

THE ROLE OF COGNITIVE SKILLS IN PREDICTING EARNINGS IN THE US

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Skill, Productivity, and Earnings

- **Productivity is central to economic growth**
- **Skills create market value based on their contribution to productivity of firms**
- **Education and work experience are the usual proxy for skills**
- **But can we move beyond the proxy and measure skills directly?**
- **One approach is to assess cognitive skills**

Major Questions We Address

- How closely are PIAAC's measures of cognitive skills associated with earnings?
- Do educational attainment and occupation account for all or nearly all the earnings gains associated with these skills, or are the gains sustained even after accounting for them?
- For which demographic, education and occupation groups do PIAAC measures of skills matter most?
- What are the implications for using educational attainment as the proxy for skill, when other skill-related factors affect earnings?

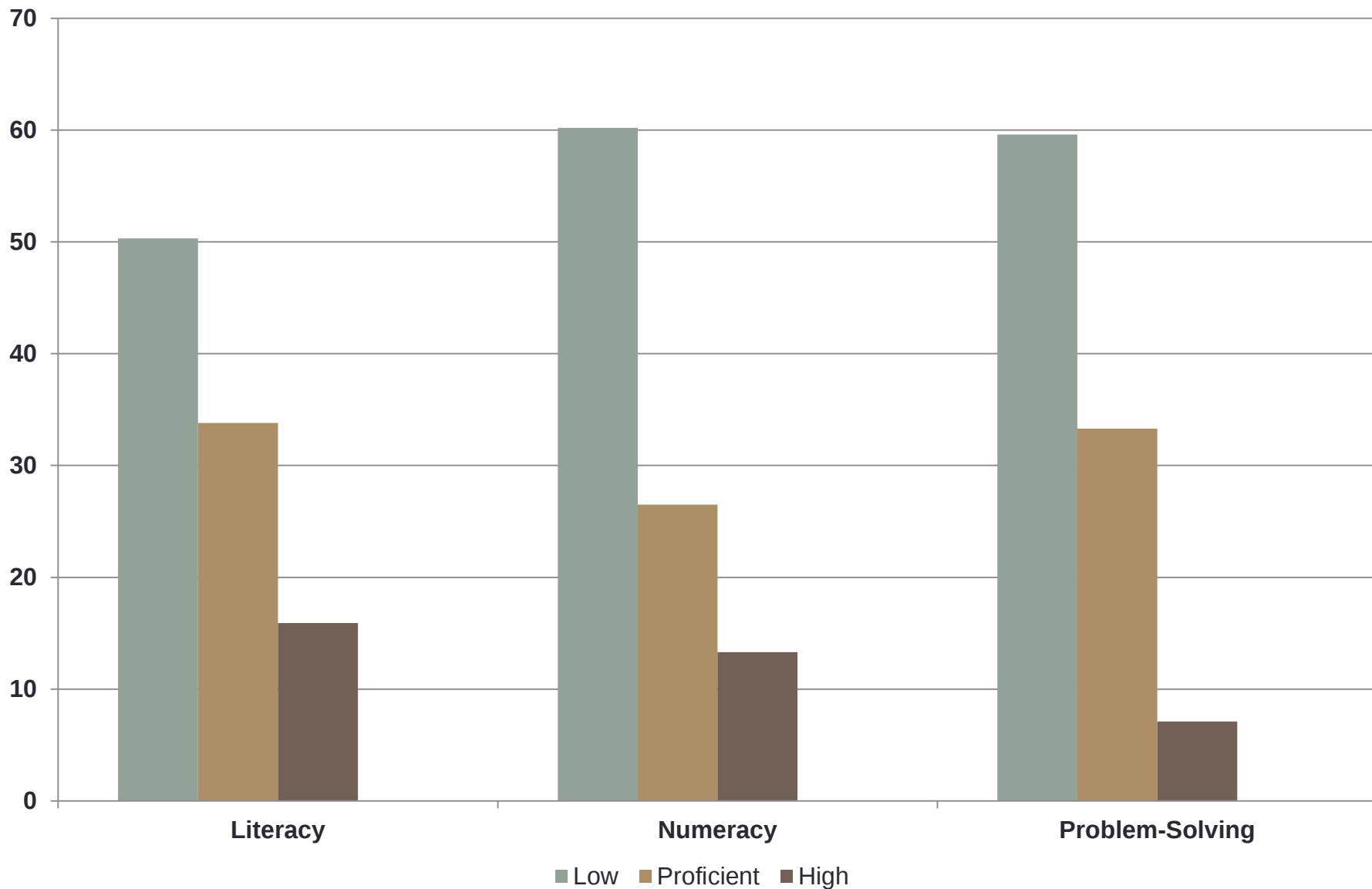
Questions and Analysis Plan

- **How do the patterns of literacy, numeracy, and problem-solving in a computer rich environment vary among workers with different characteristics?**
- **How do earnings vary by skill proficiency?**
- **Do earnings vary with literacy and numeracy skill levels even after controlling for education and occupation?**
- **Begin with tabulations and then turn to multivariate regressions**

Sample and Definitions

- **Sample: All workers in Ages 25-65**
- **Earnings between \$500 and \$20,000 per month**
- **Proficiency Levels: Low (≤ 2), Proficient (3), High (4-5) for Literacy and Numeracy**
- **Low (0-1), Proficient (2) and High (3) for Problem-Solving**
- **Subgroups by education, sex, native and foreign-born, occupation**

Figure 1: Percent of Employed U.S. Workers at Low, Proficient and High Literacy, Numeracy, and Problem-Solving Skills



Percent of Worker Subgroups with Low Levels of Literacy, Numeracy, and Problem-Solving

	Literacy	Numeracy	Problem-Solving
Male	49.6	54	57.7
Female	51.0	65.8	61.6
Age 25-35	46.9	56.6	53.6
Age 35+	51.4	61.3	61.4
Foreign-Born	72.8	74.5	74.3
U.S.-Born	48.4	60.3	57.7

Percent of Worker Subgroups with High Levels of Literacy, Numeracy, and Problem-Solving

	Literacy	Numeracy	Problem-Solving
Male	17.7	17.1	8.5
Female	14.3	9.3	5.7
Age 25-35	17.8	14.8	8.4
Age 35+	15.3	12.9	6.7
Foreign-Born	5.6	6.4	1.9
U.S.-Born	13.9	10.5	7.8

Low Levels of Literacy, Numeracy, and Problem-Solving Vary by Educational Attainment

	Literacy	Numeracy	Problem-Solving
High School Dropout	81.1	91.1	78.7
High School Graduate	61.8	74.6	70.6
Some College	50.2	63.3	63.3
BA Degree	26.3	36.6	42.2
Above BA	18.0	24.1	38.5

High Levels of Literacy, Numeracy, and Problem-Solving Vary by Educational Attainment

	Literacy	Numeracy	Problem-Solving
High School Dropout	1.4	0.7	2.7
High School Graduate	5.8	4.2	4.1
Some College	11.5	6.8	5.3
BA Degree	24.7	19	13.6
Above BA	34.1	28.8	10.5

Skill Proficiency Raises Earnings

Multivariate Estimates of the Impacts of Literacy, Numeracy, and Problem-Solving Levels on the Log of Earnings

	No Education Controls		Education Controls	
Literacy-Proficient	0.105	***	0.04	
Literacy-High	0.167	***	0.062	
Numeracy-Proficient	0.191	***	0.097	***
Numeracy-High	0.331	***	0.179	***
Problem Solving-Proficient	0.128	***	0.01	***
Problem Solving-High	0.181	***	0.161	***

Note: Regressions control for sex, foreign-born, and age.

Skill Proficiency Effects Vary by Sex

Multivariate Estimates of the Impacts of Literacy and Numeracy Levels on Monthly Earnings of Employed Workers in the U.S.

<u>No Education Controls</u>	<u>Male</u>	<u>Female</u>
Literacy-Proficient	\$607***	\$586***
Literacy-High	991***	1373***
Numeracy-Proficient	1422***	1025***
Numeracy-High	2796***	1773***
<u>Education Controls</u>		
Literacy-Proficient	230	222
Literacy-High	348	859***
Numeracy-Proficient	902***	469***
Numeracy-High	1846***	1066***

Note: Regressions control for foreign-born, and age.

Skill Effects Vary by U.S., Foreign Born

Multivariate Estimates of the Impacts of Literacy and Numeracy Levels on Monthly Earnings of Employed Workers in the U.S.

<u>No Education Controls</u>	<u>U.S. Born</u>	<u>Foreign-Born</u>
Literacy-Proficient	\$434 **	\$889 **
Literacy-High	865 ***	1931 **
Numeracy-Proficient	1345 ***	1445 ***
Numeracy-High	2810 ***	1579 **
<u>Education Controls</u>		
Literacy-Proficient	79	343
Literacy-High	290	624
Numeracy-Proficient	996 ***	227
Numeracy-High	2237 ***	202

Note: Regressions control for age and sex.

Impacts Vary By Education Level

Multivariate Estimates of the Impacts of Literacy and Numeracy Levels on Earnings of Employed by Educational Level in the U.S.

	High School or Less	Some College	BA or Higher
Literacy-Proficient	\$529***	\$158	\$112
Literacy-High	735**	498	537
Numeracy-Proficient	790***	407	798**
Numeracy-High	1044**	208	1918***

Note: Regressions control for age, sex, and foreign-born.

Literacy and Numeracy Impacts Vary Widely Within Occupations

Multivariate Estimates of the Impacts of Literacy and Numeracy Levels on Earnings of Employed by Occupation Category in the U.S.

	Proficient in Literacy	Literacy, High	Proficient in Numeracy	Numeracy, High
Managers, Professionals	\$213	\$834**	\$1051***	\$2293***
Technicians	507**	871**	427	422
Clerical	128	13	283	25
Craft, Operatives, Assembly	41	-72	1011***	-639
Laborers, Service Workers	527**	17	-230	136

Note: These results come from regressions that control for age, sex and nativity but not for educational attainment.

Summary of Key Earnings Effects

- Proficiency in literacy, numeracy, and problem-solving raises earnings, even after taking account of education levels
- Numeracy generally matters most
- Skill proficiency levels influence earnings of both low and high education groups
- Numeracy is especially important for managers, professionals, and craft workers while literacy is important for laborers
- Much unexplained after skills and education, perhaps occupational & employability skills

Implications for Policy/Practice

- **Raising proficiency levels, especially in numeracy, is a critical need**
 - 75% of high school graduates and over 60% of those with some college are not proficient in numeracy
- **Need to find new approaches to raise proficiency levels of workforce**
 - Link literacy, numeracy instruction with occupational training that applies these skills
 - Focus literacy training on foreign-born

Implications for Further Research

- Educational attainment captures only some of the role of skills in affecting earnings; cognitive skill levels vary widely within education groups
- Important to understand the mechanisms by which poor cognitive skills limit occupational success; what are the causal roles of literacy and numeracy?
- How best can cognitive skills be increased? Can information about the link between earnings and cognitive skills increase the motivation of workers to improve their literacy, numeracy, and problem-solving?