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.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

University graduates with lower levels of literacy and numeracy skills

by Darcy Hango

Overview of the study

This article examines the share of adults aged 25 to 65 with a university degree who were in the lower range for literacy skills, numeracy skills, or both, and the factors most likely to be associated with lower levels of literacy or numeracy among university graduates. In this article, individuals in the lower range for literacy and numeracy are defined as those who scored at level 2 or below (out of 5 levels) in tests administered to survey respondents who participated in the Programme for the International Assessment of Adult Competencies (PIAAC).

- Of all Canadian adults aged 25 to 65 in 2012, 49% were in the lower range for literacy proficiency, 55% were in the lower range for numeracy proficiency, and 43% were in the lower range for both literacy **and** numeracy.
- University graduates were less likely than other educational attainment groups to be in the lower range for skills. For example, 27% of university graduates were in the lower range for literacy skills, compared with 88% among those with less than a high school diploma.
- Foreign-born university graduates were more likely to be in the lower range of literacy and/or numeracy. For instance, 45% of them were in the lower range for literacy, compared with 16% of Canadian-born university graduates.
- Among the Canadian-born university graduates, the proportion of those in the lower range for literacy and numeracy varied across various factors, such as age, field of study, and number of books at age 16 (used as a proxy for cultural capital).
- Canadian-born university graduates who were classified in the lowest skill proficiency levels were as likely to be employed as those who were in the top three levels, but those who were employed were less likely to work as professionals or managers.

Introduction

Higher education is typically associated with greater benefits, especially in the labour market, both in the short-term and over longer term.[1] For instance, a recent study based on a cohort of individuals in the early stages of their career in 1991 suggested that Canadian men with a bachelor's degree earned $728,000 more on average than their counterparts with a high school diploma over a 20-year period. For women, the difference between high and low education levels was less, but still substantial at about $442,000.[2] Meanwhile, other research, measuring proficiency skills more directly, suggests that factors such as literacy may also have a substantial impact on earnings.[3] Other studies found that over one-half of the education effect on earnings can be explained via cognitive factors (such as literacy).[4] More recent evidence also finds that higher cognitive skills, such as literacy and numeracy, raise earnings—an effect present in over 20 countries.[5]

While it is well-known that education is closely tied to the labour market, it is also increasingly being discovered that cognitive skills, separately and in combination with education, are important determinants of labour market success.[6] Therefore, knowing the level of skills, such as literacy and numeracy, in conjunction with level of education, can contribute to our understanding of labour market success. To this end, this study will examine those

who graduated from university, yet were in the lower range of literacy and/or numeracy scores. Recent results from the Programme for the International Assessment of Adult Competencies (PIAAC) suggest that even though the university-educated have higher literacy and numeracy skill levels than their less-educated counterparts, a significant proportion of university graduates in Canada are at level 2 or below in terms of literacy or numeracy proficiency. In 2012, around 27% of university graduates aged 25 to 65 were in the 2nd proficiency level or below for literacy, while the figure was 31% for numeracy.[7]

Those who are highly educated but find themselves at the bottom of the skills distribution represents individuals who, beyond the required credentials, may not have the necessary skill set to succeed in the labour market. As university degree-holders in Canada continue to increase in numbers, employers may value other, perhaps less tangible, qualities, such as literacy or numeracy skills. Thus, differences in literacy and numeracy skills could help explain why individuals with a similar educational background sometimes differ in their labour market outcomes.

In this article, new data from the Programme for the International Assessment of Adult Competencies (PIAAC) are used.[8] PIAAC is a large survey that collected information on the information processing skills of youth and adults between the ages of 16 and 65 in Canada and 23 other countries in 2011 and 2012 (See *Data sources, methods and definitions*). This article begins by providing descriptive statistics about the proportion of individuals who were in the lower range for literacy, numeracy, or both. The second part of this article examines the characteristics of university graduates with lower levels of skills, with a focus on the Canadian-born population. The third section of this paper examines the extent to which lower levels of skills could be linked to lower employment outcomes among university graduates.

Higher levels of literacy and numeracy skills for university graduates

In PIAAC, each survey respondent had to answer questions aimed at measuring their information processing skills, and obtained scores ranging from 0 to 500. In the case of literacy, respondents were measured for their ability to engage with written texts (print-based and digital). In the case of numeracy, respondents were measured for their ability to engage with mathematical information "in order to manage the mathematical demands of a range of situations in everyday life".[9] On the basis of such scores, respondents can be classified across levels (ranging from below level 1 to level 5). The higher the level, the more respondents are capable of processing more complex information and understanding complex representations.

Since the focus of this study is on university graduates, who typically have higher average levels of literacy and numeracy, it is appropriate to qualify individuals who are at level 2 or below as those who are in the "lower range" for literacy or numeracy skills. University degree holders below level 3 may not have mastered the minimum foundation of literacy needed to attain higher levels of performance. Conversely, those at level 3 and above generally have positive economic, social and educational outcomes, and thus may be better equipped to occupy professional or managerial jobs that normally require a university education.[10]

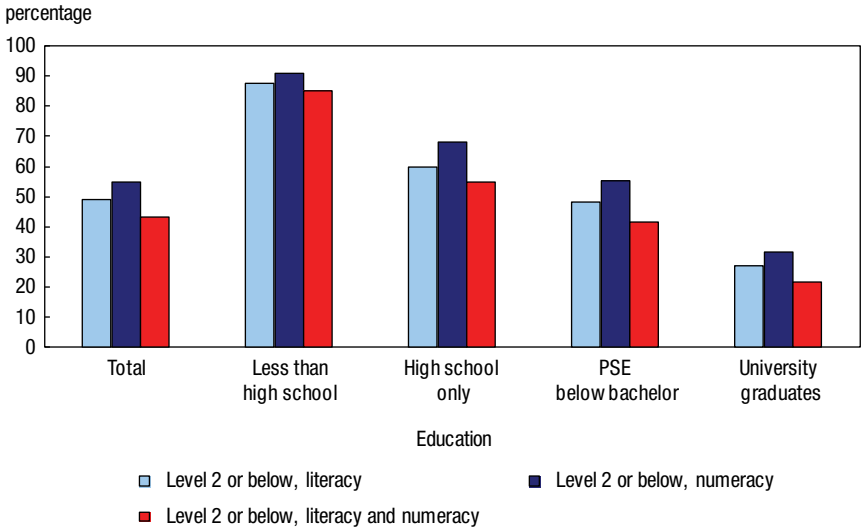
With respect to literacy, individuals at level 2 or below are less likely to undertake tasks that involve the integration of information across multiple sources and more likely only to have the ability to undertake tasks of limited complexity such as locating single pieces of information in short sections of text.

For numeracy, individuals at level 2 or below are less likely to be able to perform and understand complex mathematical information and work with mathematical models. They are also less likely to use problem solving strategies, and more likely only to have the ability to perform simpler mathematical operations (See *Data sources, methods and definitions* for a description of each level).[11]

Across the entire population aged 25 to 65, 49% had a literacy score at level 2 or below, while 55% had a numeracy score at level 2 or below (Chart 1). About 43% of Canadians aged 25 to 65 scored at level 2 or below on both literacy **and** numeracy.

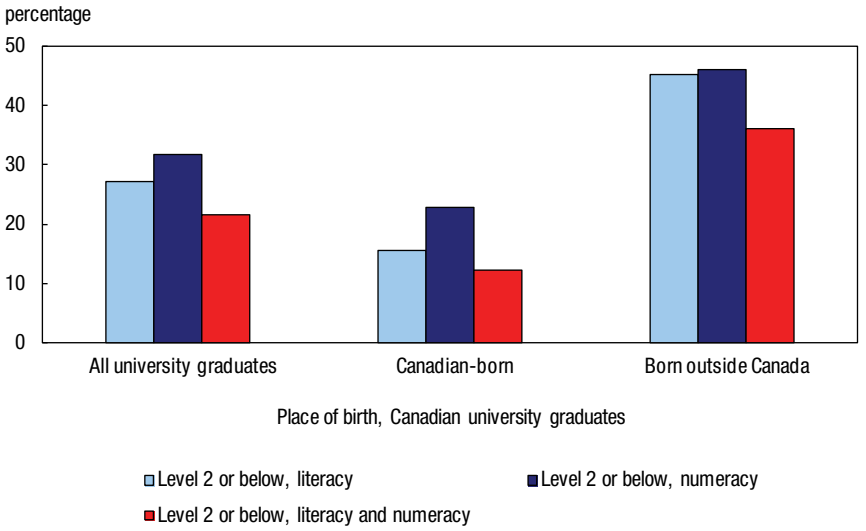
As might be expected, the level of education is positively correlated with skills.[12] Not only do individuals gain more skills and enhance their competencies while in an educational program, these programs are also selective of skills and competencies in the first place. For example, recent work has highlighted the link between greater reading proficiency at age 15 and university attendance by age 21.[13] Furthermore, university-educated individuals are more likely to work in occupations that require the use of more complex skills.[14]

Chart 1
Proportion of adults aged 25 to 65 at level 2 or below in skill proficiency levels, by educational attainment category



Note: PSE = Postsecondary education
Source: OECD, Programme for the International Assessment of Adult Competencies (PIAAC), 2012.

Chart 2
Proportion of Canadian adults aged 25 to 65 with a university degree at level 2 or below in skill proficiency levels, by place of birth



Source: Programme for the International Assessment of Adult Competencies (PIAAC), 2012.

This same relationship was found in PIAAC as well. For example, 27% of PIAAC respondents aged 25 to 65 with a university degree had literacy skills in the lower range (level 2 or below). This increased to 48% for those with a non-bachelor PSE diploma, to 60% for those with a high school diploma and to 88% for those with less than a high school diploma. A similar trend across educational attainment categories was found for numeracy, although the proportions (at level 2 or below) were higher in each category (from 32% among university graduates to 91% among those with less than a high school education). Lastly, the proportion of individuals aged 25 to 65 who were in the lowest levels of literacy **and** numeracy also varied across the education gradient, from 22% among university graduates to 85% among those with less than a high school diploma.

University-educated immigrants are more likely to be in the lower range of literacy and numeracy

Because a relatively large proportion of university graduates in Canada are foreign-born (about 4 in 10), the scores obtained by immigrants may influence the results of university graduates as a whole. It is also noteworthy that PIAAC tests were administered in French or English to all survey respondents (including immigrants), meaning their results could be influenced by their proficiency in the test language (81% of foreign-born university graduates had a native tongue other than English or French).

Among university graduates, about 45% of the foreign-born were in the lower range for literacy (level 2 or below), while 16% of the Canadian-born were in the same situation (Chart 2). The results for numeracy were similar: 46% of immigrants had numeracy in the lower range (level 2 or below), while the figure was 23% among the Canadian-born. Furthermore, 36% of foreign-born university graduates had both numeracy and literacy in the lower range, compared with 12% of the

Canadian-born university population. The differences between immigrants and the Canadian-born, however, were much reduced when looking only at immigrants who completed their studies in Canada (see *Results by location of study and immigration status*).

Because PIAAC has been administered in other countries, some international comparisons are possible, notably with the United States. Comparisons indicate that in both countries, the shares of university graduates who were in the lower range for numeracy and literacy skills were relatively similar (Chart 3). Of all university graduates in the United States, 22% were in the lower range for literacy (compared with 27% in Canada), 31% were in the lower range for numeracy (32% in Canada) and 18% were in the lower range for both (22% in Canada). The gap between immigrants and the native-born, however, was smaller in the United States—the result of relatively higher rates among those who were born in the United States (compared to those who were born in Canada) and relatively lower rates among immigrants in the United States (compared to their Canadian counterparts).

Understanding why immigrants score lower in numeracy and literacy would require an examination of, among other factors, language, ethnic origin, and location of study. In the near future, results for immigrants (and the Aboriginal population) will be examined more extensively in other thematic reports. In the rest of the present analysis, only Canadian-born respondents are included, since the factors outlined above may not be as relevant in explaining why some Canadian-born university graduates have lower levels of literacy and numeracy.

Characteristics associated with lower levels of literacy and numeracy among Canadian-born university graduates

As previously observed, a significant portion of the Canadian-born university-educated scored at level 2 or lower in PIAAC tests (16% in literacy and 23% in numeracy). This section examines the characteristics associated with the Canadian-born university graduates with lower levels of literacy or numeracy. Personal characteristics are examined, as well as family background variables and educational background variables (Table 1).

Personal characteristics

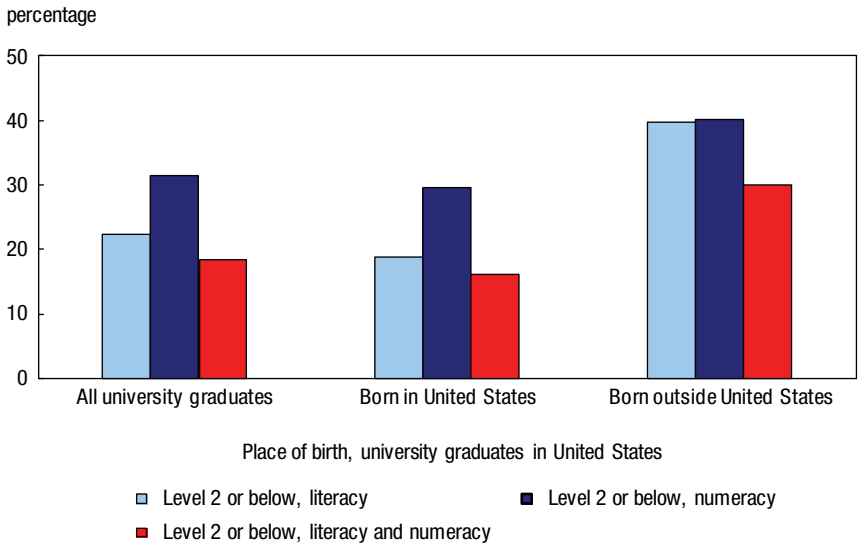
Some personal characteristics that may be related to lower levels of literacy and numeracy among Canadian-born university graduates include gender, age, language, and province.

First, the proportion of those who had a level 2 or below in numeracy was higher among women (27%, compared with 17% among men).[15] However, similar proportions of men and women had a level 2 or below in literacy (14% for men and 16% for women).[16]

Differences could also be found across age groups, even among university graduates.[17] The proportions of those at level 2 or less were lowest among those aged 35 to 39, (with percentages of 9% for literacy and 17% for numeracy). Conversely, the highest percentages were found among those aged 55 and over—about one-quarter of this population had literacy in the lower range and nearly one-third had numeracy in the lower range.

Since this analysis is restricted to the university-educated Canadian-born, the majority had either English (66%) or French (27%) as their mother tongue, while the remaining

Chart 3
Proportion of American adults aged 25 to 65 with a university degree at level 2 or below in skill proficiency levels, by place of birth



Source: Programme for the International Assessment of Adult Competencies (PIAAC), 2012.

7% had another first language. Of these individuals with a mother tongue other than English or French, three-quarters had parents who were born outside Canada; that is to say second-generation Canadians. In this population, 24% were in the lower range for literacy, compared with 13% among those who reported English as their mother tongue. At 19%, individuals with French as their mother tongue also had a significantly higher rate than individuals whose mother tongue was English. The differences in the results for numeracy, however, were not significant between the three groups.

The pan-Canadian PIAAC report had found that, among all people in Canada aged 16 to 65, average levels of literacy and numeracy were highest in Alberta and lowest in Newfoundland and Labrador.[18] However, with respect to the probability of having literacy or numeracy in the lower range for the Canadian-born university-educated, there was little variation across provinces. The one exception was Quebec, which had a higher proportion of university graduates in the lower literacy range than Ontario (19% versus 13%).

Family background

As indicated above, the acquisition of numeracy and literacy skills is a complex process, resulting from the interaction of complex life experiences, including work experiences, education decisions, individual abilities and family background. The educational attainment of parents is one aspect of family background collected in PIAAC.

The links between parental education and that of their children are well-founded.[19] Better-educated

Table 1
Proportion of Canadian-born university graduates aged 25 to 65 at level 2 or below in skill proficiency levels across various socioeconomic characteristics

	Level 2 or below, literacy	Level 2 or below, numeracy
	percentage	
Gender		
Men (ref.)	13.6	16.8
Women	16.2	26.8*
Age group		
25 to 29	12.3	19.5
30 to 34	11.3	17.4
35 to 39 (ref.)	8.6	17.4
40 to 44	13.7	21.2
45 to 49	14.2	22.0
50 to 54	17.9*	26.8
55 to 59	23.8*	29.0*
60 to 65	23.9*	29.3*
First language spoken (mother tongue)		
English (ref.)	12.7	20.6
French	18.5*	24.0
Other	23.8*	30.3
Province of residence		
Newfoundland and Labrador	15.7	23.6
Prince Edward Island	15.1	24.5
Nova Scotia	15.1	22.6
New Brunswick	17.6	27.5
Quebec	19.4*	25.2
Ontario (ref.)	13.0	20.0
Manitoba	17.3	28.6
Saskatchewan	13.1	20.3
Alberta	13.0	20.4
British Columbia	12.3	21.0
Parental education		
Less than a high school diploma (ref.)	26.6	34.7
At least one has a high school diploma	18.8	26.8
At least one has a PSE below bachelor	11.7*	18.7*
At least one has a university degree	11.5*	18.0*
Number of books in home at age 16		
10 or less (ref.)	30.9	39.1
11 to 25	20.5	30.5
26 to 100	17.0	24.0*
101 to 200	14.4*	20.8*
More than 200	8.6*	15.4*
Field of study		
STEM (ref.)	9.4	11.5
Humanities, languages and arts	17.9*	29.4*
Social science, business and law	13.1	20.9
Teacher training and education science	22.2*	29.1*
Health and welfare	15.5	26.5*
Educational attainment		
Bachelor's degree (ref.)	16.0	23.4
1st professional degree (medical, veterinary medical, dental, optometry, law, divinity)	13.1	19.3
Masters or Doctorate	13.2	19.9

* significantly different from the reference category (ref.) ($p < 0.05$)

Note: PSE = Postsecondary education. STEM includes science, technology, engineering, mathematics and computer science.
Source: Programme for the International Assessment of Adult Competencies (PIAAC), 2012.

parents may have higher literacy and numeracy skills to pass on to their children. The benefits may also be witnessed among university graduates: using numeracy as an example, more than one-third of university graduates whose parents had less than a high school education were at level 2 or below in numeracy skills, compared with less than one-fifth among those whose parents were university graduates. Similar results were found for literacy.

Another important family background characteristic is access to cultural capital at a young age. It is believed that exposure to various sources of intellectual stimulation in childhood has a positive impact on academic outcomes.[20] In PIAAC, these sources of cultural capital can be proxied with the estimated number of books in the home when respondents were in high school. The availability of reading material can be beneficial for developing and building skills, especially reading skills, as youth enter adulthood. Even among the Canadian-born and university-educated, not everyone had access to a critical mass of books at home when they were 16. About 32% of Canadian-born university graduates aged 25 to 65 said they had over 200 books in their home when they were 16, while 6% had access to 10 books or less.

As expected, Canadian-born university graduates who had 10 books or less at home at age 16 were more likely to be in the lower range for literacy (31%). This proportion declined over successive groups, to 9% for university graduates with over 200 books. The same general relationship was found with respect to numeracy: the proportion who were in the lower range among those who had 10 books or less was 39%, a rate that was significantly higher than those who had 101 to 200 books (21%) and those who had more than 200 books (15%).

Educational background

It may be that individuals gain more skills in some specific educational programs, and/or that students with better skills may be concentrated in certain types of programs. As a result, the type of educational experience may also be a determinant of literacy and numeracy skills among adults. The results are compared across five types of instructional programs.

For both literacy and numeracy, the lowest proportions of those at level 2 or below were found among those who graduated from science, technology, engineering, mathematics, and computer science (STEM) programs (9% for literacy and 12% for numeracy). With respect to numeracy, differences between STEM graduates and other types of instructional programs could be expected, since most STEM programs typically involve more complex mathematical techniques, and also because STEM graduates may be more likely to work in jobs allowing them to maintain such skills. But even for literacy, the proportion for those who graduated from STEM programs was significantly lower than graduates from teacher training and education science programs (22%), and graduates from humanities, languages and arts programs (18%). This finding could perhaps highlight the more selective nature of STEM program participation, especially as it pertains to skills requiring greater mathematical ability.[21]

Lastly, no significant differences were found between graduates with a bachelor degree and those with a masters or doctorate, or with those in professional degree programs (such as medical, dental or optometry programs).

Some of the variables discussed above are related. For example, parental education is strongly correlated with the number of books at home at age 16. However, when the variables are considered together in logistic regression models (with a dependent variable equal to 1 if the respondent is at level 2 or below, and 0 otherwise), differences by gender, age group, number of books at home at age 16, and field of study remained significant. Conversely, differences by first language spoken and parental education lost their significance. In the latter case, this is likely because of the close association between parental education and other control variables, particularly the number of books at home at age 16, and age (i.e., older respondents are less likely to have university-educated parents).

Employment outcomes of university graduates in lower skill levels

In this section, the links between lower skill levels and employment outcomes are examined among Canadian-born adults aged 25 to 65 with a university degree. Specifically, two questions are examined: (1) are university graduates with lower levels of numeracy or literacy less likely to be employed than those at higher skill levels?; and (2) among those who are employed, are those at lower literacy and numeracy skill levels less likely to employed in high-skilled occupations?

Both questions can be answered by using multivariate models. In the employment models, the dependent variable is equal to 1 if the respondent is employed and equal to 0 otherwise.

Three sets of explanatory variables are then applied. In the first set, only one variable is included, indicating whether the respondent has a level 2 or below for literacy (or numeracy). In subsequent models, demographic and education-related variables are included to account for the other factors (other than skills) that may influence the probability of employment. Separate models are applied for literacy and numeracy.[22]

Results from the first model indicate that having a level 2 or below for literacy was associated with a 10 percentage-point reduction in the probability of being employed, compared with those who were at level 3 or higher (Table 2). Put differently, university graduates with a level 2 or below had a 79% probability of being employed, compared with 89% among those with a level 3 or higher. The results for numeracy were similar, as those with a level 2 or below had an 8 percentage-point reduction in the probability of employment (or 81%, compared with 89% for those with a level 3 or higher).

However, when other demographic or educational variables were included in the model, the difference between lower- and higher-skilled individuals shrank to the point of becoming non-significant. This suggests that, as far as employment is concerned, lower levels of literacy and numeracy would have little influence on the probability of being employed—at least among Canadian-born university graduates.

Similar models can be used within the employed population to determine whether skill levels are associated with a lower probability of being employed in occupations typically requiring a university degree ('professional' occupations) **or** in management occupations. In 2012, 85% of Canadian-born university graduates who had a job were employed in such occupations.[23]

Table 2
Relationship between skill levels and the probability of employment, all Canadian-born university graduates aged 25 to 65

	Model 1 Controls for skill levels only	Model 2 Add demographic factors	Model 3 Add education-related factors
Marginal effects of being employed[1]		percentage point	
Literacy (ref.: level 3 or above)			
Level 2 or below	-9.8*	-4.1	-3.5
Predicted probabilities		percentage	
Level 3 or above	88.9	91.3	91.4
Level 2 or below	79.0	87.2	87.9
Numeracy (ref.: level 3 or above)		percentage point	
Level 2 or below	-8.0*	-3.9	-3.2
Predicted probabilities		percentage	
Level 3 or above	89.2	91.5	91.6
Level 2 or below	81.2	87.7	88.4

* significantly different from the reference category (ref.) ($p < 0.05$)
1. These are marginal effects at the mean.
Notes: Additional controls: Model 2 – gender, presence of children in the home, live with partner/spouse, first language learned as a child, province of residence, and age group; Model 3 – Model 2 controls plus field of study, level of education, and parental education.
Source: Programme for the International Assessment of Adult Competencies (PIAAC), 2012.

Results from the first model (with only the skills variable as a covariate) indicate that among university graduates who were employed in 2012, those with a level 2 or below in literacy or numeracy were about 8 or 10 percentage points, respectively, less likely than those with higher skills to be employed in a professional or managerial occupation (Table 3). When these results are translated into proportions, 82% of employed university graduates with a level 2 or below in literacy were employed in a professional or managerial occupation, compared with 90% among employed university graduates who had a level 3 or above. For numeracy, the results were 82% among those with a level 2 or below and 91% among those with a level 3 or above.

However, and somewhat contrary to the employment results, the effect of skill does not entirely disappear once other covariates are included in the second or third model (at least in the case of numeracy). Using the results of the third model as an example, university graduates who had a level 2 or below for numeracy had a probability of employment in skilled occupations that was about 8 percentage points lower than individuals with skills at level 3 or higher, even after taking other demographic and educational variables into account. The results for literacy however, indicate that once educational factors are considered in Model 3, the impact of literacy skills on the probability of working in a skilled occupation becomes non-significant.

Such results indicate that university graduates of different skill levels are just as likely to be employed, but not necessarily as likely to occupy the same type of work because those in the lower range of skills (at least in the case of numeracy)

are significantly less likely to work in managerial and professional occupations than their higher-skilled counterparts.[24] These results reflect associations between variables, and not necessarily cause-and-effect relationships. In other words, the fact that employed individuals with lower skill levels are less likely to be employed in skilled occupations does not necessarily mean that such individuals had lower skills in the first place. The type of job may also have an impact on skills; for example, if the skills normally acquired at university are not subsequently used by workers on a regular basis, a certain degree of skill loss may occur. More research will be needed to understand the dynamics between lower skills and low-skilled occupations.

Conclusion

Skills such as literacy and numeracy are important factors for the successful economic integration of university graduates, therefore knowing whether graduates with similar levels of education have varying degrees of success in the labour market becomes an important area of concern not only for potential employees, but also for employers and society in general. In 2012, about 16% of Canadian-born university graduates aged 25 to 65 scored at level 2 or below for literacy (out of five categories determined by PIAAC) and 23% scored at level 2 or below for numeracy.

With regard to the characteristics most associated with lower skill levels among Canadian-born university graduates, three findings are of particular significance: older individuals were more likely to have lower levels of skills than their younger counterparts; the field of study of university graduates was an important factor, since graduates from STEM fields had higher levels of skills; and the greater the number of books in the home when the respondent was age 16, the less likely he or she was to end up with a lower level of skill as an adult. These findings suggest that those who benefit from a higher level of cultural capital during their youth may end up having higher literacy and numeracy skills, even within the population of university graduates.

Even though literacy and numeracy skill levels did not seem to affect the employment probability of university graduates, it did have a relationship with the type of occupations held by those who were employed. More precisely, those with lower skill levels (especially numeracy) were at least 8 percentage points less likely to be employed in managerial and professional occupations, even after accounting for other demographic and educational factors. Such results do not provide clear answers as to why some university graduates end up having lower skills as adults, since proficiency scores reflect a vast array of education, work, and personal experiences. They may, however, help explain why some university graduates are less well-matched with their current occupation for their given level of education.

Table 3
Relationship between skill levels and the probability of employment in professional and managerial occupations, employed Canadian-born university graduates aged 25 to 65

	Model 1 Controls for skill levels only	Model 2 Add demographic factors	Model 3 Add education-related factors
Marginal effects of being employed in skilled occupations[1]		percentage point	
Literacy (ref.: level 3 or above)			
Level 2 or below	-8.4*	-8.3*	-7.2
Predicted probabilities		percentage	
Level 3 or above	90.5	91.5	93.2
Level 2 or below	82.0	83.2	85.9
Numeracy (ref.: level 3 or above)		percentage point	
Level 2 or below	-9.6*	-9.5*	-7.5*
Predicted probabilities		percentage	
Level 3 or above	91.3	92.3	93.7
Level 2 or below	81.7	82.8	86.2

* significantly different from the reference category (ref.) ($p < 0.05$)
1. These are marginal effects at the mean.
Notes: Additional controls: Model 2 – gender, presence of children in the home, live with partner/spouse, first language learned as a child, province of residence, and age group; Model 3 – Model 2 controls plus field of study, level of education, and parental education.
Source: Programme for the International Assessment of Adult Competencies (PIAAC), 2012.

Darcy Hango *is a researcher in the Centre for Education Statistics of Statistics Canada.*

Data sources, methods and definitions

Data sources

The Programme for the International Assessment of Adult Competencies (PIAAC) is an international collaborative effort between the Organisation for Economic Co-operation and Development (OECD) and numerous other international organizations. Canada is one of 24 countries and sub-national regions that participated in the first round of PIAAC. The survey, which was administered by Statistics Canada from November 2011 to June 2012, was conducted with collaboration and support from Employment and Social development Canada (ESDC), the Council of Ministers of Education, Canada (CMEC) and many other partners, including provincial and territorial ministries and departments responsible for education. PIAAC is a complex survey of the information-processing skills of youth and adults between the ages of 16 and 65. The PIAAC survey is made up of three main parts: a background questionnaire, a direct assessment, and a module on the use of skills.

Definitions

Literacy

Respondents are evaluated for their ability to engage with written texts (print-based and digital) and thereby participate in society, achieve goals, and develop their knowledge and potential. This requires accessing, identifying and processing information from a variety of texts that relate to a range of settings.

Numeracy

Respondents are evaluated for their ability to engage with mathematical information in order to manage the mathematical demands of a range of situations in everyday life. This requires understanding mathematical content and ideas (e.g., quantities, numbers, dimensions, relationships), and the representation of that content (e.g., objects, pictures, diagrams, graphs).

Description of skill proficiency levels

Individuals with a 2nd proficiency level or below are those who had a score of 275 or less (out of 500) on the literacy and numeracy assessments, and are defined as those who are in the "lower range" for literacy or numeracy. Of note, these proficiency levels "do not represent strict demarcations between abilities but instead describe a set of skills that individuals possess to a greater or lesser degree. This means that individuals scoring at lower levels are not precluded from completing tasks at a higher level – they are simply less likely to complete them than individuals scoring at the higher level".[1] The descriptions for each level are as follows (readers are invited to consult the pan-Canadian report for more details):

	Literacy	Numeracy
5	Tasks may require the respondent to search for and integrate information across multiple, dense texts; construct syntheses of similar and contrasting ideas or points of view; or evaluate evidenced based arguments. Application and evaluation of logical and conceptual models of ideas may be required to accomplish tasks. Evaluating reliability of evidentiary sources and selecting key information is frequently a key requirement.	Tasks require the respondent to understand complex representations and abstract and formal mathematical and statistical ideas, possibly embedded in complex texts. Respondents may have to integrate multiple types of mathematical information where considerable translation or interpretation is required; draw inferences; develop or work with mathematical arguments or models; and justify, evaluate and critically reflect upon solutions or choices.
4	Tasks may require the respondent to search for and integrate information across multiple, dense texts; construct syntheses of similar and contrasting ideas or points of view; or evaluate evidenced based arguments. Complex inferences and application of background knowledge may be needed to perform successfully.	Tasks require the respondent to understand a broad range of mathematical information that may be complex, abstract or embedded in unfamiliar contexts. These tasks involve undertaking multiple steps and choosing relevant problem-solving strategies and processes.
3	Texts are often dense or lengthy, and include continuous, non-continuous, mixed, or multiple pages of text. Understanding text and rhetorical structures become more central to successfully completing tasks, especially navigating of complex digital texts. Tasks require the respondent to identify, interpret, or evaluate one or more pieces of information, and often require varying levels of inference.	Tasks require the respondent to understand mathematical information that may be less explicit, embedded in contexts that are not always familiar and represented in more complex ways. Tasks require several steps and may involve the choice of problem-solving strategies and relevant processes.
2	The medium of texts may be digital or printed, and texts may comprise continuous, non-continuous, or mixed types. Tasks in this level require respondents to make matches between the text and information, and may require paraphrasing or low-level inferences. Some competing pieces of information may be present.	Tasks require the respondent to identify and act on mathematical information and ideas embedded in a range of common contexts where the mathematical content is fairly explicit or visual with relatively few distractors.
1	Most of the tasks require the respondent to read relatively short digital or print continuous, non-continuous, or mixed texts to locate a single piece of information that is identical to or synonymous with the information given in the question or directive.	Tasks require the respondent to carry out basic mathematical processes in common, concrete contexts where the mathematical content is explicit with little text and minimal distractors.
Below 1	The tasks at this level require the respondent to read brief texts on familiar topics to locate a single piece of specific information. There is seldom any competing information in the text and the requested information is identical in form to information in the question or directive.	Tasks require the respondents to carry out simple processes such as counting, sorting, performing basic arithmetic operations with whole numbers or money, or recognizing common spatial representations in concrete, familiar contexts where the mathematical content is explicit with little or no text or distractors.

1. See Statistics Canada et al. (2013).

Data sources, methods and definitions (continued)

Interaction between lower literacy and lower numeracy

There is a relatively high degree of overlap between proficiency in literacy and proficiency in numeracy. That is, individuals with lower (or higher) scores on one are likely to have lower (or higher) scores on the other. For example, 43% of respondents aged 25 to 65 had a level 2 or less for both literacy and numeracy, and about 40% had a level 3 or above for both literacy and numeracy. Relatively few were either low on one and high on the other: 12% had a level 3 or above for literacy and a level 2 or below for numeracy, while 6% had a level 2 or below for literacy and a level 3 and above for numeracy.

Educational programs

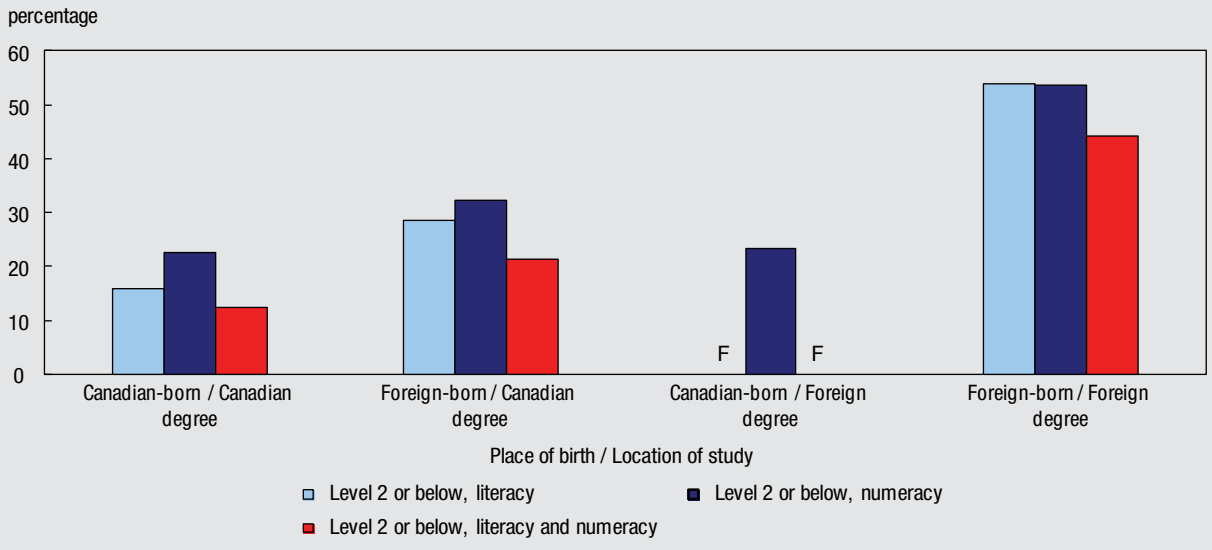
In PIAAC, respondents were asked the field of study of their highest level of education in response to the following question: "Which of the following categories would best represent the field of study of your highest level of schooling? If there was more than one, please choose the one you consider most important." The respondent was given nine broad categories, which were then collapsed into five for the current analysis: STEM (science, technology, engineering, mathematics, and computer science); humanities, languages and arts; social sciences, business and law; teacher training and education science; and health and welfare. The STEM groupings used here also include a relatively small proportion of graduates from agriculture and veterinary programs. As a result of the lack of precision with this question, the definitions may not correspond exactly to certain Classification of Instructional Programs (CIP) definitions. However, the current categorizations are nonetheless useful for the purpose of examining the possible relationship between field of study and lower levels of skills.[2]

2. For more information on Statistics Canada's recommended STEM groupings, see Variant of CIP 2011- STEM groupings.

Results by location of study and immigration status

Location of study is related to lower levels of literacy and numeracy scores among immigrants. Among foreign-born university graduates who did not have a degree from a Canadian university, 54% were in the lower range for literacy (level 2 or below), 54% were in the lower range for numeracy, and 44% were in the lower range for both (Chart A.1). This compared with rates of 29% (literacy), 32% (numeracy) and 21% (both) among the foreign-born university graduates whose degree was from a Canadian institution.

Chart A.1
Proportion of adults aged 25 to 65 with a university degree at level 2 or below in skill proficiency levels, by place of birth and location of highest degree



F too unreliable to be published
Source: Programme for the International Assessment of Adult Competencies (PIAAC), 2012.

The group with the lowest proportion of individuals with a level 2 or below were the Canadian-born university graduates whose degrees were obtained in Canada: the results were 16% for literacy, 23% for numeracy and 12% for both. The Canadian-born university graduates with a degree from outside Canada represented a smaller portion of the overall sample, but had comparable results to the Canadian-born who studied in Canada (in terms of numeracy).

Notes

1. See Hango (2010).
2. See Frenette (2014).
3. For instance, Green and Riddell (2001) discovered that annual earnings increased about 3% for every 10-point increase on a literacy scale ranging from 0 to 500.
4. See Barone and van de Werfhorst (2011).
5. See Hanushek et al. (2013).
6. See Barone and van de Werfhorst (2011) and Holmes and Miller (2006).
7. Of these, 6% were at level 1 or below in literacy, and 8% were at level 1 or below in numeracy.
8. See Schleicher (2008) and OECD (2013).
9. Statistics Canada et al. (2013), page 8.
10. Previous work using earlier skills surveys has suggested that an important demarcation in skill level is observed between proficiency levels 2 and 3. Individuals below level 3 may not have mastered the minimum foundation of literacy needed to attain higher levels of performance, while those at level 3 and above typically had positive outcomes associated with economic, social and educational outcomes (See Murray, Kirsch, and Jenkins, 1997; Statistics Canada, 2005; and Tuijnman, 2001). While this distinction has not been made with PIAAC, one would expect university graduates to be at least able to have skills corresponding to the third proficiency level, since many high skilled occupations require competencies at this level.
11. It is important to stress that individuals whose literacy and numeracy scores fall below level 3 are not necessarily unable to complete tasks at higher levels. Rather, it means they are less likely to complete these higher-level tasks (see Statistics Canada et al., 2013).
12. The link between skills, competency and educational attainment is well-founded. See Park and Kyei (2011), OECD/Statistics Canada (2005) and Statistics Canada et al. (2013).
13. See Bussière et al. (2009).
14. See Uppal and LaRochelle-Côté (2014).
15. This result echoes the findings of earlier reports (OECD/Statistics Canada, 2005; Statistics Canada, et al., 2013).
16. In some supplementary analyses however, there was only one significant gender difference by field of study: females with degrees in the social sciences, business or law had a significantly higher probability to be in the lower range for numeracy than their male counterparts in these fields.
17. Earlier work using PIAAC (see Statistics Canada et al., 2013) found that literacy and numeracy differences by age group among the university population are less than among the entire population. However, this study reveals that differences across age groups remain even with this more selective higher educated population. Note that cross-sectional data like PIAAC cannot make statements regarding skill loss over time or skill loss by age. As a result, PIAAC data cannot be used to separate age, period, and cohort effects.
18. See Statistics Canada et al. (2013).
19. See Turcotte (2011).
20. See De Graaf et al. (2000), Jaeger (2011) and Sullivan (2001).
21. See Trusty (2002) and Burrow et al. (2012)
22. Literacy and numeracy are not included together in the models as independent factors due to a relatively high correlation between them, also in order that the relative impact of each can be more easily isolated.
23. Skilled occupations are defined using the International Standard Classification of Occupations (ISCO), which "group occupations based on the nature of the job and the required skill level, where a job is defined as the set of tasks and duties to be performed, and skills are defined as the abilities to carry them out" (Statistics Canada et al., 2013, p. 38).
24. 'Skilled occupations', which include professional and managerial occupations, point to occupations that typically demand a higher level of education.

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