

## Revisiting the determinants of literacy proficiency

*Richard Desjardins*

### **What are the research questions?**

This study focuses on two questions: What factors influence literacy proficiency at the individual (micro) level? How does observed change in national literacy profiles relate to country (macro) level changes in the factors that influence literacy proficiency at the individual level?

### **Why this study?**

Together, the PIAAC and IALS studies make two comparable measures of literacy proficiency available spanning about 20 years for 12+ countries, making it possible to examine changes to the underlying structure of the determinants of literacy proficiency in a cross-national setting, and to ascertain how well changes in micro-level determinants of proficiency over time aggregate into changes to macro-level literacy profiles. For policymakers to augment adult literacy competencies, it is important to understand how the determinants of literacy proficiency may be implicated in the development of literacy from an individual lifecycle perspective, as well as how they may be implicated in development of national profiles of literacy proficiency as countries' socio-demographic make-up, socio-cultural practices and economies change over time.

### **What are the findings?**

- With some variation, education is one of the most important micro-level predictors over time and across models. This is followed by immigration status, parents' education and type of occupation.
- When indirect effects of parents' education are taken into account using a structural model, parent's education becomes the most important predictor in the UK and US, and this has increased over time.
- A few countries have significantly worse literacy profiles over time (incl. Norway, Sweden, US). More so than otherwise expected from increases to the proportion of foreign speaking adults and despite substantial increases to the proportion: of higher level qualifications among individuals and their parents; those who undertake adult education/training; and, those working in high skilled occupations.
- Despite growing number of adults with higher qualifications and in higher skilled occupations, there is a drop in the proportion of adults who report engaging in at least two types of reading at work per week in most countries including the US.

### **What are the implications?**

The findings suggest that micro-level relationships and results related to the determinants of literacy proficiency do not aggregate well into macro-level results. This is an indication of the importance of assessing micro-level statistical results within a macro level framework of analysis with careful consideration of the mechanisms that link antecedent factors and outcomes. Educational and occupational quality may partly explain why micro-level results do not necessarily translate into macro level results. Alternatively stated, there is increasing variation in proficiency among higher-level qualifications and skilled occupations, particularly as these become more prevalent. Moreover, this increased variation may be related to socioeconomic status (SES) whereby advantaged SES plays an increased role in the positional competition for quality education and quality jobs. For the US, the overall increase in the predicative capacity of parents' education, an indicator of SES, combined with the rise in the direct effect of SES from IALS to PIAAC is an indication that as educational systems are expanding access, they are having difficulties redressing inequalities emanating from the home background. In other words, educational systems are becoming more stratified according to socio-economic background. A similar phenomenon may be occurring in relation to skilled occupations. This raises important implications for equitable access to quality education as well as the changing nature of work practices related to literacy proficiency.

## Literacy and growth: Policy implications of new evidence from PIAAC

*Guido Schwerdt, Simon Wiedehold, and T. Scott Murray*

### What's the problem?

Rates of economic growth are below the level needed to support collective economic and social objectives. There is also growing evidence of rapid increases in literacy skill-based wage and income inequality<sup>1</sup>.

### What the new analysis reveals

The new analysis suggests that the impact of literacy skill on rates of inter-country GDP growth have doubled from 1960-1995 (Coulombe and colleagues) to 1970-2010. Specifically, a one-percent increase in literacy skills translates into a three-percent increase in GDP per capita in the steady state i.e. the point at which the economy has absorbed all of the productivity benefits generated by higher literacy levels. This suggests that the skills generated by one additional year of schooling (8 PIAAC points or 3 percent of mean PIAAC skills) lead to a nine-percent increase in GDP per capita.

The analysis also suggests that higher proportions of adults in Level 1 and 2 – the two lowest proficiency levels – reduce GDP and labour productivity growth rates significantly. Interestingly, differences in proportions with high proficiency levels – Levels 4 and 5 – appear to have no impact on comparative growth rates. Countries that manage to raise their average literacy skill levels by improving the literacy skills of low skilled workers will realize even higher levels of downstream growth.

The current analysis finds that differences in the skills of women have had a larger impact on observed differences in growth rates than the skills of men have had.

Importantly, increases in literacy skill have led increases in GDP and labour productivity rather than the reverse where higher levels of wealth might be used to buy more literacy. This finding fits with the results of randomized controlled trials of adult literacy skill upgrading that document significant positive impacts of higher literacy skill of on productivity and safety.

Finally, the Weiderhold and Schwerdt analysis also suggests that the economy reaches a new steady state after an increase in literacy skill averages rather quickly by economic standards. Specifically, the analysis suggests that it would take between six and nine years to close half of the gap to the new economic steady state i.e. the point at which all of the benefits of higher skill levels have all been realized. Recent Canadian research documents that current instructional technology is capable of realizing a 24-point gain in as little as 30 hours of high quality adult literacy instruction, so the instructional technology exists to create meaningful amounts of new literacy skill supply and, thereby, higher rates of economic growth.

Give the potential positive impacts on growth rates, governments should undertake an analysis of what mix of policy measures might generate increases in average literacy skills. These measures include, among others, increasing the skills of youth entering the labour market, upgrading the skills of workers already in the labour market and increasing the intensity of skill use in jobs that serves to reduce literacy skill loss.

---

<sup>1</sup> See for example First we Learn to Read, the Canada West Foundation, 2018

## Examining the Ways that Numeracy Skills and Soft Skills are Related to Occupational Status: The Case of U.S. Workers

*Huacong Liu and Frank Fernandez*

Policymakers are increasingly concerned that employees need both foundational skills, such as numeracy, and soft skills, such as planning and influence skills, to be successful in the 21st century economy. Empirical research has demonstrated that high-paying jobs increasingly require soft skills. In particular, literature has documented a higher growth rate of wages over the past three decades for U.S. workers with high social skills and high mathematics skills compared to workers with high mathematics skills yet low social skills (Deming, 2017).

There is little empirical research that examines whether foundational skills, such as numeracy and soft skills, have independent or interactive relationships with occupational status. Our study expands the literature on the importance of soft skills in the labor market. In particular, our paper addresses the following research questions:

1. After controlling for foundational skills as measured by PIAAC's numeracy assessment, are soft skills significantly related with workers' occupational status?
2. Are the relationships between soft skills and occupational status different at various levels of proficiency in numeracy?

The soft skills measures that are positively correlated with occupational status are (a) *Readiness to Learn*; (b) *Influence*; (c) *Planning*; and (d) *Task Discretion*. Based on our analysis of PIAAC data, we find that all four self-reported measures of the use of soft skills at work have statistically significant, positive relationships with an employee's occupational status—and that these relationships are independent of numeracy skill. We also estimate interaction effects between numeracy skill proficiency and all four aspects of soft skills. We find that of the four soft skill types, two (planning and influence) have significantly different relationship to the occupational status between workers with low and high numeracy proficiency. That is, workers with low-numeracy skills tend to be in occupations with more occupational prestige if they more frequently exercise planning or influence skills at work (compared to workers with high numeracy proficiency). Independent of soft skills, workers with higher levels of numeracy skills also tend to have higher occupational status.

Our paper echoes previous literature on the importance of soft skills in today's labor market, gauging from the angle of occupational status. Our findings also show that it may be especially important to promote soft skill development among workers with lower levels of numeracy proficiency. This suggests that policymakers may need to promote soft skills, in addition to focusing on basic skills education in math. Future research may build on our preliminary findings by distinguishing different soft skill domains and examining independent effects of those domains to further inform policy discussions about national efforts at soft skill formation.

## **Associations Between Adults' Numeracy Skills and Employment Status: An Analysis of PIAAC's U.S. Dataset**

*Leah Katherine Saal, Melissa Gholson, Krisanna Machtmes, and Ryan Machtmes*

### **(1) What are the research questions?**

- What is the relationship between numeracy skills and employment status compared to the relationship between the other skills measured in PIAAC (literacy and problem solving in technology-rich environments) among U.S. adults?
- What is the relationship between numeracy-related skills used in everyday life and employment status for U.S. adults?

### **(2) Why this study?**

While many U.S. adult education programs and policies (including the Workforce Innovation and Opportunity Act (WIOA)) focus on low literacy skill as a barrier to employment, this study recognizes the role of increasing numeracy skill as critical in reducing the probability of unemployment. This study used a series of regression analyses to examine the relationship between numeracy and employment status across four categories (currently employed, no experience with paid work, short-term unemployment, and long-term unemployment). Variables investigated included: participants' scale scores on literacy, numeracy, and PS-TRE assessments and selected demographic characteristics.

### **(3) What are the key findings?**

- Only increases in numeracy skills were protective the (un)employment categories no experience with paid work and long-term unemployment after all variables were added to the model.
- The study's results point to the centrality of advanced numeracy skills as protective of continued employment for marginalized groups in the U.S. like women, older adults, and some racial or ethnic minorities.
- Some numeracy related everyday life skills, like calculator use, were related to employment status.

### **(4) What are the policy/practice Implications?**

This study's findings on the importance of numeracy as protective of employment are particularly relevant to those interested in programming related to adult education and workforce development as outlined by WIOA of 2014. This study demonstrates the need for:

- Expanding offerings in numeracy programming and curricula for adult education and workforce development programs.
- Expanding professional development/training on instructional practices for teaching numeracy skills for adult education and workforce development professionals.
- Including "low levels of numeracy" as one of the pre-identified "employment barriers" by WIOA similar to "low levels of literacy."
- Connecting adult education and workforce development programs with regional workforce agencies to better understand the required numeracies of specific local industries.

## Are Canadian jobs more or less skilled than American jobs?

*Kristyn Frank and Marc Frenette*

### Introduction:

Current debates about the future of work focus on the degree to which technological advancements will change the skills required of workers and suggest that the automation of job tasks will change the nature of many occupations. Consequently, workers whose current jobs require higher level technical skills, such as those required in science, technology, engineering, or mathematics (STEM) occupations and skills that are complementary to new technologies, such as complex problem solving, analytical thinking, or social perceptiveness, may be better prepared for changing skill demands.

Canadian and U.S. labor markets share many similarities, suggesting that the occupational skill requirements of Canadian and American workers may be comparable. However, previous research indicates that Canadians have higher educational attainment, literacy, and numeracy skills than Americans. These differences may contribute to occupational skill gaps between the two countries.

This study compares the occupational skill level requirements of jobs held by paid employees aged 25 to 64 in Canada and the United States. PIAAC data (2012) were linked to 35 occupational skill level ratings from the Occupational Information Network (O\*NET) database. The following questions are addressed:

1. Are the occupational skill level requirements of Canadians' jobs higher or lower than those of Americans' jobs? Are there notable gaps in particular skill areas (e.g., STEM skills)?
2. How do occupational skill requirements differ among workers with the same level of education?
3. To what extent do workers' characteristics (e.g., sex, age, immigrant status, education level, literacy, numeracy) account for differences in occupational skill levels?

### Findings:

- Canadian workers are generally employed in more highly skilled jobs than their American counterparts, particularly in STEM areas such as science, math, programming, operations analysis, equipment maintenance and selection. Canadian workers' jobs also had higher skill level requirements in reading, writing, speaking, negotiation, and complex problem solving.
- The Canadian advantage in occupational skills is mostly attributable to its large proportion of workers with non-university post-secondary credentials, who hold higher skilled jobs than their U.S. counterparts.
- Overall, numeracy explained a large portion of Canada-U.S. occupational skill gaps. Literacy and educational attainment played smaller, but still notable, roles in explaining the skill gaps.

### Policy/Theory Implications:

The results suggest that higher numeracy skills have led Canadian workers to be matched to higher skilled occupations than their U.S. counterparts. Therefore, improving workers' numeracy skills could increase their likelihood of obtaining higher skilled employment, which may facilitate their readiness for the changing skill demands of future jobs.

## Using Log Files to Identify Sequential Patterns in PIAAC Problem Solving Environments by U.S. Adults' Employment Status

*Dandan Liao, Qiwei He, and Hong Jiao*

### **Introduction:**

This research project aims at identifying malleable factors associated with problem solving skills that can be of use in improving these competences in U.S. adult education. Process data in log files were analyzed to identify key factors associated with digital literacy. Additionally, we compare patterns in problem solving derived from a closer examination of the different strategies used by groups that vary in employment-related characteristics (e.g., job category, learning at work, salary).

### **Research Questions:**

- Which employment-related characteristics are significant related to the success of PSTRE items, and how do features extracted from process data differ by these employment statuses?
- Clustering test takers based on features extracted from process data, what do test takers in each cluster have in common regarding employment-related characteristics?
- What are the employment-related characteristics of test takers that are consistent, versus those who are inconsistent, regarding their features extracted from process data?

### **Findings:**

- Young and well-educated test takers with more work experience and higher work-related skills have higher chances to succeed in solving digital tasks.
- The higher-performing group is more likely to use actions demonstrating clear sub-goals, whereas the lower-performing group shows more frequent use of aimless actions.
- Test takers are found to be in three clusters with differential levels of test taking effort (e.g., response time and number of actions). Test takers in the lowest effort group perform substantially lower than their peers, while those in the highest and moderate effort groups do not show remarkable differences in their proficiency levels.
- Test takers in the highest effort group demonstrate the highest proficiency level, but not necessarily possess the highest income, work-related skill use, or education level.
- Elder test takers who have non-skilled occupations with lower income, work-related skill use and education, exhibit consistent patterns in low effort and lower proficiency levels in problem solving items.

### **Practical Implications:**

This project provides insights about the strategies that differentiate high and low PSTRE proficiency, and how it relates to adults' employment status. This would be of importance for policymakers to find better solutions to support adults' training for enhancing their problem-solving skills. When features from process data cannot be easily extracted, number of actions and response time could also be informative regarding the extent to which interventions are needed, especially when test takers are not able to provide correct answers. Special attention needs to be paid to groups with consistent low effort on PSTRE items.



## Collaboration at Work and PIAAC Skills

*Tobin Lopes, Ellen Scully-Russ, Jill Zarestky, and Joshua C. Collins*

### Research Questions

1. What is the relationship between cooperation/collaboration and information sharing and *literacy, numeracy, and PS-TRE skills* across industry sectors, controlling for gender and education?
2. How does the relationship between cooperation/collaboration and information sharing and *adults' use of specified skills* differ by industry, controlling for gender and education?

### Findings and Discussion

#### Research Question 1:

- Negative correlation to all three PIAAC measures of competencies for those who cooperate all the time as compared to those who cooperate sometimes.
- Those that shared information once a week or more had a positive association with PIAAC competencies with varying degrees across industries and competencies when compared to those who shared information less frequently.
- The idea that one's literacy, numeracy and digital problem-solving skills are negatively related to frequent cooperation/collaboration conflicts with previous research showing a positive relationship.
- Across all industries (for all educational profiles), those who share work-related information once a week or more can expect to have higher literacy, numeracy, and PS-TRE scores and vice-versa

#### Research Question 2:

- Cooperation/collaboration at work and sharing work-related information were largely positively related to reading, writing, numeracy, and information and communication technology skills use, although the extent of the relationship varied by industry.
- Sharing work-related information was positively related to the use of the four skills across industries while collaborating at work was only related to skills use in four of eight industries – Construction, Education, Human health and social work, and Wholesale and retail trade including repair of motor vehicles and motorcycles.
- Education level was positively correlated to many of the measures of skills use.

### Policy/Practice Implications

***Workplace practice:*** Consider opportunities to encourage sharing work-related information as opposed to cooperation/collaboration, perhaps by giving job-holders information and having them perform tasks alone rather than creating highly cooperative environments.

***Organizational policy:*** Consider the ways in which employees' PIAAC skills and corresponding ability to successfully complete work will support achieving an organization's goals. More skillful employees are more likely to be adaptable to changing work environments and organizational pressures, making them better contributors over time and supporting organizational survival in changing economic conditions. Designing tasks and responsibilities in which people share work-related information rather than collaborating may build stronger employee skills.

***National policy:*** Design and delivery of workforce development and adult basic education programs should specifically aim to leverage individuals' knowledge sharing skills in addition to abilities to cooperate/collaborate effectively.

***International Policy:*** Further research is needed on the links between soft skills and labor market outcomes, and their role in the formation and maintenance of the PIAAC cognitive competencies. OECD recognized the importance of these skills by including them in the PIAAC background questionnaire. A measure of soft skills to support their assessment in future cycles of PIAAC would enable researchers to conduct deeper analysis on the role of soft skills in adult workplace learning and labor market success (Martin, 2018).

## The Importance of Skills and Majors in Determining Future Earnings

*Karly Ford and Junghee Choi*

### 1. Summary of the research questions

The purpose of this study is to better understand the relationship between college majors and earnings, while considering the possible role of cognitive skills, measured as numeracy and literacy in this study. While the knowledge and skills conferred by an academic major are tightly connected to certain fields and areas (hereafter “major-specific skills”), cognitive skills refer to general skills that can be developed and applicable independent of fields and areas. The existing literature, media narratives, and policy discussions tend to focus on the seemingly tight connection between academic major and earnings, but it is possible for earnings to vary according to differences in cognitive skills. More specifically, our research questions are as follows:

- Do cognitive skills explain within-major heterogeneity in earnings?
- How do cognitive skills interact with major-specific skills to explain earnings?

### 2. Findings and Discussion

- On average, among the graduates of the same academic major, higher levels of numeracy and literacy are associated with higher earnings.
- Separate analyses by academic major indicate that numeracy is significantly associated with higher earnings for humanities, social sciences, and STEM majors, and literacy is significantly associated with higher earnings for humanities, social sciences, and health majors.
- There are interactional effects between majors and cognitive skills to explain earnings. That is, relative to education majors, earnings and numeracy are more strongly related for humanities, social sciences, and STEM majors, and earnings and literacy are more strongly related for humanities, social sciences, and health majors.

### 3. Policy/practice implications

- While earnings are in no way the most important outcome for higher education, students do consider potential economic outcomes in their decisions for academic majors. Accounting for the role that cognitive skills can play in the majors-earnings relation can better inform students and advisers on choice of academic major.
- Designing policy based solely on simple short-term relationships between majors and earnings may not increase the efficiency of higher education funding as measured by graduates’ earnings.
- Higher education institutions should value the development of students’ cognitive skills, as they are connected to students’ economic success following graduation, beyond differences in major-specific skills.



## **Relations between Socio-economic Status and Skills in PIAAC**

*Juliet Holmes and Markus Broer*

### **Introduction:**

Traditionally, PIAAC uses parental education as a proxy for socio-economic status (SES). This study is focused on the following research question:

1. How does an index composed of several SES proxies compare with the one-variable parental education SES proxy?

This study uses a methodology of creating an SES index that has previously been demonstrated with NAEP and TIMSS data (Broer et al., 2017; Bai & Broer, 2017).

### **Data and Methods:**

This study demonstrates the creation of a proxy SES index for the U.S. PIAAC sample that includes five components: the mother's highest education level, the father's highest education level, the respondent's number of books in the home at age 15, the respondent's highest education level, and the respondent's observed SES status (U.S. interviewers were asked to indicate the rough SES status of the respondent's household from poor to affluent/upper middle class).

### **Findings:**

The proxy SES index explains more of the variation in literacy and numeracy scores than parental education alone. Parental education explains about 14% of the variation in numeracy scores, while the proxy SES index explains about 34% of the variation. Moreover, our results suggest that a large part of Black-White and Hispanic-White achievement gaps is explained by different SES levels between the subgroups when using the proxy SES index. Using parental education alone to represent SES would have underestimated the extent to which SES can explain racial skill gaps.

### **Implications:**

When applying research to policy, researchers and policy makers should consider the confounding effects of socio-economic status. Analyses showing the association between certain predictors and skill outcomes without using a more nuanced indicator of SES may overestimate the potential effect of predictors on the outcome. Thus, research that uses a more comprehensive SES indicator as control variable is more likely to identify malleable factors for policy initiatives or rigorous testing.

## Parental Education and Skill Indicators of Children: An Intergenerational Mobility Study

*Sara Oloomi*

### Introduction:

This study explores the extent of the association between parental education and economic and educational outcomes of the adults in the form of intergenerational mobility in the United States for the population as a whole, as well as differentiated by gender and race/ethnicity. Study of intergenerational mobility is important because it shows whether individuals can prosper in a society independent of their socioeconomic circumstances. Using parental education as a proxy of socioeconomic status, this research studies the following research questions:

1. What is the extent of the association between parental education and outcomes of adults, including education, employment status, occupational skill classification, earnings, and cognitive skills (literacy, numeracy, and problem-solving scores) in the U.S.?
2. Is parental education associated with the propensity to study in the Science, Technology, Engineering, and Mathematics (STEM) fields?
3. Does the association between parental education and outcomes of adults mentioned in research questions 1 and 2 vary across different segments of the population including racial/ethnic and gender groups in the U.S.?

### Findings:

This study finds that adults with higher educated parents are more likely to have higher cognitive skills (literacy, numeracy, and problem solving), achieve college degrees, be employed, engage in skilled occupations, and receive higher quartiles of earnings than adults with less parental education. Findings show the existence of gender gap in skilled occupation (with advantages for females), earnings (with advantages for males), and employment status (with advantages for males). Gender gap in earnings and skilled occupations tend to decrease among adults with higher parental education. Results indicate that racial gaps in the outcomes of the adults, including education, earnings, and employment status disappear among adults with high parental education. Results also indicate a persistent gender gap, which is independent of parental education, in STEM (higher probability to study among males than females).

### Policy Implications:

The highly influential role that parental education plays in the education and economic outcomes of adults throughout life highlight the importance of the policies promoting adult literacy and education. Such policies will help parents better reach their full potentials in upbringing the next generation. The recommended policies will also help reducing racial gaps in the economic and education outcomes of the adults since racial gaps tend to disappear among adults with high-educated parents.

Besides policies promoting adult education, there is need for policies to compensate inadequate parenting skills or/and financial abilities, in the form of redistributive policies and social assistance programs (e.g. Head Start). Such policies, with the purpose of shaping equal opportunities for all children, help to reduce the impact of low socio-economic background on individual's life chances. This study did not find any significant relationship between parental education and propensity to study in STEM. Based on the literature review, policies promoting higher parental involvement through education system as well as ensuring high standards in learning, classroom size and student teacher ratio across all classrooms and neighborhoods are effective in reducing gender gap in STEM (Kugler et al. 2017).

## Writing Behaviors Relation to Literacy and Problem Solving in Technology Rich Environments: Results from the 2012 and 2014 U.S. PIAAC Study

*Iris Feinberg, Elizabeth L. Tighe, Amani Talwar, and Daphne Greenberg*

**Introduction:** This study focuses broadly on the relations of writing behaviors at home and at work to adults' performance on the Literacy and Problem Solving in Technology Rich Environments (PSTRE) domains. In particular, we addressed three aims: (1) understanding the relations among writing and reading behaviors at home and at work for the overall population and for low-skilled adults, (2) exploring potential differences in functional writing behaviors (e.g., writing emails) by demographic characteristics (e.g., race) for adults with lower and higher skills, and (3) examining the relations of reading behaviors, Literacy, and PSTRE to writing behaviors at home and at work for the overall population.

Reading and writing are fundamental skills for adults to function in society. Research with children suggests a strong relation between reading and writing skills; however, very little is known about the functional reading and writing behaviors that adults engage in (e.g., filling in a form, reading directions, writing emails). A recent meta-analysis reports that engaging in writing-to-learn tasks that are impromptu and help students think through key ideas results in academic achievement gains, and that institutions of higher education also recognize the importance of writing in academic and professional settings. With technological advances and the shift to writing moving to online platforms, it is important to also understand the relations between writing and digital technologies. Data shows that reading and writing are correlated for children; our study further shows that this may also be true for adults, in particular, when reading and writing are within the same context such as writing and reading at work.

**Findings:** Our findings for Aim 1 indicate that there are positive relationships between reading and writing behaviors at home and at work; and that these relationships are of similar magnitudes for the overall population and adults with low literacy skills. In particular, reading and writing behaviors at work exhibited the strongest correlation. Our findings for Aim 2 suggest some important differences among demographic characteristics and among proficiency groups in reported frequencies of writing behaviors at home and at work. Broadly, there were many differences in writing frequencies between low-skilled and high-skilled adults (Literacy and PSTRE) by age, race, native language status, and job categories, with higher-skilled adults always reporting more frequent writing engagement. More specifically, within the low-skilled Literacy group, adults who were non-native English Speakers or who identified as Hispanic reported the lowest frequencies of writing behaviors. Our findings for Aim 3 reveal that PSTRE and reading behaviors at home were most predictive of writing behaviors at home for the overall population. Similarly, PSTRE and reading behaviors at work were most predictive of writing behaviors at work.

**Policy Implications:** There is a relationship between reading and writing behaviors on the job and at home on the same task, thus strengthening reading and writing skills simultaneously in adult education classrooms may help low-skilled adults improve literacy outcomes. Those in higher skilled occupations write more frequently; improving low-skilled adults' writing behaviors may help them achieve stronger economic outcomes. Digital technology continues to replace pencil and paper; developing technology as tools for writing instruction can help adults at varying literacy and PSTRE levels increase their academic and workplace skills.

## **Adults' Civic Engagement in the U. S. and Germany: Evidence from the PIAAC Survey**

*Amy D. Rose, Thomas J. Smith, Jovita M. Ross-Gordon, Jill Zarestky, Tobin Lopes, M Cecil Smith, Anke Grotlüschen, and Marion Fleige*

We examine civic engagement among foreign- and native-born adults in the US and Germany—world-leading nations with different responses to immigration and assimilation. Civic engagement involves the practices and beliefs underpinning the democratic functions of citizenry, and is operationalized in this study as voluntary work, political efficacy, and social trust.

### **Research Questions**

1. Among adults in the US and Germany, are age, education, gender, immigration status, skill proficiency, work status, and number of years worked associated with civic engagement (i.e., voluntary work for non-profit organizations, political efficacy, and dimensions of social trust)?
2. Do the associations of age, education, gender, immigration status, skill proficiency, work status, and number of years worked with civic engagement (i.e., voluntary work for non-profit organizations, political efficacy, and dimensions of social trust) differ between individuals in the US and Germany?

### **Findings and Discussion**

Across both countries, only education was a consistently positive predictor of civic engagement, and different forms of skills—literacy, numeracy, and digital problem solving—predicted dimensions of civic engagement. For comparisons between the two countries, immigrant status was negatively related to volunteer work in Germany, but there was no difference between foreign- and native-born adults in the US for volunteering. There were positive relationships of skills to political efficacy and aspects of social trust in both countries. While numeracy and digital problem solving were strongly associated with social trust in the U.S., it was literacy that was strongly associated with the social trust in Germany. These findings suggest that with greater opportunities for skill improvement, social trust may also increase.

### **Policy Implications**

The finding of no differences between native-born and immigrant adults in aspects of civic engagement suggest that, at least for the US, policy efforts to promote societal integration may be showing success. Also, efforts to improve adults' skills might be necessary, but not sufficient, to increase civic engagement. Policymakers cannot assume that efforts to increase literacy (or other skills) will lead to increased civic engagement. Better skills may contribute to attitudes such as social trust; but better skills may not lead to change in behaviors, such as participating in voluntary work.

## Understanding Educational Aspiration among People in Prison

*Ruth Delaney and Lionel Smith*

**Summary of the Research:** This paper aims to assess the role that cognitive skills, as well as demographic and socio-economic factors play in shaping educational aspirations among people in prison. This paper pursues this objective through two research questions using two different analytic strategies.

**Research Question 1:** What demographic and skill-level factors predict the aspiration to enroll in *any* education class or program among people in prison in the U.S.?

- **Binary logistic regression:** gender, age, race/ethnicity, parental education attainment, personal educational attainment, literacy proficiency score, numeracy proficiency score.
- **Findings:** Having stronger literacy or numeracy skills may increase a person's interest in educational programs – these skills are dynamic and can change with skill-building programs

**Research Question 2:** What demographic and skill-level factors predict the aspiration to enroll in a *postsecondary* education class or program among people in prison in the U.S.?

- **Chi-square:** gender, age, race/ethnicity, parental education attainment, personal educational attainment.
- **Findings:** Those interested in postsecondary education had higher average literacy and numeracy skill scores than those interested in other types of educational programs; a large majority of all but one category (those without high school credentials) were interested in postsecondary programs (75-99 percent).

**Policy/Practice Implications:** One of the most important findings is actually within the summary statistics: the fact that 70 percent of people in prison would like to enroll in an education program.

- Aspirations in prison outstrip opportunities: High school is the highest level of educational programming that is consistently available in prison.
- Among incarcerated people, educational attainment may not be as strong a predictor of interest in education as assessed cognitive skill. This suggests skill-building may spur more interest for more schooling.
- Skill-building could be accomplished through offering challenging adult basic education courses and college preparatory work even where college programs do not yet exist.
- The opportunity this interest presents to engage incarcerated people in adult learning programs should not be ignored. About 95 percent of incarcerated people will eventually leave prison and return home.

**Conclusion:** 2.2 million people may further their educations while incarcerated in the United States. Educators, researchers, policymakers, and funding agencies should begin to look at prisons as a legitimate and important site of learning in American society.

## Prison-based Education: Programs, Participation and Proficiency in Literacy/Numeracy

*Jinghong Cai, Anil Ruhil, and Dianne Gut*

Today, more people are incarcerated in the United States than in past decades, and we have the infamous distinction of being the nation that leads in incarceration rates (670 per 100,000 persons as per Walmsley 2018). Although an increasing body of research shows that correctional education works in terms of enhancing post-release employability and reducing recidivism, there is a paucity of literature that identifies the educational programs that benefit inmates the most vis-à-vis developing the literacy/numeracy skills needed for reentry into an ever-changing labor market. Identifying the type, amount and intensity of programs that reduce recidivism is not a choice, it is a critical path to reducing recidivism.

Given this need our study focuses on 3Ps – prison-based education programs, prisoners' participation in academic/vocational programs, and their proficiency in literacy and numeracy as assessed during their incarceration by the Program for the International Assessment of Adult Competencies (PIAAC) Survey of Incarcerated Adults in 2014.

### **Our investigation spans the following broadly defined questions –**

- 1) How do inmates differ from the household population in the use of literacy/numeracy skills in life and at work?
- 2) How do participants in different types of prison-based educational programs (such as basic skills, General Equivalency Degree (GED), employment readiness and job training) reflect literacy and numeracy proficiency? That is, does proficiency vary by program?
- 3) Do inmates who participate in prison-based academic and/or vocational programs use more literacy and numeracy skills in their prison life, compared with non-participants?

**Our study identified three types of prison-based programs** that serve inmates who possess a range of literacy and numeracy levels – (i) programs targeting basic skills serve inmates without a GED or high school diplomas; (ii) programs that help inmates obtain a GED or high school diplomas that equip inmates with necessary proficiency in literacy and numeracy to pursue appropriate job training programs/postsecondary education, and; (iii) vocational/professional training programs that advance skills in areas such as computers, mechanics and technology.

### **What we found –**

- Compared with the household population, a large proportion of inmates rarely use certain literacy/numeracy skills (e.g., reading bills, invoices and financial statements, reading diagrams, maps and schematics, filling in forms and writing reports at prison jobs) in life or work during incarceration, particularly when it comes to numeracy.
- Inmates who did not reach high school level and did not participate in any programs had the lowest literacy and numeracy. By contrast, inmates who participated in basic skills programs performed significantly higher than this reference group in both literacy and numeracy.
- Over two-thirds of inmates who participated in vocational programs (i.e. employment readiness and/or job training) had a high school diploma, and participants in vocational programs during incarceration were likely to use more literacy and numeracy skills in their prison life than the non-participants.

We recommend that policy makers consider the valuable link we found between skills-use and participation in vocational programs or career and technical education (CTE). From the perspective of need-based education, expanding programs targeting basic skills is a must, as almost one in three inmates have education levels lower than high school diploma. Since evidence shows that educational programs in prison benefit inmates on improving skills, CTE should receive more resources precisely because these programs lead not only to obtaining but also retaining employment, which is a critical policy lever if we truly wish to reduce recidivism.

## **Incarcerated Adults with Low Skills: Findings from the 2014 PIAAC Prison Study**

*Margaret Becker Patterson*

### **Introduction:**

Incarcerated adults face multiple educational, economic, and health challenges. Even with basic or high school equivalency (HSE) correctional education programs widely available in prisons, proportionately few incarcerated adults complete them. This paper investigates:

- ❖ the characteristics and assessed skill levels of incarcerated adults with less than high school (LHS) education attainment;
- ❖ how characteristics and assessed skill levels differ by gender and from the general population;
- ❖ the role of current and future learning in the lives of incarcerated adults with low skills

### **Findings:**

Among findings are educational and health vulnerabilities for incarcerated men and women with less than high school education attainment (LHS), such as lower numeracy scores than LHS adults in the general population. The rate of learning disabilities (LD) among LHS incarcerated adults is four times that of the general population. Two-fifths of LHS incarcerated women report fair or poor health, versus one-fourth of LHS incarcerated men doing so. Adults in basic or high school equivalency (HSE) correctional education programs cite jobs after release and gaining knowledge as reasons to attend; the same reasons tend to motivate them for future learning. Even so, the rate of LHS incarcerated adults completing programs and gaining credentials (5%) is even lower than reported in earlier research.

### **Implications for Practice:**

Without at least a high school education, incarcerated and re-entering adults are left educationally vulnerable, and this vulnerability is heightened in impoverished, stressed communities. Both correctional and re-entry education programs need to fully assess entering learners for skills and any unmet learning needs and to review the instructional and support services for adults with learning disabilities, to ensure those services facilitate learning. Prison officials have an opportunity to review adult participation in basic skills programming and to identify ways more incarcerated adults can participate in programming to reduce recidivism after release. As adults re-enter society, re-entry service providers must be prepared to respond to LHS adults' external, family, and community circumstances as adults seek education and employment.



## **Factors That Influence the Educational Attainment, Employment, Economic Mobility, and Successful Reentry of Incarcerated Parents**

*Daniel M. Leeds, Juliana Pearson, Leslie Scott, and Simone Robers*

### **Introduction:**

Many prison inmates returning to their communities are parents. Parental incarceration is associated with poor outcomes for children, including lower family incomes and a higher risk of child homelessness, aggressive behavior, depression, and poor academic achievement. Children with parents in prison are six times more likely to be incarcerated than the overall population. Correctional education may help previously incarcerated adults and their children because prison inmates have lower levels of education (and underlying literacy and numeracy skills) than the U.S. population, all of which are correlated with poor life outcomes.

PIAAC's background questionnaire provides an opportunity to learn about incarcerated parents' pre-incarceration education levels and employment, current skill levels, and factors that influence enrollment in and access to educational programming in prison.

### **Findings:**

PIAAC data on incarcerated parents demonstrate a clear need for them to build their skills so that they can access employment opportunities upon release. More than three-quarters of incarcerated parents with a child under the age of 18 (dependent children) have low literacy and numeracy skills. The majority have completed a high school diploma or alternative credential and many have been employed for a clear majority of their potential working years, but very few possess a postsecondary credential. Incarcerated parents of dependent children differ from other incarcerated individuals, though not always in ways that lead to a clear narrative. They are less likely to be interested in tertiary degrees or courses than other incarcerated individuals. They have often been employed for a greater share of their potential working years than incarcerated individuals who do not have children. They are more likely to be interested in job opportunities upon release than individuals with grown children. Incarcerated adults had disproportionately low-educated parents and were disproportionately low-educated themselves, so additional education may help prevent this cycle of low education from continuing into the future. Given the potential gains from further education, it is surprising that roughly a quarter of incarcerated parents of dependent children were not interested in academic courses. Moreover, over half of those uninterested in academic coursework and close to 40 percent of those uninterested in job skill courses did not provide clear reasons; therefore, further research is needed to determine demand-side barriers to prison education. Such research could also focus on how reasons for not participating in career-focused programs differs from reasons for not participating in academic correctional education programs.

### **Policy/Theory Implications:**

Our hope is that this analysis can strengthen policymakers' understanding of the education, skills, and job readiness of incarcerated parents returning to their communities. State policymakers can use the information to inform investment in education, training, reentry, and supplemental support programs for justice-involved populations during and after incarceration. The study could also inform the reauthorization of the federal Carl D. Perkins Career and Technical Education Act and the Second Chance Act, both of which provide resources to fund educational programs in prison settings.

## Numeracy and Preventive Health Care Service Utilization among Middle-aged and Older Adults in the U.S.

*Takashi Yamashita, Anthony R. Bardo, and Darren Liu*

### Introduction:

This study is focused on the following research questions:

RQ1: What cut-point(s) reflects a threshold for numeracy skills in the context of preventive health care service utilization among U.S. adults aged 45 to 74 years old?

RQ2: Is numeracy proficiency associated with preventive health care service utilization after accounting for predisposing, enabling and need factors among U.S. adults aged 45 to 74 years old?

Numeracy proficiency (i.e., quantitative literacy) reflects an essential set of skills needed to identify and comprehend numeric information. Numeric information is pervasive in American society, and numeric competency is critical in many aspects of daily life. A major area of life that often requires one to use and work with numbers surrounds health and health-related behaviors. Yet, the role that numeracy plays in relation to health care service utilization remains relatively unknown. Thus, the present study draws on nationally representative data from the Program for International Assessment of Adult Competencies (PIAAC) to establish some of the first generalizable associations between preventive health care service utilization and numeracy. We focus on middle- to older age—a time in life when health generally begins to deteriorate, and health care utilization becomes more frequent. Specifically, we examine whether there are meaningful numeracy score cut-points (e.g., low vs. high numeracy) in the context of preventive health care service utilization—including dental checkup, vision screening, influenza vaccination, and osteoporosis screening—among American adults age 45 to 74 years old.

### Findings:

An evaluation of four possible numeracy proficiency level classifications (i.e., continuous, 5-level, 3-level, and dichotomous) revealed that a dichotomous cut-point (i.e., low vs. medium and high numeracy) presented the most robust association in the context of preventive health care service utilization. This dichotomous cut-point was associated only with dental checkup utilization after controlling for predisposing (e.g., age, gender, race, education, employment), enabling (i.e., health insurance, literacy skills, numeracy skill use at home), and need (self-rated health) factors. However, numeracy was not associated with vision screening, influenza vaccination, or osteoporosis screening.

### Policy/Theory Implications:

Findings suggest that health care providers may want to give special attention to how numeric health information is communicated in the preventive care for dental health. Additionally, dental care providers could consider assessing patients' numeracy to identify at-risk populations. Given that the prevention of ill-health is typically an ongoing process, early education intervention may reflect a useful strategy to help at-risk adults identify and assess long-term risks and benefits associated with routine preventive health care service utilization. Future research needs to consider both the advantages and disadvantages of various numeracy assessment tools to locate their applicability in specific health care settings. Other health-related outcomes such as the use of specific health information sources and gender-specific cancer prevention (e.g., mammogram, pap test) should also be examined in relation to numeracy proficiency.

## An Examination of PIAAC Data for Unemployed Adults Aged 45 to 74

*Phyllis Cummins, Takashi Yamashita, and Annabelle Arbogast*

### Research Questions

This study focused on the following research questions for U.S. adults ages 45 to 74:

1. **Lifelong learning:** Are there any differences in adult education and training (AET) participation among those who are employed, unemployed, and out of the labor force, and what are the reasons for non-participation?
2. **Employment status:** Are there any differences in literacy skills or use of reading and writing skills at home among those who are employed, unemployed, and out of the labor force?
3. **Retirement:** Are there any differences in literacy skills or use of reading and writing skills at home among those who are retired, employed, and unemployed?
4. **Health:** Are there any relationships among health status, literacy skills, use of reading and writing skills at home, education, and employment status?

As the U.S. population ages, middle-aged and older workers represent an increasingly large segment of the labor force, accounting for nearly half of all workers. At the same time, labor force participation rates for males ages 45 – 54 have declined in recent decades. Technological advances in a global knowledge economy requires continuous skill upgrades for people of all ages. Little previous research has used the nationally representative data from the Program for International Assessment of Adult Competencies (PIAAC) data to analyze the relationship between AET, employment status, and literacy skills for this population.

### Findings and Discussion

Overall, employed adults ages 45 – 65 participate in AET significantly more than the unemployed and out of the labor force groups. For all employment groups, individuals with higher levels of education were significantly more likely to participate in AET as compared to those with lower levels of education. Employed adults ages 45 – 65 had higher AET participation rates than the 66 – 74 age group. For ages 45 – 65 the unemployed or out of the labor force were more likely to have lower literacy skills than those who were employed. Among the 45 – 65 and 66 – 74 age groups, there was no difference in the use of reading and writing skills at home among the employed, unemployed, and out of the labor force groups. Comparing the employed with those who are retired, for both age groups, employed were more likely to use writing skills at home. For ages 45 – 65, those with greater literacy skills were more likely to report better health. Also, adults with higher educational attainment were more likely than those with lower educational attainment to report good health. Moreover, those who are unemployed and out of the labor force were less likely to report better health than the employed. Among the 65 - 74 age group, greater literacy skills were associated with better self-rated health and employed adults were more likely than those out of the labor force to report good self-rated health. Among both the 45-65 and 66+ age groups, use of reading and writing skills at home was not associated with self-rated health.

### Policy/Practice Implications

Results of this study, specifically lower levels of participation in AET by the unemployed, out of the labor force, and by those with lower levels of education, suggest the need for policies and practices that promote participation in lifelong learning activities. This is especially important in light of declines in labor force participation by males ages 45 – 54. In addition, programs that encourage participation in AET for ages 66 – 74 might result in continued employment at older ages. From a practice standpoint, outreach programs by educational providers that inform adults ages 45 – 65 and 66 - 74 about the benefits of lifelong learning activities and facilitate their participation could also increase involvement. These efforts will help promote the physical and economic well-being of the workforce in later life.

## Who Is Not Digitally Literate in the United States?

*Saida Mamedova and Emily Pawlowski*

### Introduction:

This study is focused on the following research questions:

- What is the demographic, skills, and employment profile of U.S. adults who are not digitally literate?
- How does the U.S. compare to other developed countries on digital literacy and on computer use at work and in everyday life?

Adults are increasingly going online for everything from finding recipes and making retail purchases to trading stocks or filing taxes. This research addresses the gap in the information about adults who are not digitally literate, reporting on the demographic and socio-economic background of the 32 million Americans who do not have sufficient comfort or competence with technology to use a computer.

The study defines not digitally literate using the requirements that PIAAC established for determining basic computer competence: (1) prior computer use, (2) willingness to take the assessment on the computer, and (3) passing a test of basic computer skills, such as using a mouse and highlighting text on the screen. Adults who did not meet any one of these requirements are classified as not digitally literate.

### Findings:

Our analysis found that:

- U.S. adults who are not digitally literate tend to be less educated, male, 45 years old or older, Black or Hispanic, have lower literacy and numeracy scores, had lower labor force participation rates, and tend to work in lower-skilled jobs when they were employed;
- a smaller proportion of adults in U.S. are not digitally literate than on average internationally;
- a larger portion of U.S. adults use computers at work compared to adults internationally, but a smaller proportion of U.S. adults use computers in every-day life compared to adults internationally.

### Policy/Theory Implications:

These findings indicate that targeted digital literacy interventions are needed, given the profile of the adults-in-need:

- digital literacy needs of older adults, i.e. in the later stages of their working years, should be reflected in digital literacy course offerings and curricula;
- digital literacy skills can be incorporated into other basic skills interventions;
- more opportunities or funding for those not in the workforce are needed with the aim of improving digital literacy and increasing ICT use in everyday life.

These results also show that a focus on increasing use and proficiency with technology outside of work is needed in the U.S., given international context.

**Service Sector Workers' Skills:  
Findings from PIAAC and Implications for Educators**  
*Amanda Bergson-Shilcock, B. Jasmine Park, Katie Landeros Herz,  
Emily Pawlowski, and Jaleh Soroui*

**Research questions**

- What is the incidence of low literacy, numeracy, and digital skills among service-sector workers?
- What are the skills that workers need to use on the job?
- What percentage of workers are attempting to upskill or pursue additional education?

**Findings and discussion**

- Overall, 62% of service-sector workers in the target occupational categories have limited literacy skills, and 74% have limited numeracy skills. Seventy-three percent (73%) lack digital problem-solving skills, not including the workers who declined to take the technology portion of the test.
- Among workers with low skills, a majority (61%) are women. Nearly half (46%) are white, 20% are black, 26% Hispanic, 5% Asian/Pacific Islander, and 4% report their race or ethnicity as other. A quarter (25%) are immigrants, and 75% are **over** the age of 25.
- Despite their low skills, many of these workers regularly need to use literacy and numeracy skills at their current jobs: 73% need to read directions; 55% use computers; 50% calculate prices, costs, and budgets; and 36% **write** letters, memos, and e-mails. More than half (55%) are actively engaged in **learning** new things in their current jobs, and 38% are **teaching** others on the job. Nearly one in four (23%) are **supervisors**.
- Some low-skilled workers had recently demonstrated interest in upskilling: 27% had pursued a formal degree or certificate program in the past year.

**Policy/practice implications**

- Employers can address upskilling needs by: 1) Participating in industry sector partnerships to identify talent gaps and meet training needs; 2) serving as the employer partner for registered apprenticeship programs; 3) partnering with training organizations and community colleges.
- Policymakers can address upskilling by: 1) Investing in adult education and workforce development programs; 2) investing in sector partnerships; 3) incentivizing private investment in upskilling through employer tax credits and other mechanisms; 4) implementing proven models such as Integrated Education and Training.