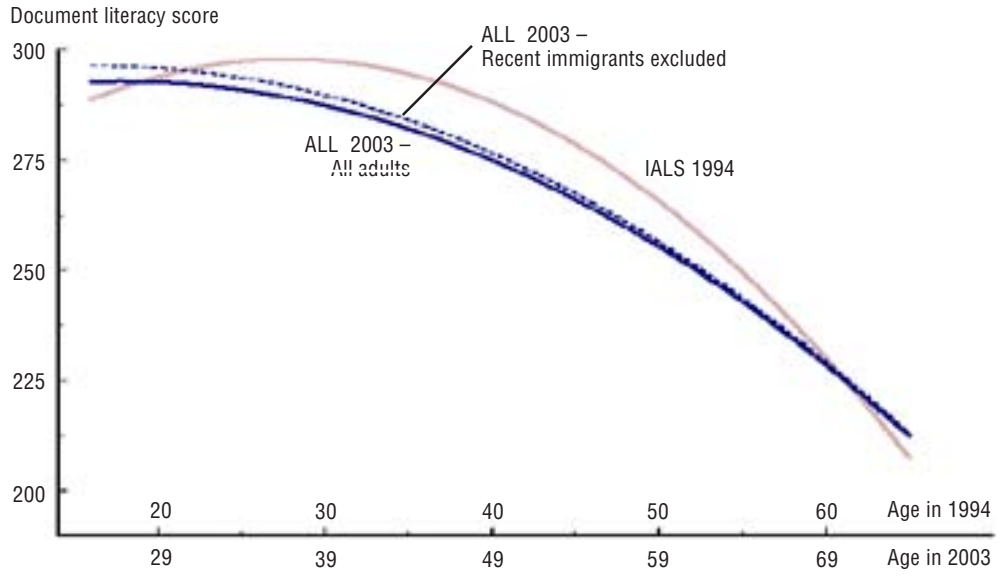


Chart 2 indicates that there was a skill loss, on average, for Canadian adults in the middle of the age 16 to 65 age range. The lines cross at the points when adults were 20 or 60 years old in 1994. For these cohorts there is virtually no skill loss or gain. Table 1 provides estimates of the skill gain or loss for adults at ages 25, 40, and 55 for all of Canada, for all Canadian males and females, and for each of the provinces.[7] The table also shows the standard errors of the estimates[8], which provide an indication of their accuracy. Skill gains or losses that were statistically significant ($p < 0.05$) are marked with an asterix.

Table 1

Estimates of skill gain (or loss) for adults at ages 25, 40, and 55, based on IALS (1994) and ALL (2003)

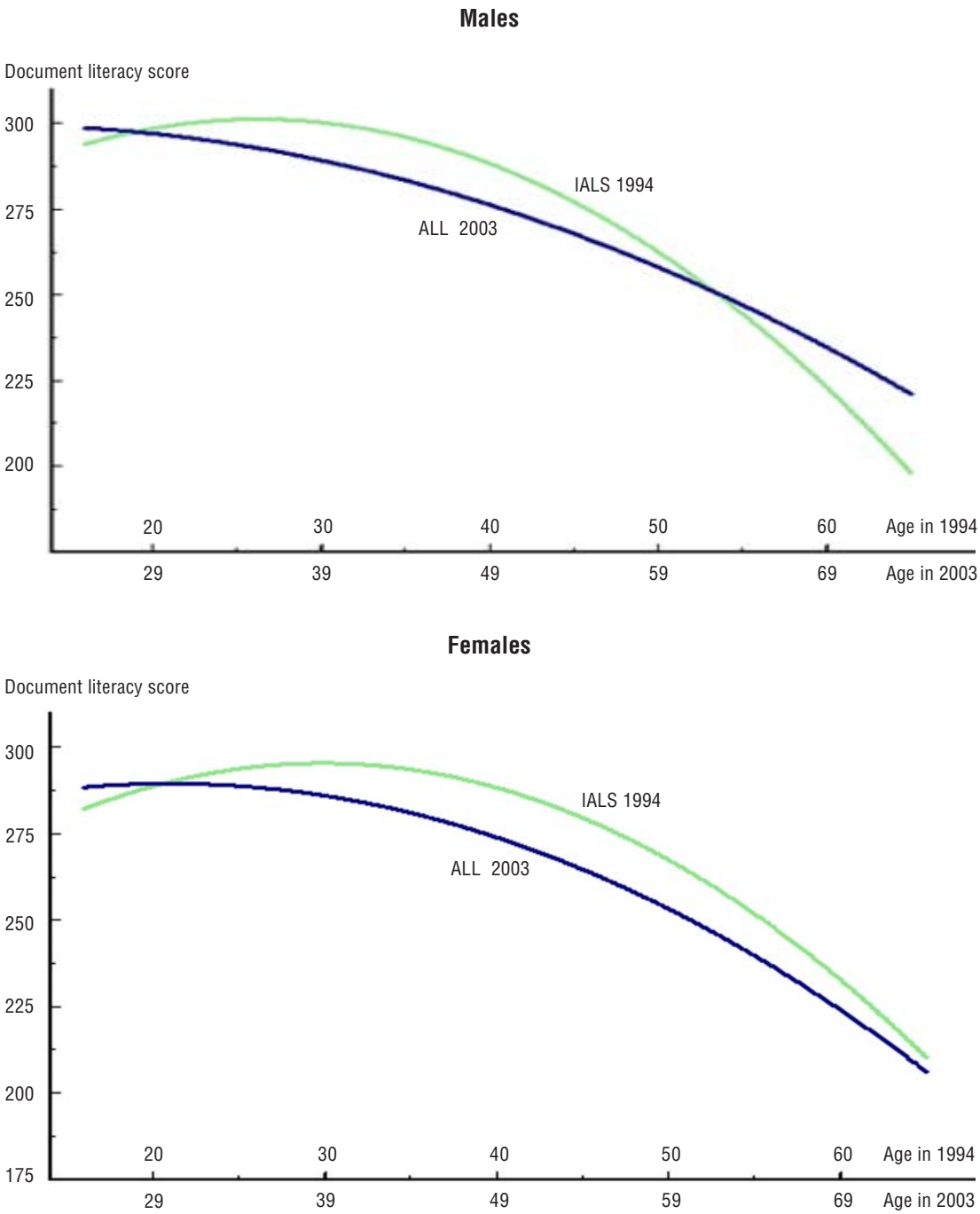
	Age 25		Age 40		Age 55	
	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
Canada	-3.6*	(4.4)*	-11.6*	(5.5)*	-4.4*	(6.8)*
Males	-5.2	(7.3)	-10.8	(6.7)	3.2	(9.3)
Females	-2.0	(4.8)	-12.6*	(6.2)	-11.4	(11.4)
Atlantic	2.1	(4.1)	-2.2	(5.1)	-2.4	(6.1)
Quebec	-6.0	(7.4)	-8.1	(11.1)	-2.4	(21.9)
Ontario	-6.3	(6.5)	-22.9*	(9.3)	-9.7	(11.2)
Prairie provinces	-4.9	(7.6)	-7.8	(5.4)	-3.3	(10.0)
British Columbia	7.8	(13.7)	5.3	(10.2)	2.7	(7.8)

* Statistically significant ($p < 0.05$).

For all of Canada, as Chart 2 suggested, the skills losses are large for middle-age adults, those at about age 40. For them, the skill loss amounts to about 13 points. It is important to put these estimates of skill loss in perspective. Average years of schooling rose by almost a full year between 1994 and 2003; this is an amount that would normally be associated with skill gain in the order of 25 points. Comparison of results from the 2000 and 2003 cycles of OECD PISA assessment of 15 year olds reading literacy suggests that skill levels of secondary graduates have at least remained stable. Finally, public and private per capita expenditure on education rose during the period, an increase that should have had a positive effect on skill levels. Thus, it would be reasonable to expect that literacy skill levels should have risen between 1994 and 2003. The fact that skills actually appear to have fallen suggests that skill loss is real.

Chart 3 shows the skill versus age curves for males and females for Canada. The distributions are quite similar, except that the skill loss for females is more pronounced, especially among late middle age adults. The skill loss for females at age 40 is statistically significant, and for males it is not significant; however, the sexes do not differ significantly in the extent of their skill loss.

Chart 3
Document literacy scores versus age, by sex, 1994 and 2003



2. Factors related to literacy skills and skill loss

We now expand the regression analysis in an attempt to achieve a more accurate estimate of skill loss, and possibly explain some of the observed loss. The argument is that the literacy skills of a cohort are related to people's demographic characteristics and their experiences at home and at work. We therefore introduce these factors into our model for document literacy skills such that our two cohorts are statistically comparable. This work builds on previously published analysis, which has revealed that skill loss is concentrated in adults from lower socio-economic backgrounds, a fact that raises concerns about the quality of tertiary education for these individuals and about their ability to compete in a labour market that rewards literacy skill to a high degree (Statistics Canada and Organisation for Economic Cooperation and Development, 2005).

Our model includes the following controls: gender, age, age-squared, level of education (coded in four categories, with high school completion as the base category), people's engagement in general literacy activities at work, people's engagement in technical literacy activities at work, and people's engagement in literacy activities at home. The regression analyses were conducted separately for each cohort. We found that skill loss (the cohort effect) varied by the level of respondent's education, and therefore a separate model tested whether the relevant interaction terms were statistically significant.

The most immediate finding is that the estimate of average skill loss from 1994 to 2003 was 12.7 points, which is approximately the same as for the base model, which was 11.6 points. This means that controlling for these various factors, which improves our synthetic cohort analysis by ensuring the two cohorts are statistically comparable, yields an estimate of the skill loss that is approximately the same.

A by-product of this analysis is that it provides estimates of the effects associated with level of education, and engagement in literacy activities. The results indicate that compared with high school graduates, adults who did not complete secondary school scored about 48 points lower on the document literacy scale, while those who had completed some post-secondary scored 15 points higher than high school graduates, and those who had completed university scored about 30 points higher. An important finding, though, is that skill loss interacted with level of education. For dropouts, there was no skill loss (i.e., -12.7 + 14.6), while for high school grads, and those who completed some post-secondary and university graduates, the skill loss was the same as in the general population (i.e., the interaction terms were small and not statistically significant).

The results also indicate that adults who had participated in further education and training in the previous twelve months scored about 16 points higher than those who had not participated. Adults who were regularly engaged in literacy activities at work or at home had higher literacy scores[9]. The effects associated with general literacy engagement at work and at home were 11.1 and 14.3 points respectively. The effect associated with engagement in technical activities at work was positive, but not statistically significant.

Table 2

Estimates of effects of level of education and engagement in literacy activities, and the skill gain (or loss) for adults at age 40

	IALS 1994		ALL 2003		1994 to 2003	
	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
Adjusted mean	288.6*	(28.6)	271.9*	(36.5)	288.3*	(6.50)
Skill gain (adjusted, 1994 to 2003)	…	…	…	…	-12.7*	(6.20)
Gender (female = 1; male =0)	-0.2	(11.5)	-4.9	(7.9)	-2.6	(2.30)
Age (centered at age = 40)	-1*	(0.6)	-0.73	(0.5)	-1.01	(0.24)
Skill gain by age interaction	...	...	...	...	0.33	(0.3)
Age-squared	-0.01	(0.0)	-0.01	(0.0)	-0.01	(0.0)
Skill gain by age-squared interaction	…	…	…	…	0.01	(0.0)
Did not complete secondary (versus high school graduate)	-47.6*	(25.3)	-34.6*	(25.8)	-48.4*	(5.8)
Skill gain by did not complete secondary	…	…	…	…	14.6*	(5.5)
Completed some post-secondary (versus high school graduate)	13.9*	(18.0)	10.3*	(5.4)	15*	(6.9)
Skill gain by completed some post-secondary	...	...	...	...	-5	(7.3)
Completed university (versus high school graduate)	28*	(6.3)	32.5*	(15.4)	29.9*	(7.4)
Skill gain by completed university	...	...	...	...	1.6	(8.0)
Participated in further education and training	17.1*	(5.8)	15.4*	(3.8)	16*	(2.4)
Engaged in literacy activities at work – general	16.5*	(15.7)	5.8*	(26.7)	11.1*	(2.5)
Engaged in literacy activities at work – technical	2.7	(6.1)	6.6	(18.9)	4.6	(3.4)
Engaged in literacy activities at home	14.1*	(6.4)	14.7*	(4.8)	14.3*	(3.3)
Not in labour force	-12.5*	(5.9)	-10.7*	(6.6)	-11.9*	(4.2)

… not applicable

* Statistically significant ($p < 0.05$).

Source: IALS (1994) and ALL (2003).

We now ask whether the factors found to be related to literacy skills in the above analysis can account for the variation among provinces in their literacy skills. To address the question we fit an hierarchical linear model to the data, with adults nested within provinces[10]. As in Table 2 we can also get an estimate of the skill gain after controlling for the various factors that are in the model. The results are presented in Table 3.

The first model simply estimates the variation in skill levels among provinces in their 1994 literacy scores, and in their skill gain or loss from 1994 to 2003, with statistical adjustment for sex and age. We refer to this as the base model[11]. The results indicate, as one would expect from Table 1, that provinces vary significantly in their literacy skills. The variance is 173.7, and the standard deviation is 13.2. The amount of skill loss from 1994 to 2003 also varies among provinces: the variance is 38.4, and the standard deviation is 6.2. Considering our earlier results, which suggested that there is a significant skill loss for adults at age 40, these results confirm that the amount of skill loss varies among provinces and regions of the country.

Table 3

Variation among provinces in average levels of document literacy scores and in skill gain (or loss) for adults at ages 40

	Variation among provinces in literacy scores		Variation among provinces in skill gain or loss	
	Variance	Standard deviation	Variance	Standard deviation
Base model (Adjusted for age and sex)	173.7*	13.2*	38.4*	6.2*
Adjusted for level of education	103.5*	10.2*	43.4*	6.6*
Adjusted for engagement in literacy activities at home and at work	82.6*	9.1*	43.3*	6.6*
Adjusted for level of education and engagement in literacy activities at home and at work	76.3*	8.7*	49.9*	7.1*

* Statistically significant ($p < 0.05$).

Source: IALS (1994) and ALL (2003).

The second model adds the variables describing level of education to the base model. The variance in 1994 provincial means is reduced from 173.7 to 103.5, or by about 40%, when respondents' level of education is included in the model. Recall that this model yields a better estimate of the skill loss or gain than the base model, as the 1994 and 2003 populations have been equated for level of education. The variance among provinces is slightly greater with this model, with a variance in skill loss of 43.4.

The third model extends the base model with the work and home literacy engagement variables, as well as the indicator denoting whether a person was not in the labour force. This model reduces the inter-provincial variance from 173.6 to 82.6, or by about 52%. The variance in skill loss is 43.3. This is how much variance we observe when the provinces are equated for levels of literacy engagement.

The final model includes both the level of education and the literacy engagement variables. The inter-provincial variance in means is reduced slightly, to 76.3, while the variance in skill loss estimates increases to 49.9.

The increase in the variance in skill gains or losses deserves comment, as one might expect the models to help explain why some provinces had bigger or smaller skill gains or losses than others. The base model, which includes age and sex, essentially equates the two synthetic cohorts within provinces. When level of education is added to the model, the "equating" of the synthetic cohorts within provinces is improved, such that we get better estimates of the skill gain or loss in each province. However, this should not have any material effect on the variation in the estimates among provinces. The same argument applies when we add the engagement variables.

We attempted to examine whether *changes* in average levels of engagement, from 1994 to 2003, were related to the observed levels of skill gain or loss. This involves entering mean levels of engagement, and measures of changes in engagement, into the second level of the model. However, the results were inconclusive because with only 10 provinces there was not enough statistical power to discern an effect. In the next section, we examine the extent to which provinces' scores varied on the key factors found by ALL to relate to literacy scores.

In summary, the statistical models employed in these analyses are able to explain a little more than half of inter-provincial differences in literacy skill, leaving almost half of these differences unexplained. However, the models fail to explain inter-provincial differences in skill loss identified in the previous analysis.

3. Secular changes in the factors affecting literacy scores

In a synthetic cohort study it is difficult to assess whether changes in literacy scores for a jurisdiction, such as a province or community, are related to specific policy initiatives. This is because the statistical power is not strong enough to disentangle effects associated with period and cohort effects at this level. As noted earlier, one needs prospective longitudinal studies, and local monitoring systems that collect data that is sensitive to interventions. However, the ALL data can provide a general indication as to what factors are changing in the right direction. The analyses above suggested that while a person's age and gender play a role, their participation in the labour market, their level of educational attainment, their participation in further education and training, and their engagement in literacy activities at work and at home are all related to their literacy skills.

Table 4 is a provincial scorecard which shows the percentage of adults who had attained various levels of educational attainment, the percent *not* in the labour force, the percent that had received further education or training, and the percent that had engaged in literacy activities at home and at work. The results pertain to the cohorts aged 16 to 65 in each province, and for all of Canada, rather than for the synthetic cohorts used in the analyses above. The 1994 estimates of these indicators are not as accurate as the 2003 estimates at the provincial level, because the 1994 IALS sample was much smaller than the ALL sample. However, with the combined sample, one can obtain relatively accurate estimates of the change from 1994 to 2003 on each indicator, and the jackknife weighting methodology allows one to discern whether any observed changes are statistically significant.

The results show that in all provinces the percentage of adults who had not completed secondary school decreased over the 9-year period. Some of this change is attributable simply to demographic changes: the older adults in the 16 to 65 age range on average have fewer education credentials than young adults, and therefore as the older adults leave the cohort and younger adults join it, the average level of education increases. However, some of the secular changes are attributable to changes in school practices at the primary and secondary levels, and to increased access to post-secondary programs. The net result is that the percentage of adults that had left secondary school before graduating decreased in every province, and by 11% for all of Canada.

Table 4

Factors affecting literacy skills, percentage of adults aged 16 to 65, 1994 and the percent change from 1994 to 2003

	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	**Can.**
Did not complete secondary school											
1994	38.6	43.7	38.9	37.0	41.6	25.7	49.7	29.0	31.8	23.6	**32.2**
Change 1994-2003	-9.0* [1]	-16.4* [1]	-12.3* [1]	-13.4* [1]	-20.3* [1]	-5.2* [1]	-25.9* [1]	-8.1* [1]	-10.7* [1]	-3.8* [1]	**-11.0* [1]**
Completed secondary school											
1994	35.3	21.7	28.7	28.1	28.2	36.1	36.4	37.6	33.9	44.6	**34.5**
Change 1994-2003	-3.0	7.0* [1]	1.2	6.5* [1]	4.5* [1]	-2.6	0.6	-5.1	-3.1* [1]	-9.8* [1]	**-1.3* [1]**
Some post-secondary											
1994	24.2	20.4	17.2	19.8	20.9	16.9	6.0	15.2	19.3	12.4	**17.4**
Change 1994-2003	2.4	4.0	8.3* [1]	8.0* [1]	7.0* [1]	6.4* [1]	18.2* [1]	16.8* [1]	8.5* [1]	12.9* [1]	**8.3* [1]**
Completed university											
1994	2.0	14.2	15.3	15.1	9.3	21.3	7.8	18.1	15.1	19.4	**16.0**
Change 1994-2003	9.6* [1]	5.3* [1]	2.8* [1]	-1.1	8.8* [1]	1.4	7.1* [1]	-3.6* [2]	5.3* [1]	0.7	**3.9* [1]**
Not in labour force											
1994	31.9	10.3	30.1	24.7	28.0	25.5	27.1	14.3	15.7	15.5	**23.9**
Change 1994-2003	-6.0* [1]	3.5* [2]	-8.8* [1]	-7.3	-9.3* [1]	-8.9* [1]	-12.5* [1]	0.3	-4.1* [1]	3.2* [2]	**-6.8* [1]**
Further education and training											
1994	26.9	36.6	38.8	37.9* [1]	36.5	43.6	31.4	49.9	54.9	51.1	**42.8**
Change 1994-2003	14.6* [1]	14.3* [1]	18.5* [1]	10.8* [1]	12.2* [1]	10.9* [1]	22.6* [1]	7.1* [1]	4.3* [1]	10.0* [1]	**11.4* [1]**
Work engagement – general											
1994	17.8	42.0	27.9	34.7	29.0	35.8	23.0	43.8	39.0	38.1	**33.8**
Change 1994-2003	4.8* [1]	-10.3* [2]	3.8* [1]	-5.3* [2]	1.1	-2.4	9.2* [1]	-13.5* [2]	-6.2* [2]	-4.8* [2]	**-1.7* [2]**
Work engagement – technical											
1994	14.9	16.7	7.3	13.7	10.1	14.8	15.1	20.9	28.5	16.9	**15.1**
Change 1994-2003	2.6	5.5	13.6* [1]	4.8* [1]	12.0* [1]	9.2* [1]	8.6* [1]	4.7* [1]	0.0	8.3* [1]	**8.8* [1]**
Home engagement											
1994	51.7	37.1	43.7	42.4	36.3	52.7	44.2	53.7	54.0	54.3	**47.9**
Change 1994-2003	-17.4* [2]	2.2	-4.7* [2]	-7.7* [2]	-4.2* [2]	-10.6* [2]	-6.8* [2]	-14.7* [2]	-11.6* [2]	-6.8* [2]	**-8.1* [2]**

* Changes from 1994 to 2003 that are statistically significant.

1. Positive changes (e.g., more adults in the labour force, higher levels of engagement).
2. Negative changes.

Changes in secondary school graduation rates, shown in the second pair of rows, are slightly more difficult to interpret as being favourable or unfavourable, because an increased prevalence in this category could be attributable to either a decrease in the prevalence of adults not completing secondary school, or to a decrease in post-secondary participation. In Prince Edward Island, New Brunswick, and Quebec the increases in secondary graduation rates can be interpreted as positive because they are associated with marked decreases in the prevalence of non-completion and increases in post-secondary participation. In contrast, the prevalence of secondary school graduates in Alberta and British Columbia decreased, but this is clearly associated with a shift towards greater post-secondary participation.

In all provinces there was an overall increase in post-secondary education, in terms of adults attending some post-secondary, completing university, or both. These increases are evident in the national charts, with increases of 8.3% attending some post-secondary, and 3.9% completing university.

The rates of participation in further education and training also increased dramatically, with significant increases in every province, and a national increase of 11.4%. Moreover, the inter-provincial distribution of further education and training became more equitable, as provinces with low levels in 1994 tended to achieve larger increases over the 9-year period; Newfoundland and Labrador and Manitoba are good examples, while Saskatchewan, Alberta, and British Columbia, which had relatively high levels of participation in 1994 had smaller increases.

The pattern of engagement in literacy activities at work is less even. In three provinces, Newfoundland and Labrador, Nova Scotia, and Manitoba, the levels of engagement in general work activities increased. However, these three provinces had levels of engagement that were below national norms in 1994. These increases brought Nova Scotia and Manitoba close to the national norm of about 32%, but Newfoundland and Labrador still lags behind. Five provinces, Prince Edward Island, New Brunswick, Saskatchewan, Alberta, and British Columbia, had significantly lower levels of general work engagement in 2003 than in 1994. These decreases brought each of the provinces to within 2 to 3% of the 2003 national norm. The levels of work engagement for Quebec and Ontario remained steady over the period, also close to the national norm.

All provinces except Newfoundland and Labrador and Alberta had increased levels of engagement in technical literacy activities at work, which undoubtedly reflects the increased demand for technical skills in most occupations. Newfoundland and Labrador's level of engagement was comparable to national norms in 1994, but by 2003 it had fallen significantly behind. Alberta level was above national norms in 1994, and it maintained its relatively high position.

The starkest finding of this analysis is the substantial decrease in people's engagement in literacy activities at home, which parallels a similar decline in the US (National Endowment for the Arts, 2004). Nationally, the percentage of adults scoring above the 1.5 point threshold fell from about 48% to 40% from 1994 to 2003, which is a decrease of nearly 1% per year. All provinces except Prince Edward Island had significant decreases in home engagement over this period. Although the effects of this secular change is arguably offset by higher levels of formal education and greater participation in further education and training, they undoubtedly contribute to the skill loss revealed in the previous analyses of this report.

The results presented in Tables 2 and 4 present a paradox about the effects of post-secondary education. On the one hand, education levels increased during the period 1994 to 2003. The prevalence of adults who failed to complete secondary school fell by 11%, while the prevalence of those who had completed college and university programs increased by about 8% and 4% respectively. However, the results in Table 2 indicate that the average levels of literacy skills of adults not completing secondary school remained about the same, changing from 241 to 237. In contrast, the average level of literacy skills of college students fell from 303 to 282, while that of university graduates fell from 317 to 304. The results clearly indicate that adults who attend Post-secondary education have much higher skills than those who do not pursue Post-secondary education. However, it may be that as provinces expand Post-secondary education, students with lower levels of literacy skills are selected, and these students reduce the observed difference associated with Post-secondary education.

4. Summary and implications

Young children differ substantially in their language and literacy skills when they enter school at age 5, in large measure due to their exposure to language and their interactions with parents and siblings (Hart and Risley, 1995). During the primary school years, the rate of acquiring literacy skills continues to vary considerably. Family experiences continue to play a prominent role, but the quality of schooling contributes also. The transition from "learning-to-read' to "reading-to-learn", which for most children should occur during the second or third grade, is critical, as children who fail to make this transition tend to be poor readers throughout their school career, and are prone to leaving secondary school before graduating. Different groups of people leave the educational system at different points, and have much different skill levels.

However, literacy is not a static commodity that is acquired in youth and maintained throughout life. Some groups of individuals find a way to add to their level of skill over their adult lives, while others manage to maintain their skill level and others lose skill. The data from the IALS and ALL provide a rare opportunity to compare the distributions of literacy skills for nationally representative samples of adults in 1994 and 2003. The two studies used comparable assessment tools and sampling designs such that one can construct "synthetic cohorts" of people who were born in the same time period but assessed at different ages. This provides a means of untangling the effects on literacy skills associated with aging versus cohort and period effects. The analyses in this paper examine the synthetic cohorts for Canada, with attention to levels of skill gains or losses for different sub-populations.

The results provide compelling evidence that on average people lose skills after the period of formal schooling, but the amount of skill loss differs considerably from group to group. Skill loss in Canada appears to be a gradual process, which begins at about age 25, peaks at around age 40, and tapers off during late middle age. For example, adults who were age 40 in1994 had average scores on the IALS literacy test of about 288, while the same cohort, when tested 9 years later at age 49, had average scores of about 275. A skill loss of about 13 points is roughly equivalent to nearly half a year of additional schooling over the nine-year period.[12] Taking into account that skill loss appears to be less for young and late middle age adults, we estimate that on average most Canadian adults experience a skill loss over their lifetime of about one grade level.

The analyses also provide an account of the factors related to skill acquisition, based on data from the combined IALS and ALL data sets. Exposure to education appears to have a positive impact on skill change. Individuals with university completion have average scores that are about 30 points higher than secondary school graduates, and even those with some post-secondary education do better, by about 15 points. Those who have not completed secondary school do considerably worse, scoring nearly 50 points lower than their counterparts who finish secondary school, a drop equivalent to the average learning gain associated with over a year and a half of additional education. These are the effects associated with level of education across all adults, after controlling for labour market participation, further education and training, and engagement in literacy practices.

The level of general reading engagement at work also has a positive effect: individuals who read more frequently and a wider range of materials scored about 11 points higher than those with low levels of engagement. Similarly, those who had participated in further education or training scored about 16 points higher than those who had not participated. The combined effect of these two factors is equivalent to the positive effect associated with completing university. We cannot conclude that increasing further education and training or opportunities for work engagement would *cause* higher literacy skills. Clearly there are selection effects at play that are not captured by the other variables in the model. However, as descriptive data, they do suggest that there are likely certain occupations and firms that create a culture that supports and values the acquisition and maintenance of literacy skills.

Engagement in technical literacy practices at work increased over the study period, but this does not seem to have as strong an impact on people's literacy skills. In contrast, the amount and range of what people choose to read at home, away from the job, seems to have a strong influence on skill development. In fact, the increase in skill observed for individuals with higher levels of reading at home is about the same as the skill loss observed on average over the ten-year period when skill loss is greatest. Clearly, lifestyle and individual choice matter.

Finally, employment seems to have a very positive effect on literacy skills – those individuals who were employed scored about 12 points higher than those who were not in the labour force. As was noted with regards to the effects associated with further education and engagement at in literacy activities at work, this analysis does not allow one to determine if this loss is the result of unemployment or simply a symptom, but the effect is real and socially significant to the individuals involved and to the economy.

Our analysis also examined differences among the provinces in their average levels literacy and their skill loss. We found that provinces and regions varied substantially in their average levels of skills. A small proportion of this difference is simply attributable to differences in the demographic age and sex distributions of the provinces. But even when this is taken account, there remains considerable variation, ranging from about 13 points below the national average to 13 points above it, or about one grade level. The levels of education attained by adults in each province explain about 40% of this variation. A finding that is more salient though is that the other factors – employment, further education and training, and engagement in literacy practices at home and at work – account for over one-half of the inter-provincial variation. The variance explained by these factors overlaps that associated with level of education, such that the two sets of factors together explain nearly 60% of the inter-provincial variation.

The statistical modeling allows us to obtain more accurate measurement of the skill loss, essentially by equating the two synthetic cohorts in terms of their sex and age distribution. However, the design does not allow us to estimate the effects of changes in levels of further education or engagement on skill loss. When we examined the changes from 1994 to 2003 in the various factors that drive literacy scores, we found that while levels of both formal and informal education and training had increased, levels of engagement at work had fallen slightly, and levels of home engagement had fallen considerably.

The results presented in this report are troubling and hold several important messages for policy makers. First, the existence of literacy skill loss is confirmed. Second, the magnitude of skill loss is high when judged in educational terms, eliminating literacy acquisition that took months, or even years, to acquire on average. Third, given the relationship of literacy skill to individual economic and social outcomes, and to macro economic performance, it is reasonable to assume that the economy is paying a price for skill loss. Fourth, the probability of whether a group will gain or lose skills appears to depend on a variety of factors over which both individuals and governments can exert some degree of control. Post-secondary education, the

amount of reading on the job and off, and stable employment all appear to have had a positive impact on the stock of literacy skills and reduce the magnitude of skill loss.

One interpretation of these findings is that Canadians are over-educated, that our education systems are producing individuals with literacy skills that the economy is not able to absorb. If this is true then one might consider reducing investments in post-secondary education where the losses appear to be the greatest.

A second interpretation of the findings is that governments need to do something to increase the social and economic demand for literacy skill. Literacy skills drive economic growth. The fact that one observes skill loss implies either that some individuals are adopting lifestyles that do not support and maintain skill levels, or that some employers are employing economically sub-optimal strategies which, while profitable, are constraining the performance of the overall economy. Both forces could be at play. If this is true then it could be taken as evidence of a market failure of the sort that only governments can correct. If so, investments by government might induce employers to make full use of the available human capital to the benefit of all.

A third interpretation of these findings is that Canada's education system is failing to impart durable skills, or at least the attitudes, values and behaviours that would allow their graduates to retain the literacy skills they learned. If this is true, then Canadian educators need to take a hard look at the content and delivery of instruction to see what might be improved.

This report does not pretend to provide answers to these questions, or to say which of these interpretations is correct. This is a matter for careful and thoughtful analysis and debate. The report does show that something is wrong and that the economic and social consequences of ignoring it are likely to large to bear.

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Notes

1. The term refers specifically to Level 1 proficiency as defined in the International Adult Literacy Survey (IALS).
2. Many observers have suggested that processes of informal learning add considerably to the stock of skill available to the labour market and broader society. Although the estimates of the volume of informal learning collected by the ALL study are large, there is little evidence that the small differences observed among population sub-groups or countries lead to any long-term economic advantage for those countries with higher levels of participation.
3. The IALS study measured prose literacy, document literacy and quantitative literacy whereas the ALL study measured prose literacy, document literacy, numeracy and problem solving skill.
4. See for example the UK's Skills for Life initiative and the recently announced skills initiative in Australia.
5. It is not possible to account for two additional skill flows in the current analyses: the loss of skill through emigration and the loss of skill through death. The impact of the former flow is likely to be limited because of the small number of individuals involved and the latter will only have a marked impact on results at older ages.
6. The results were estimated with a simple linear regression of document literacy skills on age and age-squared for the combined sample, with age-by-cohort interactions to capture the synthetic cohort differences:

$$Y_i = \beta_0 + \beta_1 Cohort_t + \beta_2 Age_i + \beta_3 Age_i^2 + \beta_4 Cohort_t * Age_i + \beta_3 Cohort_t * Age_i^2 + \varepsilon_i$$

7. The sample sizes in the 1994 IALS were much smaller than those realized in the 2003 ALL, which limits the amount of disaggregation of results at the provincial level. The multi-level, multivariate methods employed in this analysis make use of the full information and provide standard error estimates that permit one to judge the reliability of the results.
8. The research and sampling design for IALS and ALL entailed the use of multiple test booklets, and a stratified sample design. The estimation of the standard errors requires special programming that uses the replicate jackknife design weights and a set of plausible test scores.
9. The scores on the scales for literacy engagement range from 0 to 2, with 0 indicating little or no engagement to 2 indicating daily engagement in literacy activities. To simplify the interpretation of the results in this section and the next section, dummy variables were created using a score of greater than 1.5 as the cut-off. Using the dichotomous indicators versus the continuous measures did not substantially change the results.
10. For the analyses reported in Table 1, results for the Prairie and Atlantic provinces were aggregated into regions. For these analyses, the second level of analysis is provinces, not regions, as we are interested in assessing the extent of variation among provinces. The hierarchical linear modeling technique weights results according to how accurately they are estimated.
11. Because the age and sex distributions do not differ substantially among provinces, these variables explain only a small percentage of the null model variances in average literacy scores and in skill loss. (Variance in means for the null model is 150.8, and the variance in skill loss is 46.1).
12. In earlier work based on the IALS, Willms (1999) found that for the full international youth cohort aged 16 to 25, an effect size of 0.15 of a standard deviation, or 30 points on the literacy scale, was associated with about one additional year of schooling. This was determined by regressing the standardized literacy scores on the "years of education" reported by the respondent, and by examining the relationship between respondents' standardized literacy scores and their level of education (for example, completed secondary school, some college or university, university graduate).