Symposium IV

Symposium: Competence measures and general mental ability

Chair
Frank Goldhammer (German Institute for International Educational Research (DIPF), Germany)
& Claus H. Carstensen (Leibniz Institute for Educational Trajectories, Germany)

Room: Beethoven-Saal 1

Abstract
PIAAC assesses adult competencies in the domains of literacy, numeracy and problem solving in technology-rich environments. This symposium addresses these competencies both from a measurement perspective and a substantive point of view. Specifically, the presented research work investigates the validity of test score interpretation, that is, whether the assumption that PIAAC test scores reflect individual differences in competencies can be justified. Furthermore, methodological challenges in modelling longitudinal data from PIAAC-L are addressed, and the role of competencies in developing romantic relationships. The symposium starts with the presentation by Engelhardt et al. who address the fundamental question of whether the competence measures in PIAAC actually measure more than general cognitive ability. For this, the dimensional structure of literacy, numeracy and reasoning items as well as differences in the convergent evidence of educational variables with these constructs have been investigated. The second presentation by Goldhammer et al. is about test-taking disengagement in PIAAC which potentially affects the validity of test score interpretations if test-takers differ in their willingness to engage into task completion. Specifically, determinants of test-taking disengagement measured by means of response times are investigated at person (e.g., competence) and item level (e.g., difficulty). The next presentation by Gaasch et al. investigates whether adult competencies as assessed in PIAAC and PIAAC-L change over three years. From a technical point of view, this research addresses the question of how to include a huge amount of background variables into the estimation of plausible values. Three different approaches for selecting background variables are proposed and compared. Finally, the presentation by Blossfeld et al. addresses the competence match (i.e., homophily) of romantic couples using PIAAC-L data to shed light on social closure and social inequalities. Amongst others, partners are compared regarding their formal education, the duration of their partnership, and age differences. Thus, the symposium will present various research work on PIAAC competence measures with data from PIAAC and PIAAC-L. Thereby, it will demonstrate the great analytical potential of the data from these studies.

Presentations

- Title: Levels of education and age: Are they differently predictive for PIAAC competencies and general cognitive ability?
  Authors: Lena Engelhardt & Frank Goldhammer (German Institute for International Educational Research (DIPF) and Centre for International Student Assessment (ZIB), Germany)

- Title: Effects of person and item characteristics on test-taking engagement in PIAAC
  Authors: Frank Goldhammer (German Institute for International Educational Research (DIPF) and Centre for International Student Assessment (ZIB), Germany), Thomas Martens (Hamburg Medical School, Germany) & Oliver Lüdtke (IPN – Leibniz Institute for Science and Mathematics Education and Centre for International Student Assessment, Germany)
Title: Levels of education and age: Are they differently predictive for PIAAC competencies and general cognitive ability?

Authors
Lena Engelhardt & Frank Goldhammer (German Institute for International Educational Research (DIPF) and Centre for International Student Assessment (ZIB), Germany)

Abstract
"Competence tests like Literacy and Numeracy in PIAAC are intended to assess, beyond general cognitive ability, also the outcomes of learning processes (OECD, 2016). The goal of this study is to continue previous research on whether competence tests measure something different than general cognitive ability, which was done before for student populations in PISA and TOSCA by dimensionality analyses (e.g. Baumert, Lüdtke, Trautwein, & Brunner, 2009).

We focus on an adult population from the PIAAC study, which allows investigating the relation of education level and age to competence test performance. Since competence tests should measure aspects resulting from education, we expect that the education level predicts success in competence tests stronger than in tests that measure general cognitive ability (Hypothesis 1). Based on the assumption that fluid intelligence declines with age compared to abilities resulting from learning experiences, like crystalized intelligence (Horn & Cattell, 1967), we expect that age predicts success in a test measuring general cognitive ability more negatively than in competence tests (Hypothesis 2).

A longitudinal German subsample (N = 857) of PIAAC 2012 completed in 2016 a number series test (McArdle & Woodcock, 2009), which serves as a measure for general cognitive ability. For data analyses, a three-dimensional generalized linear mixed model was used with random effects for person abilities across domains (one-tailed tests). The effects of education level (1 = low, 2 = medium, 3 = high) differed for Numeracy positively from the number series test (Level 2: $\hat{\beta} = 0.59$, $p < .001$, Level 3: $\hat{\beta} = 0.41$, $p = .016$) but not for Literacy (Level 2: $\hat{\beta}^* = 0.29$, $p = .069$, Level 3: $\hat{\beta}^* = 0.05$, $p = .404$). Age differed positively (and was less negative) for both competence tests (Numeracy: $\hat{\beta}^* = 0.16$, $p = .004$; Literacy $\hat{\beta}^* = 0.12$, $p = .036$) from the number series test. Results support, that competence tests were less affected by age and success in Numeracy depended more on education level. One explanation why this held not for Literacy could be that Literacy depends also on current skill use, which should be included in further analyses."
Abstract
A potential problem of low-stake large-scale assessments such as the Programme for the International Assessment of Adult Competencies (PIAAC) is low test-taking engagement. If test takers are not motivated to show what they know and can do, the validity of inferences based on test scores is threatened. To better understand conditions of test-taking disengagement the present study pursued two goals: First, a model-based approach was used to investigate whether item indicators of disengagement constitute a latent person variable by assessment domain. Second, the effect of person and item characteristics on disengagement was jointly tested using explanatory item response models. The analyses were based on the Canadian sample of PIAAC round one with N = 26 683 participants completing test items in the domains of literacy, numeracy, and problems solving. Binary item disengagement indicators were defined by means of response time thresholds. The results show that disengagement indicators define a latent dimension by domain. Disengagement increased with lower educational attainment, lower cognitive skills, and if the test language is not the native language. Gender did not show any effect and age only a positive one for problem solving. Item position was positively related to disengagement as was item difficulty. The latter effect was negatively moderated by cognitive skill suggesting that especially poor test takers rush through more difficult items.

Title: The PIAAC-Longitudinal study in Germany – do adult competencies change over three years of time?

Authors
Christoph Gaasch, Sebastian Prechsl & Claus H. Carstensen (Leibniz Institute for Educational Trajectories, Germany)

Abstract
"In the national study PIAAC-L the participants of the German PIAAC sample were followed up with three further waves of data collection. The data comprises new information in terms of additional background variables, additional participants (partners and household members of the PIAAC participants) and additional competency assessments including a repeated measurement of the PIAAC competence tests.
Plausible values, which are provided to the user via the corresponding scientific use files, represent the state of the art to perform analyses with large scale assessment competency data. However, given the number of available background variables in PIAAC-L resulting from four waves of data collection, the number of model parameters gets too large to obtain reliable estimates. Thus, a reduced number of background variables has to be selected to estimate plausible values. This selection is made either through theoretical considerations or statistical criteria. For instance, principal components can be extracted from the total set of background variables to achieve a dimensionality reduction in the population model. Using PIAAC-L data, we examine different specifications of the population model: i) a covariate set as large as feasible, ii) a reduced covariate set by principal components and iii) a reduced covariate set by theoretical considerations. We compare the results of these specifications with regard to the change in competencies over time in German adults and particular sub populations of adults."

Title: Competence homophily among couples.

Authors
Gwendolin Blossfeld & Sebastian Prechsl (Leibniz Institute for Educational Trajectories,
The International Conference on PIAAC and PIAAC-Longitudinal, 
April 5 – 6, 2017 in Mannheim, Germany

Abstract

"In the course of globalization and modernization, the complexity of requirements of individuals and societies has changed dramatically. In this context, education gains in importance both as capital and as an asset of individuals. In addition to formal education certificates, skills gain in relevance for individuals since they have an impact on their successful working life, their social participation as well as their partner choice and family decisions. The question of “Who enters into a (romantic) union with whom?” is central to our understanding of the reproduction of social inequality in modern societies. Rates of homophily within a society reflect the degree to which individuals with specific characteristics (e.g. age, education, religion, race, ethnicity, occupation) bond with each other. For two reasons, this is of great sociological interest: (1) it is an indicator of social closure in a society; and (2) homophily leads to an accumulation of advantageous and disadvantageous conditions within couples and, therefore, intensifies social inequalities between families. Research has shown that, even though partner selection is a formally free choice in modern societies, individuals prefer to choose a partner who is similar to themselves with regard to certain characteristics e.g. educational attainment.

Due to data restrictions, research on educational homophily has only focused on formal certificates so far. Though formal education is seen as a key factor for the development of skills, it has been shown that competencies of adults do not always match their formal education level. Hence, there is a mismatch between formal education levels and key competencies when we study adults. This contributions aims to analyze cross-sectionally the competence homophily among couples using data from the Program for the Assessment of Adult Competencies – Longitudinal (PIAAC-L) Wave 2. The data allows us to study the competence match among partners with regard to their formal education, the duration of their partnership, age differences among partners, their partnership status (cohabiting or married) as well as the existence of (and if so age of) children."