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An Examination of Literacy and Computer Literacy Skills Amongst Adults Who Are Incarcerated: An Analysis of the PIAAC

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Background and Rationale

Print literacy and computer literacy are foundational skills necessary for health, education, and employment opportunities in our current world (Chua, 2017; Organization for Economic Co-Operation and Development, 2012; Rocha & Ponczek, 2011). Unfortunately, the educational skills of adults who are incarcerated are significantly lower than the literacy skills of adults in the general population (Moody et al., 2000; Shippen et al., 2010). Additionally, access to technology is very limited and varied in correctional facilities (Contardo, 2016; Moraff, 2016).

The *Program for the International Assessment of Adult Competencies* (PIAAC) US datasets has been touted to be the "most comprehensive international survey of adult skills every undertaken" (Krenzke et al., 2016, p. 1-1). The PIAAC provides information on print and computer literacy, as well as computer experiences among the prison and general household samples. The current investigation used the PIAAC to explore relationships among print and computer literacy and computer experience within and between these two samples.

Research Questions

1. Can literacy performance by predicted by computer experience? How much of literacy performance can be explained by computer experience?
2. Are there differences in computer experiences between the household and prison samples?
3. Are there differences in literacy performance based on computer experience between the household and prison samples?
4. Is there a trend in computer experience across age bands? How do these trends differ between the household and prison samples?

Methodology

The PIAAC study is composed of two main components: (a) the Cognitive Assessment, which assessed literacy, numeracy, and problem-solving in technology-rich environments; and (b) the Background Questionnaire. There were two nationally representative samples in the United States: (a) the household sample that included 8,600 adults between 16-74 years old who participated in 2012 and 2014; and (b) the prison sample that included 1,546 inmates in 98 prisons who participated in 2014.

In order to determine basic computer experience, the PIAAC required the following: (1) prior computer use, (2) willingness to take the assessment on the computer, and (3) successful completion of four of six simple tasks on a basic computer test, such as using the mouse and highlighting text on the screen (Mamedova & Pawlowski). In the PIAAC, meeting these criteria was noted in the variable, PBROUTE. For the purposes of this investigation, a dummy variable was created using the PBROUTE variable, dividing participants into a group with and without computer experience.

The statistical analyses were conducted in the International Association for the Evaluation of Educational Achievement's International Database Analyzer (IDB) and the National Center for Education Statistics' International Data Explorer whenever possible, since both take into account PIAAC's sampling and assessment design (e.g., the use of ten plausible values for the Literacy scores). In addition, IBM SPSS Version 26 was used when the aforementioned programs' capabilities were not sufficient for the type of analysis being conducted.

Disclosure

The author attended an ETS and IES-funded training on the PIAAC database in August 2019 and has received technical support from PIAAC's AIR team.

Statistical Methods

For research question one, a linear regression analysis was conducted using the researcher-created dummy variable for computer experience which was then inputted into the IDB analyzer. The dummy variable was the independent variable and the literacy scores were the dependent variable. For research question two, to determine if there were differences in the distribution of computer experiences between the general and prison samples, a chi-square test of homogeneity was first conducted. Afterwards, post-hoc analyses of pairwise comparisons using multiple z-tests of two proportions with a Bonferroni correction were conducted. For research question three, the mean scores of literacy for the two samples was aggregated and statistical significance was calculated. For the last research question, a crosstab was created with the variables of computer experience, 10-year age bands, and prison vs. household samples. The information from the crosstabs was then converted to a line graph.

Results

RQ 1. Can literacy performance be predicted by computer experience? How much of literacy performance can be explained by computer experience?

Yes, literacy scores can be predicted by computer experience. The R^2 for the household sample was .18 (*SE* = .01), for the prison sample, .02 (*SE* = .01), and for the total average, .10 (*SE* = .01). In other words, 18% of the literacy scale score could be predicted by computer experience in the household sample, 2% in the prison sample, and 10% on average across both samples.

RQ 2. Are there differences in computer experiences between the household and prison samples?

To determine whether the differences in the distribution of computer experiences were significant between the household and prison samples, a chi-square test of homogeneity was conducted. The two multinomial probability distributions were not equal in the population, $\chi^2(3) = 247.264$, $p < .001$. Post hoc analyses of pairwise comparisons using multiple z-tests of two proportions with a Bonferroni correction were conducted. The differences between the household and prison samples were all statistically significant at $p = <.01$ except for those who failed the ICT Core stage 1. As suggested by the crosstabulations (Table 1) there were differences in the computer experiences of respondents in the U.S. general household and prison samples.

Table 1

Crosstabulation of computer experiences in household vs. prison samples

	U.S. general household sample	U.S. prison sample
No computer experience*	449	137
	5.2%	10.4%
Failed ICT Core stage 1 (assessed basic computer skills)	391	57
	4.5%	4.3%
Refused the computer based assessment*	749	267
	8.6%	20.2%
Took the computer based assessment*	6880	843
	79.4%	63.9%
Uncategorized*	201	15
	2.3%	1.1%

* Statistically significant at $p < .001$

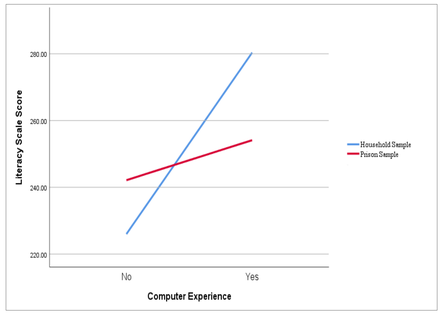
Results

RQ3. Are there differences in literacy performance based on computer experience between the household and prison samples?

As seen in Figure 1, for those with no computer experience, the literacy score mean for the household sample was 226.0 (*SE* = 2.21; *SD* = 51.53) and for the prison sample, *M* = 242.13 (*SE* = 3.52; *SD* = 5.50). For those with computer experience, the literacy score mean for the household sample was 280.36 (*SE* = 1.01; *SD* = 44.74) and for the prison sample, *M* = 254.11 (*SE* = 1.37; *SD* = 42.49). The differences for both were statistically significant at $p < .001$.

Figure 1

Literacy performance based on computer experience between household and prison samples

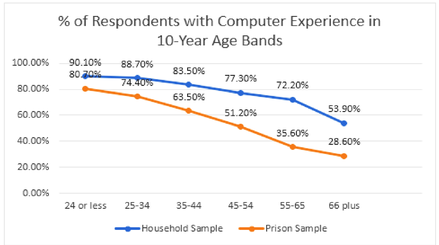


RQ4. Is there a trend in computer experience across age bands? How do these trends differ between the household and prison samples?

There is almost a direct trend that as age increases, the percentage of those with computer experience decreases across both samples. As it pertains to comparing the trends of the household to the prison samples, there are two main trends observed. The first trend is that the decrease in computer experience with age increase is more prominent in the prison sample compared to the household sample. A second trend is that there are consistently lower rates of computer experience across all age bands in the prison sample compared to the household sample. This difference between the prison and household samples generally widens as age increases.

Figure 2

Percentage of respondents with computer experience in 10-year age bands



Discussion

First, computer experience was found to predict literacy performance. This corroborates the findings of Tate et al. (2019) who reported that fifth grade students' prior computer use predicted writing performance on a computer-based assessment and extends the findings to adults and general print literacy. In the case of the PIAAC, assessments were provided via computer to those who had computer experience and basic computer skills and via paper-and-pencil to those who did not have computer experience or basic computer skills. Nonetheless, computer experience predicted literacy performance. One possible reason for this is that both computer experience and literacy are related to socioeconomic status since there are inequities of technology access between SES with low-SES communities having significantly lower access to technology (Rainie, 2017; Anderson & Kumar, 2019).

Consistently, across the latter three research questions, there were marked differences between the household and prison samples. One difference was that the prison sample had significantly less computer experiences overall compared to the household sample. The percentage of those in the prison sample (10.4%) with no computer experience was two times as much as those who were in the general sample (5.2%). This is concerning, given the implications of post-release outcomes for those with no computer experience (Organization for Economic Co-Operation and Development, 2012). In addition to this, those with no computer experience scored the lowest on literacy, as seen in RQ 3, indicating a double deficit for this subset of the population.

Another difference was that the household sample respondents with no computer experience scored significantly lower on literacy than those in the prison sample with no computer experience and vice versa. One theory to explain the higher rates of literacy in the no computer experience group in the prison sample is that there are higher rates of no computer experience in the prison sample than in the household sample, inflating the scores. In addition, there may have been lower rates of literacy amongst respondents with computer experience in the prison sample because of overall lower rates of literacy in the prison sample in general.

Lastly, there was a direct relationship between increasing age and: (a) decreased computer experience; as well as (b) the widening gap between the prison and household samples in their computer experiences. The discrepancy in the percentage of respondents with no computer experience between the prison and household samples almost tripled over time, from 9.4% in the youngest age band to a 25.3% difference in the oldest age band. This might be attributable to the fact that older inmates who have been incarcerated for an extended time, may have been incarcerated prior to the advent of the common use of computers and the internet.

Adults who are incarcerated with low literacy proficiency and no to minimal computer skills are doubly disadvantaged since both skills are related to positive life outcomes (OECD, 2015; Chua, 2017; Rocha & Ponczek, 2011). Based on these findings, it is recommended that the implementation of evidence-based literacy interventions and explicit computer skills instruction increase in correctional facilities.

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