"Gender and Numeracy Skill Use: Cross-National Revelations from PIAAC"

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A Research Void

- Previous scholarship: Women are less likely than men to enter and persist within Science, Technology, Engineering, and Math (STEM) disciplines and occupations, across western countries (*e.g.* Else-Quest, Hyde, and Linn 2010; van Langen and Dekkers 2005; van Langen, Bosker, and Dekkers 2006)

  Problematic:

  Economically inefficient (*e.g.* Hill, Corbett, and St. Rose 2010)

  Puts females at double disadvantage re: earnings (*e.g.* England, Allison, and Wu 2006)

  Human capital supply issue (*e.g.* Burning Glass Technologies 2014)

- This work typically uses college major, occupation, or in some cases mathematical proficiency as its unit of analysis.

Hypothesis:

Women *are* using numeracy in their jobs to the same extent as men, but they are doing it in non-"STEM" occupations.

Methods: Analyses

- Data from the 2012 PIAAC (Programme for the International Assessment of Adult Competencies) Survey of Adult Skills allow us, for the first time, to look at gender gaps in the *use* of numeracy at work.

- Two overarching analyses:

How, if at all, do gender gaps in numeracy skill use at work vary cross-nationally? What is the importance of a variety of covariates – e.g. education level, age cohort– to these gendered outcomes?

When women in the United States do engage in large amounts of numeracy skill use, in what jobs do they do it?

Methods: Dependent Variable

- Respondents were asked a series of questions about how often at their jobs they engaged in a variety of tasks (*e.g.* "calculating prices, costs, or budgets")
- Responses collected using a Likert scale, ranging from "Never" to "Every Day."
- The dependent variable "numeracy skill use at work" utilizes a skill use index derived by PIAAC study personnel, based on IRT estimation procedures.

Results

- Males measure significantly higher than women on the index of numeracy skill use at work, across most OECD countries.

- However, this was not true for *every* country, nor was it true for every sub-group of the population.

Results

Average Numeracy Skill Use at Work Index Measures, by Gender and Jurisdiction (PIAAC 2012), *All Persons Employed in the Past 12 Months*

*** p < .001

	Male		***Female***	
Jurisdiction	Average	Standard Error	Average	Standard Error
Australia***	2.30	(0.023)	2.06	(0.020)
Austria***	2.07	(0.023)	1.78	(0.025)
Canada***	2.31	(0.019)	2.07	(0.016)
Czech Republic	2.16	(0.033)	2.14	(0.044)
Denmark***	2.06	(0.023)	1.71	(0.021)
Estonia***	2.02	(0.021)	1.94	(0.017)
Finland***	2.25	(0.024)	1.97	(0.021)
France***	2.08	(0.017)	1.87	(0.020)
Germany***	2.14	(0.025)	1.87	(0.027)
Ireland***	2.08	(0.027)	1.89	(0.026)
Italy	1.95	(0.035)	1.89	(0.042)
Japan***	2.05	(0.021)	1.60	(0.018)
Netherlands***	2.19	(0.027)	1.64	(0.022)
Norway***	2.00	(0.019)	1.65	(0.022)
Poland	1.93	(0.030)	1.96	(0.032)
Republic of Korea***	2.11	(0.024)	1.82	(0.024)
Slovak Republic	2.10	(0.028)	2.14	(0.028)
Spain***	2.14	(0.029)	1.95	(0.034)
Sweden***	1.97	(0.020)	1.67	(0.020)
United States***	2.34	(0.029)	2.08	(0.028)

Results

Average Numeracy Skill Use at Work Index Measures, by Gender, Jurisdiction, and Age (PIAAC 2012), *All Persons 24 or Younger Employed in the Past 12 Months*

* p < .05 ** p < .01 *** p < .001

Jurisdiction	***Male***		***Female***	
	Average	Standard Error	Average	Standard Error
Australia	1.99	(0.07)	1.94	(0.07)
Austria	1.78	(0.06)	1.81	(0.06)
Canada	1.87	(0.04)	1.92	(0.03)
Czech Republic	1.92	(0.08)	1.95	(0.09)
Denmark	1.57	(0.05)	1.53	(0.05)
Estonia	1.73	(0.06)	1.80	(0.04)
Finland	1.87	(0.06)	1.80	(0.06)
France*	1.96	(0.07)	1.77	(0.06)
Germany**	1.92	(0.07)	1.67	(0.05)
Ireland	1.85	(0.10)	1.71	(0.07)
Italy	*1.61*	*(0.10)*	‡	*(†)*
Japan	1.59	(0.08)	1.51	(0.05)
Netherlands*	1.73	(0.06)	1.53	(0.06)
Norway	1.63	(0.04)	1.60	(0.05)
Poland	1.77	(0.04)	1.84	(0.04)
Republic of Korea	1.66	(0.09)	1.67	(0.06)
Slovak Republic	1.98	(0.08)	1.95	(0.09)
Spain	1.71	(0.10)	1.82	(0.08)
Sweden	1.60	(0.06)	1.48	(0.05)
United States*	2.11	(0.09)	1.82	(0.08)

Results

Top 5 Occupations for Numeracy Skill Use at Work, by Gender *(United States Only)*

	Male		***Female***	
Rank	**Occupation**	**Percentage *(Weighted)***	**Occupation**	**Percentage *(Weighted)***
1	Mining, manufacturing and construction supervisors	5.48%	Shop salespersons	9.75%
2	Shop salespersons	5.02%	Administrative and specialised secretaries	5.87%
3	Manufacturing, mining, construction, and distribution managers	4.44%	Business services and administration managers	4.77%
4	Sales, marketing and development managers	4.08%	Nursing and midwifery professionals	4.39%
5	Engineering professionals (excluding electrotechnology)	3.78%	Sales and purchasing agents and brokers	3.88%

Summary of Findings

- Occupational gender segregation involves stratification in *skill use* as well as in category of job.
- BUT mean differences in numeracy skill use are not statistically significant within every OECD country or sub-population.
- In the United States, men and women who perform large amounts of numeracy skill use in their occupations are employed within many of the same job categories.
- BUT numeracy skill use at work is also stratified in ways that align with historical patterns of occupational gender stratification.

Limitations

1. Relatively low sample sizes for analyses of top-quintile numeracy performers in the U.S.

2. Numeracy index incorporates both basic and advanced skills.

3. Numeracy index does not align exactly with all skills needed across all STEM jobs.

#2 and #3 also strengths: enabling very specific, unique contribution to literature on gender and STEM

Implications and Conclusions

- Previous work eclipses numeracy skill usage across a spectrum of occupational categories.
- The contexts where the most workers in the United States engage in large amounts of numeracy are not all occupations requiring advanced, or even undergraduate, degrees.
- Notion that women are being filtered out of quantitatively-oriented careers is not wholly accurate (paradoxically, high numeracy use in “pink collar” occupations).

Suggestions for Research and Policy

- Research turning attention to quantitatively-oriented professions not typically falling under "STEM" umbrella

- Career and technical education programs oriented toward gender parity

- Research focusing on OECD countries *without* significant gender gaps (*e.g.* economies, educational systems, job market structures)

Future Directions for PIAAC Research

- Longitudinal assessments (unraveling age and cohort explanations)
- Matching field of study with current job to uncover "escape routes" for women who leave STEM pipeline
- Connection between gender, numeric *proficiency*, and numeracy skill use.

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