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Reconstructing the Evolution of the American Supply of Cognitive Skills: A Synthetic Cohort Analysis

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Abbreviations

ALL	Adult Literacy and Life Skill Survey
CLLN	Canadian Learning and Literacy Network
GDP	Gross Domestic Product
HRSDC	Human Resources and Skills Development Canada
IALS	International Adult Literacy Survey
IALSS	International Adult Literacy and Skills Survey
ICT	Information and Communication Tecchnologies
LSUDA	Literacy Skills Used in Daily Activities
OECD	The Organisation for Economic Cooperation and Development
PIAAC	Programme for the International Assessment of Adult Competencies

Chapter 1 Introduction

The policy community recognizes 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 below, 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.

> *The annual labor 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 labor, 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)

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] is associated with a reduction of 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.

[1] Level 1 and 2 on the 5 level literacy proficiency scales

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 – defined in terms of 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. 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 and the United States are among a select group of countries that invested heavily in increasing its stock of human capital, expending a significant proportion of GDP on education in the post-World War II 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 and the United States now boast among the world's highest levels of educational attainment. For example, Canada 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).

Literature review

Policy makers have mistakenly assumed that cognitive skills, including literacy skill, are a static commodity i.e. once acquired they cannot be lost. As a result, very little research was undertaken that included the repeated measures of skill for the adult population needed to explore the evolution of adult skill trajectories and the underlying determinants of skill gain and loss. An early study by Bynner and Parsons used repeated skill literacy and numeracy measures available in the British Birth Cohort data (Bynner and Parsons, 1998). They showed that it took an average of three years for half of numeracy skills to disappear after leaving the formal education system and that the cognitive demands of the job influenced the amount of skill gain and loss. Krahn and Lowe used cross-sectional estimates of skill and skill use indices from the 1987 LSUDA study and the 1994 IALS for Canada to formulate a hypothesis of skill gain and loss that was linked to job quality that they dubbed "Use it or lose it" (Krahn and Lowe, 1995). Willms and Murray subsequently used data from the 1994 IALS and the 2003 IALSS studies for Canada to create a synthetic cohort to support a deeper analysis of skill gain and loss. Their analysis suggested that a massive amount of skill loss was occurring in adulthood, loss that was concentrated in the more skilled and educated end of the distribution (Wlllms and Murray, 2007). Murray and Shillington conducted a related analysis using the 1994 IALS, 2003 IALSS and 2011 PIAAC data for Canada that showed that changes in

observed average skill levels were the product of shifts in the demographic composition of the adult population and a significant amount of individual skill gain and loss (Murray and Shillington, 2013). Skill loss observed between 1994 and 2003 was sufficient to have offset all of the skill associated with higher education levels realized over the period. Based on the strong relationship between literacy skill level and individual labour market and health outcomes they suggested that skill loss was associated with a significant loss of economic potential. It is this loss of economic potential that motivated their analysis, using a synthetic cohort analysis of the 2003 IALSS and 2011 PIAAC Canadian data, of the determinants of skill gain and loss at the individual level. The Canadian analysis revealed that job characteristics have a marked impact on the observed level of skill gain and loss. More specifically, the level of cognitive demand imposed by the job had a significant influence on the level of skill gain and loss experienced by individuals. This finding suggests a need for policy makers to pay more attention to the knowledge and skill intensity of jobs. The current analysis replicates the Canadian synthetic cohort analysis using 2003 ALL and 2011 PIAAC data for the US. Given similarities in economic structure and the level of economic integration with the Canadian economy we expect, within the limits of the smaller American sample sizes, to see similar results.

Research question findings from the International Adult Literacy Survey (IALS) and the 2003 Adult Literacy and Life Skills Survey (ALL) suggest that the Canadaian and American 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 (Willims and Murray, 2007). This creates our interest in understanding the process of skill gain and loss over time.

Ideally, one would rely on longitudinal data to explore the magnitude and determinants of skill gain and loss over time. Since such data does not exist, a Canadian analysis used a form of cohort analysis in which individuals are matched statistically to create synthetic individuals for whom repeated test data are available. Synthetic cohorts allow one to reconstruct a reasonable approximation of the true distribution of skill gain and loss at the individual level over time.

Analysis of the Canadian data from the three cycles of adult skill assessment reveals that changes in overall average scores over time, and in distributions by proficiency level, reflect shifts in the demographic composition of the population. For example, rising education levels precipitated the expected steady increase in average adult literacy scores in Canada, and concomitant reductions in the proportions of adults the lowest literacy levels.

Synthetic cohort analysis of the 1994 and 2003 Canadian data revealed, however, that the skill gain from higher education levels was been eroding by significant amounts of individual skill loss that begins immediately after the point of school-leaving (Willms and Murray, 2007). The Canadian analysis mirrors work by Bynner with the British Birth Cohorts longitudinal data that showed significant and rapid numeracy skill loss in British youth after

leaving formal education (Bynner, 2003). Some Canadian population subgroups manage to increase their average skill levels over time, while in others average skill levels drop.

Overall, enough literacy skill was lost between 1994 and 2003 to offset all of the skill gain that had been generated from the Canadian adult population having gained a full year of additional education. Between 2003 and 2011 skill loss was sufficient to cause the average literacy score to actually fall 7 points in the population aged 16 to 65 despite steadily increasing education levels.

Finding evidence of such massive skill loss is of concern to policy makers.

First, because the lost skill was expensive to create, it represents an enormous loss of return on public investment in education.

Second, analysis has shown that the lost skill represents a huge loss of economic potential, denominated in foregone productivity and GDP growth (Murray and Shillington, 2013). To find evidence of such significant skill loss is troubling given the relationships between literacy and overall economic performance, and between literacy and measures of individual success as defined in terms of wages, health outcomes and social engagement (CLLN, 2011; Murray and McCracken, 2010). At a minimum, literacy skill loss erodes the public and private returns on investments in it's acquisition and denies both individuals and the economy the benefits associated with strong literacy skills.

The current study uses United States data from the 2003 Adult Literacy and Life Skills Survey (ALL) and the 2011 Program for the International Assessment of Adult Competencies (PIAAC) to explore whether America's stock of literacy skill evolved over the eight-year period from 2003 to 2011 in the same way that the Canadian stock did.

The study seeks to answer four linked research questions:

- What is the level and distribution of skill gain and loss in the United States adult population over the period 2003-2011?
- How does the distribution of skill gain and loss vary among key population sub groups?
- To what extent do job characteristics explain observed differences in skill gain and loss
- In each case to what extent do results mirror those observed for Canada?

The study replicates an analysis undertaken by the authors with Canadian data from the 1994 IALS study, the 2003 IALSS study and the 2011 PIAAC study. The United States analysis was restricted to the 2003 and 2011 cycles because no previous cohort analysis had been done with the United States data.

The Canadian analysis revealed the presence of significant literacy skill loss in adulthood, loss that would seem to be concentrated in adults from lower socio- economic backgrounds and in jobs that impose low levels of cognitive demand on workers. More specifically, the Canadian analysis revealed several insights of interest to policy makers, including:

- Average skill levels in the adult population aged 16 to 65 fell over the period despite significant increases in the average level of educational attainment.
- Notwithstanding falling average scores, adults in the lower end of the skill distribution improved their skill levels to a significant degree and at a much more rapid rate than predicted in 2003. This finding suggests that significant shifts occurred in the relationships among the variables that determined literacy distributions in the intervening period.
- A synthetic cohort analysis suggested that average skills declined in key subpopulations defined by age, gender and education level. Interestingly, average skill levels of immigrants rose, a finding thought to be the result of a tightening of language requirements for entry.
- The synthetic cohort analysis also revealed that both skill loss and gain were predicted by a set of variables that reflect job quality. Jobs that afford workers with the opportunity to apply their literacy and numeracy skills in non-routine ways tended to support skill gain, whereas jobs that only afforded workers the opportunity to apply routine procedural knowledge tended to be associated with skill loss.

Thus, understanding the social and economic processes that underlie skill gain and loss is of critical interest to both educational and economic policy makers. Similarly, given the influence that literacy skill appears to exert in Canada and Britain upon individual labor market success, and the overall performance of the economy, understanding the social and economic processes that underlie the loss and what, if anything, should be done by individuals, institutions or governments to slow or reverse the loss, should be a priority.

About PIAAC and ALL

The Program for the International Assessment of Adult Competencies (PIAAC) is a cyclical, large-scale study that was developed under the auspices of the Organization for Economic Cooperation and Development (OECD). In the United States, this household study was conducted in 2011-2012 with a nationally representative sample of adults between the ages of 16 and 65. Similar samples of adults were surveyed in each of the 23 other participating countries, including Canada. The goal of PIAAC is to assess and compare the basic skills and the broad range of competencies of adults around the world. The assessment focuses on cognitive and workplace skills needed for successful participation in 21st-century society and the global economy. Specifically, PIAAC measures relationships between individuals' educational background, workplace experiences and skills, occupational attainment, use of information and communications technology, and cognitive skills in the areas of literacy, numeracy, and problem solving.

PIAAC is a complex assessment: the data collection is being conducted in multiple languages, in numerous countries with diverse populations, cultures, education and life experiences. All participating countries follow the quality assurance guidelines set by the OECD consortium, and closely follow all the agreed-upon standards set for survey design, implementation of the assessment, and the reporting of results.

PIAAC builds on knowledge and experiences gained from previous international adult assessments - **the International Adult Literacy Survey (IALS) and the Adult Literacy and Lifeskills Survey (ALL).** PIAAC enhances and expands on these previous assessments' frameworks and, at the same time, improves upon their design and methodologies.

In the United States, the PIAAC assessment is conducted in English only; however, the PIAAC survey background questions are administered either in English or Spanish. Data collection for the PIAAC Field Test was conducted in 2010, and the Main Study data collection began in August 2011 and finished in April 2012. NCES's **"First Look" report** of the PIAAC data and the OECD's international **PIAAC reports** were released in October 2013.

The United States collected data from a sample of 3,420 adults aged 16 to 65 in the 2003 ALL survey and 5,010 adults in the 2011 PIAAC study. Comparable sample sizes in Canada were much larger, 20,059 in 2003 ALL/IALSS and 30,549 in PIAAC.

Importantly for this analysis the ALL and PIAAC data are placed on the same 500 point scale that has been linked through common item equating.

Chapter 2 Research Methods

Synthetic cohort creation

The research uses synthetic cohort analysis to reconstruct the entire distribution of skill gain and loss in different cohorts of United States adults aged 16 to 65 who had their skills assessed in ALL and PIAAC.

Previous analysis of this type has looked only at differences in average skill gain and loss experienced by different sub-groups in the population, an approach that only allows one to explore the impact of changes in average values of key explanatory covariates.

The current analysis extends and refines the synthetic cohort approach to explore the evolution of individual literacy skill profiles over time. More specifically, it creates a synthetic longitudinal file in which respondents in the 2003 ALL public micro data file are linked probabilistically to similar respondents in the 2011 PIAAC public micro data file.

The actual linkage was conducted in four steps.

First, the smaller of the two datasets was adjusted to have the same number of records as the larger File within each cell in the linking matrix and the sampling weights adjusted accordingly. This provides for a one to one match between the 2003 and 2011 files.

Second, the two files were classified by static characteristics, including age and sex to provide a pool of potential donors for matching.

Third, the donor pools of like individuals were further subdivided by education level.

Finally, records in the two files were matched on age and gender, conditionally on education (where the condition specified that education had to be equal to or greater than that observed in 2003) and by reading skill score (where the condition was that a match was made between the two records resulting in the least change in score, either positive or negative).

This approach to creating the synthetic cohort ensures that records are matched to the record that generates the least amount of literacy skill change of all possible matches. Application of this approach with the Canadian data yields estimates of change in average skill gain that match those obtained by comparing cross-sectional aggregates, a finding that suggests that the linkage yields a plausible reconstruction of the true evolution of the skill distribution.

Conversely, linkage approaches that drop the "nearest neighbour" constraint would be expected to yield higher levels of skill gain and loss. By definition, any other match might yield the same average score change but would be based on higher levels of skill gain and loss.

If one accepts that such an approach allows one to construct a reasonable approximation of the individual skill trajectories that underlie changes observed in the shape and level of the skill distribution over time, one can then use the combined data to explore the factors that explain which population subgroups experience the most skill gain and loss and what impact the demands of the job have on whether someone in a specific subpopulation gains or losses literacy skill.

It is difficult, if not impossible, to compute standard errors for the synthetically derived estimates of skill gain. The estimated distributions of skill gain and loss are relatively large, and are highly likely to be statistically significant when aggregated to the level of large population sub-groups. To put differences in perspective a 25-point skill gain is the average gain associated with an additional year of formal schooling. Significance levels are reported for the regression analyses reported in Chapter 4.

The analysis uses the weights from ALL, as the key research questions has to do with what happened to that cohort's skill over time.

Both the descriptive analysis and the regression analysis use estimates of skill change based on first plausible value. Replication of the analysis using other plausible values. Replication of the analysis using other plausible values would yield slightly different estimates of skill gain and loss and of estimated covariance's. These small variances in results are not large enough to alter the inferences drawn.

Analysis of skill change

The analysis of changes in the level and social distribution of literacy skill use simple tabulation and comparison of average scores and score distributions.

Analysis of predictions of skill change

The analysis of the factors that explain change in literacy skill applied a regression analysis using the GLM procedure in SAS separate analyses were under taken for the estimate of overall change in literacy skill for adults who lost skill and for adults who gained skill to guard against the possibility that different processes predict skill gain and loss.

Chapter 3 Changes in Average Literacy Scores and Literacy Score Distributions in Canada and the United States

The first series of charts documents changes in average scores observed in key demographic groups in the United States over the period 2003 to 2011.

The charts reveal a similar pattern to that observed in the Canadian data where one observed skill loss across the board. A notable exception was recent immigrants to Canada where average skill levels have increased in response to a recent tightening of admission language requirements.

The first chart looks at changes in average scores by age group in the United States. The Canadian results have been provided for comparative purposes.

Figure 1 Average difference in average literacy score between ALL and PIAAC by age at the time of the PIAAC study, United States, 2011

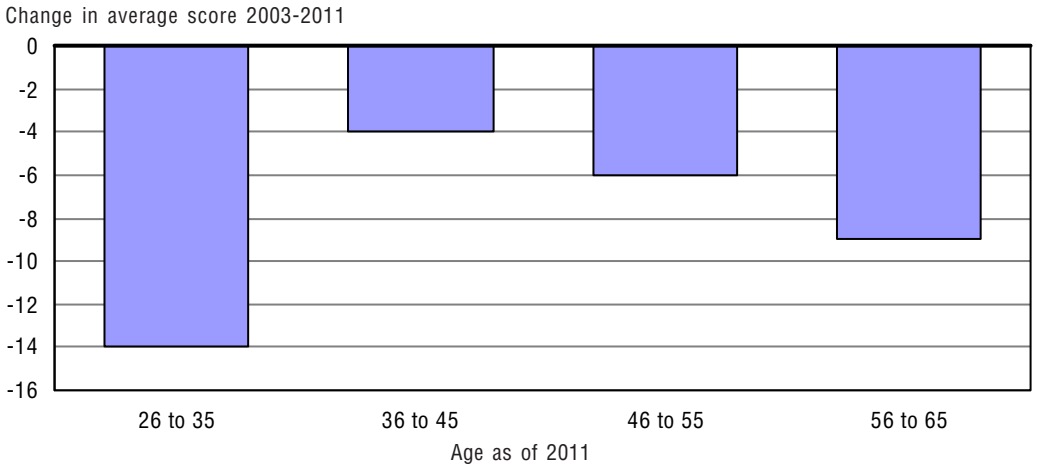

Table 1 Average literacy scores for the synthetically matched survey responses age at the time of the PIAAC survey, United States

	ALL score 2003	Difference	PIAAC score 2011
26 to 35	269	-14	255
36 to 45	271	-4	267
46 to 55	270	-6	264
56 to 65	270	-9	261

Adults in the United States appear to have lost skill in every age group but the average change in scores varies significantly by age group. One sees significant skill loss in the youth cohort that was 16 to 25 in 2003 despite the fact that they are likely to have benefited from participation in post-secondary studies.

Again, this result mirrors that observed for Canadian adults who also appear to have lost skill over the same period. The Canadian results for 1994 and 2003 have been adjusted to reflect the demographic composition in 2011 by age, gender, education and immigration.

Figure 2 Average predicted literacy scores by age group, 1994, 2003 and 2011 standardized to PIAAC population composition, adults aged 16 to 65, Canada

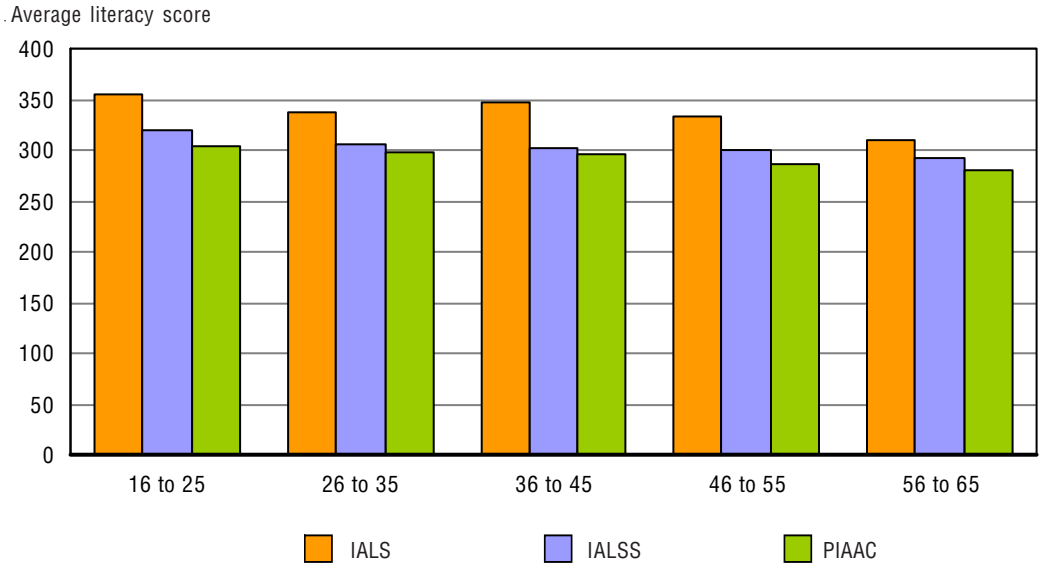

Table 2 Average predicted literacy scores by age group, 1994, 2003 and 2011 standardized to PIAAC population composition, adults aged 16 to 65, Canada

	Original Surveys			Standardized to PIACC			Effect of Standardization		
Age group	IALS	IALSS	PIAAC	IALS	IALSS	PIAAC	IALS	IALSS	PIAAC
16 to 25	344	321	304	354	320	304	10	-1	-
26 to 35	331	304	298	338	307	298	6	2	-
36 to 45	343	298	296	347	301	296	4	3	-
46 to 55	318	296	286	334	301	286	17	4	-
56 to 65	303	285	281	309	292	281	6	7	-
Total	**329**	**299**	**291**	**335**	**302**	**291**	**5**	**3**	**-**

Source: PIAAC, 2011, IALSS 2003 and IALS 1994.

The second chart looks at changes in average scores by gender.

Figure 3 Average difference in average literacy score between ALL and PIAAC by gender at the time of the PIAAC study, adults aged 26 to 65, United States, 2011

Table 3 Average literacy scores for the synthetically matched survey responses gender, adults aged 26 to 56 United States, 2011

	ALL score 2003	Difference	PIAAC score 2011
Male	268	-6	262
Female	270	-10	262

Both men and women in the United States appear to have Post skill over the 8-year period but women seem to have lost more skill on average than men. In Canada both males and females also lost skill over the three assessment cycles.

Figure 4 Average predicted literacy scores by gender, 1994, 2003 and 2011 standardized to PIAAC population composition, adults aged 16 to 65, Canada

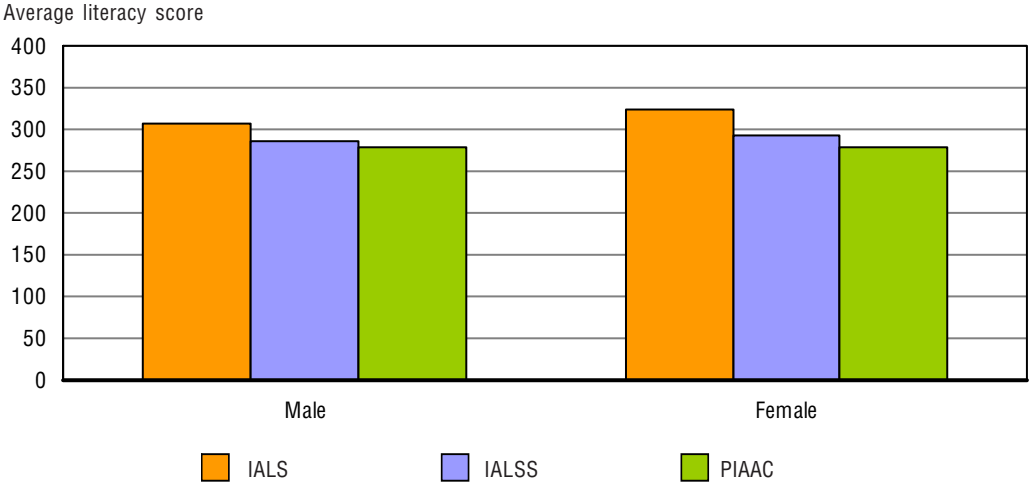

Table 4 **Average predicted literacy scores by gender, 1994, 2003 and 2011 standardized to PIAAC population composition, adults aged 16 to 65, Canada**

	Original surveys			Standardized to PIACC			Effect of standardization		
Sex	IALS	IALSS	PIAAC	IALS	IALSS	PIAAC	IALS	IALSS	PIAAC
Male	273	278	279	307	285	279	35	7	-
Female	285	283	279	323	292	279	37	9	-

Source: PIAAC, 2011, IALSS 2003 and IALS 1994.

The third chart documents changes in average scores by the level of educational attainment in 2011.

Figure 5 **Average predicted literacy scores by education, 2003 ALL and 2011 PIAAC, adults aged 26 to 65, United States, 2011**

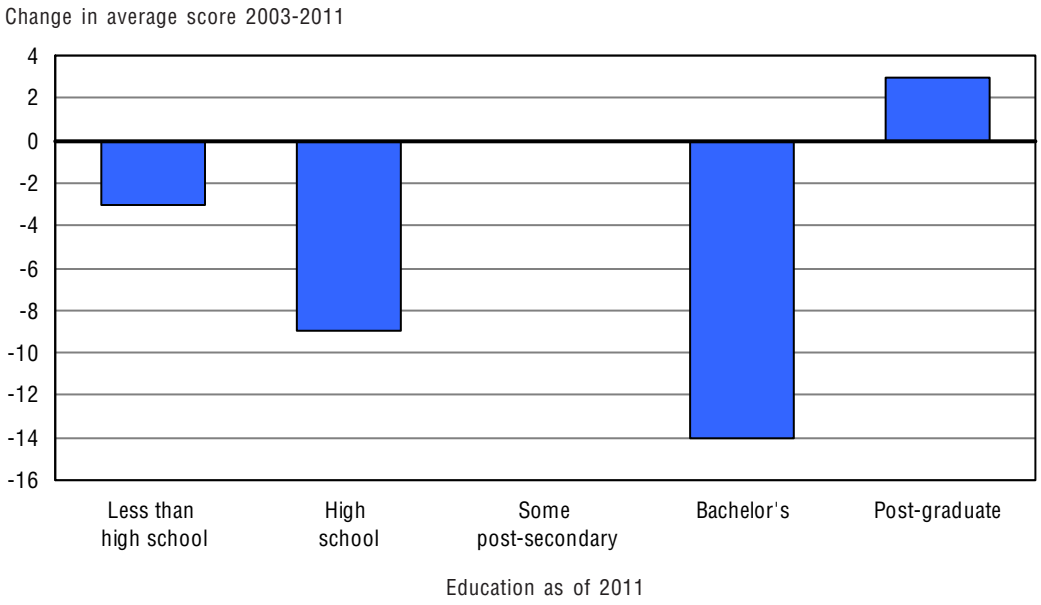

Table 5 **Average literacy scores for the synthetically matched survey responses education, adults aged 26 to 65, United States, 2011**

	ALL score 2003	Difference	PIAAC score 2011
Less than high school	226	- 3	223
High school	267	- 9	258
Some post-secondary	272	- 0	272
Bachelors	307	-14	293
Post-graduate	300	3	304

The chart reveals an interesting pattern of results in which different levels of education realized different levels of average skill loss. Interestingly, adults with post-graduate degrees, people judged to be central to participation in the emerging knowledge economy, are the only group to have gained a small amount of literacy skill on average.

Again, the Canadian results mirror those in the United States - adults at all levels of education appear to have lost literacy skill on average.

Figure 6 Average predicted literacy scores by education level, 1994, 2003 and 2011 standardized to PIAAC population composition, adults aged 16 to 65, Canada

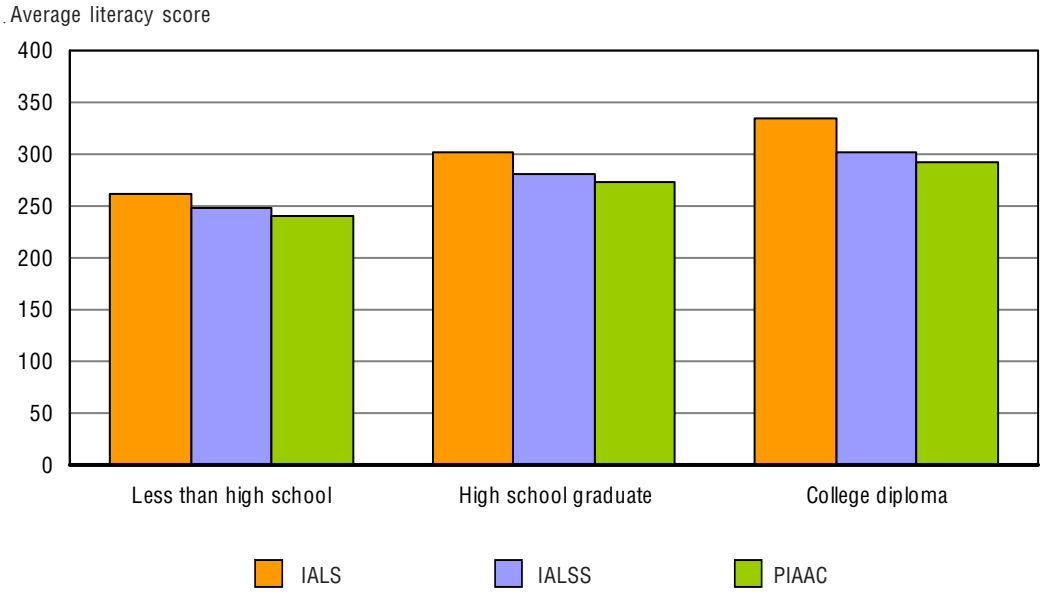

Table 6 Average skill gain/loss, 2003-2011, educational attainment, adults aged 16 to 65, Canada

	Original surveys			Standardized to PIAAC			Effect of standardization		
Education	IALS	IALSS	PIAAC	IALS	IALSS	PIAAC	IALS	IALSS	PIAAC
Less than high school	261	243	240	262	249	240	1	6	-
High school graduate	303	278	273	302	281	273	-1	3	-
College diploma	329	299	291	335	302	291	5	3	-

Source: PIAAC, 2011, IALSS 2003 and IALS 1994.

The fourth chart documents changes in average literacy scores in immigrant and non-immigrant adult populations.

Figure 7 **Average difference in average literacy scores between ALL and PIAAC by immigrant status, adults aged 26 to 65, United States, 2011**

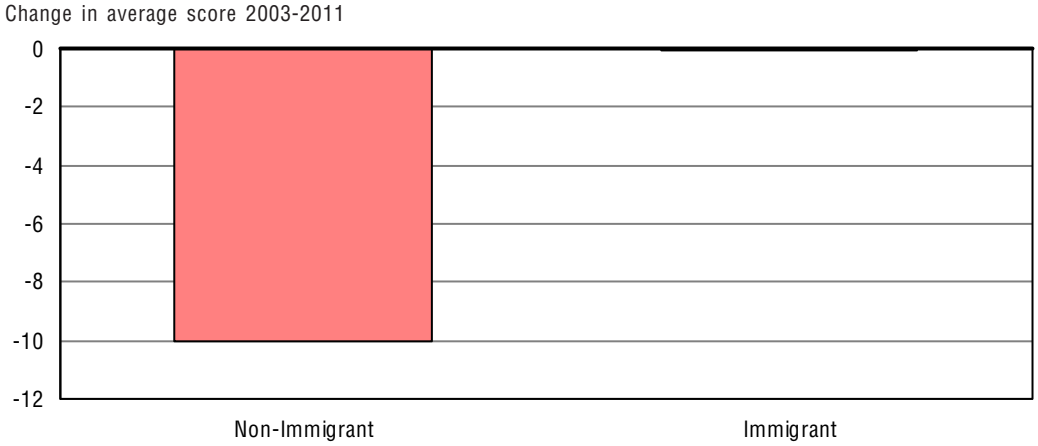

Table 7 **Average literacy scores for the synthetically matched survey responses immigration status, 2003-2011, United States**

	ALL score 2003	Difference	PIAAC score 2011
Non-Immigrant	276	-10	267
Immigrant	235	-0	235

The chart reveals that immigrants appear to have maintained their average literacy skill level whereas non-immigrants to the United States appear to have lost a significant amount of skill over the eight-year period.

In Canada non-immigrants have lost skill on average over the three assessment cycles whereas immigrant's average skill level rose between 2003 and 2011.

Figure 8 **Average predicted literacy scores by immigrant status, 1994, 2003 and 2011 standardized to PIAAC population composition, adults aged 16 to 65, Canada**

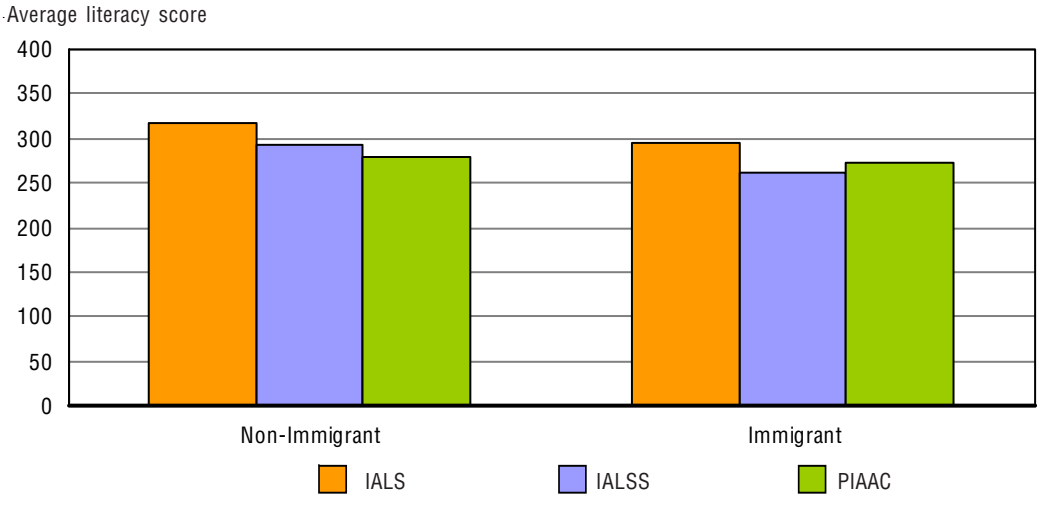

Table 8 **Average predicted literacy scores by immigrant status, 1994, 2003 and 2011 standardized to PIAAC population composition, adults aged 16 to 65, Canada**

	Original surveys			Standardized to PIACC			Effect of standardization		
Immigrant	IALS	IALSS	PIAAC	IALS	IALSS	PIAAC	IALS	IALSS	PIAAC
Non-Immigrant	285	288	280	318	292	280	33	5	-
Immigrant	259	252	273	294	261	273	35	9	-

Source: PIAAC, 2011, IALSS 2003 and IALS 1994.

Distributions of change in literacy scores 2003-2011

The following series of charts plot the distribution of score gain and loss observed in key population subgroups in the synthetically matched cohort of United States adults.

The first chart plots the distribution of score gain and loss by the level of educational attainment observed in the United States PIAAC data in 2011. The + sign reflects the median, the upper bound of the box the 75th percentile of skill change and the lower bound of box the 25th percentile of skill change.

Figure 9 **Change in literacy scores by education for the synthetically matched adults, 2003 ALL and 2011 PIAAC responses, United States, 2003-2011**

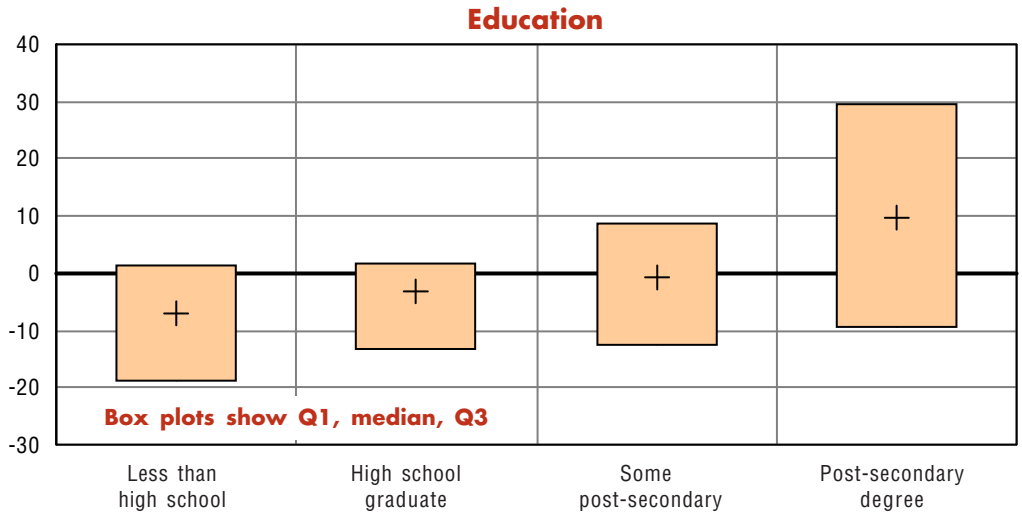

Table 9 **Distribution of literacy scores by education for the synthetically matched survey ALL and PIAAC responses, adults, United States, 2003-2011**

	Less than high school	High school graduate	Some post-secondary	Post-graduate Degree
Median	-7	-3	-1	10
Q1 25th percentile	1	2	9	30
P5 5th percentile	1	2	9	30
P95 95th percentile	-19	- 13	-13	-9
Q3 25th percentile	-19	-13	-13	-9

The analysis suggests that the amount of skill gain increases as educational attainment rises. Only adults with a degree gained skill on average.

To put these results in context, the average skill gain associated with an additional year of education around the average level of education is 25 points. Thus, the amount of skill gain and loss experienced by some individuals is educationally significant, and because of the relationship of skill to labour market and health outcomes, economically significant as well. (OECD and HRSDC, 1997; OECD and Statistics Canada, 2005).

The second chart in the series plots the distribution of skill gain and loss experienced by men and women.

Figure 10 Distribution of change in literacy score by gender for the Synthetically matched adults, 2003 ALL and 2011 PIAAC responses, United States

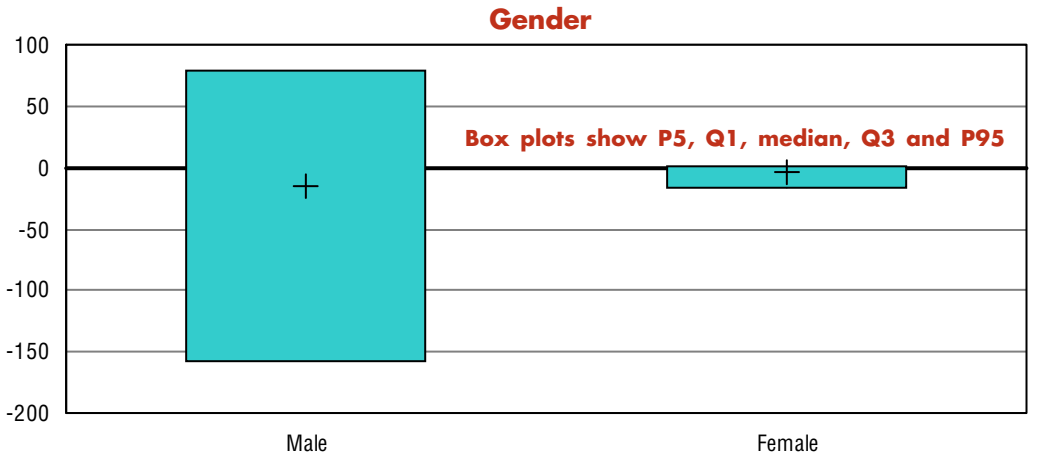

Table 10 Distribution of literacy scores by gender for the synthetically matched survey ALL and PIAAC responses, adults, United States

	Male	Female
Median	- 16	- 4
Q1 75th percentile	78	2
P5 5th percentile	78	2
P95 95th percentile	-157	-17
Q3 5th percentile	- 157	- 17

The chart reveals interesting results. Women appear to have neither gained nor lost skill. In sharp contrast, levels of skill gain and loss among males is widely distributed. On average men lost 6 points, equivalent to the skill gain normally associated with an additional 7.7 months of education. There is, however, considerable variation around this average - average skill gain at the 75th percentile is a staggering 78 points and average skill loss at the 25th percentile 157 points.

The third chart in the series plots skill gain and loss by age group as of 2003.

Figure 11 Distribution of change in literacy scores by age group, for the synthetically matched adults, 2003 ALL and 2011 PIAAC responses, United States, 2003-2011

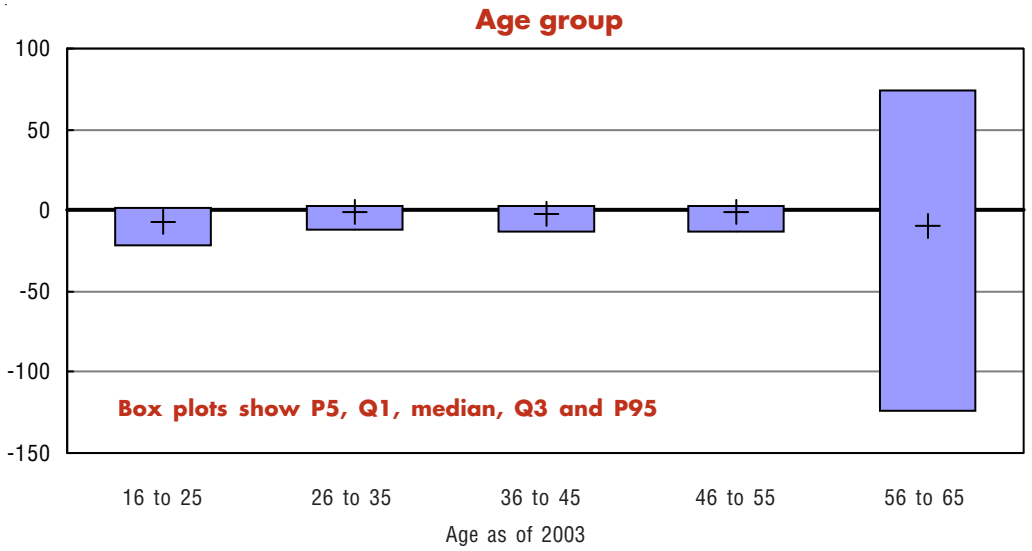

Table11 Distribution of literacy scores by age group, for the synthetically matched adults, 2003 ALL and 2011 PIAAC responses, United States, 2003-2011

Age as of 2003 Age as of 2011	16 to 25 26 to 35	26 to 35 46 to 55	36 to 45 56 to 65	46 to 55 65 +	26 to 65
Median	-7	-1	-2	-1	-9
Q1 75th percentile	1	3	3	3	74
P5 5th percentile	1	3	3	3	74
P95 95th percentile	-22	-12	-13	-14	-125
Q3 25th percentile	-22	-12	-13	-14	-125

It would appear that every age group lost a small amount of skill over the period and that the distribution of skill gain and loss is quite tight. The notable exception to this pattern is seen in the 56 to 65 year old group where the range of skill gain and loss observed between the 25th and 75th percentiles spans a staggering 199 points.

The fourth chart plots the distribution of skill gain and loss by immigration status. Note that this analysis includes immigrant who arrived in the United States up to 2005. Immigrants arriving after this data are excluded from the linkage and analysis.

Figure 12 Distribution of change in literacy scores by immigration status, for the synthetically matched adults, 2003 ALL and 2011 PIAAC responses, United States, 2003-2011

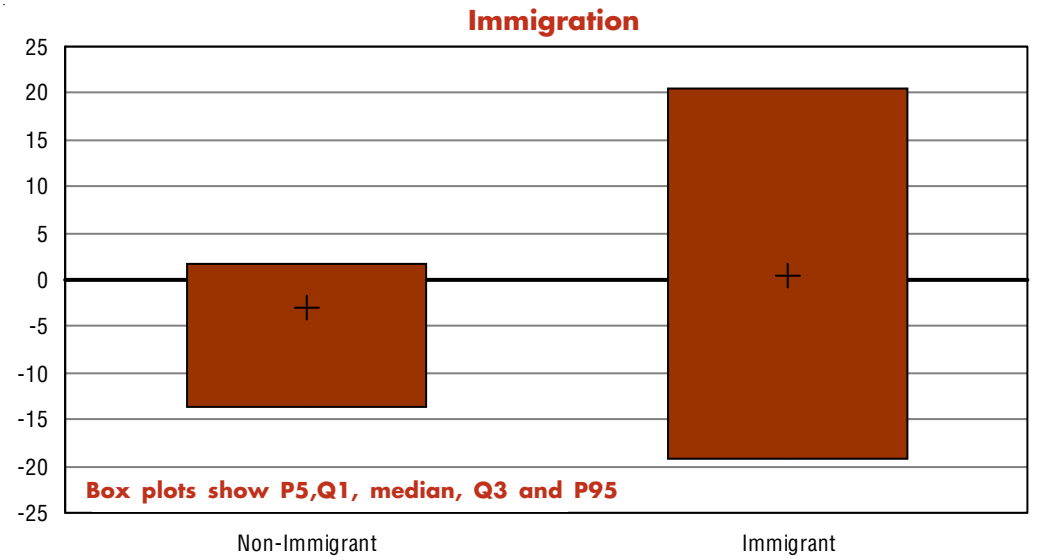

Table 12 Distribution of literacy scores by immigration status, for the synthetically matched adults, 2003 ALL and 2011 PIAAC responses, United States, 2003-2011

	Non-Immigrant	Immigrant
Median	3	0
Q1 75th percentile	2	21
P5 5th percentile	2	21
P95 95th percentile	-14	-19
Q3 25th percentile	-14	-19

The chart reveals that non-immigrants lost 3 points on average over the 8-year period whereas immigrants neither gained nor lost literacy skill.

The distribution of skill gain and loss around these averages differs for the two groups. Immigrants appear to have much more variable experience – the gap between the 25th and the 75th percentiles for immigrants is 40 points compared to 16 points for non-immigrants.

Collectively, these charts reveal ariation in the distribution of skill gain and loss across demographic groups, differences that are large enough to imply material differences in economic outcomes across groups.

Chapter 4 Analysis of the Determinants of Skill Gain and Loss in the United States

The following analysis explores the factors that underlie the differences in the distribution of skill gain and loss among United States adults aged 16 to 55 in 2003.

The analysis replicates a regression analysis undertaken with the Canadian data to explore whether the characteristics of the job might explain some of the observed skill gain and loss in the United States data.

The Canadian analysis, documented in Table 13 in Annex C, revealed that a small number of variables had a statistically significant impact on the magnitude of skill change. Key variables included:

- Gender
- Age
- Immigrant status
- The use of information and communication technologies at work
- Discretion over tasks at work
- Selling at work
- Planning at work strong

Variable	DF	Type III SS	Mean Square	F Value	Pr > F
Sex	1	280895788.1	280895788.1	363.55	<.0001
Age_grp	4	164814811.7	41203702.9	53.33	<.0001
Immig_01	1	106048376.9	106048376.9	137.25	<.0001
ICTWORK - Index of ICT use at work	1	37256832.4	37256832.4	48.22	<.0001
INFLU - Index of influencing people	1	13574595.2	13574595.2	17.57	<.0001
TASKDISC - Index of task discretion at work	1	21200889.0	21200889.0	27.44	<.0001
Firm_Size	1	14104937.7	14104937.7	18.26	<.0001
Skill_USE_WORK_Selling	1	34429494.0	34429494.0	44.56	<.0001
Skill_USE_WORK_Plannig	1	28328135.9	28328135.9	36.66	<.0001

Previous research had shown that indices of skill use on the job explained a significant proportion of observed variation in literacy scores.

In the Canadian analyses these simple indices of skill use carried on ALL and PIAAC do not appear to have the same effect. We believe this is because the reading indices do not reflect underlying differences in the complexity of what is being read and applied. The Canadian analysis did, however, reveal a strong association between the cognitive demands of jobs and the level of skill gain and loss experienced. Several of the "skill use on the

job" measures in PIAAC tap the non-routine application of problem solving skill that characterizes occupations the demand literacy level 3 or better. It would appear that workers in jobs that are cognitively challenging gain skill, those that face lower levels of cognitive demand tend to lose skill.

These results can be traced back to the theory that underpins the literacy measures assessed in ALL and PIAAC that allows one to predict the relative difficulty of reading tasks to a high degree of precision (Statistics Canada, 2005). Careful application of the framework allows one to place both tasks and individuals on the same 500-point scale that is then divided into five proficiency levels that are meant to reflect points along the continuum where the nature of cognitive processing shifts. In the framework, task difficulty is predicted by four sets of variables – the type of requested information, the type of processing, the type of match and distracting information. Analysis of data from IALS, ALL and PIAAC identifies the cut point between literacy Levels 2 and 3 as being a critical one.

In cognitive terms, making the shift from Level 2 to 3 involves mastering conditional information, being able to summarize, compare and contrast and explain, being able to draw low level inferences and being able to ignore distracting information that is in close proximity to the needed information.

In cognitive terms, moving from Level 2 to 3 involves moving from the use of the recall processes in the back of the brain that allow routine procedural knowledge to be applied to the pre-frontal cortex that is used to apply fluid problem solving skills (OECD and HRSDC, 1997; OECD and Statistics Canada, 2005; Murray, T.S., 2009)

Bloom's revised taxonomy classifies learning objectives into three domains: cognitive, affective and psychomotor. In curricular terms, moving from Level 2 to 3 on the IALS/ALL/PIAAC scales involves moving from applying to analyzing in the cognitive dimension of Bloom's revised taxonomy.

The work-related variables included in the Canadian regression analysis tap into behavioral dimensions of these concepts as they are applied at work and at home. More specifically, the variables reflect what is known in the literature as manifestations of "practice-engagement" theory that posits that, once acquired, observed skill level is a function of the incidence of use, the frequency of use, the range of content used the criticality of use and complexity of use (Reder, 2009). Adults with high levels of use will maintain or improve their skill level whereas adults with low levels of skill use are likely to lose skill over time. Since jobs differ significantly in the skill demands that they place on workers it is of interest to know if these differences help explain who lost and who gained skill in the ALL/PIAAC synthetic dataset. Kjell Rubensson, a researcher at the University of British Columbia, has dubbed this effect "the long arm of the job".

The following variables were included in the initial United States regression analysis:

Index of learning at work
Index of readiness to learn
Skill use at work - index of ICT use at work
Skill use at home - index of ICT use at home
Skill use work - How often - Influencing people
Skill use at home - index of numeracy at home
Skill use at work - index of numeracy at work
Skill use at work - Index of use of planning skills at work
Skill use home - index of reading at home
Skill use work - index of reading at work
Skill use at work - Index of use of task discretion at work
Skill use at home - index of writing at home
Skill use at work - index of writing at work
Skill use at work - Time cooperating with co-workers
Skill use at work - How often - Sharing work-related info
Skill use at work - How often - Teaching people
Skill use at work - How often - Presentations
Skill use at work - How often - Selling
Skill use at work - How often - Advising people
Skill use at work - How often - Planning own activities
Skill use at work - How often - Planning others activities
Skill use at work - How often - Organising own time
Skill use at work - How often - Influencing people
Skill use at work - How often - Negotiating with people
Skill use at work - Problem solving - Simple problems
Skill use at work - Problem solving - Complex problems
Skill use at work - How often - Working physically for long
Skill use at work - How often - Using hands or fingers
Skill use at work - Not challenged enough
Skill use work - Need more training

The Canadian analysis included three sets of variables:

Demographic characteristics

Job characteristics

Skill use variables

Replication of the Canadian analysis on United States data did not yield interpretable results when both job characteristics and skill use variables were included. It appears that the United States sample size is simply too small to distinguish small effects associated with variables that are

themselves correlated. The large size of the Canadian samples avoids this problem.

In order to get some results the United States analysis was adjusted and six sets of regression analyses were undertaken:

A regression estimating the impact of skill use variables on score differences

A regression estimating the impact of skill use variables on skill gain

A regression estimating the impact of skill use variables on skill loss

A regression estimating the impact of other job characteristics on score differences

A regression estimating the impact of other job characteristics on skill gain

A regression estimating the impact of other job characteristics on skill loss

The following series of tables summarize the results of each of these regressions.

The impact of skill use variables on score differences

This regression explains 19% of the variance in score differences. The variables highlighted in red each have a significant impact on the overall level of skill change.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	**35**	**12456549934**	**355901427**	**14.40**	**<.0001**

Marginal effect of each variable

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	**4**	**4298749053**	**1074687263**	**43.49**	**<.0001**
Age_10_Cohort	**3**	**1142342283**	**380780761**	**15.41**	**<.0001**
LEARNATWORK Index of learning at work (derived)	**1**	**500219288**	**500219288**	**20.24**	**<.0001**
ICTHOME Index of use of ICT skills at home (derived)	**1**	**856350003**	**856350003**	**34.66**	**<.0001**
F_Q02a Skill use work - How often - Sharing work-related info	**1**	**536642560**	**536642560**	**21.72**	**<.0001**
F_Q02b Skill use work - How often - Teaching people	**1**	**990884169**	**990884169**	**40.10**	**<.0001**
F_Q03a Skill use work - How often - Planning own activities	**1**	**403645573**	**403645573**	**16.34**	**<.0001**
F_Q04a Skill use work - How often - Influencing people	**1**	**1307203061**	**1307203061**	**52.90**	**<.0001**
F_Q05a Skill use work - Problem solving - Simple problems	**1**	**518019853**	**518019853**	**20.96**	**<.0001**
F_Q05b Skill use work - Problem solving - Complex problems	**1**	**424384001**	**424384001**	**17.17**	**<.0001**
F_Q06c Skill use work - How often - Using hands or fingers	**1**	**365957405**	**365957405**	**14.81**	**<.0001**

All variables simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Age_10_Cohort	**3**	**1487513908**	**495837969**	**20.07**	**<.0001**

The impact of skill use variables on skill gain

The second set of regressions restrict the analysis to those respondents who appear to have gained skill. This regression explains a little better than 20% of observed skill gain. The variables highlighted in red have a significant impact on the magnitude of skill gain when entered individually, but these effects disappear when they are included simultaneously.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	**35**	**6920121788**	**197717765**	**8.88**	**<.0001**
Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	**4**	**1184445323**	**296111331**	**3.30**	**<.0001**
Age_10_Cohort	**3**	**708394091**	**236131364**	**10.61**	**<.0001**
Immig_01	**1**	**1393956422**	**1393956422**	**62.63**	**<.0001**
F_Q02a Skill use work - How often - Sharing work-related info	**1**	**507892774**	**507892774**	**22.82**	**<.0001**
F_Q02b Skill use work - How often - Teaching people	**1**	**1061431693**	**1061431693**	**47.69**	**<.0001**
F_Q04a Skill use work - How often - Influencing people	**1**	**339995674**	**339995674**	**15.28**	**<.0001**
F_Q05a Skill use work - Problem solving - Simple problems	**1**	**376619488**	**376619488**	**16.92**	**<.0001**

The impact of skill use variables on skill loss

The third set of regressions restrict the analysis to those respondents who appear to have lost skill. This regression explains 34.5% of observed skill gain. The variables highlighted in red have a significant impact on the magnitude of skill gain. When all variables are included simultaneously only age has a significant impact on the magnitude of skill loss.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	**35**	**4062741930**	**116078341**	**13.53**	**<.0001**
Educ_5	**4**	**1511732538**	**377933135**	**44.05**	**<.0001**
Age_10_Cohort	**3**	**362856917**	**120952306**	**14.10**	**<.0001**
Immig_01	**1**	**627146744**	**627146744**	**73.10**	**<.0001**
D_Q11d Current work - Work flexibility - Working hours	**1**	**269038154**	**269038154**	**31.36**	**<.0001**
F_Q03a Skill use work - How often - Planning own activities	**1**	**558181274**	**558181274**	**65.07**	**<.0001**
F_Q04a Skill use work - How often - Influencing people	**1**	**226480970**	**226480970**	**26.40**	**<.0001**
All variables simultaneously					
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Age_10_Cohort	**3**	**210415383.8**	**70138461.3**	**8.18**	**<.0001**

Collectively, these three sets of regressions confirm that a subset of skill use variables have a significant impact on skill gain and loss. The impact of skill use variables is particularly pronounced on skill loss, a finding that confirms the old adage the asserts "Use it or lose it".

The impact of other job characteristics on score differences

The fourth set of regressions shifts the focus on the impact of other job characteristics on the overall difference in skill. This regression explains less variance (14%) of the observed change in skill. The variables highlighted in red have a significant impact on the magnitude of skill change. When all variables are included simultaneously only the index of readiness to learn has a significant effect.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	7246697337	345080826	13.32	<.0001
Educ_5	3	2389845589	79661519	30.75	<.0001
Age_10_Cohort	3	1166650458	388883486	15.01	<.0001
READYTOLEARN Index of readiness to learn (derived)	1	528575402	528575402	20.40	<.0001
ICTHOME Index of use of ICT skills at home (derived)	1	576756406	576756406	22.26	<.0001
ICTWORK Index of use of ICT skills at work (derived)	1	1132440633	1132440633	43.71	<.0001
NUMHOME Index of numeracy at home	1	481440617	481440617	18.58	<.0001

All variables simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
READYTOLEARN Index of readiness to learn (derived)	1	589823980.8	589823980.8	22.77	<.0001
Parameter		Estimate	Standard Error	t Value	Pr > |t|
READYTOLEARN Index of readiness to learn (derived)	1	9.9836595	2.09236607	4.77	<.0001

The impact of other job characteristics on skill gain

The fifth set of regressions restricts the analysis to the impact of other job characteristics on respondents who gained skill. This regression explains even less variance (11%) of the observed change in skill for those who gained skill. The variables highlighted in red have a significant impact on the magnitude of skill change. When all variables are included none of the other job characteristics have a significant impact on skill gain.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	3132949038	149188049	5.64	<.0001
Source	DF	Type I SS	Mean Square	F Value	Pr > F
Immig_01	1	659539651.3	659539651.3	24.91	<.0001

The impact of other job characteristics on skill loss

The final set of regressions restrict the analysis of the impact of other job characteristics to those respondents who appear to have lost skill.

The regression explains a remarkable 49% of observed skill loss. A small number of variables, highlighted in red, have a statistically significant impact on the amount of skill loss.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	3372994241	160618773	30.76	<.0001
Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	3	1357904339	452634780	86.69	<.0001
Age_10_Cohort	3	460559711	153519904	29.40	<.0001
Immig_01	1	696832034	696832034	133.46	<.0001
ICTWORK Index of use of ICT skills at work (derived)	1	483349991	483349991	92.57	<.0001
NUMWORK Index of numeracy uAse at work (derived)	1	90074393	90074393	17.25	<.0001
Parameter		Estimate	Standard Error	t Value	Pr > |t|
Age_10_Cohort	4	-38.90328657 B	7.84806924	-4.96	<.0001
Immig_01	0	22.35207658 B	3.81643229	5.86	<.0001
B_Q12e Activities - Last year - Seminars or workshops	1	-18.49013704	3.56325934	-5.19	<.0001

Collectively these results are mixed. Demographic characteristics have a significant impact in all three analyses. Several of the other job characteristics appear to have a small impact on the overall level of skill change but none on skill gain. The analysis suggests that, of the other job characteristics, only participating in seminars or workshops had a significant impact on skill loss.

The fact virtually all of the effects disappear when all the explanatory variables are entered simultaneously suggests a more complex covariance structure than the American sample size can understand.

Chapter 5 Summary, Conclusions and Implications for Policy and Research

The social and economic theories that underpin the IALS, ALL and PIAAC studies suggest a market model of skill in which skill demand evolves with time in response to technical advance and associated changes in the organization of work and, more broadly, society. Research suggests that most, but not all, technical advance is skill biased in the sense that it requires higher levels of skill to release the full productivity potential of innovations.

Skill supply also evolves with time in response to learning, both formal and informal, over the life course.

Skill supply and demand meet in a series of markets that matching supply and demand. For example, the labour market matches the skill demand of specific occupations with the skills of qualified candidates. The health system, the education system and the social system also function as markets that grant access and advantage to those that have the needed level of skill. Skill in these contexts is thought of as a productive asset that generates value when put to use. Market inefficiency emerges when the fit between supply and demand is not tight at either the individual or aggregate level. Such market inefficiencies are the means by which differences in outcomes emerge, for individuals, for the social institutions that make use of skills and for overall economic development and social progress.

Traditionally, public policy has paid the most attention to ensuring an adequate supply of skill through investments in formal education and on improving market efficiency through the creation of credentials that reliably signal skill. Implicitly, policy makers have assumed that skills, once created, would be maintained. Public policy has focused much less on demand-side measures, on the belief that the labour market would manage itself.

Canada's 2011 average adult literacy skill level in the population aged 16 to 65 sits at 273.5 points versus 269.8 points in the United States – close enough to have limited impact on our relative competitive position on global markets. Average skill levels in the two countries are heading in the same direction. Canada's average score fell 7 points whereas the United States average fell by almost 10 points. This level of is sufficiently large and economically important to warrant the attention of policy makers in both countries.

Implications for policy

The insight offered by the analysis is of critical importance to both educational and economic policy. Educational policy over the past 60 years has assumed that increased literacy skill supply would generate its own demand. Similarly, economic policy has focused almost exclusively on generating additional literacy skill supply and on improving the efficiency of that markets that mediate literacy skill supply and demand – an approach that makes the strong assumption that markets will naturally generate literacy skill demand that are adequate to absorb and put to good use any and all additional skill supply.

The current analysis offers a way to judge whether more policy attention needs to be focused on the demand side, if only to ensure that the available literacy skill supply gets fully utilized. More plainly put, if employers do not create jobs that are knowledge and skill intense then literacy skills will evaporate through a lack of use. In the PIAAC framework jobs that require workers to apply their reading skills in non-routine ways to solve problems and to think critically will lead to skill gain whereas jobs that only require the routine application of procedural knowledge will lead to skill loss. Level 3 or better skills are required for the former type of jobs, level 2 the latter. The analysis builds on a small body of research that suggests that the skill demands of jobs have a marked impact on whether adults gain or lose skills over the life course (Kohn and Schooler, 1982; Frese, 1982).

The analysis suggests that the Canadian and United States education and labour markets have functioned in same ways over the reference period 2003 to 2011. With the notable exception of recent immigrants, Canadian adults have lost skill on average. The analysis reveals, however, that there is considerable variation around this average with some individuals gaining skill and other losing skill. In Canada demographics, measures of skill use on the job and other job characteristics explain significant differences in levels of skill gain and loss. Only immigrants to Canada managed to gain literacy skill on average over the period for employed adults.

The regression analysis for the United States dose, however, reveal a similar pattern of results. The sample size fielded in the United States are too small to yield definitive results the suggest the same relationships exist, including:

- Skill gain and loss in the United States is highly dependent on demographic characteristics. Adults with advanced levels of education, older adults, immigrants and men appear to be at particular risk of experiencing high levels of skill change and more specifically skill loss
- Indices of skill use explain significant amounts of skill change in the United States but the impact of low level of skill use appear to be strongest on skill loss.
- Other job characteristics seem to have a smaller impact on levels of skill change and skill loss in the United States than in Canada.

The evidence of skill loss in both countries warrants attention to the demand side, specifically to measures that governments might take to induce employers to increase the knowledge and skill intensity of their jobs.

Implications for research

Literacy skill plays a central in generating income and income inequality at both the individual and macro-level. The current analysis provides some hints at the forces that underlie skill gain and loss in adulthood but the results are suggestive rather than definitive. Additional analysis would be helpful, particularly if it were based on longitudinal data that provided more reliable estimates of individual skill trajectories. Collecting such data will be both expensive and will take time to yield results.

Larger sample sizes in the United States would permit additional synthetic cohort analysis, over a longer period of time and including a wider array of variables, than the current analysis can. These analyses might provide enough insight to guide policy makers until longitudinal data can provide unequivocal insights into the determinants of skill gain and loss.

Changes in the average skill level of the population of this magnitude are non-trivial when judged in economic terms. For example, the loss of 7 points in Canada is associated with a loss of some $118,000,000,000 in labour income per year, or almost a trillion dollars over the 8-year period.

The evidence of such massive skill loss in both countries suggests that current levels of economic and social demand are not sufficient for individuals to maintain their skill levels. Skill loss is pervasive and extensive and seems to
be concentrated in workers in jobs that face a level of skill demand below Level 3, the level believed to be needed to compete on global markets. (OECD and HRSDC, 1997).

The options for Canadian public policy makers are limited. Either they find ways to reduce the supply of literacy skill or they find ways to increase the demand for skill enough to attenuate skill loss. The former option is, however, not really an option, The emergence of global markets for capital, raw materials and advanced production technology have reduced North American's price advantage and the rapidly rising global supply of literacy skill has eroded our productivity advantage in that part of the market that relies on the routine application of procedural skill associated with Level 2. These jobs have, and will continue to, migrate to lower cost labour markets. Any replacement jobs will, by definition, have to be more knowledge and skill intense in order to be productive enough to compete. The somewhat ironical conclusion is that policy makers in Canada will have to find ways to incent employers to simultaneously further reduce the proportion of adults with Level 1 and 2 literacy skills and to increase the knowledge and skill intensity of jobs.

The evidence for the United States tells a similar story. On average American adults lost skill. Average skills of adults currently sit just below the lower threshold of Level 3, a level that will allow them to compete successfully on global markets for the time being. Notwithstanding this positive result the synthetic cohort analysis did reveal evidence of skill loss in

the United States adult population that appears to be driven by the same forces i.e. jobs that do afford workers the opportunity to apply the skills to Level 3. Public policies that incented firms to increase the knowledge and skill intensity of their jobs in the United States would pay handsome economic dividends.

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Methods used to create the synthetic cohort

Understanding the distribution of literacy skill gin and loss at the individual level requires a minimum of two estimates of skill for the same individual that can be used to compute an estimate of skill change. Such a dataset does not exist so the goal of the synthetic cohort analysis is to create a data set that approximates the distribution of individual-level changes in skill.

The first step of the linkage involves harmonizing the coverage of the two datasets to the extent possible. The 2003 ALL study provides a representative sample of the US adult population at that time. The 2011 PIAAC study offers a representative sample of the same population 8 years later. The only differences in coverage between the two studies are associated with in-migration, out-migration and death occurring during the period. The linkage controls for in-migration by excluding immigrants who arrived after 2003. One cannot control for death directly but the analysis limits its impact on the results by restricting the analysis to adults 65, an age at which the probability of death is low. The analysis cannot control for the impact of outmigration since little is known about the characteristics of out-migrants. The analysis assumes that the flows are small enough to have little impact on the overall result.

The second step in the linkage is to create a set of potential 2011 donors for every individual in the 2003 file. Individuals in both files are classified into groups by single years of age and gender. To enable a one to one linkage, the files are forced to have the same number of records in each cell defined by the matrix of static linking variables. More specifically, the number of records in each cell in the static linking matrix is adjusted upwards to the year that has the larger number of records and the weights adjusted to reflect the lower probabilities of selection. This step creates a set of potential donors for each cell in the static linking matrix.

The third step involved subdividing each group by educational attainment. This step allows the subsequent match to be made conditional on the 2011 donor having the same or higher level of attainment i.e. no one can lose education as the result of the match.

The final step involves identifying the 2011 donor that matches the 2003 recipient on:

Gender,

Single year of age (age as of 2003 and age as of 2003 +8),

2011education greater than or equal to 2003 education and that results in the least change in education

The 2011 donor that has the literacy score that is the closest, either positive or negative, to the 2003 score.

Linking each record in this way yields a sample of records for which scores are available for both 2003 and 2011 and where the 2011 skill use variables can be used to explain the magnitude and direction of skill gain/loss. Restricting the linkage in this latter way ensures that the linkage will yield the smallest possible estimate of skill gain and loss. Importantly for the current analysis, this approach to linkage yields levels of average score change that match the levels of change observed through a comparison of change in cross-sectional average scores between the two periods. We take this a strong indication that the linkage yields a reasonable approximation of the true distribution of score changes. Any other linkage might yield the same difference in average score but would necessarily be the product of much higher variance in skill change.

Such an approach cannot yield definitive results but can yield indicative findings that can help policy makers judge the importance of balancing supply-side skill measures with measures that serve to increase the demand for the cognitive skills that support the application of technical skills and knowledge in work. At a minimum, a failure to ensure skill demand is adequate to ensure full utilization of the available supply of cognitive skill will reduce public and private returns on educational investments and serve to increase levels of wage and income inequality.

Annex A Regaression Results

Table 13 Predictors of skill loss, 1994-2011, selected demographic groups, adults aged 16 to 65, Canada

Differences less than zero

The GLM Procedure

Class Level Information

Class	Levels	Values
Sex	2	1 2
age_grp	5	2 3 4 5 6
Immig_01	2	0 1

Number of Observations Read7980
Number of Observations Used3392
Differences lt 0 less than 0 skill loss
The GLM Procedure
Dependent Variable: Difference
Weight: PIACC_weight

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	43	794205131	18469887	23.90	<.0001
Error	3348	2586827604	772649		
Corrected Total	3391	3381032736			

R-Square	Coeff Var	Root MSE	Difference Mean		
	0.234900	-2855.511	879.0043	-30.78273	

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Sex	**1**	**280895788.1**	**280895788.1**	**363.55**	**<.0001**
age_grp	**4**	**164814811.7**	**41203702.9**	**53.33**	**<.0001**
Immig_01	**1**	**106048376.9**	**106048376.9**	**137.25**	**<.0001**
Seminars_or_workshop	1	1306161.1	1306161.1	1.69	0.1936
Private_Lessons	1	4673897.3	4673897.3	6.05	0.0140
LEARN	1	7276909.5	7276909.5	9.42	0.0022
READY	1	6005504.4	6005504.4	7.77	0.0053
ICTHOME	1	5224519.2	5224519.2	6.76	0.0094
ICTWORK	**1**	**37256832.4**	**37256832.4**	**48.22**	**<.0001**
INFLU	**1**	**13574595.2**	**13574595.2**	**17.57**	**<.0001**
NUMHOME	1	2952588.3	2952588.3	3.82	0.0507
NUMWORK	1	4016626.2	4016626.2	5.20	0.0227
PLANNING	1	26467.2	26467.2	0.03	0.8532
READHOME	1	1854537.9	1854537.9	2.40	0.1214
READWORK	1	65924.7	65924.7	0.09	0.7702
TASKDISC	**1**	**21200889.0**	**21200889.0**	**27.44**	**<.0001**
WRITHOME	1	380512.2	380512.2	0.49	0.4829
WRITWORK	1	6667057.4	6667057.4	8.63	0.0033

Table 13 Predictors of skill loss, 1994-2011, selected demographic groups, adults aged 16 to 65, Canada (concluded)

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Firm_Size	**1**	**14104937.7**	**14104937.7**	**18.26**	**<.0001**
flex_Sequence	1	355457.3	355457.3	0.46	0.4976
flex_How	1	635.6	635.6	0.00	0.9771
flex_Speed	1	24293.0	24293.0	0.03	0.8593
flex_Working	1	2961993.4	2961993.4	3.83	0.0503
Skill_USE_WORK_coope	1	3565123.7	3565123.7	4.61	0.0318
Skill_USE_WORK_Shari	1	6679925.3	6679925.3	8.65	0.0033
Skill_USE_WORK_Teach	1	425763.5	425763.5	0.55	0.4579
Skill_USE_WORK_Prese	1	2427720.4	2427720.4	3.14	0.0764
Skill_USE_WORK_Selli	**1**	**34429494.0**	**34429494.0**	**44.56**	**<.0001**
Skill_USE_WORK_Advis	1	2242175.9	2242175.9	2.90	0.0886
Skill_USE_WORK_Plan_	1	2852265.9	2852265.9	3.69	0.0548
Skill_USE_WORK_Plan_	**1**	**28328135.9**	**28328135.9**	**36.66**	**<.0001**
Skill_USE_WORK_Organ	1	83048.1	83048.1	0.11	0.7430

Table 14 The impact of skill use variables on score differences

Dependent Variable: Difference in literacy scores
Weight: IALSS_weight

Source	DF	Sum of squares	Mean square	F Value	Pr > F
Model	**35**	**12456549934**	**355901427**	**14.40**	**<.0001**
Error	2137	52805222842	24709978		
Corrected Total	2172	65261772776			

R-Square	Coeff Var	Root MSE	Difference Mean		
		0.190871	50570.47	4970.913	9.829676

Marginal effect of each variable

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	**4**	**4298749053**	**1074687263**	**43.49**	**<.0001**
Sex	1	1036000	1036000	0.04	0.8378
Age_10_Cohort	**3**	**1142342283**	**380780761**	**15.41**	**<.0001**
Immig_01	1	14497725	14497725	0.59	0.4438
B_Q12e Activities - Last year - Seminars or workshops	1	8763292	8763292	0.35	0.5516
B_Q12g Activities - Last year - Private lessons	1	127339809	127339809	5.15	0.0233
LEARNATWORK Index of learning at work (derived)	**1**	**500219288**	**500219288**	**20.24**	**<.0001**
READYTOLEARN Index of readiness to learn (derived)	1	62367336	62367336	2.52	0.1123
ICTHOME Index of use of ICT skills at home (derived)	**1**	**856350003**	**856350003**	**34.66**	**<.0001**
TASKDISC Index of use of task discretion at work (derived)	1	8692209	8692209	0.35	0.5532
D_Q11a Current work - Work flexibility - Sequence of tasks	1	231724083	231724083	9.38	0.0022
D_Q11b Current work - Work flexibility - How to do the work	1	104921492	104921492	4.25	0.0395
D_Q11c Current work - Work flexibility - Speed of work	1	3469063	3469063	0.14	0.7079
D_Q11d Current work - Work flexibility - Working hours	1	86809794	86809794	3.51	0.0610
F_Q02a Skill use work - How often - Sharing work-related info	**1**	**536642560**	**536642560**	**21.72**	**<.0001**
F_Q02b Skill use work - How often - Teaching people	**1**	**990884169**	**990884169**	**40.10**	**<.0001**
F_Q02c Skill use work - How often - Presentations	1	24401621	24401621	0.99	0.3205
F_Q02d Skill use work - How often - Selling	1	3649300	3649300	0.15	0.7008
F_Q02e Skill use work - How often - Advising people	1	19518227	19518227	0.79	0.3742
F_Q03a Skill use work - How often - Planning own activities	**1**	**403645573**	**403645573**	**16.34**	**<.0001**
F_Q03b Skill use work - How often - Planning others activities	1	72445912	72445912	2.93	0.0870
F_Q03c Skill use work - How often - Organising own time	1	5788581	5788581	0.23	0.6284
F_Q04a Skill use work - How often - Influencing people	**1**	**1307203061**	**1307203061**	**52.90**	**<.0001**
F_Q04b Skill use work - How often - Negotiating with people	1	76457291	76457291	3.09	0.0787
F_Q05a Skill use work - Problem solving - Simple problems	**1**	**518019853**	**518019853**	**20.96**	**<.0001**
F_Q05b Skill use work - Problem solving - Complex problems	**1**	**424384001**	**424384001**	**17.17**	**<.0001**
F_Q06b Skill use work - How often - Working physically for long	1	236804091	236804091	9.58	0.0020
F_Q06c Skill use work - How often - Using hands or fingers	**1**	**365957405**	**365957405**	**14.81**	**<.0001**
F_Q07a Skill use work - Not challenged enough	1	3022252	3022252	0.12	0.7266
F_Q07b Skill use work - Need more training	1	20444607	20444607	0.83	0.3631

Table 14 The impact of skill use variables on score differences (concluded)

All variables simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Educ_5	4	492530720	123132680	4.98	0.0005
Sex	1	5273318	5273318	0.21	0.6442
Age_10_Cohort	**3**	**1487513908**	**495837969**	**20.07**	**<.0001**
Immig_01	1	35321218	35321218	1.43	0.2320
B_Q12e Activities - Last year - Seminars or workshops	1	80664945	80664945	3.26	0.0709
B_Q12g Activities - Last year - Private lessons	1	32144203	32144203	1.30	0.2542
LEARNATWORK Index of learning at work (derived)	1	32607467	32607467	1.32	0.2508
READYTOLEARN Index of readiness to learn (derived)	1	8798695	8798695	0.36	0.5508
ICTHOME Index of use of ICT skills at home (derived)	1	311641651	311641651	12.61	0.0004
TASKDISC Index of use of task discretion at work (derived)	1	144103757	144103757	5.83	0.0158
D_Q11a Current work - Work flexibility - Sequence of tasks	1	109321594	109321594	4.42	0.0355
D_Q11b Current work - Work flexibility - How to do the work	1	27103535	27103535	1.10	0.2951
D_Q11c Current work - Work flexibility - Speed of work	1	55116257	55116257	2.23	0.1355
D_Q11d Current work - Work flexibility - Working hours	1	91045311	91045311	3.68	0.0551
F_Q02a Skill use work - How often - Sharing work-related info	1	25424804	25424804	1.03	0.3105
F_Q02b Skill use work - How often - Teaching people	1	57163625	57163625	2.31	0.1284
F_Q02c Skill use work - How often - Presentations	1	105914142	105914142	4.29	0.0385
F_Q02d Skill use work - How often - Selling	1	6007616	6007616	0.24	0.6220
F_Q02e Skill use work - How often - Advising people	1	107247431	107247431	4.34	0.0373
F_Q03a Skill use work - How often - Planning own activities	1	35972811	35972811	1.46	0.2277

Table 15 The impact of skill use variables on skill gain

where Difference greater than 0 skill gain
With Skill Use Job Variables Only
The GLM Procedure
Dependent Variable: Difference
Weight: IALSS_weight

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	**35**	**6920121788**	**197717765**	**8.88**	**<.0001**
Error			1202	26754458076	22258285
Corrected Total	1237	33674579864			

R-Square	Coeff Var	Root MSE	Difference Mean		
		0.205500	20464.66	4717.869	23.05374

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	**4**	**1184445323**	**296111331**	**3.30**	**<.0001**
Sex	1	86266426	86266426	3.88	0.0492
Age_10_Cohort	**3**	**708394091**	**236131364**	**10.61**	**<.0001**
Immig_01	**1**	**1393956422**	**1393956422**	**62.63**	**<.0001**
B_Q12e Activities - Last year - Seminars or workshops	1	128214345	128214345	5.76	0.0165
B_Q12g Activities - Last year - Private lessons	1	18244585	18244585	0.82	0.3655
LEARNATWORK Index of learning at work (derived)	1	159588246	159588246	7.17	0.0075
READYTOLEARN Index of readiness to learn (derived)	1	62121889	62121889	2.79	0.0951
ICTHOME Index of use of ICT skills at home (derived)	1	268138187	268138187	12.05	0.0005
TASKDISC Index of use of task discretion at work (derived)	1	1360009	1360009	0.06	0.8048
D_Q11a Current work - Work flexibility - Sequence of tasks	1	12225417	12225417	0.55	0.4588
D_Q11b Current work - Work flexibility - How to do the work	1	22001275	22001275	0.9	0.3203
D_Q11c Current work - Work flexibility - Speed of work	1	140819336	140819336	6.33	0.0120
D_Q11d Current work - Work flexibility - Working hours	1	60538197	60538197	2.72	0.0994
F_Q02a Skill use work - How often - Sharing work-related info	**1**	**507892774**	**507892774**	**22.82**	**<.0001**
F_Q02b Skill use work - How often - Teaching people	**1**	**1061431693**	**1061431693**	**47.69**	**<.0001**
F_Q02c Skill use work - How often - Presentations	1	4661681	4661681	0.21	0.6473
F_Q02d Skill use work - How often - Selling	1	8771941	8771941	0.39	0.5303
F_Q02e Skill use work - How often - Advising people	1	16937818	16937818	0.76	0.3832
F_Q03a Skill use work - How often - Planning own activities	1	1260900	1260900	0.06	0.8119
F_Q03b Skill use work - How often - Planning others activities	1	2404071	2404071	0.11	0.7425

Table 15 The impact of skill use variables on skill gain (continued)

Source	DF	Type I SS	Mean Square	F Value	Pr > F
F_Q03c Skill use work - How often - Organising own time	1	53275872	53275872	2.39	0.1221
F_Q04a Skill use work - How often - Influencing people	**1**	**339995674**	**339995674**	**15.28**	**<.0001**
F_Q04b Skill use work - How often - Negotiating with people	1	25420629	25420629	1.14	0.2854
F_Q05a Skill use work - Problem solving - Simple problems	**1**	**376619488**	**376619488**	**16.92**	**<.0001**
F_Q05b Skill use work - Problem solving - Complex problems	1	103507101	103507101	4.65	0.0312
F_Q06b Skill use work - How often - Working physically for long	1	65153405	65153405	2.93	0.0874
F_Q06c Skill use work - How often - Using hands or fingers	1	103936033	103936033	4.67	0.0309
F_Q07a Skill use work - Not challenged enough	1	742171	742171	0.03	0.8551
F_Q07b Skill use work - Need more training	1	1796789	1796789	0.08	0.7764

All variables simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Educ_5	4	203825986.5	50956496.6	2.29	0.0579
Sex	1	3001362.2	3001362.2	0.13	0.7135
Age_10_Cohort	3	180987016.2	60329005.4	2.71	0.0438
Immig_01	1	33902230.8	33902230.8	1.52	0.2174
B_Q12e Activities - Last year - Seminars or workshops	1	10050198.4	10050198.4	0.45	0.5017
B_Q12g Activities - Last year - Private lessons	1	815610.2	815610.2	0.04	0.8482
LEARNATWORK Index of learning at work (derived)	1	19661368.6	19661368.6	0.88	0.3475
READYTOLEARN Index of readiness to learn (derived)	1	1753667.8	1753667.8	0.08	0.7790
ICTHOME Index of use of ICT skills at home (derived)	1	220928174.1	220928174.1	9.93	0.0017
TASKDISC Index of use of task discretion at work (derived)	1	19752294.6	19752294.6	0.89	0.3464
D_Q11a Current work - Work flexibility - Sequence of tasks	1	38995448.7	38995448.7	1.75	0.1859
D_Q11b Current work - Work flexibility - How to do the work	1	8365954.9	8365954.9	0.38	0.5399
D_Q11c Current work - Work flexibility - Speed of work	1	8828731.0	8828731.0	0.40	0.5289
D_Q11d Current work - Work flexibility - Working hours	1	4548511.8	4548511.8	0.20	0.6513
F_Q02a Skill use work - How often - Sharing work-related info	1	360507.6	360507.6	0.02	0.8988
F_Q02b Skill use work - How often - Teaching people	1	19442398.5	19442398.5	0.87	0.3502
F_Q02c Skill use work - How often – Presentations	1	135140.2	135140.2	0.01	0.9379
F_Q02d Skill use work - How often – Selling	1	7118648.8	7118648.8	0.32	0.5718
F_Q02e Skill use work - How often - Advising people	1	8240857.4	8240857.4	0.37	0.5430
F_Q03a Skill use work - How often - Planning own activities	1	44607607.0	44607607.0	2.00	0.1571

where Difference greater than 0 **skill gain**
With Skill Use Job Variables Only
The GLM Procedure
Dependent Variable: Difference

Source	DF	Type III SS	Mean Square	F Value	Pr > F
F_Q03b Skill use work - How often - Planning others activities	1	16818927.0	16818927.0	0.76	0.3849
F_Q03c Skill use work - How often - Organising own time	1	1786226.4	1786226.4	0.08	0.7770
F_Q04a Skill use work - How often - Influencing people	1	25110092.3	25110092.3	1.13	0.2884
F_Q04b Skill use work - How often - Negotiating with people	1	31850390.3	31850390.3	1.43	0.2318
F_Q05a Skill use work - Problem solving - Simple problems	1	11019874.8	11019874.8	0.50	0.4818
F_Q05b Skill use work - Problem solving - Complex problems	1	35941573.7	35941573.7	1.61	0.2041
F_Q06b Skill use work - How often - Working physically for long	1	5349037.3	5349037.3	0.24	0.6241
F_Q06c Skill use work - How often - Using hands or fingers	1	37356045.2	37356045.2	1.68	0.1954
F_Q07a Skill use work - Not challenged enough	1	729181.7	729181.7	0.03	0.8564
F_Q07b Skill use work - Need more training	1	1796789.0	1796789.0	0.08	0.7764

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		-90.66191290 B	225.0303327	-0.40	0.6871
Educ_5	1	78.44164013 B	37.3262629	2.10	0.0358
Educ_5	2	43.82446868 B	36.9215940	1.19	0.2355
Educ_5	3	25.73971206 B	27.1349921	0.95	0.3430
Educ_5	4	14.84628566 B	29.1608403	0.51	0.6108
Educ_5	5	0.00000000 B	.	.	.
Sex	1	5.70861687 B	15.5459598	0.37	0.7135
Sex	2	0.00000000 B	.	.	.
Age_10_Cohort	2	-39.04356696 B	21.7412629	-1.80	0.0728
Age_10_Cohort	3	-3.50167567 B	22.4963415	-0.16	0.8763
Age_10_Cohort	4	-15.15812489 B	25.0867507	-0.60	0.5458
Age_10_Cohort	5	0.00000000 B	.	.	.

Table 15 The impact of skill use variables on skill gain (concluded)

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Immig_01	0	-25.95303617 B	21.0290609	-1.23	0.2174
Immig_01	1	0.00000000 B	.	.	.
B_Q12e Activities - Last year - Seminars or workshops	1	11.36860111	16.9186442	0.67	0.5017
B_Q12g Activities - Last year - Private lessons	1	-7.75557415	40.5152450	-0.19	0.8482
LEARNATWORK Index of learning at work (derived)	1	6.90391332	7.3457189	0.94	0.3475
READYTOLEARN Index of learning at work (derived)	1	4.41674340	15.7352755	0.28	0.7790
ICTHOME Index of use of ICT skills at home (derived)	1	17.41742365	5.5284605	3.15	0.0017
TASKDISC Index of use of task discretion at work (derived)	1	-29.44658548	31.2587791	-0.94	0.3464
D_Q11a Current work - Work flexibility - Sequence of tasks	1	27.13743884	20.5025435	1.32	0.1859
D_Q11b Current work - Work flexibility - How to do the work	1	-5.69848516	9.2949596	-0.61	0.5399
D_Q11c Current work - Work flexibility - Speed of work	1	-10.93985904	17.3703444	-0.63	0.5289
D_Q11d Current work - Work flexibility - Working hours	1	7.42196666	16.4183753	0.45	0.6513
F_Q02a Skill use work - How often - Sharing work-related info	1	0.99796321	7.8415721	0.13	0.8988
F_Q02b Skill use work - How often - Teaching people	1	-7.73581969	8.2770821	-0.93	0.3502
F_Q02c Skill use work - How often – Presentations	1	-0.70258394	9.0167849	-0.08	0.9379
F_Q02d Skill use work - How often - Selling	1	1.75086351	3.0959886	0.57	0.5718
F_Q02e Skill use work - How often - Advising people	1	-6.77936772	11.1416327	-0.61	0.5430
F_Q03a Skill use work - How often - Planning own activities	1	-7.13173398	5.0377489	-1.42	0.1571
F_Q03b Skill use work - How often - Planning others activities	1	-6.77200683	7.7904777	-0.87	0.3849
F_Q03c Skill use work - How often - Organising own time	1	2.37370571	8.3792368	0.28	0.7770
F_Q04a Skill use work - How often - Influencing people	1	13.69613392	12.8949506	1.06	0.2884
F_Q04b Skill use work - How often - Negotiating with people	1	14.81723609	12.3867014	1.20	0.2318
F_Q05a Skill use work - Problem solving - Simple problems	1	6.62369310	9.4136428	0.70	0.4818
F_Q05b Skill use work - Problem solving - Complex problems	1	-7.39885795	5.8225334	-1.27	0.2041
F_Q06b Skill use work - How often - Working physically for long	1	3.10188672	6.3275264	0.49	0.6241
F_Q06c Skill use work - How often - Using hands or fingers	1	8.87710318	6.8523047	1.30	0.1954
F_Q07a Skill use work - Not challenged enough	1	-4.53825388	25.0736034	-0.18	0.8564
F_Q07b Skill use work - Need more training	1	-11.88994242	41.8482261	-0.28	0.7764

Note: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Table 16 The impact of skill use variables on skill loss

where Difference less than 0 **skill loss**
With Skill Use Job Variables Only
The GLM Procedure
Class Level Information

Class		Levels	Values		
Educ_5	1	2	3	4	5
Sex	2	1	2		
Age_10_Cohort	4	2	3	4	5
Immig_01	2	0	1		
Number of Observations Read	1769				
Number of Observations Used	935				

where Difference less than 0 skill loss
With Skill Use Job Variables Only

The GLM Procedure
Dependent Variable: Difference
Weight: IALSS_weight

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	**35**	**4062741930**	**116078341**	**13.53**	**<.0001**
Error			899	7712292189	8578745
Corrected Total	934	11775034118			

	R-Square	Coeff Var	Root MSE	Difference Mean
	0.345030	-31369.38	2928.950	-9.336969

Table 16 The impact of skill use variables on skill loss (continued)

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	**4**	**1511732538**	**377933135**	**44.05**	**<.0001**
Sex	1	86657475	86657475	10.10	0.0015
Age_10_Cohort	**3**	**362856917**	**120952306**	**14.10**	**<.0001**
Immig_01	**1**	**627146744**	**627146744**	**73.10**	**<.0001**
B_Q12e Activities - Last year - Seminars or workshops	1	1854523	1854523	0.22	0.6421
B_Q12g Activities - Last year - Private lessons	1	27535	27535	0.00	0.9548
LEARNATWORK Index of learning at work (derived)	1	9149540	9149540	1.07	0.3020
READYTOLEARN Index of readiness to learn (derived)	1	41449043	41449043	4.83	0.0282
ICTHOME Index of use of ICT skills at home (derived)	1	23667593	23667593	2.76	0.0971
TASKDISC Index of use of task discretion at work (derived)	1	48045394	48045394	5.60	0.0182
D_Q11a Current work - Work flexibility - Sequence of tasks	1	1104052	1104052	0.13	0.7199
D_Q11b Current work - Work flexibility - How to do the work	1	568720	1568720	0.18	0.6690
D_Q11c Current work - Work flexibility - Speed of work	1	598530	598530	0.07	0.7917
D_Q11d Current work - Work flexibility - Working hours	**1**	**269038154**	**269038154**	**31.36**	**<.0001**
F_Q02a Skill use work - How often - Sharing work-related info	1	4703837	4703837	0.55	0.4592
F_Q02b Skill use work - How often - Teaching people	1	5308013	5308013	0.62	0.4317
F_Q02c Skill use work - How often - Presentations	1	8788897	8788897	1.02	0.3117
F_Q02d Skill use work - How often - Selling	1	40016417	40016417	4.66	0.0311
F_Q02e Skill use work - How often - Advising people	1	73605625	73605625	8.58	0.0035
F_Q03a Skill use work - How often - Planning own activities	**1**	**558181274**	**558181274**	**65.07**	**<.0001**
F_Q03b Skill use work - How often - Planning others activities	1	16085783	16085783	1.88	0.1712
F_Q03c Skill use work - How often - Organising own time	1	33175218	33175218	3.87	0.0495
F_Q04a Skill use work - How often - Influencing people	**1**	**226480970**	**226480970**	**26.40**	**<.0001**
F_Q04b Skill use work - How often - Negotiating with people	1	20265495	20265495	2.36	0.1247
F_Q05a Skill use work - Problem solving - Simple problems	1	29393232	29393232	3.43	0.0645
F_Q05b Skill use work - Problem solving - Complex problems	1	17012229	17012229	1.98	0.1594
F_Q06b Skill use work - How often - Working physically for long	1	3142950	3142950	0.37	0.5451
F_Q06c Skill use work - How often - Using hands or fingers	1	35885100	35885100	4.18	0.0411
F_Q07a Skill use work - Not challenged enough	1	3475356	3475356	0.41	0.5246
F_Q07b Skill use work - Need more training	1	2324776	2324776	0.27	0.6028

All variables simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Educ_5	4	71889791.6	17972447.9	2.09	0.0796
Sex	1	5209000.7	5209000.7	0.61	0.4360
Age_10_Cohort	**3**	**210415383.8**	**70138461.3**	**8.18**	**<.0001**
Immig_01	1	966973.9	966973.9	0.11	0.7371
B_Q12e Activities - Last year - Seminars or workshops	1	1348392.3	1348392.3	0.16	0.6919
B_Q12g Activities - Last year - Private lessons	1	73080341.3	73080341.3	8.52	0.0036
LEARNATWORK Index of learning at work (derived)	1	411092.5	411092.5	0.05	0.8268
READYTOLEARN Index of readiness to learn (derived)	1	5111309.8	5111309.8	0.60	0.4404
ICTHOME Index of use of ICT skills at home (derived)	1	46013.2	46013.2	0.01	0.9416
TASKDISC Index of use of task discretion at work (derived)	1	16981396.7	16981396.7	1.98	0.1598
D_Q11a Current work - Work flexibility - Sequence of tasks	1	7317281.9	7317281.9	0.85	0.3560
D_Q11b Current work - Work flexibility - How to do the work	1	44923145.2	44923145.2	5.24	0.0223
D_Q11c Current work - Work flexibility - Speed of work	1	3097043.2	3097043.2	0.36	0.5481
D_Q11d Current work - Work flexibility - Working hours	1	36301932.9	36301932.9	4.23	0.0400
F_Q02a Skill use work - How often - Sharing work-related info	1	349986.9	349986.9	0.04	0.8400
F_Q02b Skill use work - How often - Teaching people	1	197374.2	197374.2	0.02	0.8795
F_Q02c Skill use work - How often - Presentations	1	67830589.7	67830589.7	7.91	0.0050
F_Q02d Skill use work - How often - Selling	1	4219824.2	4219824.2	0.49	0.4833
F_Q02e Skill use work - How often - Advising people	1	12651291.2	12651291.2	1.47	0.2249
F_Q03a Skill use work - How often - Planning own activities	1	1809346.5	1809346.5	0.21	0.6462

Table 16 The impact of skill use variables on skill loss (concluded)

where Difference less than 0 **skill loss**
With Skill Use Job Variables Only
The GLM Procedure
Dependent Variable: Difference

All variables simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
F_Q03b Skill use work - How often - Planning others activities	1	90544.7	90544.7	0.01	0.9182
F_Q03c Skill use work - How often - Organising own time	1	2302995.1	2302995.1	0.27	0.6045
F_Q04a Skill use work - How often - Influencing people	1	29862084.0	29862084.0	3.48	0.0624
F_Q04b Skill use work - How often - Negotiating with people	1	991105.5	991105.5	0.12	0.7340
F_Q05a Skill use work - Problem solving - Simple problems	1	6491841.5	6491841.5	0.76	0.3846
F_Q05b Skill use work - Problem solving - Complex problems	1	1495810.5	1495810.5	0.17	0.6764
F_Q06b Skill use work - How often - Working physically for long	1	242412.5	242412.5	0.03	0.8665
F_Q06c Skill use work - How often - Using hands or fingers	1	40842041.8	40842041.8	4.76	0.0294
F_Q07a Skill use work - Not challenged enough	1	4783312.4	4783312.4	0.56	0.4554
F_Q07b Skill use work - Need more training	1	2324776.0	2324776.0	0.27	0.6028

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		-233.8278348 B	105.0545555	-2.23	0.0263
Educ_5	1	21.2832498 B	21.2202687	1.00	0.3161
Educ_5	2	-29.9774670 B	13.3006516	-2.25	0.0244
Educ_5	3	3.4854522 B	18.7195895	0.19	0.8523
Educ_5	4	10.2210278 B	15.9131038	0.64	0.5208
Educ_5	5	0.0000000 B	.	.	
Sex	1	-7.4934231 B	9.6164536	-0.78	0.4360
Sex	2	0.0000000 B	.	.	.
Age_10_Cohort 2		-32.3012344 B	21.1661495	-1.53	0.1273
Age_10_Cohort	3	-56.9690732 B	36.2867324	-1.57	0.1168
Age_10_Cohort	4	-29.5195671 B	32.7459398	-0.90	0.3676
Age_10_Cohort	5	0.0000000 B	.	.	.
Immig_01	0	3.9918672 B	11.8899660	0.34	0.7371
Immig_01	1	0.0000000 B	.	.	.
B_Q12e Activities - Last year - Seminars or workshops	1	7.3568477	18.5564768	0.40	0.6919
B_Q12g Activities - Last year - Private lessons	1	69.9336911	23.9606204	2.92	0.0036
LEARNATWORK Index of learning at work (derived)	1	1.2669132	5.7874728	0.22	0.8268
READYTOLEARN Index of readiness to learn (derived)	1	5.4301522	7.0348978	0.77	0.4404
ICTHOME Index of use of ICT skills at home (derived)	1	0.4992559	6.8170065	0.07	0.9416
TASKDISC Index of use of task discretion at work (derived)	1	-35.1174214	24.9601855	-1.41	0.1598
D_Q11a Current work - Work flexibility - Sequence of tasks	1	13.4627662	14.5771057	0.92	0.3560
D_Q11b Current work - Work flexibility - How to do the work	1	12.5566215	5.4871852	2.29	0.0223
D_Q11c Current work - Work flexibility - Speed of work	1	-8.6596939	14.4125491	-0.60	0.5481
D_Q11d Current work - Work flexibility - Working hours	1	21.3231896	10.3657131	2.06	0.0400
F_Q02a Skill use work - How often - Sharing work-related info	1	1.3994986	6.9288072	0.20	0.8400
F_Q02b Skill use work - How often - Teaching people	1	-1.2919840	.5177295	-0.15	0.8795
F_Q02c Skill use work - How often – Presentations	1	-11.2367054	3.9961160	-2.81	0.0050
F_Q02d Skill use work - How often – Selling	1	-1.1447243	1.6321709	-0.70	0.4833
F_Q02e Skill use work - How often - Advising people	1	-8.4595891	6.9661646	-1.21	0.2249
F_Q03a Skill use work - How often - Planning own activities	1	1.5774959	3.4349409	0.46	0.6462
F_Q03b Skill use work - How often - Planning others activities	1	0.4988774	4.8559501	0.10	0.9182
F_Q03c Skill use work - How often - Organising own time	1	-2.7103456	5.2310643	-0.52	0.6045
F_Q04a Skill use work - How often - Influencing people	1	12.0735982	6.4712556	1.87	0.0624
F_Q04b Skill use work - How often - Negotiating with people	1	2.2909869	6.7402274	0.34	0.7340
F_Q05a Skill use work - Problem solving - Simple problems	1	4.4347396	5.0979558	0.87	0.3846
F_Q05b Skill use work - Problem solving - Complex problems	1	-2.7438660	6.5710762	-0.42	0.6764
F_Q06b Skill use work - How often - Working physically for long	1	0.9518975	5.6627135	0.17	0.8665
F_Q06c Skill use work - How often - Using hands or fingers	1	7.7300526	3.5427509	2.18	0.0294
F_Q07a Skill use work - Not challenged enough	1	16.5280289	22.1344423	0.75	0.4554
F_Q07b Skill use work - Need more training	1	-13.0012061	24.9749702	-0.52	0.6028

Note: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Table 17 The impact of other job characteristics on score differences

All Merged
With Extra Job Variables
The GLM Procedure
Class Level Information

	Class	Levels	Values		
Educ_5	4	2	3	4	5
Sex	2	1	2		
Age_10_Cohort	4	2	3	4	5
Immig_01	2	0	1		
Number of Observations Read	4079				
Number of Observations Used	1647				

All Merged
With Extra Job Variables
The GLM Procedure
Dependent Variable: Difference in literacy scores

Weight: IALSS_weight

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	**21**	**7246697337**	**345080826**	**13.32**	**<.0001**
Error	1625	42098982993	25907066		
Corrected Total	1646	49345680331			

	R-Square	Coeff Var	Root MSE	Difference Mean
	0.146856	44896.73	5089.898	11.33690

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	**3**	**2389845589**	**79661519**	**30.75**	**<.0001**
Sex	1	19566179	19566179	0.76	0.3849
Age_10_Cohort	**3**	**1166650458**	**388883486**	**15.01**	**<.0001**
Immig_01	1	66867687	66867687	2.58	0.1083
B_Q12e Activities - Last year - Seminars or workshops	1	220153111	220153111	8.50	0.0036
B_Q12g Activities - Last year - Private lessons	1	79814071	79814071	3.08	0.0794
LEARNATWORK Index of learning at work (derived)	1	19594413	19594413	0.76	0.3846
READYTOLEARN Index of readiness to learn (derived)	**1**	**528575402**	**528575402**	**20.40**	**<.0001**
ICTHOME Index of use of ICT skills at home (derived)	**1**	**576756406**	**576756406**	**22.26**	**<.0001**
ICTWORK Index of use of ICT skills at work (derived)	**1**	**1132440633**	**1132440633**	**43.71**	**<.0001**
INFLUENCE	1	124259791	124259791	4.80	0.0287
NUMHOME Index of numeracy at home	**1**	**481440617**	**481440617**	**18.58**	**<.0001**
NUMWORK Index of numeracy at work	1	136911233	136911233	5.28	0.0216
PLANNING	1	3334	3334	0.00	0.9910
READHOME Index of reading at home	1	103702	103702	0.00	0.9496
READWORK Index of reading at work	1	302292302	302292302	11.67	0.0007
TASKDISC	1	1422411	1422411	0.05	0.8148

All variables simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Educ_5	3	196699573.6	65566524.5	2.53	0.0556
Sex	1	360269745.9	360269745.9	13.91	0.0002
Age_10_Cohort	3	454347752.8	151449250.9	5.85	0.0006
Immig_01	1	110908833.0	110908833.0	4.28	0.0387
B_Q12e Activities - Last year - Seminars or workshops	1	184617353.4	184617353.4	7.13	0.0077
B_Q12g Activities - Last year - Private lessons	1	172463430.9	172463430.9	6.66	0.0100
LEARNATWORK Index of learning at work (derived)	1	29976720.4	29976720.4	1.16	0.2822
READYTOLEARN Index of readiness to learn (derived)	**1**	**589823980.8**	**589823980.8**	**22.77**	**<.0001**
ICTHOME Index of use of ICT skills at home (derived)	1	364042627.3	364042627.3	14.05	0.0002
ICTWORK Index of ICT use at work	1	8998507.8	8998507.8	0.35	0.5557
INFLUENCE Index of use of influencing skills at work (derived)	1	115465.8	115465.8	0.00	0.9468
NUMHOME Index of numeracy at home	1	6831346.8	6831346.8	0.26	0.6077
NUMWORK Index of numeracy at work	1	116561509.8	116561509.8	4.50	0.0341
PLANNING	1	264557.7	264557.7	0.01	0.9195
READHOME Index of reading at home	1	89254836.3	89254836.3	3.45	0.0636

Table 17 The impact of other job characteristics on score differences (concluded)

Source	DF	Type III SS	Mean Square	F Value	Pr > F
READWORK Index of reading at work	1	230544273.4	230544273.4	8.90	0.0029
TASKDISC	1	1422410.6	1422410.6	0.05	0.8148

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		145.8654918 B	50.87011834	2.87	0.0042
Educ_5	2	9.8591378 B	10.24773885	0.96	0.3362
Educ_5	3	4.4354108 B	13.14453646	0.34	0.7358
Educ_5	4	23.0043774 B	8.76204306	2.63	0.0087
Educ_5	5	0.0000000 B	.	.	.
Sex	1	37.8410938 B	10.14749636	3.73	0.0002
Sex	2	0.0000000 B	.	.	.
Age_10_Cohort 2		-29.6164076 B	13.81822645	-2.14	0.0322
Age_10_Cohort 3		-18.3744450 B	14.92325361	-1.23	0.2184
Age_10_Cohort 4		-45.8490252 B	13.35950243	-3.43	0.0006
Age_10_Cohort 5		0.0000000 B	.	.	.

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With Extra Job Variables
The GLM Procedure
Dependent Variable: Difference in literacy scores

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Immig_01	0	12.5093944 B	6.04591919	2.07	0.0387
Immig_01	1	0.0000000 B	.	.	.
B_Q12e Activities - Last year - Seminars or workshops	1	-15.7715769	5.90810190	-2.67	0.0077
B_Q12g Activities - Last year - Private lessons	1	-56.1380878	21.75796253	-2.58	0.0100
LEARNATWORK Index of learning at work (derived)	1	-3.0303860	2.81718269	-1.08	0.2822
READYTOLEARN Index of readiness to learn (derived)	**1**	**9.9836595**	**2.09236607**	**4.77**	**<.0001**
ICTHOME Index of use of ICT skills at home (derived)	1	9.5227773	2.54036797	3.75	0.0002
ICTWORK Index of use of ICT at work	1	-1.6190682	2.74719198	-0.59	0.5557
INFLUENCE Index of use of influencing skills at work (derived)	1	0.4963872	7.43537842	0.07	0.9468
NUMHOME Index of numeracy use at home	1	4.4755816	8.71576344	0.51	0.6077
NUMWORK Index of numeracy use at work	1	8.6300811	4.06861329	2.12	0.0341
PLANNING Index of use of planning skills at work (derived)	1	0.3251611	3.21771441	0.10	0.9195
READHOME Index of reading use at home	1	-8.3149679	4.47975041	-1.86	0.0636
READWORK Index of reading use at work	1	-26.2556859	8.80147213	-2.98	0.0029
TASKDISC Index of use of task discretion at work (derived)	1	0.8775974	3.74534593	0.23	0.8148

Note: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Table 18 The impact of other job characteristics on skill gain

where Difference greater than 0 **skill gain**
With Extra Job Variables
The GLM Procedure
Class Level Information

Class		Levels	Values		
Educ_5	4	2	3	4	5
Sex			2	1	2
Age_10_Cohort	4	2	3	4	5
Immig_01		2	0	1	
Number of Observations Read	2310				
Number of Observations Used	952				

where Difference greater than 0

With Extra Job Variables
The GLM Procedure
Dependent Variable: Difference
Weight: IALSS_weight

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	**21**	**3132949038**	**149188049**	**5.64**	**<.0001**
Error	930	24621880728	26475141		
Corrected Total	951	27754829766			

	R-Square	Coeff Var	Root MSE	Difference Mean
	0.112879	21625.84	5145.400	23.79283

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	3	166133799.9	55377933.3	2.09	0.0997
Sex	1	37086750.1	37086750.1	1.40	0.2369
Age_10_Cohort	3	414825340.6	138275113.5	5.22	0.0014
Immig_01	**1**	**659539651.3**	**659539651.3**	**24.91**	**<.0001**
B_Q12e Activities - Last year - Seminars or workshops	1	377670717.0	377670717.0	14.27	0.0002
B_Q12g Activities - Last year - Private lessons	1	11604107.6	11604107.6	0.44	0.5081
LEARNATWORK Index of learning at work (derived)	1	58921343.1	58921343.1	2.23	0.1361
READYTOLEARN Index of readiness to learn (derived)	1	97980711.1	97980711.1	3.70	0.0547
ICTHOME Index of use of ICT skills at home (derived)	1	351159447.4	351159447.4	13.26	0.0003
ICTWORK Index of use of ICT skills at work (derived)	1	160208303.0	160208303.0	6.05	0.0141
INFLUENCE Index of use of influencing skills at work (derived)	1	288831168.0	288831168.0	10.91	0.0010
NUMHOME Index of use of numeracy at home	1	391549310.3	391549310.3	14.79	0.0001
NUMWORK Index of use of reading at work	1	2092699.4	2092699.4	0.08	0.7787
PLANNING Index of use of planning skills at work (derived)	1	52278168.1	52278168.1	1.97	0.1603
READHOME Index of reading use at home	1	36708519.6	36708519.6	1.39	0.2393
READWORK Index of reading use at work	1	24860036.5	24860036.5	0.94	0.3328
TASKDISC Index of use of task discretion at work (derived)	1	1498965.3	1498965.3	0.06	0.8120

All variable simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Educ_5	3	40917704.3	13639234.8	0.52	0.6719
Sex	1	17536430.6	17536430.6	0.66	0.4159
Age_10_Cohort	3	2073875.0	691291.7	0.03	0.9943
Immig_01	1	32051404.2	32051404.2	1.21	0.2715
B_Q12e Activities - Last year - Seminars or workshops	1	9544548.7	9544548.7	0.36	0.5484
B_Q12g Activities - Last year - Private lessons	1	9454856.2	9454856.2	0.36	0.5503
LEARNATWORK Index of learning at work (derived)	1	5357313.8	5357313.8	0.20	0.6529
READYTOLEARN Index of readiness to learn (derived)	1	219463531.8	219463531.8	8.29	0.0041
ICTHOME Index of use of ICT skills at home (derived)	1	160921893.1	160921893.1	6.08	0.0139
ICTWORK Index of use of ICT skills at work (derived)	1	13686505.0	13686505.0	0.52	0.4723
INFLUENCE Index of use of influencing skills at work (derived)	1	1624489.5	1624489.5	0.06	0.8044
NUMHOME Index of use of numeracy at home	1	17397558.5	17397558.5	0.66	0.4178
NUMWORK Index of use of numeracy at work	1	34875.3	34875.3	0.00	0.9711
PLANNING Index of use of planning skills at work (derived)	1	40437481.1	40437481.1	1.53	0.2168

Table 18 The impact of other job characteristics on skill gain (concluded)

Source	DF	Type III SS	Mean Square	F Value	Pr > F
READHOME Index of reading use at home	1	62425585.7	62425585.7	2.36	0.1250
READWORK Index of reading use at work	1	13230265.6	13230265.6	0.50	0.4798
TASKDISC Index of use of task discretion at work (derived)	1	1498965.3	1498965.3	0.06	0.8120

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		126.2070643 B	84.02845511	1.50	0.1334
Educ_5	2	20.4468253 B	23.69978809	0.86	0.3885
Educ_5	3	1.2095395 B	22.81943884	0.05	0.9577
Educ_5	4	4.4539841 B	15.89979125	0.28	0.7794
Educ_5	5	0.0000000 B	.	.	.
Sex	1	17.2066689 B	21.14196445	0.81	0.4159
Sex	2	0.0000000 B	.	.	.
Age_10_Cohort	2	0.6947970 B	21.63678551	0.03	0.9744
Age_10_Cohort	3	3.4403862 B	30.69606590	0.11	0.9108
Age_10_Cohort	4	-1.5913212 B	28.21559796	-0.06	0.9550
Age_10_Cohort	5	0.0000000 B	.	.	.

where Difference greater than 0 **skill gain**
With Extra Job Variables
The GLM Procedure
Dependent Variable: Difference

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Immig_01	0	-10.7919150 B	9.80830863	-1.10	0.2715
Immig_01	1	0.0000000 B	.	.	.
B_Q12e Activities - Last year - Seminars or workshops	1	-5.6850476	9.46837709	-0.60	0.5484
B_Q12g Activities - Last year - Private lessons	1	-23.2088565	38.83697690	-0.60	0.5503
LEARNATWORK Index of learning at work (derived)	1	-2.1330135	4.74175590	-0.45	0.6529
READYTOLEARN Index of readiness to learn (derived)	1	9.0831016	3.15480214	2.88	0.0041
ICTHOME Index of use of ICT skills at home (derived)	1	10.0494949	4.07620300	2.47	0.0139
ICTWORK Index of use of ICT skills at work (derived)	1	3.3128295	4.60757000	0.72	0.4723
INFLUENCE Index of use of influencing skills at work (derived)	1	3.7883897	15.29379728	0.25	0.8044
NUMHOME Index of numeracy use at home (derived)	1	-17.7088209	21.84563284	-0.81	0.4178
NUMWORK Index of numeracy use at work (derived)	1	-0.2695933	7.42794892	-0.04	0.9711
PLANNING Index of use of planning skills at work (derived)	1	-7.7018960	6.23196122	-1.24	0.2168
READHOME Index of reading use at home (derived)	1	-11.8089171	7.69038175	-1.54	0.1250
READWORK Index of reading use at work (derived)	1	-10.7999210	15.27761057	-0.71	0.4798
TASKDISC Index of use of task discretion at work (derived)	1	-1.7502489	7.35568572	-0.24	0.8120

Note: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Table 19 The impact of other job characteristics on skill loss

where Difference lt 0 **Skill loss**
With Extra Job Variables
The GLM Procedure
Dependent Variable: **Difference in literacy scores**
Weight: IALSS_weight

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	**21**	**3372994241**	**160618773**	**30.76**	**<.0001**
Error	673	3513997438	5221393		
Corrected Total	694	6886991679			

	R-Square	Coeff Var	Root MS	Difference Mean
	0.489763	-30648.51	2285.037	-7.455621

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Educ_5	**3**	**1357904339**	**452634780**	**86.69**	**<.0001**
Sex	1	61649537	61649537	11.81	0.0006
Age_10_Cohort	**3**	**460559711**	**153519904**	**29.40**	**<.0001**
Immig_01	**1**	**696832034**	**696832034**	**133.46**	**<.0001**
B_Q12e Activities - Last year - Seminars or workshops	1	42327999	42327999	8.11	0.0045
B_Q12g Activities - Last year - Private lessons	1	1402091	1402091	0.27	0.6045
LEARNATWORK Index of learning at work (derived)	1	27847866	27847866	5.33	0.0212
READYTOLEARN Index of readiness to learn (derived)	1	27132939	27132939	5.20	0.0229
ICTHOME Index of use of ICT skills at home (derived)	1	684850	684850	0.13	0.7173
ICTWORK Index of use of ICT skills at work (derived)	**1**	**483349991**	**483349991**	**92.57**	**<.0001**
INFLUENCE Index of use of influencing skills at work (derived)	1	8651756	8651756	1.66	0.1985
NUMHOME Index of numeracy use at home (derived)	1	12654893	12654893	2.42	0.1200
NUMWORK Index of numeracy uAse at work (derived)	**1**	**90074393**	**90074393**	**17.25**	**<.0001**
PLANNING Index of use of planning skills at work (derived)	1	10325206	10325206	1.98	0.1601
READHOME Index of reading use at home (derived)	1	34974705	34974705	6.70	0.0099
READWORK Index of reading use at work (derived)	1	43428218	43428218	8.32	0.0041
TASKDISC Index of use of task discretion at work (derived)	1	13193713	13193713	2.53	0.1124

All variables simultaneously

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Parameter		Estimate	Standard Error	t Value	Pr > ltl
Intercept		14.62288586 B	37.53531076	0.39	0.6970
Educ_5	2	-3.08274690 B	5.70283439	-0.54	0.5890
Educ_5	3	-0.48544784 B	8.16816645	-0.06	0.9526
Educ_5	4	17.29361942 B	4.98298803	3.47	0.0006
Educ_5	5	0.00000000 B	.	.	.
Sex	1	22.13466687 B	5.89636297	3.75	0.0002
Sex	2	0.00000000 B	.	.	.
Age_10_Cohort	2	-30.69389988 B	9.28132993	-3.31	0.0010
Age_10_Cohort	3	-17.84820087 B	8.91128200	-2.00	0.0456
Age_10_Cohort	**4**	**-38.90328657 B**	**7.84806924**	**-4.96**	**<.0001**
Age_10_Cohort	5	0.00000000 B	.	.	.

Table 19 The impact of other job characteristics on skill loss (concluded)

where Difference lt 0 **Skill loss**
With Extra Job Variables
The GLM Procedure
Dependent Variable: Difference in literacy scores

Parameter		Estimate	Standard Error	t Value	Pr > ltl
Immig_01	**0**	**22.35207658 B**	**3.81643229**	**5.86**	**<.0001**
Immig_01	1	0.00000000 B	.	.	.
B_Q12e Activities - Last year - Seminars or workshops	**1**	**-18.49013704**	**3.56325934**	**-5.19**	**<.0001**
B_Q12g Activities - Last year - Private lessons	1	-14.42798059	16.58087188	0.87	0.3845
LEARNATWORK Index of learning at work (derived)	1	-1.90720846	1.68727787	-1.13	0.2587
READYTOLEARN Index of readiness to learn (derived)	1	4.14100067	1.36163924	3.04	0.0024
ICTHOME Index of use of ICT skills at home (derived)	1	2.79343092	1.72579545	1.62	0.1060
ICTWORK Index of use of ICT skills at work (derived)	1	-5.59883263	1.60618986	-3.49	0.0005
INFLUENCE Index of use of influencing skills at work (derived)	1	3.07403460	4.24527398	0.72	0.4693
NUMHOME Index of use of numeracy at work (derived)	1	10.80590672	4.54317602	2.38	0.0177
NUMWORK Index of use of numeracy at work (derived)	1	7.40925704	2.39480149	3.0	0.0021
PLANNING Index of use of planning skills at work (derived)	1	3.42846081	1.98127271	1.73	0.0840
READHOME Index of use of reading skills at home (derived)	1	2.52643223	2.96107211	0.85	0.3938
READWORK Index of use of reading skills at work (derived)	1	-18.40483917	5.59019224	3.29	0.0010
TASKDISC Index of use of task discretion at work (derived)	1	3.29240516	2.07120436	1.59	0.1124

Note: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.