Workers’ skills and how they are used at work

GLENDA QUINTINI
Directorate for Employment, Labour and Social Affairs
OECD
Paper motivation:

- Proficiency matters for labour force participation and wages
  - Survey of Adult Skills (PIAAC) provides an opportunity to test how skills – not education – affect labour market outcomes;
  - PIAAC also has rich Job Requirement Module which allows distilling information on skills use at work;
    - Skills use at work influences labour productivity and reflects the distribution of workers across occupations
  - Combining information on skills proficiency and use helps assess incidence of skills mismatch and the extent to which it leads a “waste” of human capital;
  - PIAAC provides internationally comparable data to explore these issues in 24 countries
Paper content:

- Explores how proficiency affects labour market outcomes: employment, labour force participation, hourly wages;
- Assesses the use of information processing and other generic skills in the workplace and how it varies by socio-demographic and job characteristics;
- Compares measures of competence – education and skills proficiency – with requirements at work to develop measures of qualification and skills mismatch;
- Identifies consequences of mismatch on wages and skills use.

Paper currently covers 21 countries – plans to add France and Russia to the final version.
Proficiency and labour market outcomes

- Proficiency (in literacy but also numeracy and problem solving) is positively and independently associated with:
  - The probability of participating in the labour force (employed + unemployed);
  - The probability of being employed;
  - Higher hourly wages

- YET, differences between mean literacy (or numeracy and problem solving) of employed, unemployed and inactive individuals are small pointing to pool of unexploited human capital;
Employment rate by proficiency level

- Literacy level 1 and below
- Literacy level 3
- Literacy level 2
- Literacy levels 4 and 5

Countries included: Israel, Korea, Spain, Mexico, Korea, Russia, Finland, United States, Hungary, Australia, Canada, Japan.
Unemployment to population ratios by proficiency level

- Literacy level 1 and below
- Literacy level 3
- Literacy level 2
- Literacy levels 4 and 5

Countries: Brazil, Korea, Thailand, Italy, Spain, France, Germany, Netherlands, Japan, England, Hungary, Italy, Turkey, Russia, and Mexico.
The effect of education and literacy on labour market participation

Statistically significant differences are marked in a darker tone.

- Effect of 3 additional years of education
- Effect of 46 more points of literacy proficiency (close to 1 level)

Odds ratio

Sweden, Ireland, Denmark, Norway, Slovak Republic, France (Belgium), Canada, Ireland (UK), Austria, Germany, Ireland, Australia, United States, Poland, Estonia, Czech Republic, Netherlands, Italy, Spain, Korea, Japan
Median hourly wages by proficiency level

![Bar chart showing median hourly wages by proficiency level across different countries](chart.png)
The effect of education and literacy on wages

[Bar chart showing the effect of 3 additional years of education and 46 more points of literacy proficiency across different countries.]

- Effect of 3 additional years of education
- Effect of 46 more points of literacy proficiency (close to 1 level)
Assessing skills use at work using PIAAC

- Information on tasks carried out at work can be combined to obtain indices of skills use.

- The frequency of some tasks is used directly to measure skills use:
  - One task for each skills use variable;
  - Varying from 1 (never use the skill) to 5 (skill used every day).

- Composite indices — more than one underlying task — are created using sum-scales:
  - Cronbach’s Alpha is used to test that items are grouped appropriately. Resulting scale ranges from 1 to 5;
  - Proficiency matters for labour force participation and wages.
### Assessing skills use at work using PIAAC

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Group of skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Reading documents: directions, instructions, letters, memos, e-mails, articles, books, manuals, diagrams, maps.</td>
</tr>
<tr>
<td>Writing</td>
<td>Writing documents: letters, memos, e-mails, reports, forms.</td>
</tr>
<tr>
<td>Numeracy</td>
<td>Calculating prices, costs or budgets; use of fractions, decimals or percentages; use of calculations; preparing graphs or tables; algebra or formulas; use of advanced math or statistics (calculus, trigonometry, regression).</td>
</tr>
<tr>
<td>ICT skills</td>
<td>Teachers who have used a computer before only.</td>
</tr>
<tr>
<td>Problem solving</td>
<td>Solving hard problems (at least 30 minutes of thinking to find a solution).</td>
</tr>
<tr>
<td>Task discretion</td>
<td>Choosing or changing sequence of job tasks, the speed of work; choosing how to do the job.</td>
</tr>
<tr>
<td>Learning at work</td>
<td>Learning new things from supervisors or coworkers; learning-by-doing; keeping up-to-date with new products or services.</td>
</tr>
<tr>
<td>Influencing skills</td>
<td>Instructing, teaching or training people; making speeches or presentations; advising people; planning others' activities; persuading or influencing others; negotiating.</td>
</tr>
<tr>
<td>Co-operative skills</td>
<td>Co-operating or collaborating with co-workers.</td>
</tr>
<tr>
<td>Self-organising skills</td>
<td>Organising one's time and activities.</td>
</tr>
<tr>
<td>Dexterity</td>
<td>Using skill or accuracy with one's hands or fingers.</td>
</tr>
<tr>
<td>Physical skills (gross)</td>
<td>Working physically for a long period.</td>
</tr>
</tbody>
</table>

Indicators in blue are derived from a single item.
What skills are used most in the workplace

- On average, writing skills and ICT are used more frequently at work than other information-processing skills (but only computer users answer ICT questions).
- Self-organising skills and dexterity used about once a week on average, although variance of dexterity use is rather high.
- Influencing skills are least frequently used, reflecting their link with occupational status.
- Similar results when looking at high-frequency use as opposed to average.
- Information-processing skills often used in bundles – 20-25% of workers use them with above median frequency.
The use of information-processing skills at work (selected countries)*

Index of use

- Australia
- United States
- Average
- Italy
- Japan

- 5 Every day
- 4 At least once a week
- 3 At least once a month
- 2 Less than once a month
- 1 Never

- Reading at work
- Writing at work
- Numeracy at work
- ICT at work
- Problem solving at work

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The relevance of skills at work

- Skills use at work influences labour productivity*.
- Skills use at work reflects primarily the distribution of workers across occupations (job requirements) but proficiency and qualifications matter too (workforce competences)*.
- All things being equal, skills use is:
  - Lower for women than men
  - Lower for workers on fixed-term contracts and temporary workers
  - Lower for part-timers than full-timers (but questions formulation?)
  - Interesting – youth use ICT less than older counterparts at work but more at home*.
- Firm size matters for skills use, with larger firms using the skills of their workforce more efficiently, all things equal.
- Many jobs in most countries still require only basic qualifications*.
Labour productivity and the use of reading skills at work

Slope = 1.118 (0.407)  
R² = 0.296

Adjusted prediction:  
Slope = 1.643 (0.504)  
R² = 0.371

Estimates adjusted for proficiency in literacy and numeracy

Use of reading skills at work
Mean ICT use at work and at home, by age group
<table>
<thead>
<tr>
<th>Countries</th>
<th>Reading</th>
<th>Writing</th>
<th>Numeracy</th>
<th>ICT</th>
<th>Problem-solving</th>
<th>Influence</th>
<th>Learning</th>
<th>Task discretion</th>
<th>Self-organising</th>
<th>Co-operative</th>
<th>Physical</th>
<th>Creativity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professionals</td>
<td>0.00</td>
<td>-0.27</td>
<td>-0.43</td>
<td>-0.29</td>
<td>-0.16</td>
<td>-0.39</td>
<td>0.00</td>
<td>-0.35</td>
<td>-0.17</td>
<td>-0.46</td>
<td>0.10</td>
<td>0.17</td>
</tr>
<tr>
<td>Technicians and associate professionals</td>
<td>-0.19</td>
<td>-0.10</td>
<td>-0.40</td>
<td>-0.31</td>
<td>-0.26</td>
<td>-0.65</td>
<td>-0.06</td>
<td>-0.38</td>
<td>-0.28</td>
<td>-0.27</td>
<td>0.21</td>
<td>0.30</td>
</tr>
<tr>
<td>Clerical support</td>
<td>-0.37</td>
<td>-0.21</td>
<td>-0.42</td>
<td>-0.22</td>
<td>-0.48</td>
<td>-1.01</td>
<td>-0.26</td>
<td>-0.46</td>
<td>-0.47</td>
<td>-0.44</td>
<td>-0.20</td>
<td>0.32</td>
</tr>
<tr>
<td>Service and sales</td>
<td>-0.60</td>
<td>-0.70</td>
<td>-0.92</td>
<td>-0.93</td>
<td>-0.70</td>
<td>-0.80</td>
<td>-0.19</td>
<td>-0.64</td>
<td>-0.70</td>
<td>-0.06</td>
<td>1.26</td>
<td>0.34</td>
</tr>
<tr>
<td>Skilled agricultural</td>
<td>-0.80</td>
<td>-1.13</td>
<td>-1.31</td>
<td>-1.09</td>
<td>-0.83</td>
<td>-1.15</td>
<td>-0.42</td>
<td>-0.50</td>
<td>-0.62</td>
<td>-0.11</td>
<td>2.00</td>
<td>0.80</td>
</tr>
<tr>
<td>Craft and trade</td>
<td>-0.71</td>
<td>-1.00</td>
<td>-1.33</td>
<td>-1.23</td>
<td>-0.98</td>
<td>-1.25</td>
<td>-0.28</td>
<td>-0.73</td>
<td>-0.77</td>
<td>-0.23</td>
<td>1.87</td>
<td>1.14</td>
</tr>
<tr>
<td>Plant and machine operators</td>
<td>-0.91</td>
<td>-1.50</td>
<td>-1.54</td>
<td>-1.58</td>
<td>-1.94</td>
<td>-1.65</td>
<td>-0.69</td>
<td>-1.11</td>
<td>-1.16</td>
<td>-0.53</td>
<td>1.40</td>
<td>0.70</td>
</tr>
<tr>
<td>Elementary</td>
<td>-1.18</td>
<td>-1.44</td>
<td>-1.57</td>
<td>-1.43</td>
<td>-1.17</td>
<td>-1.59</td>
<td>-0.74</td>
<td>-0.18</td>
<td>-1.06</td>
<td>-0.37</td>
<td>1.90</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Supply-side factors (proficiency and qualifications — ref. no qualifications)

<table>
<thead>
<tr>
<th>Literacy score *100</th>
<th>0.19</th>
<th>0.24</th>
<th>0.40</th>
<th>0.35</th>
<th>0.25</th>
<th>0.15</th>
<th>0.15</th>
<th>0.21</th>
<th>0.35</th>
<th>-0.24</th>
<th>-0.42</th>
<th>-0.27</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper-secondary</td>
<td>0.21</td>
<td>0.24</td>
<td>0.20</td>
<td>0.35</td>
<td>0.20</td>
<td>0.14</td>
<td>0.17</td>
<td>0.11</td>
<td>0.20</td>
<td>-0.05</td>
<td>-0.57</td>
<td>0.07</td>
</tr>
<tr>
<td>Post-secondary non-tertiary</td>
<td>0.37</td>
<td>0.39</td>
<td>0.26</td>
<td>0.25</td>
<td>0.26</td>
<td>0.25</td>
<td>0.21</td>
<td>0.12</td>
<td>0.24</td>
<td>0.02</td>
<td>-0.09</td>
<td>0.11</td>
</tr>
<tr>
<td>Tertiary</td>
<td>0.43</td>
<td>0.39</td>
<td>0.30</td>
<td>0.35</td>
<td>0.35</td>
<td>0.34</td>
<td>0.20</td>
<td>0.15</td>
<td>0.31</td>
<td>-0.04</td>
<td>-0.36</td>
<td>-0.13</td>
</tr>
</tbody>
</table>
The discrepancy between skills proficiency and use

- The discrepancy between skills proficiency and use generates pervasive mismatches which affect wages
- PIAAC provides options to derive several measures of qualification mismatch as well as skills mismatch
- In this paper:
  - Qualification mismatch = difference between worker’s qualification and qualification that she thinks are needed to get her job (+ over-qual.; - under-qual);
  - Skills mismatch = worker’s proficiency compared with proficiency of workers reporting that they are neither over-skilled nor under-skilled for their job (>max over-skilled; <min under-skilled)
Percentage of workers who are over or under qualified over- or under-skilled in literacy

- Under-qualification
- Over-qualification

Countries:
- Sweden
- Finland
- Canada
- France
- Netherlands
- Estonia
- Poland
- Denmark
- Flanders (Belgium)
- England/N. Ireland (UK)
- Norway
- United States
- Australia
- Cyprus
- Japan
- Average
- Korea
- Italy
- Slovak Republic
- Germany
- Ireland
- Czech Republic
- Spain
- Austria

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Socio demographic determinants of mismatch

Little overlap between qualification and skills mismatch.

Literacy proficiency within qualification level explains some qualification mismatch:

- Over-qualified workers are less skilled than their well-matched counterparts other things being equal (education, gender, age, foreign-born status).
- Under-qualified workers are more skilled than their well-matched counterparts, other things being equal.

Over-qualification:

- Is higher for foreign-born workers;
- Youth are more likely to be over-qualified than prime-age workers but this is often not statistically significant;
- No evidence on gender or marital status;
- Is less likely among workers in large-firms, among full-time workers and workers on permanent contracts.

No patterns for under-qualification and skills mismatch, except:

- Likelihood of over-skilling declines with age;
- Older workers are more likely to be under-qualified than prime-age workers with same education and proficiency.
Overlap between qualification and skills mismatch

Percentage

- Under-qualified who are under-skilled
- Over-qualified who are under-skilled

Countries included:
- Ireland
- Austria
- Germany
- Spain
- Italy
- Netherlands
- Slovak Republic
- Average
- Australia
- United States
- Norway
- Netherlands (England)
- Korea
- Sweden
- Finland
- Canada
- Japan
- Poland
- Estonia

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Literacy proficiency scores among over- and under-qualified

- Finland
- Germany
- Netherlands
- Sweden
- Japan
- Denmark
- Austria
- Spain
- Slovak Republic
- United States
- Average
- Ireland
- Estonia
- England/N. Ireland (UK)
- Italy
- Norway
- Czech Republic
- Poland
- Canada
- Korea
- Flanders (Belgium)

Score difference: -15 to 20

- Under-qualified minus well-matched
- Over-qualified minus well-matched

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Impact of qualification and skills mismatch

Qualification and skills mismatch have impact on skills use:

- Over-qualification and over-skilling associated with under-use of information processing skills*
- BUT no under-use associated with over-skilling once other factors are controlled for (not in the paper; controls are socio-demographic, job characteristics, proficiency etc.)

Over-qualified earn*:
- Less than equally-qualified well-matched workers
- More than well-matched workers in similar jobs (not shown, 4% on average)

Under-qualified earn:
- More than equally-qualified well-matched workers
- Less than well-matched workers in similar jobs (not shown, 17% on average)

Skills mismatch has small impact on wages suggesting employers may adjust job content or skills other than information processing skills contribute to mismatch*
Difference in wages between over-/under-qualified and well-matched employees*

Statistically significant differences are marked in a darker tone.

Over-qualification Under-qualification

Australia Austria Canada Czech Republic Denmark England/N. Ireland (UK) Estonia Finland Flanders (Belgium) Germany Ireland Italy Japan Korea Netherlands Norway Poland Slovak Republic Spain Sweden United States

* The chart illustrates the percentage difference in wages between over-qualified, under-qualified, and well-matched employees across various countries. The statistically significant differences are highlighted in a darker tone.
Difference in wages between employees who are over-/under-skilled and well-matched in numeracy*
Conclusions

- Skills proficiency is positively and independently associated with labour market outcomes but the strength of the relationship varies across countries.

- Educational qualifications and skills proficiency reflect different aspects of individuals’ human capital that are separately identified and valued in the labour market.

- The use of skills in the workplace influences a number of labour-market phenomena, including labour productivity, the gender wage gap and the wages gap between temporary and permanent workers.

- The distribution of workers across occupations is found to be important in shaping the distribution of skills use but workers’ qualifications and skill proficiency matter too.
Conclusions

- Mismatches between skills proficiency and the use of skills in the workplace are pervasive, affecting just over one in seven workers.
  - Young people are particularly affected by over-skilling;
  - Over-skilling has a relatively small negative effect on wages, suggesting most employers succeed in identifying their employees' real skills and adapt job content or that wages are negotiated based on skills other than those measured by PIAAC.
- On average across countries, about 21% of workers report that they are over-qualified and 13% report that they are under-qualified for their jobs.
  - Over-qualification is particularly common among young and foreign-born workers and those employed in small establishments, in part-time jobs or on fixed-term contracts;
  - Over-qualification has a significant impact on wages, even after adjusting for proficiency.
Find Out More About PIAAC at:

www.oecd.org/site/piaac
All national and international publications
The complete micro-level database

Email
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Thank you