

JOB MISMATCHES AMONG INDIGENOUS WORKERS IN CANADA: FINDINGS FROM PIAAC DATA

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Abstract

Using data from the Programme for the International Assessment of Adult Competencies (PIAAC), this study examined skill-job mismatches among Indigenous workers in Canada. Skill mismatches (over-skilled or under-skilled conditions) were based on direct measures of skill competencies in numeracy and literacy provided by PIAAC data.

On average, Indigenous workers were more likely to be under-skilled, and less likely to be over-skilled, than their non-Indigenous counterparts. These findings may be explained by the fact that the level of education and the skill scores of Indigenous workers were significantly lower than those of non-Indigenous workers. When education was controlled, however, there were no differences in being under- or over-skilled in literacy between Indigenous and non-Indigenous workers. That is, education level played an important role in determining skill levels as well as job mismatches.

Certain job-related conditions were associated with the likelihood of job mismatch among Indigenous workers. Compared to full-time workers, part-time Indigenous workers were more likely to be over-skilled; compared with employees, self-employed Indigenous workers were less likely to be under-skilled; and a higher level of skill-job mismatches were found among Indigenous workers who majored in the field of science, technology, engineering, and mathematics (STEM) in their post-secondary education than their non-STEM counterparts.

Resumé

Faisant usage de données du Programme pour l'évaluation internationale des compétences des adultes (PEICA), cette étude a examiné les discordances entre qualifications et emplois parmi les travailleurs autochtones au Canada. Ces discordances (travailleurs surqualifiés ou sous-qualifiés) s'appuyaient sur l'évaluation directe de compétences (mathématiques, lecture

et écriture) issues des données du PEICA.

En moyenne, les travailleurs autochtones étaient plus susceptibles d'être sous-qualifiés, et moins d'être surqualifiés, que leurs collègues allochtones. Ce fait s'expliquerait par le fait que le niveau d'instruction comme le degré de compétence des premiers étaient nettement plus faibles que ceux des seconds. Une fois qu'on prend en compte le niveau d'instruction, cependant, autochtones et allochtones ne différaient pas les uns des autres en ce qui concerne la surqualification ou la sous-qualification en lecture et en écriture. Bref, le niveau d'instruction joue un rôle important dans la détermination du niveau de qualification (sur- ou sous-) pour le travail.

On a associé certaines conditions liées au travail avec un manque plus probable de correspondance entre qualifications et travail parmi les travailleurs autochtones. Comparés aux travailleurs à temps plein, les travailleurs autochtones à temps partiel étaient plus susceptibles d'être surqualifiés; comparés aux employés, les travailleurs autochtones autonomes étaient moins susceptibles d'être sous-qualifiés; et on a trouvé un niveau plus élevé de manque de correspondance entre qualifications et travail parmi les ouvriers autochtones détenteurs d'un diplôme en science, en technologie et en mathématiques que parmi les ouvriers autochtones détenteurs d'un diplôme dans un autre domaine.

Key words

Indigenous, skill mismatch, Programme for the International Assessment of Adult Competencies, over-skilled, under-skilled, field of study, education

Introduction

Skill mismatch occurs when a worker's skills are inadequate relative to the job requirements (Quintini, 2011). It involves under-skilling (also referred as skill deficit), a situation in which an individual lacks the skills and abilities necessary to perform their current job to acceptable standards, and over-skilling (or skill surplus), a situation where an individual is not able to fully utilize their skills and abilities in their current job (Desjardins & Rubenson, 2011; CEDEFOP, 2010). The purpose of this study is to examine characteristics of Indigenous workers whose skills are mismatched with their current job. Data from the Programme for the International Assessment of Adult Competencies (PIAAC) provide a unique opportunity to assess mismatch conditions in the Canadian labour market by provid-

ing direct measures of skill competencies in three domains - literacy, numeracy, and problem-solving -- as well as detailed information on respondents' level of education and type of occupation. Using PIAAC data, this study examines skill mismatch among Indigenous workers and compares them with those among non-Indigenous workers. Moreover, this study identifies correlates for job mismatch among Indigenous workers, especially its associations with labour market characteristics.

Background

In an environment with intensifying global competition, rapid technological changes, and significant demographic shifts, skill mismatch of workers has become an important policy issue. Skill mismatch involves various types of imbalances between skills offered and skills needed in the labour market and can refer not only to skill shortages or gaps, but also to qualifications, knowledge and skills not matched to job requirements (CEDEFOP, 2010). Some jobs are unfilled because employers cannot find workers with the right skills (jobs without people). Also, there is an increase in the number of qualified Canadians looking for work yet not being able to find one (people without jobs). This may take place because opportunities in certain occupations disappear (Tal, 2012), for example, due to skills obsolescence.

As a result, a considerable number of employees can be mismatched, that is, possessing an education/skill level higher or lower than what is typically required for their job (Uppal & LaRochelle-Côté, 2014). Over-skilling takes place when skills possessed by the workers exceed those required by their work, and under-skilling occurs when skills of the workers fall short of the level required for their job (Perry et al., 2014). Similarly, over-education/over-qualification occurs when an individual has more education (or a higher qualification) than the current job requires; under-education/under-qualification occurs when an individual has less education (or a lower qualification) than the current job requires.

The issue of skill mismatch is important not just to individual workers, but to all labour market actors, including governments and companies who all benefit when occupational requirements are matched through adequate education and training (ILO, 2014). From the societal point of view, skill mismatch indicates an inefficient use of human capital or a lack of knowledge of the actual supply and demand of labour, and may contribute to a rise in long-term unemployment and limit the growth potential of the labour market and the economy as a whole (McGowan and Andrews 2015; Gingras and Roy 2000; Frenette 2000 and 2004; Li et al 2006). For individuals, matched

jobs are essential for personal labour market success. The over-educated suffer a wage penalty and may be trapped in lower-level jobs, whereas the under-educated or under-skilled are paid more than those with the same level of education in matching jobs and, therefore, have no incentive to move (CEDEFOP, 2010).

Mismatch between the types of skills, not merely levels, also has a negative impact on earnings. This type of horizontal mismatch occurs because the level of education or skills matches job requirements, but the type of education or skills is inappropriate. This can be related to skills obsolescence, which is a situation where skills previously utilized in a job are no longer required or have diminished in importance. Nowadays, this can occur over a short number of years due primarily to rapid technological changes. Hence, lifelong learning becomes more essential for successful careers (CEDEFOP, 2010). Moreover, it is reported that mismatched (over-educated, in particular) workers tend to be at risk of poorer mental health and general health decline (Chen et al., 2010; Johnson & Johnson, 1999). Also, mismatched workers may suffer from lower wages and are less satisfied with their jobs than if they were properly matched; employers may suffer from lower productivity; and the economy may suffer from a loss of output, economic growth, and competitiveness (Desjardins & Rubenson, 2011; CEDEFOP, 2010). Individual mismatched workers tend to have lower job satisfaction and lower levels of productivity compared to matched workers (Allen and van der Velden 2001; Crompton 2002; Frenette 2000; Li et al 2006).

The literature points out that specific population groups may be at differential risk of job mismatch compared to the Canadian population (Galarneau & Morissette, 2004; Frenette, 2000, 2004; Li et al., 2006). Mismatch is more prevalent among young people entering the labour market, older workers, women, ethnic minorities, and those with disabilities (CEDEFOP, 2010). Identifying these subgroups and addressing their specific risks is an important area for policy research. This study focuses on the mismatch conditions among Indigenous workers.

Evidence from previous research has shown that Indigenous people in Canada have historically had limited access to the resources and conditions necessary to maximize socio-economic status (Galabuzi, 2004), which is also related to the historical legacy of colonialization and experiences of residential schools. As a result, Indigenous people are less likely than other Canadians to participate in the labour force and are less likely to be employed. According to the 2011 National Household Survey, unemployment rates among individuals aged 25-64 are higher for Registered Indians (17%), non-status Indians (9%), Inuit (17%), and Métis (9%) compared to an unemployment rate of 6% for the non-Indigenous population (AANDC, 2013). Moreover,

there exists a considerable gap in employment earnings between Indigenous and non-Indigenous workers, with Indigenous people tending to be employed in low-paying and support labour positions. For example, the top three occupations for Indigenous people were sales and service (mainly retail sales clerks and cashiers, food and beverage occupations, protective service, and child care and home support); trades, transport and equipment operators (mainly mechanics, contractors, construction trade workers, and transportation equipment operators); and business, finance and administration (mainly clerical workers, and administrative and regulatory workers) (Luffman & Sussman, 2007; Usalcas, 2011).

Indigenous people's labour market disadvantages, such as higher unemployment rates and lower earnings, have been explained by their lower level of educational attainment, especially the lack of post-secondary levels of education, and the history of residential school and mass discrimination (Health Council of Canada, 2005; Bougie et al., 2013; Centre for the Study of Living Standards, 2012; Conference Board of Canada, 2012). However, in the past two decades, there has been an increase in the attainment of post-secondary education among the Indigenous population (Gordon & White, 2014). The benefit of one's educational attainment is maximized when it is associated with a matched job in the labour market. A recent analysis shows that Indigenous workers with university education were less likely to be over-qualified than non-Indigenous workers (Park, 2018). It is especially worth investigating whether Indigenous workers' jobs match with their increased level of skills and education. In other words, it is important to examine whether Indigenous workers are likely to be over-skilled (or under-skilled) for their job.

Despite a number of empirical reports on the general labour market conditions of Indigenous people, there has been little documentation as to whether Indigenous people have jobs which match their education or skill levels. This study attempts to fill this data gap. The 2012 Programme for the International Assessment of Adult Competencies (PIAAC) offers a unique opportunity to examine skill mismatch using a direct assessment of literacy and numeracy skills in technology-rich environments (OECD 2013), as well as self-reported data on job match and skill use at work. The survey also provides detailed demographic and labour market information including level of education, field of study, employment status, and occupational categories. Using PIAAC data, this study investigates the level of job mismatch among Indigenous workers in the Canadian labour market in comparison with non-Indigenous workers. This study examines job mismatches and social-demographic and labour market correlates by using an internationally standardized direct measurement of reading, writing, and math skills (skill mismatch) and by using the informa-

tion on educational attainment and occupation (education mismatch). More specifically, this study answers the following research questions:

- Are Indigenous workers more likely to be mismatched on skills than non-Indigenous workers?
- What are the demographic correlates (e.g., age, gender, Indigenous group, education) of skill mismatch among Indigenous workers?
- What are the labour market correlates (e.g., part-time/full-time employment, self-employment, job-training, skill-use) of education mismatch and skill mismatch among Indigenous workers?
- How are job satisfaction associated with education mismatch and skill mismatch?
- How are health conditions (e.g., self-perceived health, longstanding illness) correlated with education mismatch and skill mismatch among Indigenous workers?

Methods

Data sources

The PIAAC is an international collaborative effort between the Organization for Economic Co-operation and Development (OECD) and numerous other international organizations. In 2012, Canada was 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 in collaboration with and with 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 and is made up of three main parts—a background questionnaire, a direct assessment, and a module on the use of skills.

Study population

This study population includes employed workers aged 16–65, including more than 468,000 off-reserve Indigenous workers and 17,060,000 non-Indigenous workers (its sample size was 3,600 and 16,000, respectively). In this analysis, Indigenous identity was determined by asking respondents, “Are you an Aboriginal person, that is, First Nations, Métis, or Inuit? First Nations include Status and

Non-Status Indians.” Those who reported Indigenous identity were asked to specify whether they were First Nations, Métis, or Inuit. They were also asked, “Are you a Status Indian (Registered or Treaty) as defined by the Indian Act of Canada?” Based on these questions, where sample size allowed, this analysis used four Indigenous groups: Registered Indians, First Nations (not Registered Indians), Métis, and Inuit. The cases of multiple answers of Indigenous identity were excluded for analysis.

Measures

Over- and under-education

The measures of over- and under-education used in this study are based on the education–occupation matrix developed by ESDC, a department of the Government of Canada responsible for social programs and the labour market at the federal level (HRSDC, 2011; Uppal & LaRoche-Côté, 2014). Over-educated workers are individuals who hold higher levels of education than required for their job. Post-secondary graduates working in jobs that require a high school diploma or less, i.e., National Occupation Code (NOC)-Skill levels C, D are said to be over-educated in this analysis.

Under-educated workers are individuals who hold lower levels of education than required for their job. In this study, those with high school graduation or less working in jobs that require post-secondary education, i.e., NOC-Skill levels A, B were said to be under-educated.

Over- and under-skilled mismatch

To measure skill mismatch, we relied on the method suggested by Perry et al. (2014). This method of measuring skill mismatch consists of defining competency bandwidths for each occupation according to the average competency skill level of all respondents within a given occupation. Respondents are under- or over-skilled if they were 1.5 standard deviation below or above the mean for their occupation, respectively. For this method, occupations are examined at the two-digit level of International Standard Classification of Occupations (ISCO). This method also involves more complex computations since it repeated the classification procedure for all 10 plausible values (PV), and took the average of the results computed with each PV to derive their final mismatch estimates (Bougie & Park, forthcoming). Here is a step-by-step description of the data manipulations involved:

Step 1: Cases with missing data for occupation ($n=27$) were excluded from the sample. Also excluded were cases working in occupations with a small sample size. Following Perry et al. (2014), the minimum number of cases per two-digit ISCO occupation level was set to 30 in the overall sample. We thus deleted cases working in occupations Group 01 (Commissioned armed forces officers $n=17$), Group 02 (Non-commissioned armed forces officers $n=14$), Group 03 (Armed forces occupations, other ranks $n=14$), Group 62 (Market-oriented skilled forestry, fishery, and hunting workers $n=24$), and Group 63 (Subsistence farmers, fishers, hunters and gatherers $n=13$).

Step 2: In step 2 we standardized the mean competency skill score for workers by occupation. A Z-score was computed for each of the 10 plausible values.

Step 3: Respondents were classified as being under- or over-skilled if they were 1.5 standard deviations below or above the mean for their occupation. This classification was executed 10 times, once for each plausible value. As a result, respondents could be categorized simultaneously as being well-matched and mismatched. Following Perry et al, we took the average of the results computed with each plausible value to derive the final mismatch classification estimate.

- **Literacy scores:** As part of the PIAAC, respondents were evaluated on their ability to engage with written texts (print-based and digital). This includes accessing, identifying, and processing information from a variety of texts that relate to a range of settings. Individuals who scored 275 or higher (out of 500) on the literacy assessments were considered as having high literacy proficiency, and those who scored lower than 275 were considered as having low literacy proficiency. Workers were defined as over-skilled in literacy when they were both of high literacy proficiency and when their literacy scores were 1.5 standard deviation above the mean literacy score for their two-digit ISCO occupation group. Workers were defined as under-skilled in literacy when they were both of low literacy proficiency (below 275) and when their literacy scores were 1.5 standard deviation below the mean literacy score for their two-digit ISCO occupation group.

- **Numeracy scores:** Respondents were evaluated on their ability to engage with mathematical information to manage the mathematical demands of a range of situations in everyday situations. This requires understanding mathematical content

and ideas (e.g., quantities, numbers, dimensions, and relationships) and the representation of that content (e.g., objects, pictures, diagrams, and graphs). Individuals who scored 275 or higher (out of five hundred) on the numeracy assessments were considered as having high numeracy proficiency, and those who scored lower than 275 were considered as having low numeracy proficiency. Workers were defined as over-skilled in numeracy when they were both of high numeracy proficiency and their scores were 1.5 standard deviations above the mean numeracy score for their two-digit ISCO occupation group. Workers were defined as under-skilled in numeracy when they were both of low numeracy proficiency and when their scores were 1.5 standard deviation below the mean numeracy score for their two-digit ISCO occupation group.

Employed workers: A person is considered employed if he or she reported having a job in the week preceding the survey; this includes persons who were temporarily absent for the entire week. Respondents were asked to name one employment category best described their current work situation. Based on the answers to this question, workers were grouped into two categories: full-time workers and part-time or other workers. Also, they were asked whether they worked as an employee or whether they were self-employed.

Field of study: Respondents were asked to identify the field of study of their highest level of schooling. Response categories included: general programs; teacher training and education science; humanities, language, and arts; social sciences, business, and law; science, mathematics and computing; engineering, manufacturing and construction; agriculture and veterinary; health and welfare; and services. For this analysis, the categories were collapsed into two groups: STEM (Science, Technology, Engineering, or Mathematics) and non-STEM. STEM majors included respondents whose field of study were science, mathematics and computing, or engineering, manufacturing, and construction. All others were considered as non-STEM.

Skill use was assessed by asking how often specific reading and writing skills were used at work. For literacy, respondents were asked how often they read directions or instructions; letters memos or mails; newspapers or magazines; professional journals or publications; books; manuals or reference materials; financial statements; or diagrams maps or schematics. Literacy skill use was also assessed by asking respondents how often they write: letters, memos, or mails; articles; reports; or filled in forms. For numeracy, respondents were asked how often they: calculate costs or budgets; use or calculate frac-

tions or percentages; use a calculator; prepare charts graphs/tables; use simple algebra or formulas; or use advanced mathematics or statistics. Each item was scored on a five-point scale as follows: never (1); less than once a month (2); less than once a week but at least once a month (3); at least once a week but not every day (4); every day (5). For this analysis, the sum of literacy use scores was divided by 12 and the sum of numeracy use scores was divided by 6, to obtain the mean scores.

Job training: Respondents reported attending any organized sessions for on-the-job training, or had received training by supervisors or co-workers, during the past 12 months were considered to have received job training.

Job satisfaction was measured by asking respondents, "All things considered, how satisfied are you with your current job?" Respondents were considered as satisfied if they answered, "extremely satisfied" or "satisfied" as opposed to "neither satisfied nor dissatisfied" "dissatisfied" or "extremely dissatisfied".

Negative self-perceived health is based on a general health question asking, "In general, would you say your health is excellent, very good, good, fair, or poor?" Reporting general health as fair or poor was considered as negative self-perceived health.

Disability was measured by asking "Do you have any long-standing illnesses or longstanding health problems that have lasted, or are expected to last, for 6 months or more?" Those who answered "yes" were considered to be disabled.

Data Analysis

Descriptive statistics were calculated for rates of mismatches due to over- and under-qualification, as well as over- and under-skilled conditions (in literacy and numeracy) by Indigenous status, Indigenous groups (Registered Indian, Non-status First Nations, Inuit, and Métis), and education levels. Another set of descriptive analyses was conducted to show characteristics of mismatched Indigenous workers such as field of study, job training, labour market conditions, job satisfaction, and general health.

By conducting multivariate analyses, correlates of job mismatches among Indigenous workers were identified. A series of logistic regression models were constructed to examine correlates of each of mismatch conditions including under-educated, under-skilled in literacy, under-skilled in numeracy, over-educated, over-skilled in literacy, over-skilled in numeracy. Regression models included demographic and labour market

related variables such as age, gender, Indigenous groups, job training, work status and employment status.

Results

Sample characteristics

Compared to their non-Indigenous counterparts (41 years), Indigenous workers were slightly younger with a mean age of 39 years (Table 1). A higher proportion of Indigenous workers were female compared to their non-Indigenous counterparts. Overall, Indigenous workers showed a lower level of educational attainment than non-Indigenous workers. More than one in five Indigenous workers reported that they did not have high school education compared to 10% of non-Indigenous workers, and 14 percent of Indigenous workers were university graduates compared to almost 30 percent of non-Indigenous workers. For those workers with post-secondary education, there was one notable difference in terms of fields of study: about 27 percent of Indigenous workers were graduates of STEM fields (science, technology, engineering, and mathematics) compared with 32 percent of non-Indigenous workers.

In general, Indigenous workers showed lower economic circumstances compared to their non-Indigenous counterparts. Among Indigenous workers, 23 percent (33 percent among Inuit workers) belonged to the lowest income quintile. Two-thirds of Indigenous workers held full-time positions compared with 72 percent of non-Indigenous workers. The proportion of self-employment was lower among Indigenous workers than non-Indigenous workers (10% vs. 14%). In terms of occupations, 16 percent of Indigenous workers were managers and professionals (skill level A) compared about a quarter of non-Indigenous workers.

Indigenous workers tend to have a lower level of literacy and numeracy skills compared to non-Indigenous workers. As well, their use of skills at work was lower than that of non-Indigenous workers. For example, Indigenous workers had on average about 10 points lower in literacy score and 17 points lower in numeracy than non-Indigenous workers. Compared to non-Indigenous counterparts, Indigenous workers had significantly lower scores of skill use both in literacy (2.7 vs. 2.8) and numeracy (2.3 vs. 2.5) skill uses. Also, a lower proportion of Indigenous workers reported receiving job-related training last year compared with non-Indigenous workers (22% vs. 24%).

Overall mismatches

Compared with non-Indigenous workers, Indigenous workers were more likely to be mismatched due to under-educated or under-skilled conditions. For example, more than 10 percent of Indig-

enous workers were under-educated compared to 5 percent of non-Indigenous workers (Chart 1). Both in numeracy and literacy skills, Indigenous workers were more likely than non-Indigenous workers to have lower scores than peers working in the same type of occupations. Particularly high rates of under-skilled conditions were found among Status Indian and Inuit workers compared to non-Indigenous workers (Table 2).

On the other hand, Indigenous workers were less likely to be mismatched due to over-educated or over-skilled conditions compared with their non-Indigenous counterparts. Less than 5 percent of Indigenous workers were over-educated for their jobs compared to 8 percent of non-Indigenous workers. Both in numeracy and literacy skills, Indigenous workers were less likely than non-Indigenous workers to have higher scores than peers working in the same type of occupations.

Mismatches by education

When level of education was taken into consideration, many of the differences in mismatches between Indigenous and non-Indigenous workers disappeared. There were no differences in being under- or over-educated and no differences in being under- or over-skilled in literacy between Indigenous and non-Indigenous workers. However, some differences were found in mismatches based on numeracy skill scores. Such differences were observed among those with less than high school education; and among those with post-secondary education below bachelor's degree (Table 3). For those with less than a high school diploma, about a quarter of Indigenous workers were under-skilled in numeracy compared to 15 percent of non-Indigenous workers. Among workers with post-secondary education below bachelor's degree, Indigenous workers were less likely to be over-skilled in numeracy (3% vs. 6%).

Moreover, when the education level was controlled, there was no statistically significant difference in average literacy scores between Indigenous and non-Indigenous workers. By contrast, Indigenous workers consistently showed lower average numeracy scores, even after level of education was controlled.

Characteristics of mismatched Indigenous workers

Among Indigenous workers, a higher proportion of under-educated workers were self-employed compared to workers whose education level and job were matched. Interestingly, under-skilled workers were less likely to be self-employed (more likely to be employees) than workers whose skill levels and jobs were well-matched. Almost twenty percent of under-educated workers were

self-employed compared to 7 percent of under-skilled workers in literacy and 5 percent of under-skilled in numeracy (Table 4).

About 40 percent of workers over-skilled in literacy have majored in fields such as science, technology, engineering, or mathematics (STEM) in their highest level of education, which was higher than about 20 percent of the matched group (Table 5). However, despite their STEM background, a considerable number of Indigenous workers could not find jobs matched with their literacy skills. Over-educated workers reported a lower rate of past year job training, tended to use literacy and numeracy skills less often in their jobs, and were more likely to be part-time workers compared to workers whose education and skill levels were matched. Over-education mismatch may be related to less job-related training and lack of job opportunities including full-time positions or jobs requiring higher skill levels. Unlike previous research indicating mismatched workers' poorer health (Chen et al., 2010; Johnson & Johnson, 1999), there was no significant difference in health status (self-perceived health as well as long-term disability) between matched and mismatched Indigenous workers. Comparing under-skilled workers and over-skilled workers, however, the former group was more likely to report negative self-perceived health.

Findings of logistic regressions

Table 4 indicates that job satisfaction was higher among under-skilled and under-educated workers compared to matched workers. Findings of logistic regression (Chart 2) show that workers under-skilled in literacy had twice the odds of being satisfied with their job than matched workers; also, under-skilled workers in numeracy were more likely to be satisfied than their matched counterparts after controlling for other confounding factors. On the other hand, the level of job satisfaction for over-educated workers was significantly lower than those workers whose education and job were matched (64% vs. 85%; Table 5). Even after controlling for other confounding factors, odds ratios of job satisfaction for over-educated workers were significantly lower (0.4) than their matched counterparts (Chart 2).

Indigenous workers who had received job-related training in the previous year were significantly more likely to be under-educated compared to those who did not receive such training (Table 6). Under-educated workers may try to fill that education gap by taking job-related courses or programs. Self-employed workers were more likely than employees to be under-educated (OR=2.58). This finding is not surprising given that education requirements are likely to be more flexible for self-employed positions. Conversely, self-employed workers were less likely than employees to be under-skilled in both literacy

(OR=0.53) and numeracy (OR=0.42). In other words, self-employed workers may be under-educated, but they were not under-skilled.

Job training was negatively associated with over-education (OR=0.39; Table 7) but showed no significant association with being over-skilled in either literacy or numeracy. Compared with full-time workers, part-time workers were more likely to be over-educated or over-skilled for their current jobs. Conversely, self-employed workers and those who studied non-STEM areas were less likely to be over-skilled in literacy.

Discussion

Skill mismatches (over-skilled or under-skilled conditions) were based on direct measures of skill competencies provided by PIAAC data. On average, Indigenous workers were more likely to be under-skilled, and less likely to be over-skilled, than their non-Indigenous counterparts. This may be explained by the fact that, on average, the skill scores of Indigenous workers were significantly lower than those of non-Indigenous workers.

Indigenous workers' mean scores of skill proficiencies were strongly affected by their levels of education, particularly by those with education levels of less than high school diploma. There were no significant differences in average literacy scores between Indigenous and non-Indigenous workers when compared within the same level of education. However, differences in numeracy scores remained significantly lower for Indigenous groups compared to non-Indigenous workers for each level of education.

Mismatch conditions were affected by the level of education as well. After controlling for education, differences remained for only two specific conditions of mismatch: Indigenous workers with an education level lower than high school graduation were more likely than their non-Indigenous counterparts to be under-skilled in numeracy; and Indigenous workers with an education level of post-secondary education below bachelor's degree were less likely than their non-Indigenous counterparts to be over-skilled in numeracy.

In sum, Indigenous workers' education level plays an important role in determining skill levels as well as job mismatches as found in previous research (Park, 2018). The greatest skill disparity between Indigenous and non-Indigenous workers was found in numeracy proficiency, which led to the disparity in skill mismatches in numeracy.

Among Indigenous workers, certain labour market conditions were associated with the likelihood of job mismatch. Compared to their full-time colleagues, part-time Indigenous workers were more likely to be over-educated and over-skilled. It is likely that those part-time workers could not find full-time employment matched to

their education/skill levels and took instead mismatched part-time positions. In other words, many of them were involuntary part-time workers (Usalcas, 2011). This finding is consistent with the previous research suggesting that employment characteristics are significant determinants of mismatch (Boudarbat & Chernoff, 2009).

Compared with employees, self-employed Indigenous workers were more likely to be under-educated among those without post-secondary education. That means that a higher proportion of Indigenous workers in self-employed businesses tend not to have graduated high school. The high mismatches found in self-employment have been reported by others (Bender & Roche, 2013). Interestingly, however, those who were self-employed were more likely to have a job-skill match among Indigenous workers without post-secondary education. Compared to their salaried employee counterparts, self-employed Indigenous workers were less likely to be under-skilled in both literacy and numeracy and less likely to be over-skilled in literacy. It could also be interpreted those self-employed Indigenous workers, despite their lower level of educational attainment, might possess adequate literacy and numeracy skills for their jobs. For self-employment, one's level of skills may be more important than one's level of education.

These findings confirm another recent analysis of the relationship between skill-mismatch and self-employment. Sanchez et al. (2015) argued that self-employment may be a way to avoid skill mismatches. Their empirical findings also suggest that those who are self-employed were less likely to be mismatched on skills, but also, those individuals who changed from salaried employment to self-employment showed a reduced probability of skill mismatches after the transition.

Some associations between job training and job match were found in the present study. Indigenous workers with post-secondary education who received job training in the previous year were more likely to be in a matched job than an over-educated job. This may also mean that over-educated Indigenous workers do not attend organized sessions for on-the-job training or training by supervisors or co-workers. On the other hand, a higher prevalence of job training was found among under-educated Indigenous workers. They may try to improve on skills and lower qualification with job training, or more opportunities may be given by employers to those employees who need to improve their skills. It is argued that expanding on-the-job training programs will reduce labour skill shortages and mismatches leading to increased economic growth, improved employment rates, significantly less under-employment, more satisfied and healthy employees and employers, and increased productivity (Miner, 2014).

A higher level of skill-job mismatches (being over-skilled

in literacy) was found among Indigenous workers who majored in the field of STEM in their post-secondary education. In other words, highly skilled workers with STEM backgrounds were less likely to find appropriately matched jobs in terms of their level of literacy skills compared to non-STEM majors. It is ironic given that several previous studies have pointed out a potential skill shortage and a high demand of STEM-skilled individuals especially among under-represented populations in STEM such as women and Indigenous people (Council of Canadian Academies, 2015).

The relationship between job mismatches and job satisfaction has been well documented (LaRochelle-Côté & Hango, 2016; Allen & van der Velden, 2001; Quintini, 2011; Sloane, 2014). It has been consistently found that over-educated or over-skilled workers report lower levels of job satisfaction than well-matched workers. In the present study, results on the association between job satisfaction and under-educated or under-skilled conditions were inconsistent. Among Indigenous workers, under-skilled conditions showed a significantly positive relation to job satisfaction, which remained significant even after controlling for factors such as age, gender, income, field of study, work status, employment status, and job training. Compared to matched workers, under-skilled workers tended to be satisfied with their current job. However, unlike the previous research, over-skilled Indigenous workers did not differ in job satisfaction compared to their skill matched colleagues. Over-educated workers reported a much lower rate of job satisfaction, 20 percent point lower than that of under-educated workers (64% vs. 85%). Among Indigenous workers, job dissatisfaction was related more directly to mismatches in educational credentials than mismatches in skills.

No relationships between health outcomes and job mismatches were found, possibly because there were too few health-related items in the survey. Health outcome included self-perceived health and long-term disability. More work-related health outcomes such as mental health, job stress and work injuries might be more related to mismatches.

Limitations

The PIAAC data allowed for an analysis of education/skill mismatches based on assessed skills and their socio-demographic and labour market correlates for Indigenous respondents. However, a few limitations are worthy to note. Due to the restricted sample sizes of Indigenous respondents, mismatches by specific field of study (beyond STEM/Non-STEM) could not be examined. Correlates of job mismatches for specific Indigenous groups (Registered Indian, Non-status First Nations, Inuit, and Métis) could not be analyzed

separately, although group differences would certainly emerge. Because PIAAC was a cross-sectional survey, associations between job mismatches and other related variables do not indicate a causal relationship.

Policy implication and future research needs

Above all, education seems to be an important factor for job skills and skill mismatch. Our findings showed that many discrepancies in skills between Indigenous and non-Indigenous workers disappeared when the level of education was controlled for. Moreover, Indigenous, and non-Indigenous workers with an education level of bachelor's degree or higher did not show any difference in skill mismatch. Indigenous workers' lower skill scores increased the likelihood of mismatches.

In addition, job-related training was found to be associated with job mismatches. For instance, under-educated workers were more likely to participate in job training. Thus, Indigenous workers' opportunities in education and job-related training are significant for matched jobs.

This analysis examined the relationship between job mismatch and labour market conditions of Indigenous workers. Further investigation of Indigenous workers' occupation may be important as they may hold occupations that are different from non-Indigenous workers; and mismatch varies by occupation (Marin & Hayes 2017; Flisi et al. 2017). Thus, future studies may wish to focus on occupational categories to reflect differing skill requirements.

The present analysis mainly dealt with vertical mismatch, a situation where the level of skills or qualifications is either more or less than the level required for the current job. It is highly likely, however, that some workers were in the state of horizontal mismatch, a situation where the level of education or skills match job requirements, but the type of education or skills is inappropriate for the current job. Future research could examine this horizontal mismatch. Differentiating mismatch may be important in developing strategies to improve education and skill levels of Indigenous people.

In addition to the outcomes examined here, future studies' analysis of health outcomes could include variables more relevant to work. It is worthwhile to examine how job mismatches are associated with health outcomes that are job-related such as job strain, job insecurity, and work injuries. Moreover, future studies may longitudinally assess the relationship between the length of mismatch and health outcomes in addition to their concurrent associations.

Table 1. Sample characteristics for Indigenous and Non-Indigenous workers aged 18-65, 2012

	Percents (except for mean age, skill scores, skill use scores)					
	Status Indian	First Nations	Métis	Inuit	All Indigenous	Non- Indigenous
Mean age (years)	39.3 *	37.6 *	39.1 *	37.1 *	38.9 *	40.6
Gender						
Male	47.5 *	48.6	51.3	48.8	49.4 *	52.9
Female	52.5 *	51.4	48.7	51.2	50.6 *	47.1
Education level						
Less than high school diploma	23.8 *	19.2 *	19.3 *	47.2 *	21.9 *	10.1
High school graduation	24.1	34.6 *	27.8 *	17.7 E	27.0 *	23.3
PSE below bachelor's degree	37.9	34.8	37.4	27.4 *	36.9	37.5
Bachelor's degree or higher	14.2 *	11.4 *	15.5 *	7.7 E*	14.2 *	29.1
Field of study (for PSE or higher)						
STEM	19.9 *	34.8	29.8	38.6 E	26.9 *	32.1
Non STEM	80.1 *	65.2	70.2	61.4 E	73.1 *	67.9
Occupation						
Skill level A: Managers & professionals	17.0 *	12.0 *	16.8 *	14.1 *	16.1 *	23.7
Skill level B: College/apprenticeship training	38.2	43.2	40.1	38.4	39.8	38.6
Skill level C: High school or job-specific training	28.4	22.6 *	30.5 *	28.2	28.5	26.8
Skill level D: On-the-job training	16.3 *	22.3 *	12.6	19.3 *	15.5 *	10.9
Income quintile						
1st (lowest)	25.2 *	32.5 *	16.4 *	32.8 *	22.5 *	19.8
2nd	22.6	25.1 *	17.5	12.2 *	20.3	19.4
3rd	22.9	14.5 *	22.8	16.4	21.5	19.6
4th	15.5 *	18.1	22.7	18.2	19.2	19.5
5th (highest)	13.8 *	9.8 *	20.6	20.4	16.6 *	21.7
Work status						
Full-time	63.4 *	64.5 *	69.6	57.0 *	66.2 *	71.6
Part-time/others	36.6 *	35.5 *	30.4	43.0 *	33.8 *	28.4
Employment status						
Employee	89.8 *	90.2 *	90.5 *	90.6	90.2 *	85.7
Self-employed	10.2 *	9.8 *	9.5 *	9.4	9.8 *	14.3
Skill level						
Average literacy score	260.3 *	270.2 *	278.2	223.2 *	268.6 *	278.7
Average numeracy score	244.9 *	254.6 *	266.9 *	206.7 *	255.0 *	272.3
High literacy skill proficiency (275+)	40.5 *	49.4 *	58.9	14.8 E*	49.2 *	56.7
High numeracy skill proficiency (275+)	27.2 *	35.2 *	44.2 *	11.0 E*	35.5 *	51.0
Skill use scores						
Average literacy skill use	2.67 *	2.61 *	2.77	2.55 *	2.70 *	2.82
Average numeracy skill use	2.28 *	2.21 *	2.35 *	2.14 *	2.30 *	2.51
Job training (last year)						
No	78.3	79.1	78.2	82.0	78.5 *	75.8
Yes	21.7	20.9	21.8	18.0	21.5 *	24.2
Weighted frequency	174,517	65,339	209,944	14,728	468,462	17,059,712
%	1.0	0.4	1.2	0.1	2.7	97.3
Unweighted sample size	1,309	390	1,503	376	3,602	16,026

*Significantly different from Non-Indigenous workers at 95%
E CV between .166 and .333

Data source: PIAAC 2012

Table 2. Selected rates (%) of mismatch for Indigenous and Non-Indigenous workers aged 18-65, 2012

	Status Indian	First Nations	Métis	Inuit	Non- Indigenous workers
Overall					
Under-educated	12.1 *	10.2 *	8.4 *	18.7 *	4.9
Under-skilled - literacy	12.9 *	5.6	4.8 E	32.4 *	6.4
Under-skilled - numeracy	14.6 *	6.8	4.1 * E	36.0 *	6.0
Over-educated	5.8 *	4.5 *	3.9 *	F	8.1
Over-skilled - literacy	3.1 *	3.3 E*	6.5	F	6.2
Over-skilled - numeracy	2.4 *	1.4 E*	6.1	F	6.9
Average literacy score	260.3 *	270.2 *	278.2	223.2 *	278.7
Average numeracy score	244.9 *	254.6 *	266.9 *	206.6 *	272.3

*Significantly different from Non-Indigenous worker.

E CV between .166 and .333

F Suppressed due to CV greater than .333

Data source: PIAAC 2012

	Non-Indigenous workers	Indigenous workers
Under-educated	10.4	4.9
Under-skilled	8.9	6.4
Underskilled	9.4	6.0
Over-educated	4.7	8.1
Over-skilled	4.5	6.2
Over-skilled	3.9	6.9

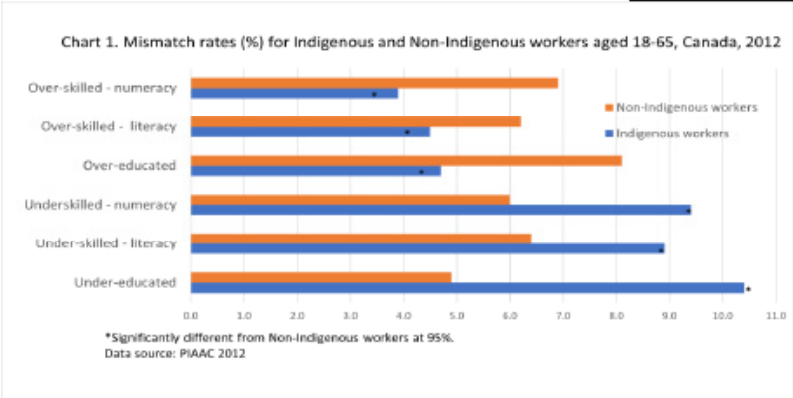


Table 3. Selected rates (%) of mismatch by education level for Indigenous and Non-Indigenous workers aged 18-65, 2012

	Indigenous workers	Non- Indigenous workers
Less than high school diploma		
Under-educated	39.8	34.9
Under-skilled - literacy	25.1	17.5
Under-skilled - numeracy	24.6 *	15.2
Average literacy score	230.2	236.7
Average numeracy score	214.6 *	229.1
High school graduation degree		
Under-educated	6.4 E	6.0
Under-skilled - literacy	5.4	6.6
Under-skilled - numeracy	6.4	7.0
Average literacy score	266.3	268.2
Average numeracy score	252.6 *	259.2
Post-secondary education below bachelor's degree		
Over-educated	6.1	7.5
Over-skilled - literacy	4.2 E	5.1
Over-skilled - numeracy	3.1 *	5.9
Average literacy score	278.4	278.1
Average numeracy score	266.6 *	272.1
Post-secondary education bachelor's degree or higher		
Over-educated	16.9	18.0
Over-skilled - literacy	13.8	10.0
Over-skilled - numeracy	10.8 E	11.2
Average literacy score	307.0	302.5
Average numeracy score	291.2 *	298.2

*Significantly different from Indigenous workers at 95% level.
E CV between .166 and .333

Data source: PIAAC 2012

Table 4. Selected characteristics of under-educated/under-skilled Indigenous workers aged 18-65, 2012

	High school graduates or less		Low proficiency literacy (score < 275)		Low proficiency numeracy (score < 275)	
	Under-educated	Matched	Under-skilled in literacy	Matched	Under-skilled in numeracy	Matched
Job training	17.9	11.3	13.6	16.4	14.8	18.3
Work status						
Full-time	56.1	58.2	58.1	60.8	56.0	63.2
Part-time/Others	43.9	41.8	41.9	39.2	44.0	36.8
Employment status						
Employee	83.0 *	93.2	93.3 †	89.0	94.9 †	90.0
Self-employed	17.0 †	6.8	6.7 *	11.0	5.1 *	10.0
Job satisfaction	85.3 †	78.3	91.3 †	80.4	89.2 †	80.5
Health						
Negative self-perceived health	18.1	16.6	23.4	15.2	20.9	15.9
Disability (6 months +)	34.1	32.2	34.0	33.2	37.0	34.4
Average literacy score	238.6 *	253.6	186.7 *	243.2	194.6 *	255.0
Average numeracy score	223.0	239.4	172.8 *	229.1	169.7 *	237.5
Average skill use - literacy	2.6 †	2.3	2.5	2.5	2.5	2.6
Average skill use - numeracy	2.3	2.0	2.1	2.1	2.1	2.1

*Significantly lower than the respective matched group at 95% level.

†Significantly higher than the respective matched group at 95% level.

Data source: PIAAC 2012

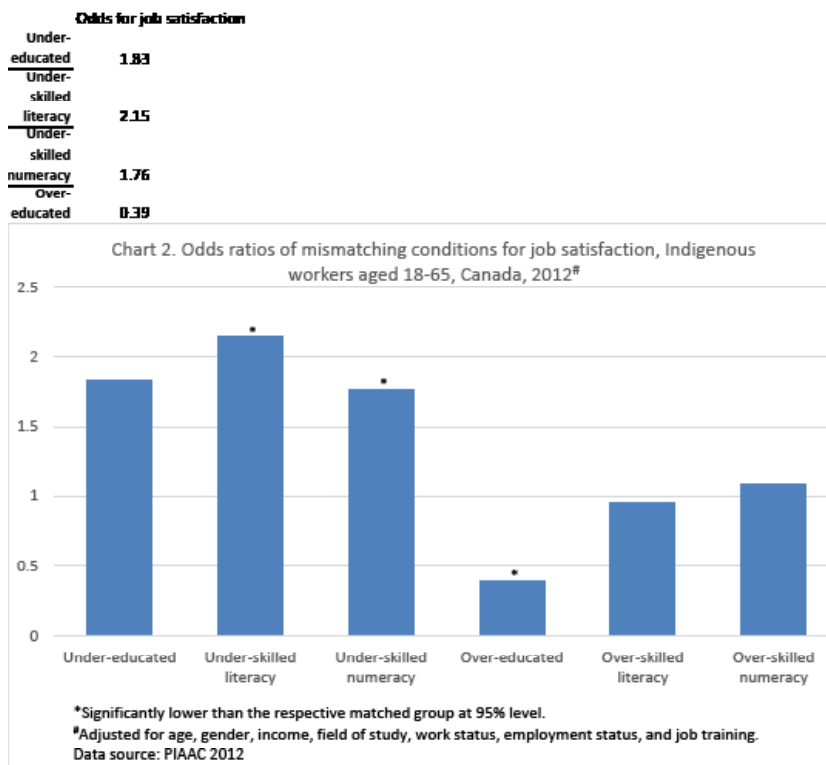


Table 6. Odds ratios for being under-educated, under-skilled among Indigenous workers aged 16 to 65 with lower than postsecondary education, 2012

	Under-educated			Under-skilled in literacy			Under-skilled in numeracy		
	OR	95% CI		OR	95% CI		OR	95% CI	
Age	1.02	1.01	1.03	1.01	1.01	1.02	1.02	1.01	1.03
Gender									
Male (ref.)	1.00	—	—	1.00	—	—	1.00	—	—
Female	1.01	0.67	1.52	0.86	0.56	1.32	1.12	0.85	1.47
Indigenous groups									
Registered Indian (ref.)	1.00	—	—	1.00	—	—	1.00	—	—
Non-status FN	0.75	0.44	1.28	0.45	0.29	0.68	0.46	0.29	0.75
Métis	0.70	0.43	1.13	0.48	0.30	0.77	0.32	0.23	0.43
Inuit	1.28	0.74	2.20	2.32	1.49	3.59	2.85	1.94	4.20
Job training	1.63	1.07	2.49	0.85	0.63	1.14	0.79	0.58	1.07
Work status									
Full-time (ref.)	1.00	—	—	1.00	—	—	1.00	—	—
Part-time	1.18	0.72	1.91	1.17	0.72	1.90	1.40	0.94	2.08
Employment status									
Employee (ref.)	1.00	—	—	1.00	—	—	1.00	—	—
Self-employed	2.58	1.70	3.91	0.53	0.34	0.81	0.42	0.26	0.68

Data source:PIAAC 2012

Table 6. Odds ratios for being under-educated, under-skilled among Indigenous workers aged 16 to 65 with lower than postsecondary education, 2012

	Under-educated			Under-skilled in literacy			Under-skilled in numeracy		
	OR	95% CI		OR	95% CI		OR	95% CI	
Age	1.02	1.01	1.03	1.01	1.01	1.02	1.02	1.01	1.03
Gender									
Male (ref.)	1.00	—	—	1.00	—	—	1.00	—	—
Female	1.01	0.67	1.52	0.86	0.56	1.32	1.12	0.85	1.47
Indigenous groups									
Registered Indian (ref.)	1.00	—	—	1.00	—	—	1.00	—	—
Non-status FN	0.75	0.44	1.28	0.45	0.29	0.68	0.46	0.29	0.75
Métis	0.70	0.43	1.13	0.48	0.30	0.77	0.32	0.23	0.43
Inuit	1.28	0.74	2.20	2.32	1.49	3.59	2.85	1.94	4.20
Job training	1.63	1.07	2.49	0.85	0.63	1.14	0.79	0.58	1.07
Work status									
Full-time (ref.)	1.00	—	—	1.00	—	—	1.00	—	—
Part-time	1.18	0.72	1.91	1.17	0.72	1.90	1.40	0.94	2.08
Employment status									
Employee (ref.)	1.00	—	—	1.00	—	—	1.00	—	—
Self-employed	2.58	1.70	3.91	0.53	0.34	0.81	0.42	0.26	0.68

Data source:PIAAC 2012

Table 7. Odds ratios for being over-educated, over-skilled among Indigenous workers aged 16 to 65 with postsecondary education, 2012

	Over-educated			Over-skilled in literacy			Over-skilled in numeracy		
	OR	95% CI		OR	95% CI		OR	95% CI	
Age	1.00	0.98	1.02	0.99	0.98	1.00	0.96	0.95	0.98
Gender									
Male (ref.)	1.00	---	---	1.00	---	---	1.00	---	---
Female	1.56	0.88	2.74	0.63	0.39	1.01	0.49	0.25	0.97
Indigenous groups									
Registered Indian (ref.)	1.00	---	---	1.00	---	---	1.00	---	---
Non-status FN	0.90	0.60	1.33	0.97	0.59	1.61	0.49	0.29	0.84
Métis	0.76	0.48	1.22	1.45	1.00	2.11	1.81	1.25	2.62
Inuit	0.78	0.09	6.84	F	---	---	F	---	---
Field of study: Non-STEM	1.22	0.45	3.26	0.49	0.27	0.88	0.67	0.33	1.37
Job training	0.39	0.27	0.56	0.68	0.41	1.13	0.80	0.47	1.35
Work status									
Full-time (ref.)	1.00	---	---	1.00	---	---	1.00	---	---
Part-time	3.75	2.43	5.80	2.19	1.34	3.58	2.64	1.49	4.69
Employment status									
Employee (ref.)	1.00	---	---	1.00	---	---	1.00	---	---
Self-employed	0.63	0.37	1.05	0.35	0.17	0.75	0.32	0.05	2.22

Data source:PIAAC 2012

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