

## Program of the virtual International PIAAC Research Conference 2022

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# PIAAC

Programme for the International  
Assessment of Adult Competencies

## International PIAAC Research Conference

# 2022

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## Welcome Address

**Dear participants,**

Photo: Markus Heissler



The Organizing Committee of the International PIAAC Research Conference 2022 welcomes all participants to the virtual conference on 24<sup>th</sup> and 25<sup>th</sup> March, 2022. Funded by the German Federal Ministry of Education and Research, we will continue our scientific conference series on PIAAC and hold the third international research conference. The conference is scheduled after the publication of the data from 3<sup>rd</sup> PIAAC round of cycle 1 as well as the field test of PIAAC cycle 2. This will allow to look at results based on more than 40 countries and address survey methodological issues from the second PIAAC cycle.

Unfortunately, the unprecedented circumstances due to the COVID-19 pandemic also impact the schedule of the PIAAC study and its implementation in participating countries – in this regard the conference will offer a discussion platform on handling related challenges and evaluate experiences.

We are happy that you have responded to our conference call. The conference program reflects the interdisciplinary focus of PIAAC. Contributions with a substantial focus as well as methodological contributions using PIAAC data offer a broad and miscellaneous conference program. We are especially thankful to the two keynote speakers, Irwin Kirsch and Rolf van der Velden.

The keynotes will highlight (1) the utility of international large-scale assessments and point out key innovations made in last decades as well as (2) the intergenerational transmission of skills, discussing inequality issues in education. Eventually, we aim to inspire additional work based on the extensive PIAAC data.

We cordially invite you to experience this exciting virtual event with us.



Prof. Dr. Beatrice Rammstedt & Dr. Débora B. Maehler  
(On behalf of the Organizing Committee)  
*GESIS – Leibniz-Institute for the Social Sciences, Mannheim*

## Sponsor

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## Scientific Advisory Board

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*(Philipps-University Marburg, Marburg, Germany)*
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*(Berlin Social Science Center, WZB, Berlin, Germany)*
- ▮ Prof. Dr. Corinna Kleinert  
*(Leibniz Institute for Educational Trajectories, LfBi, Bamberg, Germany)*
- ▮ Dr. Matthias von Davier  
*(Boston College, Boston, USA)*
- ▮ Prof. Dr. Simon Wiederhold  
*(Catholic University Eichstaett-Ingolstadt, Ingolstadt, Germany)*

## Organizing Committee

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- \\ Prof. Dr. Beatrice Rammstedt
- \\ Dr. Débora B. Maehler
- \\ Maria Kreppe-Aygün
- \\ Daniela Niederauer
- \\ Jennifer Dickson
- \\ Dennis Schüle

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## Pre-Conference Workshops

Date	Zoom Meeting
Tuesday, March 22 <sup>th</sup> 9 am – 2 pm CET	<b>Workshop: Analyzing PIAAC data with structural equation modeling in Mplus</b> Ronny Scherer (Centre for Educational Measurement at the University of Oslo, Norway) »
Wednesday, March 23 <sup>th</sup> 9 am – 2 pm CET	
Tuesday, March 22 <sup>th</sup> 3 pm – 7 pm CET	<b>Workshop: Analyzing PIAAC data using the R EdSurvey package</b> Paul Bailey <sup>1</sup> , Ting Zhang <sup>1</sup> , Saida Mamedova <sup>1</sup> , Emily Pawlowski <sup>1</sup> , Emmanuel Sikali <sup>2</sup> , Michael Lee <sup>1</sup> , Eric Buehler <sup>1</sup> , & Sinan Yavuz <sup>1</sup> ( <sup>1</sup> American Institutes for Research, USA; <sup>2</sup> National Center for Education Statistics, USA) »



## Pre-Conference Workshops

### Analyzing PIAAC data with structural equation modeling in Mplus

**Instructor** Ronny Scherer (*Centre for Educational Measurement at the University of Oslo, Norway*)

**Abstract** Structural equation modeling (SEM) represents a statistical approach to disentangle the relationships among latent and/or manifest variables, across groups, over time, and at different analytical levels. The potential of SEM has been recognized in many areas, including educational sciences, sociology, psychology, and business. This workshop provides an introduction to the principles and procedures of basic and more advanced SEM in the context of the international large-scale assessment PIAAC. Specifically, the following topics are covered: (a) Principles of structural equation modeling (model specification, identification, estimation, and evaluation), (b) Measurement models and confirmatory factor analysis, (c) Measurement invariance testing with few and many groups (including multi-group CFA, multilevel CFA, and the alignment method), and (d) Structural regression and indirect effects models (including multi-group and multilevel SEM).

### Analyzing PIAAC data using the R EdSurvey package

**Instructors** Paul Bailey<sup>1</sup>, Ting Zhang<sup>1</sup>, Saida Mamedova<sup>1</sup>, Emily Pawlowski<sup>1</sup>, Emmanuel Sikali<sup>2</sup>, Michael Lee<sup>1</sup>, Eric Buehler<sup>1</sup>, & Sinan Yavuz<sup>1</sup>  
(<sup>1</sup>American Institutes for Research, USA; <sup>2</sup>National Center for Education Statistics, USA)

**Abstract** This course will provide an overview of the PIAAC study and guidance in data analysis strategies, including the selection and use of appropriate plausible values, sampling weights, and variance estimation procedures. The course will train participants in the analysis of PIAAC data files using the R package EdSurvey, which was developed specifically to analyse large-scale assessment data with complex psychometric and sampling designs. Participants will learn how to

- \\ perform data processing and manipulation,
- \\ produce descriptive statistics;
- \\ generate cross-tabulations and plausible value means; and
- \\ perform linear and logistic regressions.

## Program Overview

Thursday, March 24 <sup>th</sup>	Online <a href="https://events.hubilo.com/international-piaac-research-conference-2022">https://events.hubilo.com/international-piaac-research-conference-2022</a>		
11.00 am – 11.15 am	Welcome Address		
11.15 am – 12.45 pm	<i>Invited Symposium I:</i> Cognitive skills and lifelong learning (Chair: M. Ehlert) »	<i>Paper Session I:</i> Response accuracy in large-scale assessments (Chair: D. Behr) »	<i>Invited Symposium II:</i> Linking PIAAC data to administrative data and other large-scale assessments (Chairs: D. Maehler & S. Martin) »
12.45 pm – 1.15 pm	Lunch Break		
1.15 pm – 2.45 pm	<i>Invited Symposium III:</i> PIAAC cycle 2: Between trend and innovation (Chair: A. Zabal) »	<i>Paper Session II:</i> Cognitive skills and labour market returns (Chair: S. Wiederhold) »	<i>Paper Session III:</i> Cognitive skills in various social groups (Chair: J. Heisig) »
2.45 pm – 3.00 pm	Coffee Break		
3.00 pm – 3.50 pm	<i>Keynote Speech</i> Irwin Kirsch: Enhancing the utility of international large-scale assessments »		
3.50 pm – 5.20 pm	<i>Invited Symposium IV:</i> Determinants of cognitive skills (Chair: S. Wiederhold) »	<i>Paper Session IV:</i> The impact of socio- emotional skills (Chair: B. Rammstedt) »	<i>Paper Session V:</i> Measures to master challenges of the 21 <sup>st</sup> century (Chair: M. Brussevich) »
5.20 pm – 5.30 pm	Closing Remarks		
5.30 pm – 6.30 pm	Open & Thematic Discussion Sessions		

## Program Overview

Friday, March 25 <sup>th</sup>	Online <a href="https://events.hubilo.com/international-piaac-research-conference-2022">https://events.hubilo.com/international-piaac-research-conference-2022</a>		
10.00 am – 11.00 am	Open & Thematic Discussion Sessions		
11.00 am – 12.30 pm	<i>Invited Symposium V:</i> Beyond competencies – Potential of PIAAC for interdisciplinary research (Chair: J. Gorges) »	<i>Paper Session VI:</i> PIAAC skills assessment (Chair: A. Zabal) »	
12.30 pm – 1.00 pm	Lunch Break		
1.00 pm – 1.50 pm	<i>Keynote Speech</i> Rolf van der Velden: <i>This is a skills world</i> »		
1.50 pm – 3.20 pm	<i>Invited Symposium VI:</i> What are PIAAC process data used for? (Chairs: F. Goldhammer, U. Kröhne & C. Hahnel) »	<i>Paper Session VII:</i> Skill use and skill mismatch (Chair: C. Kleinert) »	<i>Paper Session VIII:</i> Motivation to learn and lifelong learning (Chair: J. Gorges) »
3.20 pm – 3.30 pm	Closing Remarks and Outlook		

## Keynotes

» Graphic Recording

**Thursday, March 24<sup>th</sup>, 2022; 3.00 pm – 3.50 pm**

### **Enhancing the utility of international large-scale assessments**

**Author** Dr. Irwin Kirsch (*Educational Testing Service/ETS, USA*)

**Abstract** From modest beginnings in the late 1950s, international large-scale assessments (ILSAs) have experienced consistent growth both in scope and salience. Increasing interest in ILSA results reflects not only the recognition of the importance of cognitive skills and skill development for both economic growth and societal well-being, but also the value in benchmarking performance against peers and economic competitors. Over this period of some 60 years, ILSAs have also made substantial advances in new methodologies and various aspects of measurement science, as well as pioneering the full incorporation of digital technologies into survey design, development and implementation. Along the way these assessments have contributed to both data quality and validity and hence their increased utility for policy makers, researchers and other key stakeholders. The focus of this presentation will be on describing key aspects of these innovations as they relate to the growing interest in the international assessment of adults over the last 30 years.

#### **Dr. Irwin Kirsch**

*Educational Testing Service/ETS, USA*



**Irwin Kirsch** is the Ralph Tyler Chair in Large Scale Assessment and Director of the Center for Global Assessment at ETS in Princeton, NJ. In his role as director of the center he oversees several teams of research scientists, assessment designers and platform developers who are responsible for the development, management and implementation of various large-scale national and international assessments. Over the course of his career, Dr. Kirsch has worked in close collaboration with a number of state, national and international organizations including the World Bank, UNESCO, the International Association for the Evaluation of Educational Achievement (IEA), and the Organization for Economic Co-operation and Development (OECD) where he currently oversees the development and conduct of the two largest international assessments that provide policy makers and key stakeholders with national and international comparative data on literacy and workforce preparedness – PIAAC and PISA. In addition to his assessment work, Dr. Kirsch is a member of the ETS research management team, serves on the board of a non-profit literacy organization, and as a reviewer for several journals. He has also published numerous research articles and book chapters dealing with issues around designing, developing and interpreting cognitive-based scales and has written a number of policy reports using large-scale assessment data that focus on the growing importance of skills and their connections to life outcomes.

## Keynotes

» Graphic Recording

**Friday, March 25<sup>th</sup>, 2022; 1.00 pm – 1.50 pm**

### **This is a skills world**

**Author** Prof. Dr. Rolf van der Velden (*ROA Maastricht University, The Netherlands*)

**Abstract** In this keynote I will present the first results of the Intergenerational Transmission of Skills (ITS) project. In the ITS project we have developed a unique and unparalleled database, linking skills of parents to skills of their offspring. This database currently provides information on some 25,000 parents and 41,000 of their children. The unique feature of the dataset is that skills of parents and their children were measured at the same age (both around age 12) and with the same test (a national test measuring proficiency in language and math skills). This linked dataset is enriched with extensive information on the grandparents, the parents, and the children.

The ITS-project helps us to understand the underlying drivers of inequality of educational opportunities (IEO). These may stem from three types of parental resources: parents' key skills (i.e., proficiency in important domains such as math and language), parents' soft skills (i.e., the skills needed to navigate successfully in education), and parents' financial resources. We demonstrate that parents' key skills are the most important mechanism driving IEO. The intergenerational transmission of key skills accounts for 50–60% of the effect of all measured resources available in the family. In the presentation I will link these results to the skills as measured in PIAAC and the relevance of schools in developing these skills.

### **Prof. Dr. Rolf van der Velden**

*Maastricht University, The Netherlands*



**Rolf van der Velden** is Professor at Maastricht University and director of the Research Centre for Education and the Labour Market (ROA). He is research fellow at the Graduate School of Business and Economics at Maastricht University (GSBE) and fellow of the Amsterdam Centre for Learning Analytics (ACLA). Van der Velden supervised several national and international studies on the transition from school to work, such as the international REFLEX project (see “The Flexible Professional in the Knowledge Society” by Allen & Van de Velden, 2011) and the “Higher Education as a Generator of Strategic Competences” project (called HEGESCO). Currently he coordinates the Netherlands Cohort Study on Education (<https://nationaalcohortonderzoek.nl/>) of the Netherlands

Initiative for Education Research (NRO) and is advisor for the Programme for the International Assessment of Adult Competencies (PIAAC). His expertise is on transition from education to work (e.g., Humburg and van der Velden, 2015; Levels, van der Velden and Di Stasio, 2014), knowledge economy and the demand for 21st century skills (e.g., Humburg and van der Velden, 2017), and skills mismatches (e.g., van der Velden and Verhaest, 2017; van der Velden and Bijlsma, 2019; Fregin, Levels, and van der Velden, 2020).

## Invited Symposia

### Invited Symposium I

Thursday, March 24<sup>th</sup>, 2022; 11.15 am – 12.45 pm

#### Cognitive skills and lifelong learning

**Chair** Martin Ehlert (*WZB Berlin Social Science Center, Germany*)

**Abstract** Learning during adulthood after initial education and training is a widespread and growing phenomenon in many countries. Especially the increasing pace of technological change and digitalization is likely to further fuel this trend. New technology has the potential to change the labor market as well as many other aspects of life. The result is that skills acquired during initial training no longer suffice to remain employable and to participate in social life. Therefore, skill acquisition later in life becomes more important to ensure that nobody is left behind. Therefore, many politicians and pundits advocate lifelong learning to ensure inclusive growth despite the challenges of digitalization. Yet, it is not clear whether current adult education and training programs and systems are capable to counteract the negative repercussions of digitalization. It is well known that access to adult training and education is unequally distributed. Less-educated and less-skilled people participate less often in training courses and other learning activities. Also, workers that are more likely to lose their jobs because of technological change are less likely to take part in learning opportunities. Thus, adult education and training programs often do not reach those most in need of skill acquisition later in life. At the same time, the benefits of existing learning arrangements for adults are often unclear. Many studies show that participation in further training courses does not lead to higher skills or better jobs. Against this background, this symposium aims to advance the knowledge on lifelong learning and cognitive skills. Based on new empirical results, we will discuss both the determinants of participation in lifelong learning and its effect on the development of cognitive skills. Also, we will discuss the acquisition and development of skills over the life course more generally. A special focus will be on cross-national comparative studies. Using results on participation and skill acquisition from different countries, we aim to assess the influence of institutions such as adult education and training policies. Furthermore, we will especially discuss lifelong learning among the most vulnerable groups such as less-skilled workers.

## Presentations

- » **S1.1: Does learning help workers to keep up with technological change? Cross-national variance in the effect of non-formal and informal adult education and training on problem solving and numeracy skills.**

Authors: Martin Ehlert (*WZB Berlin Social Science Center, Germany*), Marie-Christine Fregin (*ROA, Maastricht University, The Netherlands*), Didier Fouarge (*ROA, Maastricht University, The Netherlands*), Mark Levels (*ROA, Maastricht University, The Netherlands*), Liisa Martma (*Tallinn University, Estonia*) & Rolf van der Velden (*ROA, Maastricht University, The Netherlands*)

- » **S1.2: Skills and education as factors of participation in non-formal learning.**

Authors: Liisa Martma & Ellu Saar (*Tallinn University, Estonia*)

- » **S1.3: Cross-national variation in the training disadvantage of less-educated employees: The role of job allocation versus skills.**

Authors: Carla Hornberg, Heike Solga & Jan Paul Heisig (*WZB Berlin Social Science Center, Germany*)

### **S1.1: Does learning help workers to keep up with technological change? Cross-national variance in the effect of non-formal and informal adult education and training on problem solving and numeracy skills.**

**Authors** Martin Ehlert (*WZB Berlin Social Science Center, Germany*), Marie-Christine Fregin (*ROA, Maastricht University, The Netherlands*), Didier Fouarge (*ROA, Maastricht University, The Netherlands*), Mark Levels (*ROA, Maastricht University, The Netherlands*), Liisa Martma (*Tallinn University, Estonia*) & Rolf van der Velden (*ROA, Maastricht University, The Netherlands*)

**Presenter** Martin Ehlert (*WZB Berlin Social Science Center, Germany*)

**Abstract** The demand for problem-solving and numeracy skills on the labour market is increasing due to technological innovations. To remain competitive, many workers have to acquire the needed skills. This may be achieved through non-formal and informal adult education and training. Yet, so far little is known about how well key information-processing skills (in the domains of digital problem-solving and numeracy) can be acquired in non-formal and informal learning environments and how this may be influenced by nation specific adult learning systems. Based on objective skills measurements for representative samples of workers in 26 countries from the OECD Survey of Adult Skills (PIAAC) we use information about involuntarily missed courses to identify the causal effect of courses on skills. Our results suggest that non-formal learning does not lead to higher problem-solving skills on average. Furthermore, we find no systematic cross-national variation in the effects. We discuss the possible conclusions of this finding and also the limitations of our analysis.



### **S1.2: Skills and education as factors of participation in non-formal learning.**

**Authors** Liisa Martma & Ellu Saar (*Tallinn University, Estonia*)

**Presenter** Liisa Martma (*Tallinn University, Estonia*)

**Abstract** Theoreticians concerned with job-related non-formal education make explicit distinctions between supply and demand of skills (see for example, Oosterbeek 1998) and explore why, from a policy perspective, the labour market places importance on observing certain conventions. Distinguishing between job requirements and skills of workers would provide an insight into the determinants of training gap. Nevertheless, the supply side, specifically the human capital approach, which has tended to underplay the demand side of the labour market has dominated research. Only a few empirical studies have attempted to separate the impact of supply and demand factors on participation in adult education (see Altonji and Spletzer, 1991; Desjardins, 2014; Desjardins & Rubenson, 2011; Korpi & Tählin, 2008; Saar & Räis, 2017). We are planning to extend previous analyses via the Programme for the International Assessment of Adult Competencies (PIAAC) dataset, which contains direct measures of skills, as well as skill use at work, allowing us to analyse the impact of the supply of skills and the demand for skills. The aim of this study is to understand better the relationship between participation in adult job-related training and workers' skills profiles, as well as the extent to which those skills are used in jobs and how this relationship differs in countries with different skill formation regimes. Our finding confirms the conclusion of Desjardins and Rubenson (2011) that the content and nature of work are more important factors that influence participation in learning compared with employees' skills and level of education. Skills and educational attainment therefore have no independent value without putting them to use. Although skills are important, their value regarding participation in learning is dependent on the demand for the skills in the labour market. If there are not enough skill-intensive jobs, then there is also no need for the employers to provide training and for the employees to acquire additional skills.

### **S1.3: Cross-national variation in the training disadvantage of less-educated employees: The role of job allocation versus skills.**

**Authors** Carla Hornberg, Heike Solga & Jan Paul Heisig (*WZB Berlin Social Science Center, Germany*)

**Presenter** Carla Hornberg (*WZB Berlin Social Science Center, Germany*)

**Abstract** Worker training can be considered an important aspect of labor market inequalities. Less-educated adults show the lowest rate of participation in adult education and training. Our understanding of less-educated workers' training disadvantage is still limited, however. To contribute new insights, this study addresses the more general question of the role of job placement (e.g., job tasks, work contracts, or economic sector) for participating in job-related non-formal training – compared to worker characteristics, such as their actual skills or motivation to learn. Thus, we examine the extent to which the training disadvantage of less-educated workers is explained by the simple fact that they perform different jobs than better-educated workers, and how much differences in job allocation contribute to the large cross-national variation of less-educated workers' training disadvantage. Our study uses data from 27 countries that participated in the *Programme*



*for the International Assessment of Adult Competencies (PIAAC).* We find that in all countries, differences in job allocation by educational attainment contribute significantly to the training disadvantage of less-educated workers, above and beyond skills differentials and other worker characteristics. Moreover, accounting for differences in job allocation and workers' skills at the individual level markedly reduces cross-national variation in less-educated workers' training disadvantage – yet here, skills differentials between less- and intermediate-educated workers are more important than job allocation. Educational and labor market institutions moderate the impact of job allocation and skills differentials between less- and intermediate-educated workers on less-educated workers' training disadvantage.

## Invited Symposium II

Thursday, March 24<sup>th</sup>, 2022; 11.15 am – 12.45 pm

### Linking PIAAC data to administrative data and other large-scale assessments

**Chairs** Débora B. Maehler & Silke Martin (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Abstract** The symposium addresses content and methodological issues and aims to present research based on PIAAC data linked to administrative data or other large-scale country surveys. Thereby projects and studies of three countries will be presented. Initial research based on PIAAC 2011/2012 linked to register data in Norway will be presented (N = 901). The relationship between skills acquired before the age of 16 and skills acquired later to formation of skills and subsequent NEET status was addressed in the study. The second contribution is based on PIAAC data linked to administrative data from the Institute for Employment Research (IAB) in Germany (N = 2.086). The study investigates the measurement error resulting from the difference between information on earning available in both data sources. The third contribution is based on the PISA Young Adult Follow-Up Study (PISA YAFS) conducted in the US. Study design and results comparing for instance literacy from students in PISA 2012 and in the follow up 2016 using PIAAC instruments, assessed as repeated measure, will be presented (N = 2.320). The study examined the relationship between performance, employment and educational outcomes of young adults at age 19 and their earlier reading and mathematics performance in PISA 2012 at age 15.

### Presentations

- » **S2.1: NEET status and early versus later skills among young adults: Evidence from linked register-PIAAC data (using Nordic PIAAC data).**  
Authors: Erling Barth (*Institute for Social Research, Norway*), Anna-Lena Keute (*Statistics Norway, Norway*), Pål Schøne1, Kristine von Simson (*Institute for Social Research, Norway*), & Kjartan Steffensen (*Statistics Norway, Norway*)
- » **S2.2: What's my wage again? Comparing survey and administrative data to validate earning measures (using German PIAAC-L Data).**  
Authors: Britta Gauly, Jessica Daikeler, Tobias Gummer & Beatrice Rammstedt (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)
- » **S2.3: Administering education and skills online (ESO) to PISA 2012 cohort in the United States: Findings from the 2012-2016 PISA young adult follow-up study (using PISA YAFS).**  
Authors: Saida Mamedova (*American Institutes for Research/AIR, USA*), Maria Stephens (*American Institutes for Research/AIR, USA*), Yuqi Liao (*American Institutes for Research/AIR, USA*), Josh Sennett (*American Institutes for Research/AIR, USA*), Paul Sirma (*American Institutes for Research/AIR, USA*), & Samantha Burg (*National Center for Education Statistics, USA*)

## **S2.1: NEET status and early versus later skills among young adults: Evidence from linked register-PIAAC data (using Nordic PIAAC data).**

**Authors** Erling Barth (*Institute for Social Research, Norway*), Anna-Lena Keute (*Statistics Norway, Norway*), Pål Schøne (*Institute for Social Research, Norway*), Kristine von Simson (*Institute for Social Research, Norway*), & Kjartan Steffensen (*Statistics Norway, Norway*)

**Presenter** Anna-Lena Keute (*Statistics Norway, Norway*)

**Abstract** Do skills protect against exclusion in adult ages, and how important are the skills acquired before the age of 16 years versus those acquired later on? To analyze these questions, data from the 2011/2012 PIAAC survey are matched on register data in Norway. We match the scores on numeracy and literacy skills from PIAAC for young adults backwards to grade point average (GPA) data from compulsory school education, which are measured at the age of 16 years (GPA16). We also match the data forwards to employment and education register data 2 years after the PIAAC test. Results show that there is a high correlation between GPA16 and PIAAC scores even when controlling for parental background, health status, and completion of post-compulsory school education. Including both GPA16 and PIAAC scores in a model of the probability of NEET status 2 years after the PIAAC test shows three times as large differences associated with GPA16 scores than with PIAAC scores, even though the PIAAC test is taken closer in time than the GPA16 results.

## **S2.2: What's my wage again? Comparing survey and administrative data to validate earning measures (using German PIAAC-L Data).**

**Authors** Britta Gauly, Jessica Daikeler, Tobias Gummer & Beatrice Rammstedt (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Presenter** Jessica Daikeler (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Abstract** One question frequently included in surveys asks about respondents' earnings. As this information serves, for example, as a basis for evaluating policy interventions, it must be of high quality. This study aims to advance knowledge about possible measurement errors in earnings data and the potential of data linkage to improve substantive conclusions. We use the German sample of the Programme for the International Assessment of Adult Competencies (PIAAC), a subsample of which could be linked to administrative data from the German Integrated Employment Biographies (IEB). We define measurement error as the difference between administrative and survey data. Our results show differences in the ordinary least squares estimates when the administrative and survey measures of earnings were used as the respective dependent variable, which suggests that measurement error causes biased results. Learning more about the size and type of measurement error can help to correct existing biases and improve the quality of survey data.

**S2.3: Administering education and skills online (ESO) to PISA 2012 cohort in the United States: Findings from the 2012-2016 PISA young adult follow-up study (using PISA YAFS).**

**Authors** Saida Mamedova (*American Institutes for Research/AIR, USA*), Maria Stephens (*American Institutes for Research/AIR, USA*), Yuqi Liao (*American Institutes for Research/AIR, USA*), Josh Sennett (*American Institutes for Research/AIR, USA*), Paul Sirma (*American Institutes for Research/AIR, USA*), & Samantha Burg (*National Center for Education Statistics, USA*)

**Presenter** Saida Mamedova (*American Institutes for Research/AIR, USA*)

**Abstract** 2012-2016 Program for International Student Assessment Young Adult Follow-up Study (PISA YAFS) is a study that followed a sample of U.S. students who participated in PISA 2012, when they were 15 years old, and re-assessed their literacy and numeracy skills four years later at about age 19 using the Education and Skills Online (ESO) survey, which is based on the Program for the International Assessment of Adult Competencies (PIAAC). This presentation will report on the literacy and numeracy performance of U.S. young adults at age 19, as well as examine the relationship between that performance and their earlier reading and mathematics performance in PISA 2012 at age 15. It will also present on how other aspects of their lives at age 19 – such as their engagement in postsecondary education, their participation in the workforce, their attitudes, and their vocational interests – are related to their PISA performance at age 15.

## Invited Symposium III

Thursday, March 24<sup>th</sup>, 2022; 1.15 pm – 2.45 pm

### PIAAC Cycle 2: Between trend and innovation

**Chair** Anouk Zabal (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Abstract** PIAAC collects internationally comparable data on key foundation skills as well as a wide range of background information, and it offers rich opportunities for both academic and policy-relevant research. The second cycle of PIAAC continues a tradition of international adult literacy surveys and pursues the dual aims of monitoring change over time as well as introducing necessary adjustments and innovations to reflect societal and technological change. This symposium addresses the challenge of striking the right balance between consistency and change. The first contribution looks at how the theoretical frameworks for literacy and numeracy have been updated and enhanced for the second cycle of PIAAC, and how the cognitive instruments reflect the enriched constructs while maintaining the link to the first cycle. It will consider the reading components and the newly developed numeracy components, both designed to obtain more differentiated information at the lower end of the proficiency scale. Adaptive problem solving (APS) is a key skill in a rapidly changing world, and the assessment of this cognitive domain is an important innovation. The second contribution explores similarities and differences between the domain problem solving in technology-rich environments assessed in the first cycle of PIAAC and APS. It elaborates on the theoretical underpinnings of APS and discusses the challenges of operationalizing this construct for a large-scale assessment. The information collected through the background questionnaire lends PIAAC its analytical power. The third contribution discusses how constructs and measurements from the cycle one background questionnaire have been adapted or transformed to account for societal change while considering the need to maintain trend measurement. It also reviews new constructs that have been included to broaden the scope and strengthen the analytical possibilities. A valid, reliable, and comparable measurement of educational attainment is key for PIAAC. At the same time, the measurement of formal education is one of the most challenging in the context of achieving comparability across cultures and time. The approach followed in the second cycle of PIAAC to tackle these complex issues is presented and reflected upon in the fourth contribution.

### Presentations

- » S3.1: Measuring literacy and numeracy skills in adults – trends and innovations.  
Author: Laura Halderman (*Educational Testing Service/ETS, USA*)
- » S3.2: From problem solving in technology-rich environments to adaptive problem solving – concept and measurement.  
Authors: Samuel Greiff & Juliana Gottschling (*University of Luxembourg, Luxembourg*)
- » S3.3: The background questionnaire: Maintaining trend, accounting for societal change, and adding innovative elements.  
Author: Tim Huijts (*ROA, Maastricht University, The Netherlands*)
- » S3.4: Formal education in PIAAC Cycle 2: Challenges and opportunities.  
Author: Silke Schneider (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

### S3.1: Measuring literacy and numeracy skills in adults – trends and innovations.

**Author** Laura Halderman (*Educational Testing Service/ETS, USA*)

**Presenter** Laura Halderman (*Educational Testing Service/ETS, USA*)

**Abstract** The second cycle of PIAAC carries forward the domains of Literacy and Numeracy because of the foundational role these domains have played in the assessment of adults' skills. The domains of Literacy and Numeracy maintain a strong link to the first cycle (and previous surveys) by including a subset of the Cycle 1 items. Maintaining this link is essential for measuring trends in adults' skills ten years after the first cycle. However, society has seen changes within the last ten years that warrant changes to these core domains, changes that must be balanced with the ties to the past. To that end, a group of experts in the domains of Literacy and Numeracy were selected to update the framework for each domain. Through this work, the experts identified the kinds of cognitive processes that should be represented in the new items to reflect the modern challenges adults face when engaging with Literacy and Numeracy activities in their personal, social and professional lives. The result is an item pool that contains a set of items from the first cycle of PIAAC and a set of new items that reflects the cognitive processes of the trend items and extends the item pool to represent the processes that have become more prevalent in adults' lives. In this presentation, I'll provide examples of how the Literacy and Numeracy item pools have been designed to achieve this balance. In addition, I will present the Reading and Numeracy component measures. In Cycle 1, Reading Components were administered via the paper-based assessment to capture the component reading skills of individuals with lower ICT skills. In cycle 2, Reading Components will be administered on the tablet, creating a more uniform administration with finer-grained timing information and across a wider range of skill. New measures of Numeracy Components have been designed to capture information about adults' skills at the lower end of the distribution. Collectively, these new and trend measures seek to extend what researchers know about adults' Literacy and Numeracy skills and their understanding of trends over time.

### **S3.2: From problem solving in technology-rich environments to adaptive problem solving – concept and measurement.**

**Authors** Samuel Greiff & Juliana Gottschling (*University of Luxembourg, Luxembourg*)

**Presenter** Samuel Greiff (*University of Luxembourg, Luxembourg*)

**Abstract** In today's world it has become increasingly important to deal with dynamic and changing problem situations. We are confronted with a wealth of information from a variety of sources – be it physical, social, or digital – and the need for skills that enable adults to adapt their thinking and reasoning to new and changing information has increased significantly. In order to address these new challenges, the first PIAAC cycle already included the assessment of problem-solving abilities in technology-rich environments (PS-TRE), focusing on the proficiency in the use of specific digital applications to access, search, manage, interpret, and evaluate information. The assessment of problem-solving in the second cycle of PIAAC goes beyond this and focuses on adaptive problem-solving (APS), i.e., the ability to adapt to dynamic changes in problem situations. More specifically, the assessment of APS focuses on dynamic problems that require constant monitoring and, if necessary, adaption of the initial problem solution. Furthermore, the assessment of APS in the second cycle of PIAAC puts emphasis not only on cognitive, but also on metacognitive processes. In this presentation we will introduce the underlying theoretical assumptions that guided the construction of the APS units by means of exemplary items. We will also discuss the challenges and potential pitfalls in the assessment of APS in large-scale assessments of problem-solving.

### **S3.3: The background questionnaire: Maintaining trend, accounting for societal change, and adding innovative elements.**

**Author** Tim Huijts (*ROA, Maastricht University, The Netherlands*)

**Presenter** Tim Huijts (*ROA, Maastricht University, The Netherlands*)

**Abstract** The skill measurement in PIAAC is complemented by the Background Questionnaire (BQ). The main aim of the BQ is to provide information on possible outcomes and antecedents of key information-processing skills, as well as on demographic and structural indicators that are needed to describe the distribution of such skills within and between countries. To achieve this aim, the BQ needs to include reliable, valid, and equivalent measurements of constructs relevant for understanding the causes and consequences of key information – processing skills across countries. The BQ for PIAAC Cycle 1 was the obvious starting point for developing the BQ for Cycle 2. Most constructs that were covered in Cycle 1 continue to be relevant for the skills measured in PIAAC. Additionally, maintaining measurements in the same form or in a comparable form offers the opportunity to directly compare the results of both PIAAC cycles, and to examine trends. However, societies have changed since PIAAC Cycle 1, and these changes also need to be reflected in the BQ. Moreover, several innovative elements have been brought forward to further strengthen and enrich the BQ. In this contribution, I will discuss how we worked to achieve this balance between continuity and change in the development of the BQ for PIAAC Cycle 2. More specifically, I will reflect on the implications and challenges of trend measurements in the BQ. I will explain how for several constructs we have made small changes to measurements to reflect societal change, while still maintaining comparability



between cycles. I will also give examples of constructs and measurements that needed to be changed to reflect recent societal and technological developments, such as the use of ICT skills at work and in everyday life. Finally, I will briefly cover the main areas of innovation in the BQ for PIAAC Cycle 2.

### **S3.4: Formal education in PIAAC Cycle 2: Challenges and opportunities.**

**Author** Silke Schneider (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Presenter** Silke Schneider (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Abstract** Educational attainment is closely related to both cognitive skills as well as many ‘outcomes’ measured in the PIAAC background questionnaire (BQ) – be it employment, income, health or attitudes. It is also a mediator of parental resources and thus an important element in the intergenerational transmission of (dis-)advantage and thus social inequality. A high-quality measurement of formal education in PIAAC is thus of paramount importance. However, this is highly challenging, given the ongoing changes of educational systems, their inherent lack of comparability across countries, and the revision of the International Standard Classification of Education (ISCED – the main ‘tool’ for making education data comparable across countries) in between PIAAC Cycles 1 and 2. This presentation examines two challenges in this regard: 1) the challenge of cross-national comparability and 2) the challenge of comparability over time, i.e. between PIAAC Cycle 1 and 2. The talk will present the ex-ante output harmonization and quality assurance procedures implemented for PIAAC Cycle 2 to counter both challenges. In addition, the measurement of formal education was further differentiated in PIAAC Cycle 2 compared to PIAAC Cycle 1, building on the three-digit coding scheme provided by ISCED 2011. This will allow to test more specific hypotheses regarding the effects of formal education, including vocational education and training (VET) across education levels, and more comprehensively to control for effects of (different kinds of) education. Finally, for PIAAC Cycle 2, an innovative instrument was developed to comparatively measure ‘educational pathways’, opening up new opportunities to study the effects of early transitions in tracked education systems, or the cumulation of different educational qualifications over the life course.



## Invited Symposium IV

Thursday, March 24<sup>th</sup>, 2022; 3.50 pm – 5.20 pm

### Determinants of cognitive skills

**Chair** Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*)

**Abstract** Analysis of the PIAAC data has shown the crucial importance of cognitive skills for individual success. Thus, there is a profound interest in the determinants of cognitive skills. The literature consistently argues that family background plays a key role in the formation of skills, leading to a strong persistence in educational achievement across generations. However, surprisingly little is known about which family characteristics actually matter for skill formation. The four studies combined in this symposium try to dig deeper into the determinants of cognitive skills. Some of the questions addressed in the symposium are: How strong is the correlation of cognitive skills of parents and their children, and what are the mechanisms that give rise to the intergenerational persistence of skills? How important is the transmission of cultural values from parents to children as a determinant of cognitive skills? Finally, can policies substituting for lacking family support be successful in helping disadvantaged children to improve their skills?

### Presentations

- » **S4.1: Can mentoring alleviate family disadvantage in adolescence? A field experiment to improve labor-market prospects.**  
Authors: Sven Resnjanskij (*ifo Institute, Germany*), Jens Ruhose (*University of Kiel, Germany*), Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*), & Ludger Woessmann (*ifo Institute, Germany*)
- » **S4.2: Culture and student achievement: The intertwined roles of patience and risk-taking.**  
Authors: Eric A. Hanushek (*Hoover Institution, Stanford University, USA*), Lavinia Kinne (*ifo Institute, Germany*), Philipp Lergetporer (*ifo Institute, Germany*), & Ludger Woessmann (*ifo Institute, Germany*)
- » **S4.3: Individualism, human capital formation, and labor market success.**  
Authors: Katharina Hartinger (*Catholic University Eichstaett-Ingolstadt, Germany*), Sven Resnjanskij (*ifo Institute, Germany*), Jens Ruhose (*University of Kiel, Germany*), & Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*)
- » **S4.4: The intergenerational transmission of skills. An investigation of the causal impact of families on student outcomes.**  
Authors: Eric A. Hanushek (*Hoover Institution, Stanford University, USA*), Babs Jacobs (*ROA, Maastricht University, The Netherlands*), Guido Schwerdt (*University of Konstanz, Germany*), Rolf van der Velden (*ROA, Maastricht University, The Netherlands*), & Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*)

#### **S4.1: Can mentoring alleviate family disadvantages in adolescence? A field experiment to improve labor-market prospects.**

**Authors** Sven Resnjanskij (*ifo Institute, Germany*), Jens Ruhose (*University of Kiel, Germany*), Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*) & Ludger Woessmann (*ifo Institute, Germany*)

**Presenter** Ludger Woessmann (*ifo Institute, Germany*)

**Abstract** We study a mentoring program that aims to improve the labor-market prospects of school-attending adolescents from disadvantaged families by offering them a university-student mentor. Our RCT investigates program effectiveness on three outcome dimensions that are highly predictive of adolescents' later labor-market success: math grades, patience/social skills, and labor-market orientation. For low-SES adolescents, the one-to-one mentoring increases a combined index of the outcomes by half a standard deviation after one year, with significant increases in each dimension. Part of the treatment effect is mediated by establishing mentors as attachment figures who provide guidance for the future. The mentoring is not effective for higher-SES adolescents. The results show that substituting lacking family support by other adults can help disadvantaged children at adolescent age.

#### **S4.2: Culture and student achievement: The intertwined roles of patience and risk-taking.**

**Authors** Eric A. Hanushek (*Hoover Institution, Stanford University, USA*), Lavinia Kinne, Philipp Lergtporer & Ludger Woessmann (*ifo Institute, Germany*)

**Presenter** Eric A. Hanushek (*Hoover Institution, Stanford University, USA*)

**Abstract** Patience and risk-taking – two cultural traits that steer intertemporal decision-making – are fundamental to human capital investment decisions. To understand how they contribute to international differences in student achievement, we combine PISA tests with the Global Preference Survey. We find that opposing effects of patience (positive) and risk-taking (negative) together account for two-thirds of the cross-country variation in student achievement. In an identification strategy addressing unobserved residence-country features, we find similar results when assigning migrant students their country-of-origin cultural traits in models with residence-country fixed effects. Associations of culture with family and school inputs suggest that both may act as channels.

### **S4.3: Individualism, human capital formation, and labor market success.**

**Authors** Katharina Hartinger (*Catholic University Eichstaett-Ingolstadt, Germany*), Sven Resnjanskij (*ifo Institute, Germany*), Jens Ruhose (*University of Kiel, Germany*) & Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*)

**Presenter** Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*)

**Abstract** Using data from a large international adult skill test, we establish that individualism is one of the most important cultural traits affecting educational and labor-market outcomes. Exploiting both origin-country level and person-level variation in individualism of migrants and natives, we use different approaches to disentangle culture from cross-country differences in the economic and institutional environment. We find that individualists have higher skills, show larger skill gains over time, invest more in training, receive higher wages, are less likely to be unemployed, and choose more research-oriented and abstract-task-intense occupations. Our results indicate the importance of the family in transmitting cultural traits.

### **S4.4: The intergenerational transmission of skills. An investigation of the causal impact of families on student outcomes.**

**Authors** Eric A. Hanushek (*Hoover Institution, Stanford University, USA*), Babs Jacobs (*ROA, Maastricht University, The Netherlands*), Guido Schwerdt (*University of Konstanz, Germany*), Rolf van der Velden (*ROA, Maastricht University, The Netherlands*) & Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*)

**Presenter** Guido Schwerdt (*University of Konstanz, Germany*)

**Abstract** The extensive literature on intergenerational mobility highlights the importance of family linkages but fails to provide credible evidence about the underlying family factors that drive the pervasive correlations. We employ a unique combination of Dutch survey and registry data that links math and language skills across generations. We identify a causal connection between cognitive skills of parents and their children by exploiting within-family between-subject variation in these skills. The data also permit novel IV estimation that isolates variation in parental cognitive skills due to school and peer quality. The between-subject and IV estimates of the key intergenerational persistence parameter are strikingly similar and close at about 0.1. Finally, we show the strong influence of family skill transmission on children's choices of STEM fields.

## Invited Symposium V

Friday, March 25<sup>th</sup>, 2022; 11.00 am – 12.30 pm

### Beyond competencies – Potential of PIAAC for interdisciplinary research

**Chair** Julia Gorges (*Philipps-University Marburg, Germany*)

**Abstract** The OECD PIAAC study provides in-depth information regarding adult competencies in a wide range of countries. Hence, some refer to PIAAC as “PISA for adults”. However, PIAAC is more than that. Thanks to its references to research from different disciplines and to different data sources, PIAAC has stimulated much research beyond adult competencies. Using data from the PIAAC background questionnaire, researchers have tested established assumptions on adult learning, investigated participation in education, and used national longitudinal extensions of the PIAAC study and other related data sources.

This symposium brings together research beyond competencies from different disciplinary perspectives using a wide range of datasets. Using cross-sectional data from the first PIAAC data collection in 2012, MASSING explores the importance of participation in non-formal training in order to upgrade or to maintain skills among migrants in selected countries. In particular, this contribution will focus on how different policies in different countries might affect training participation and barriers to training. Drawing on data from the 1994–1998 International Adult Literacy Survey, the 2003–2008 Adult Literacy and Life Skills and the 2011–2012 OECD Survey of Adult Skills, MERONI focuses on overeducation and skill mismatch in different age cohorts and different countries. To identify skill mismatch and overeducation, this contribution looks at both skills and educational credentials. The contribution by HESSE uses the German longitudinal extension of PIAAC to investigate the role of motivation to learn and parenthood for participation in non-job-related training. The study provides insights into the neglected concept of adult motivation to learn. To look at PIAAC’s contribution in a broader context, HERNÁNDEZ-TORRANO & COURTNEY conducted a bibliographic analysis of publications using large-scale datasets in educational research. They describe the role of PIAAC data in current educational research alongside other large-scale assessments such as PISA. Each contribution takes a specific disciplinary perspective: sociology (MASSING), economics (MERONI), psychology (HESSE), and educational research (HERNÁNDEZ-TORRANO & COURTNEY). In this interdisciplinary symposium, disciplinary priorities and major topics building on PIAAC data will be highlighted and discussed.

### Presentations

- » S5.1: Training participation of migrants and barriers to training – a cross-country comparison.

Author: Natascha Massing (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

- » S5.2: An age-period-cohort approach to the incidence and evolution of overeducation and skills mismatch.

Author: Elena Meroni (*European Commission, DG Joint Research Centre, Italy*)

- » S5.3: How compatible are parenthood and participation in further education and training? Findings from the German PIAAC longitudinal study.

Author: Franzisca Hesse (*Philipps-University Marburg, Germany*)

- » S5.4: Modern international large-scale assessment in education: An integrative review and mapping of the literature.

Authors: Daniel Hernández-Torrano & Matthew G.R. Courtney (*Nazarbayev University, Kazakhstan*)

### S5.1: Training participation of migrants and barriers to training – a cross-country comparison.

**Author** Natascha Massing (*GESIS – Leibniz Institute for the Social Sciences, Germany*)

**Presenter** Natascha Massing (*GESIS – Leibniz Institute for the Social Sciences, Germany*)

**Abstract** Lifelong learning is seen as an essential element so that individuals maintain and develop their skills in order to cope with changing demands in today's societies. In this research, I follow the human capital approach which assumes that investment in human capital has benefits for individuals but also for society. Thus, participation in training, which is one form of human capital, should create rewards and therefore there should be incentives for participation. However, research shows that migrants participate less in training than natives. Research on OECD countries also shows that migrants have lower chances on the labor market and lower educational attainment (e.g. OECD & European Union, 2015). Furthermore, qualifications of migrants educated in another country are often not recognized in the host country, or their skills do not match with the labor demands (Huddleston et al., 2013). This means that especially migrants could benefit most from participation in training. However, there are also reasons preventing individuals from participating in training, so-called barriers to training. I explore whether the barriers to training differ between migrants and natives, and also whether differences across countries can be found. The paper analyzes training participation of migrants across countries and compares their participation rates with native individuals using data from the Programme for the International Assessment of Adult Competencies (PIAAC). Doing this, I distinguish between natives, first- and second-generation migrants. Furthermore, I examine whether the same kind of barriers prevent these different groups from participating in training, and whether the reasons preventing training participation vary between countries in these groups. I discuss how policies in different countries might affect training participation and barriers to training.

### **S5.2: An age-period-cohort approach to the incidence and evolution of overeducation and skills mismatch.**

**Author** Elena Meroni (*European Commission, DG Joint Research Centre, Italy*)

**Presenter** Elena Meroni (*European Commission, DG Joint Research Centre, Italy*)

**Abstract** This paper provides new evidence on the changes in the level and persistence of occupational mismatch across countries by investigating whether differences among generations (cohorts) are at the core of these changes. Using data from the 1994–1998 International Adult Literacy Survey, the 2003–2008 Adult Literacy and Life Skills and the 2011–2012 OECD Survey of Adult Skills, we estimate an age-period-cohort model in three European countries to examine the extent to which younger cohorts face a greater (smaller) risk of being occupationally mismatched in their jobs than their older counterparts. Two definitions of occupational mismatch are used, focusing on both educational attainment and literacy skills. Results indicate that countries present different patterns of evolution of occupational mismatch from older to younger generations according to which definition is employed (overeducation or skills mismatch). Different macro-economic and educational contexts may be at the core of these results, suggesting that tailored policy responses are desirable for effectively addressing the occupational mismatch problem.

### **S5.3: How compatible are parenthood and participation in further education and training? Findings from the German PIAAC longitudinal study.**

**Author** Franzisca Hesse (*Philipps-University Marburg, Germany*)

**Presenter** Franzisca Hesse (*Philipps-University Marburg, Germany*)

**Abstract** The transition to parenthood marks a critical life event and is accompanied by major impacts on the lives of new parents. Beyond the early stages of parenthood, parents need special support at transitions in the family life cycle which can be met in non-job related training. At the same time, however, the demands of parenthood may prevent parents from participating in further education. So far, little attention has been paid to the impact of parenthood on participation in further education and training. By weighing costs and benefits to evaluate further education opportunities, individuals are assumed to consider contextual conditions and personal aspects in their decision to participate or stay away from further education. Common barriers to adult learning include lack of time because of family responsibilities and work-related appointments. Despite contextual constraints, parents' motivation to learn may promote participation in further education. This study therefore aims to investigate the role of motivation to learn and parenthood for participation in non-job-related training. We draw on the German longitudinal extension of PIAAC (N = 2967) and compare parental versus non-parental participation, using the motivation-to-learn scale from the first PIAAC background questionnaire. Analyzing longitudinal PIAAC data further enables us to draw causal conclusions about the influence of parenthood and motivation to learn on participation in non-job-related training. Socio-economic and demographic factors such as parental sex, age, marital status, level of education and age and number of children are considered. Theoretical and practical implications will be discussed.

#### **S5.4: Modern international large-scale assessment in education: An integrative review and mapping of the literature.**

**Authors** Daniel Hernández-Torrano & Matthew G.R. Courtney (*Nazarbayev University, Kazakhstan*)

**Presenter** Daniel Hernández-Torrano (*Nazarbayev University, Kazakhstan*)

**Abstract** Research in international large-scale assessment (ILSA) has become an increasingly popular field of study in education. Consequently, interest and debate in the field by practitioners, researchers, policymakers, and the public has grown over the past decades. This study adopts a descriptive bibliometric approach to map modern research on ILSA in education and provide an up-to-date picture of the recent developments and structure of the field. The analysis of 2,233 journal articles indexed in the Web of Sciences database revealed that ILSA research in education is an emerging field in a stage of exponential growth that has become increasingly international with recent substantive contributions from China, Spain, and Turkey. Research in the field is currently produced by a rapid network of scholars with diverse geographical backgrounds that engage frequently in national and international research collaborations. Also, the field is relatively interdisciplinary and has developed grounded on nine differentiated historical paths. The PISA program has received the greatest attention in the field, and a wide variety of topics have been addressed in the literature in the last decades, including equity and quality education, globalization and education policy, measurement and statistics, student motivation and self-concept, and interpersonal relationships. The paper concludes by pointing to the potential of future ILSA research to make use of new more relevant instrumentation, data linkages, and trans-regional collaborations.



## Invited Symposium VI

Friday, March 25<sup>th</sup>, 2022; 1.50 pm – 3.20 pm

### What are PIAAC process data used for?

**Chairs** Frank Goldhammer, Ulf Kröhne & Carolin Hahnel (*DIPF | Leibniz Institute for Research and Information in Education, Germany*)

**Abstract** The first round of the PIAAC study 2011–2012 was innovative in many ways. It was not only the first international large-scale assessment to be mainly computer-based, but it was also the first large-scale assessment that systematically collected log data, that is, events, event-related attributes, and timestamps reflecting the test taker's interactions with the PIAAC assessment system. Log data found their way into the public use file in the form of generic process indicators such as time on task or number of interactions by item. Moreover, the majority of countries participating in PIAAC round one provided their log data that was recorded during the computer-based assessment to make it publicly available to the research community. Together with the result data and the data from the background questionnaire, the PIAAC log data already has inspired intensive research activities (for an overview see Goldhammer et al., 2020). In this invited symposium, we have brought together four recent contributions dealing with PIAAC process data from different – both substantive and methodological – perspectives. The first presentation by Pokropek and colleagues addresses the question of how process data can be used to explore gender differences in literacy as assessed in PIAAC and PISA. The following contribution by Hahnel and colleagues investigates strategies of information processing in simulated web search environments included in the PIAAC assessment of problem solving in technology-rich environments. The third presentation by He and colleagues focuses on evaluating consistency of adult behavioral patterns across multiple problem solving tasks using PIAAC process data from the US. The final presentation by Maddox is about the PIAAC testing situation at home and considers process data derived from video data, log data etc. to capture sources of variation in the test administration.



## Presentations

- » **S6.1: Utilizing process data to examine gender differences in literacy in PISA and PIAAC.**  
Authors: Artur Pokropek (*Institute of Philosophy and Sociology of the Polish Academy of Sciences, Poland*), Francesca Borgonovi (*University College London, UK, and OECD, France*), & Lale Khorramdel (*Boston College, USA*)
- » **S6.2: Identifying strategies of information processing in PIAAC web search environments.**  
Authors: Carolin Hahnel, Frank Goldhammer, & Ulf Kroehne (*DIPF | Leibniz Institute for Research and Information in Education, Germany*)
- » **S6.3: Evaluating consistency of adult problem-solving behaviors across multiple tasks using PIAAC process data.**  
Authors: Qiwei He (*Educational Testing Service, USA*), Dandan Liao (*Cambium Assessment, Inc, USA*), Hok Kan Ling (*Queen's University, Canada*), & Hong Jiao (*University of Maryland, USA*)
- » **S6.4: Testing situations at home.**  
Author: Bryan Maddox (*University of East Anglia & CEMO, University of Oslo, Norway*)

### S6.1: Utilizing process data to examine gender differences in literacy in PISA and PIAAC.

**Authors** Artur Pokropek (*Institute of Philosophy and Sociology of the Polish Academy of Sciences, Poland*), Francesca Borgonovi (*University College London, UK, and OECD, France*), & Lale Khorramdel (*Boston College, USA*)

**Presenter** Artur Pokropek (*Institute of Philosophy and Sociology of the Polish Academy of Sciences, Poland*)

**Abstract** Gender differences in educational assessments that use standardized tests have been the subject of numerous studies for at least half a century. Strong evidence exists for two patterns: boys having higher test scores in mathematics, and girls having higher test scores in reading and literacy. To better examine the impact of problem-solving and test-taking strategies as well as differences in motivation and test-taking effort on gender differences, the current research aims to go beyond the use of classical response and rating data and will utilize log file and process data from computer-based test administrations. The proposed research aims to utilize log and process data from PISA and PIAAC cycle 1 to examine whether female and male examinees in student and adult populations use different problem solving and test-taking strategies or show differences in motivation and test-taking effort which could explain the observed differences in reading and mathematics. In a first step, existing process data indicators which are provided in the public-use data files – item-level response times, number of actions, omitted responses – will be compared between girls and boys for different item types (multiple choice versus constructed response) and at the scale and subscale level for both reading and mathematics. In a second step, big data analytics processes and data science approaches will be applied to the log data for generating new data features and indicators including data sequences, clusters, and graphs. This will be done using bottom-up as well as top-down processes and a combination of both. Theory driven

decisions and analysis will be combined with expert ratings of the content domain and item development experts. Moreover, the analysis will build on findings from prior studies and modeling approaches of test-taking efforts and motivation including findings on rapid guessing behavior, careless responding and item revisit behavior.

### **S6.2: Identifying strategies of information processing in PIAAC web search environments.**

**Authors** Carolin Hahnel, Frank Goldhammer, & Ulf Kroehne (DIPF | Leibniz Institute for Research and Information in Education, Germany)

**Presenter** Carolin Hahnel (DIPF | Leibniz Institute for Research and Information in Education, Germany)

**Abstract** Nowadays, it is a common activity to use online search engines to find information needed for a specific task or to solve an information problem. The variety of information provided usually enables web users to locate information quickly and in a focused way, but it also requires them to make numerous decisions (i.e., Is a search entry relevant? Is the information source reliable and authoritative? Is the information sufficient to solve the information problem?). In order to make efficient use of limited time and cognitive resources, web users often employ cognitive heuristics to facilitate necessary decision processes (e.g., by choosing a search result for familiarity reasons or based on its position in the search result list). The present study aims at investigating adults' approaches to process web information from search engines and their success in finding an optimal solution to a given information problem. PIAAC enables this investigation by means of two items from the domain of problem-solving in technology-rich environments (PSTRE). The items required PIAAC participants to evaluate a given search engine results page and its linked websites in order to select the search entry that is optimal for solving a respective task. More specifically, the participants were requested to select the website that provided the most credible information about a medical treatment ("Sprained ankle"), or the website that offered a product that met specific criteria ("Digital Photography Book"). Participants of the PSTRE assessment were asked to solve either one or both items. Several log data indicators (i.e., time on the search result page until first website visit, number of websites visited, order of website visits) are examined using latent class analysis to identify different groups of processing behavior (e.g. groups indicating comprehensive processing of the search result page, processing focused on the comparison of websites, or disengaged test-taking). Furthermore, we examine whether the identified processing groups differ in terms of item success and, in case of adults completing both web search items, whether processing behaviors are consistent across items. The results of this log data analysis will be presented.

### S6.3: Evaluating consistency of adult problem-solving behaviors across multiple tasks using PIAAC process data.

**Authors** Qiwei He (*Educational Testing Service, USA*), Dandan Liao (*Cambium Assessment, Inc, USA*), Hok Kan Ling (*Queen's University, Canada*), & Hong Jiao (*University of Maryland, USA*)

**Presenter** Qiwei He (*Educational Testing Service, USA*)

**Abstract** The digital assessment platform provides the possibility to collect process data such as action sequences and response times along with the responses to each task. Considering the complexity and high dimensional structure of process data, most studies that draw this new data source focus on one single item. Evaluating the behavioral consistency across items, however, renders possible capturing and modeling person-related latent characteristics, in addition to the measurement by response accuracy. This study draws on process data from log files recorded in the problem-solving in technology-rich environment (PSTRE) domain in PIAAC to evaluate the consistency of behavioral patterns across multiple items. Specifically, we presented two approaches to assess respondents' behavioral consistency across items: (1) by using aggregate-level response process variables: the number of actions and the total response time to categorize respondents into groups based on their most likely behavioral patterns, and (2) by adding finer-grained information extracted from action sequences with sequence mining techniques. The purpose of this empirical study is twofold: first, to investigate whether the consistent behavioral patterns could be identified by process data features, and second, to examine the association among the consistency of behavioral patterns with cognitive competency and background variables. In the study sample, around 80% of respondents showed consistent patterns by the two dimensions, the response time and the number of actions, when solving multiple items. Respondents who consistently used long action sequences with short response time were found using the most similar sequences to the predefined optimal solutions. These respondents obtained the highest average PSTRE scores, had the highest ICT skills at home and at work and were the youngest group compared with their peers. Comparatively, respondents who consistently used short action sequences with fast speed had the lowest PSTRE scores and were identified as those who executed the most skipping behaviors. The findings in this study can be useful to provide information for test developers, psychometricians, and instructors for a better understanding of respondents' consistent behavior during the cognitive process and may eventually contribute to improve task and assessment design.

### S6.4: Testing situations at home.

**Author** Bryan Maddox (*University of East Anglia & CEMO, University of Oslo, Norway*)

**Presenter** Bryan Maddox (*University of East Anglia & CEMO, University of Oslo, Norway*)

**Abstract** This paper will discuss the test quality and validity challenges associated with conducting PIAAC assessments in a household environment, and how they can be captured by 'process data'. The paper will begin by describing the ecological challenges of testing situations at home through presentation of video ethnographic case study examples on PIAAC (Maddox, 2017; Maddox & Zumbo, 2017; Maddox, 2018; Maddox, Keslair & Javrh, 2019). Those highlight the scope for disturbances and assistance from by-standers – family and friends, and other distractions that can legitimately impact on the test taker

experience. i.e., threats to test validity that are associated with correct test administration. The paper will describe the multiple roles of the PIAAC test administrator, in the recruitment of participants, as invigilator (proctor) in the management of the testing situation to ensure quality standards in what are sometimes unruly and idiosyncratic household interactions, and the post assessment reporting of ecological threats to validity. Informed by Latour's work in Science and Technology Studies, paper will then consider what may happen if the roles of a human administrator are replaced by 'non-human' test administration and remote invigilation. How effectively are those roles transferred to machines, and how might they be transformed in the process? The paper will consider how ecological sources of variation in the administration of test taking at home can be captured and interpreted as 'process data' (Zehner and Goldhammer, 2017; Goldhammer, Hahnel, Kroehne & Zehner, 2021) including the capture and interpretation of data from remote invigilation video data, log data on response times and keystrokes, and post assessment questionnaires.

## Paper Sessions

### Individual Paper Session I

Thursday, March 24<sup>th</sup>, 2022; 11.15 am – 12.45 pm

#### Paper Session: Response accuracy in large-scale assessment

**Chair** Dorothee Behr (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

##### Presentations

- » **P1.1: Effects of response styles on secondary analysis in International large-scale assessments.**  
Authors: Tomasz Żółtak, Artur Pokropek & Marek Muszyński (*Polish Academy of Sciences, Poland*)
- » **P1.2: Is careless responding also a problem in face-to-face mode? Analysis of PIAAC noncognitive data.**  
Authors: Marek Muszyński, Tomasz Żółtak & Artur Pokropek (*Polish Academy of Sciences, Poland*)

#### P1.1: Effects of response styles on secondary analysis in international large-scale assessments.

**Authors** Tomasz Żółtak, Artur Pokropek & Marek Muszyński (*Polish Academy of Sciences, Poland*)

**Presenter** Tomasz Żółtak (*Polish Academy of Sciences, Poland*)

**Abstract** Noncognitive constructs (personality traits, attitudes, interests, etc.) are of great interest in every area of the social sciences. Self-report scales are the main method used to measure them, present in almost all international large-scale assessments (ILSAs), including PIAAC. However, their use does not come without problems as self-reports are prone to various response biases (Khorramdel & von Davier, 2014; Meade & Craig, 2012; Paulhus, 1991). In this presentation, we will test how one of the possible biases, namely response styles (RS), affect different types of statistical modeling. Firstly, we conduct extensive simulation studies where different types and levels of RS (extreme (ERS), middle/midpoint (MRS), and acquiescence (ARS)) are generated and applied to statistical models. Surprisingly, very few simulation studies were conducted to evaluate the influence of RS on different types of statistical modeling. Ferrando and Lorenzo-Seva (2010) and Plieninger (2017) analysed the influence of RS presence on model fit, factor loadings recovery, scale reliability, validity, and scores, but these two studies are one of the very few that compared systematically the consequences of RS for the quality of the data. Moreover, the mentioned studies focused only on basic aspects of the measurement models and not on RS consequences for models usually used in secondary analyses, like analysis of variance (ANOVA), regression analysis, multilevel models, nor for more complex measurement issues like measurement invariance. We address this gap in the

proposed study which complements previous results and expands them by presenting models more closely related to substantial hypothesis testing. Secondly, we will conduct a series of analyses using PIAAC scales. Khorramdel, von Davier & Pokropek (2019) showed that response styles are present in PIAAC data, at least to a small extent. We will conduct a series of sensitivity analyses to probe the extent to which substantial conclusions based on PIAAC data might be altered by RS bias. Additionally, we will present a new statistical R package “rstyles”, designed to generate data affected by a wide variety of RS under different conditions and assumptions, allowing for handy assessment of properties of selected statistical models using Monte Carlo simulations.

### **P1.2: Is careless responding also a problem in face-to-face mode? Analysis of PIAAC noncognitive data.**

**Authors** Marek Muszyński, Tomasz Żółtak & Artur Pokropek (*Polish Academy of Sciences, Poland*)

**Presenter** Marek Muszyński (*Polish Academy of Sciences, Poland*)

**Abstract** Careless or insufficient effort responding (C/IER) is one of the main causes of low data quality in noncognitive assessments (Krosnick, 1991, 1999; Meade & Craig, 2012). However, a vast majority of the literature analysing this bias is based on either simulation or self-administrative (self-completion) data (Bowling et al., 2020; Silber et al., 2019). In this paper we will analyse whether quality of the data collected in face-to-face mode is also potentially threatened by C/IER (as it was shown that it is indeed threatened by other response biases, e.g. acquiescence (Aichholzer, 2013; Rammstedt et al., 2017) or self-enhancement (Palczyńska & Rynko, 2020). Although a large comparability between face-to-face and self-completion modes was proved (Cernat & Revilla, 2020), these analyses did not comprise C/IER comparison. In order to conduct such analysis we will use PIAAC noncognitive data and an ample set of C/IER indices, including flagging potential outliers (Emons, 2008, 2009; Mansolf & Reise, 2018; Meade & Craig, 2012), testing respondents' intraindividual variability (Dunn et al., 2018; Marjanovic et al., 2015) and gauging intraindividual consistency (Curran, 2016; Fronczyk, 2014; Huang et al., 2012) in order to identify aberrant patterns/respondents in the dataset. Moreover, we will study C/IER impact on scales' reliability and validity. Furthermore, we will also check how participant's gender, age, educational attainment and social status are related to pattern and amount of C/IER. In addition, we will conduct a sensitivity analysis to assess C/IER effect on substantial analyses, using latent regression or confirmatory factor analysis (CFA). We will also analyse if interviewer input variables from the observation module are related to C/IER. Last but not least, we will use interviewer data from one of the national PIAAC datasets in order to test whether C/IER indices evince any inter-interviewer variability (cf. Menold & Kemper, 2013). Additionally, basing on Monte Carlo simulations, we will assess the sensitivity of the C/IER detection tools in simulation settings reflecting methodology of PIAAC and alike studies.

## Individual Paper Session II

Thursday, March 24<sup>th</sup>, 2022; 1.15 pm – 2.45 pm

### Paper Session: Cognitive skills and labour market returns

**Chair** Simon Wiederhold (*Catholic University Eichstaett-Ingolstadt, Germany*)

#### Presentations

- » **P2.1: Labor market returns to adult literacy and numeracy skills: A focus on migrant assimilation over the lifecycle.**  
Authors: Christopher Erwin (*Auckland University of Technology, New Zealand*), Lisa Meehan (*Auckland University of Technology, New Zealand*), Marco Paccagnella (*OECD, France*), Gail Pacheco (*Auckland University of Technology, New Zealand*) & Stephen Reder (*Portland State University, USA*)
- » **P2.2: The part-time wage gap along the distribution: The role of cognitive and computer skills and job characteristics.**  
Authors: Britta Gauly (*GESIS – Leibniz-Institute for the Social Sciences, Germany*) & Bernd Fitzenberger (*Institute for Employment Research (IAB), Germany*)
- » **P2.3: Skills use and their effect on employment income over time: Evidence from the longitudinal and international study of adults.**  
Author: Alexander El-Hajj (*Statistics Canada, Canada*)
- » **P2.4: Selection corrected wage gaps within occupations in Germany.**  
Authors: Caroline Neuber-Pohl (*Federal Institute for Vocational Education and Training (BIBB), Germany*) & Britta Gauly (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

### P2.1: Labor market returns to adult literacy and numeracy skills: A focus on migrant assimilation over the lifecycle.

**Authors** Christopher Erwin (*Auckland University of Technology, New Zealand*), Lisa Meehan (*Auckland University of Technology, New Zealand*), Marco Paccagnella (*OECD, France*), Gail Pacheco (*Auckland University of Technology, New Zealand*) & Stephen Reder (*Portland State University, USA*)

**Presenter** Christopher Erwin (*Auckland University of Technology, New Zealand*)

**Abstract** Recent work has shown that labor market returns to schooling are biased when estimates do not consider direct measures of skill, such as literacy and numeracy. This has important ramifications not only for estimates of the return on human capital investments, but also for understanding the lifecycle earnings of migrant workers in host countries. One important aspect of lifecycle earnings for migrants is assimilation – that is, whether or not migrant workers “catch up” to native-born workers in the host country over time. Previous research in the U.S. suggests a wage penalty associated with being foreign-born which is countered by increasing returns to the number of years since migration. These estimates, however, do not consider direct measures of skill. Using data



from the Organisation for Economic Cooperation and Development's (OECD) Survey of Adult Skills, we investigate the role of literacy and numeracy skills in the earnings trajectories of migrant workers in 36 host countries. We ask two main research questions. First, what are the estimated lifecycle earnings profiles for migrant workers across countries? Second, how does the time it takes migrant earnings to "catch up" to native earnings depend on literacy and numeracy skill endowments? Our contribution to the literature is twofold. First, our study is the first to estimate models of migrant assimilation in the labor market for 36 separate OECD countries. Second, our focus on how literacy and numeracy skill endowments affect the speed of assimilation is novel in the literature. We find statistically significant returns to literacy and numeracy in the earnings function. Estimates vary widely across countries, ranging from a 15 (Sweden) – 45 (Singapore) percent increase in wages for a one standard deviation increase in literacy or numeracy. The estimated time it takes migrant workers in the U.S. to catch up to their native-born counterparts is estimated to be approximately 12.5 years. Estimates for the U.K and Canada are 9 and 20 years, respectively. Results suggest that after controlling for schooling, work experience, gender, and marital status, the returns to literacy and numeracy skills are similar across foreign-born and native-born workers in the host country.

## **P2.2: The part-time wage gap along the distribution: The role of cognitive and computer skills and job characteristics.**

**Authors** Britta Gauly (*GESIS – Leibniz-Institute for the Social Sciences, Germany*) & Bernd Fitzenberger (*Institute for Employment Research (IAB), Germany*)

**Presenter** Britta Gauly (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Abstract** For several decades, the share of part-time employed women in Germany has increased and is at an all-time high. Still, part-time employed women earn lower hourly wages compared to women working full-time. The existing literature has identified selection based on human capital as a prominent explanation for the part-time wage gap. However, differences in human capital may not fully be captured by education or experience used in previous studies. The present paper complements the existing evidence by analyzing how typically unobserved skills relate to the part-time wage gap along the entire wage distribution. Also, we exploit how job characteristics and occupational choices are related to wage differences. In particular, we test whether routine or computer-intensive tasks may increase women's substitutability without adjustment costs and lead to a smaller part-time wage gap. In our empirical analysis, we use the German PIAAC 2012 sample and focus on prime-age employed women. We apply linear quantile regressions to measure wage differences associated with part-time, conditional on individual and job characteristics. Moreover, we perform decomposition methods along the entire wage distribution to disentangle which part of the wage gap is due to differences in observable characteristics or differences in returns to those characteristics. Our results reveal a raw part-time wage gap that is hump-shaped, i.e., smaller in the lower and upper end of the distribution. Applying decomposition methods, we show that skills and workplace tasks largely explain the gap in the tails of the distribution. For example, in the low-wage sector, the small wage gap can be explained by a large share of easily dividable routine tasks. Moreover, we find that the wage gap is larger for women with higher skills, which may



reflect lower career development for high-skilled part-time women compared to their full-time counterparts. Using two-wave panel data from the German PIAAC-L study, we also show that mobility from full-time to part-time entails a much smaller wage gap than the cross-sectional estimates. This corroborates that a large part of the wage gap is due to the sorting of women with different productivity-related characteristics into full-time versus part-time employment.

### **P2.3: Skills use and their effect on employment income over time: Evidence from the longitudinal and international study of adults.**

**Author** Alexander El-Hajj (*Statistics Canada, Canada*)

**Presenter** Alexander El-Hajj (*Statistics Canada, Canada*)

**Abstract** This research aims to assess the changes in employment income over time among survey respondents who reported various skill use on the Longitudinal International Survey of Adults (LISA). The objective of this research is to reveal whether certain skills, used by respondents in Wave 1 (2012), correspond to a larger increase in employment income over a six-year period (ending 2018). To carry out this research and analysis, the four currently released waves of LISA are used in conjunction with T4 administrative tax data and PIAAC data, which is a data set that was incorporated into Wave 1 of LISA. PIAAC skills data is divided into two categories – an index score above 3, representing a high degree of skill use, and an index score below or equal to 3, representing a low degree of skill use. Analysis of thirteen skills showed that those who used information and communications technology (ICT) skills at home (44.3%), ICT skills at work (40.0%), numeracy skills at home (49.7%), numeracy skills at work (35.1%), reading skills at home (31.5%), and reading skills at work (36.0%) to a high degree had the largest percentage increase in employment income over the six years assessed. Respondents who used ICT skills at work to a high degree gained the most in employment income over the six years (\$32,935). Task discretion used to a high degree was the skill that displayed the smallest increase over the six years (8.2% and \$5,648). There is a clear relationship revealed by this research pertaining to the types of skills respondents use and their associated gain in income over a specified period. Interestingly, these results can be used both by policymakers and by those seeking new directions on which skills would better advance their wealth and career. One limitation of this research involves the inability to assess the change in skills use over time, as PIAAC data is only included in Wave 1 of LISA. Addressing this limitation with longitudinal studies could help improve our understanding of how skills use changes over time and how that impacts employment income.

## P2.4: Selection corrected wage gaps within occupations in Germany.

**Authors** Caroline Neuber-Pohl (*Federal Institute for Vocational Education and Training (BIBB), Germany*) & Britta Gauly (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Presenter** Caroline Neuber-Pohl (*Federal Institute for Vocational Education and Training / BIBB, Germany*)

**Abstract** Human capital factors such as education, skills, and labour market experience are typically associated with the gender wage gap. In recent years, human capital has played a minor role for gender wage disparities, while selection into occupation has proven to be one of the most important factors. While it is well known that female-dominated occupations pay less than male-dominated occupations, however, the size and explanations of gender wage disparities within occupations are less clear. This paper investigates differences in the gender wage gap in female and male-dominated occupations in Germany while accounting for selection of employees into occupations. Moreover, we analyze gender differences in (returns to) tasks and skills, which are considered to drive wage differences across occupations. To capture the role of occupational choice, we specifically model selection into male and female-dominated occupations. For this, we adopt an extension to the two-stage Heckman procedure. Firstly, we estimate the selection into mixed, female, and male-dominated occupations using a multinomial logit specification. Secondly, we estimate linear wage curves and decompose wage differences between men and women while controlling for a selectivity parameter retrieved from the first stage. We use the German sample of PIAAC from 2012. PIAAC provides data on cognitive skills of the working-age population as well as a rich set of information on individual's occupations and job tasks. This enables us to estimate the gender wage gap across occupations while controlling for productivity-related differences between men and women beyond formal education. Our preliminary results indicate the highest raw gender wage gap in mixed occupations, while it is smallest in female-dominated occupations. Furthermore, we find significant selection effects: While selection into occupations and individual and job characteristics can fully explain the gender wage gap in female and mixed occupations, we still find a significant unexplained gap in male occupations. Moreover, we find that women earn less for abstract tasks in male occupations. Overall, our results indicate that simply achieving a higher share of women migrating to well-paying typically male occupations may not be enough to close the gender wage gap.

## Individual Paper Session III

Thursday, March 24<sup>th</sup>, 2022; 1.15 pm – 2.45 pm

### Paper Session: Cognitive skills in various social groups

**Chair** Jan Paul Heisig (*Berlin Social Science Center, WZB, Berlin*)

#### Presentations

- » **P3.1: What are the skills of parents of school-age children?**  
Authors: Saida Mamedova & Emily Pawlowski (*American Institutes for Research, USA*)
- » **P3.2: Knowing teacher's skills in Slovakia: Evidence for further education of teachers.**  
Authors: Olga Zelmanova (*National Institute for Certified Educational Measurements – NICEM, Slovakia*) & Zuzana Wirtz (*National Institute for Certified Educational Measurements – NICEM, Slovakia*)
- » **P3.3: Inequality in quality: Population heterogeneity in literacy skills around the world.**  
Author: Claudia Reiter (*University of Vienna, Austria*)

### P3.1: What are the skills of parents of school-age children?

**Authors** Saida Mamedova & Emily Pawlowski (*American Institutes for Research, USA*)

**Presenter** Saida Mamedova (*American Institutes for Research, USA*)

**Abstract** As a result of the COVID-19 pandemic, many children are participating in remote education due to school closures, creating the need for many parents to become more involved with helping their children with their schoolwork. PIAAC provides insight into the skills of the parents of school-age children, as well as other information about their characteristics and situations, an indication of how prepared these parents are to assist in their children's education, including potentially planning and teaching lessons if schools are not providing instructional materials, reading instructions on assignments, and further explaining concepts. Previous research has shown a strong relationship between parents' outcomes, such as education level, and the outcomes and skills of their children. With greater parental involvement in their children's education, it is even more important to understand issues related to family literacy, as children with low-skilled parents may be at higher risk for learning loss due to their parents not having the necessary skills to support their learning. This study will focus on a selected group of European and North American countries that participated in PIAAC, including Finland, France, Italy, the United Kingdom, and the United States. Across these countries a significant amount of the adult population, approximately twenty-five to thirty percent of adults ages 16-to-65, are parents of school-age children. For this study, parents of school-age children are defined as those who have one or more child in the 6-to-17-year-old age range. This presentation will explore the skill levels of the parents of school-age children in the areas of literacy, numeracy, and digital problem solving. Additional information about the circumstances of the parents will also be examined, including details about their basic demographics

(including gender and age), employment status (including full-time or part-time status and income), education and training participation, and living arrangements (including number of children, number of household members, and whether they live with a partner). This information about the skills and characteristics of parents of school-age children may be indicative of where parents may need additional assistance in supporting their children's remote education and providing insight into what types of assistance might be useful.

### **P3.2: Knowing teacher's skills in Slovakia: Evidence for further education of teachers.**

**Authors** Olga Zelmanová (*National Institute for Certified Educational Measurements – NICEM, Slovakia*) & Zuzana Wirtz (*National Institute for Certified Educational Measurements – NICEM, Slovakia*)

**Presenter** Olga Zelmanová (*National Institute for Certified Educational Measurements – NICEM, Slovakia*)

**Abstract** We conducted research survey focused on teachers with OECD tool Education and Skills Online (PIAAC Online) as part of Slovak National research project of adult skills (PIAAC). In our PIAAC online study we were interested in those factors that might contribute to forming of teachers' competencies, skills and teaching style as a part of Slovak national skills strategy. We analyzed cognitive skills (comparable to PIAAC), behavioral characteristics, career interest (RIASEC) profiles of Slovakian primary and secondary teachers and compared age and gender differences to grasp deeper view of those groups. Existing research indicates important correlation of cognitive skills between teachers and children's academic achievement in school together with impact of other noncognitive factors that might play a role in teacher's performance and their teaching methods. Understanding of teacher's personality, competencies, skills and career interest provides important evidence for setting up recommendation for improving of teacher's education in universities and also for better focusing of lifelong education and learning of teachers.

### **P3.3: Inequality in quality: Population heterogeneity in literacy skills around the world.**

**Author** Claudia Reiter (*University of Vienna, Austria*)

**Presenter** Claudia Reiter (*University of Vienna, Austria*)

**Abstract** Education is a recognized source of demographic heterogeneity, with educational attainment, measuring the quantity of human capital, increasingly entering demographic analyses as an explicit dimension. However, the quality dimension of human capital, i.e. the skills people actually have, also matters greatly for many of the benefits of education and serves as an additional relevant source of demographic heterogeneity – but is still largely disregarded in demographic analyses. This research aims to accommodate this by incorporating a skills dimension into existing population distributions. Drawing on large-scale adult skills assessment surveys, I combine measures of literacy skills with population distributions by age, sex, and educational attainment for 45 countries. The resulting skills-adjusted education pyramids capture the “inequality in quality”, revealing

considerable population heterogeneity in literacy skills between countries – with significant differences even within same age-, sex- and education-groups. This paper extends the literature on education as a demographic variable, stressing the need to additionally incorporate a skills dimension and providing empirical evidence for large heterogeneity in literacy skills among otherwise similar sub-populations. Pointing at gender, generational, and geographical gaps in skills-adjusted educational attainment, this research provides new insights into distributional aspects of human capital, with clear relevance for progress towards development goals.

## Individual Paper Session IV

Thursday, March 24<sup>th</sup>, 2022; 3.50 pm – 5.20 pm

### Paper Session: The impact of socio-emotional skills

**Chair** Beatrice Rammstedt (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

#### Presentations

- » **P4.1: Soft skills and immigrants' economic outcomes in Europe: Evidence from PIAAC data.**  
Authors: Agnieszka Kanas (*Erasmus University Rotterdam, The Netherlands*) & Menno Fenger (*Erasmus University Rotterdam, The Netherlands*)
- » **P4.2: To score or not to score? A simulation study on the performance of test scores, plausible values, and SEM in regression with socio-emotional skill or personality scales as predictors.**  
Authors: Nivedita Bhaktha (*GESIS – Leibniz Institute for the Social Sciences, Germany*) & Clemens Lechner (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)
- » **P4.3: Socio-emotional skills and labour market outcomes: New evidence using the Canadian longitudinal PIAAC study.**  
Authors: Ashley Pullman (*University of Ottawa, Canada*) & Ross Finnie (*University of Ottawa, Canada*)

### P4.1: Soft skills and immigrants' economic outcomes in Europe: Evidence from PIAAC data.

**Authors** Agnieszka Kanas (*Erasmus University Rotterdam, The Netherlands*) & Menno Fenger (*Erasmus University Rotterdam, The Netherlands*)

**Presenter** Agnieszka Kanas (*Erasmus University Rotterdam, The Netherlands*)

**Abstract** This study examines the importance of soft skills for explaining immigrant-native inequalities in the labor market in Europe. Soft skills are necessary to take advantage of new technologies and adapt to changing work environments. However, we know little about their influence on immigrant-native inequalities in the labor market. This study extends and contributes to previous research by examining whether and to what extent soft skills, net of educational credentials, and cognitive skills, can explain immigrant-native inequalities in job access and quality employment (i.e., wages and occupational status). We also study whether the economic returns to soft skills vary across immigrants and natives. Given the disadvantaged position of immigrants in the labor market, with immigrants coming from nonwestern countries being most disadvantaged, an important question is whether and to what extent soft skills can enhance or alleviate this disadvantage. The analyses are based on a large-scale, comparative survey data from the Programme for the International Assessment of Adult Competencies (PIAAC 2012). The data provide detailed information about educational degrees, measures of cognitive and

noncognitive skills to explain immigrants' economic disadvantage in the labor market. We apply regression analyses with country-fixed effects and robust standard errors to adjust for clustering at the country level. We find a positive relationship between soft skills and immigrants' economic outcomes, net of educational credentials and cognitive skills. While the economic benefits from soft skills do not differ significantly among natives and immigrants originating from western countries, they are significantly lower for nonwestern immigrants.

**P4.2: To score or not to score? A simulation study on the performance of test scores, plausible values, and SEM in regression with socio-emotional skill or personality scales as predictors.**

**Authors** Nivedita Bhaktha (*GESIS – Leibniz Institute for the Social Sciences, Germany*) & Clemens Lechner (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Presenter** Nivedita Bhaktha (*GESIS – Leibniz Institute for the Social Sciences, Germany*)

**Abstract** This article addresses a fundamental question in the study of socio-emotional skills, personality traits, and related constructs: “To score or not to score?” When test scores or scale scores are used as predictors in multiple regression, measurement error in these scores tends to attenuate regression coefficients for the skill and inflate those of covariates. The different types of scores considered in this study are standardized mean scores (SMS), regression factor scores (RFS), empirical Bayes modal (EBM) score, weighted maximum likelihood estimates (WLE), and expected a posteriori (EAP) estimates. Unlike cognitive assessments, it is not fully established how severe this bias can be, that is, how well test scores recover the true regression coefficients – compared with methods designed to account for measurement error: structural equation modeling (SEM) and plausible values (PV). We present a simulation study in which these approaches were compared under conditions typical of socio-emotional skill and personality assessments. We examined the performance of five types of test scores, PV, and SEM with regard to two outcomes: (1) percent bias in regression coefficients for the skill in predicting an outcome; and (2) percent bias in the regression coefficient of a covariate. We varied the number of items, factor loadings/item discriminations, sample size, and relative strength of the relationship of the skill with the outcome. Results revealed that whereas different types of test scores are highly correlated with each other, the ensuing bias in regression coefficients varies considerably. The magnitude of bias was highest for WLE with short scales of low reliability. Bias when using SMS or WLE test scores was sometimes large enough to lead to erroneous research conclusions with potentially adverse implications for policy and practice (up 22 to 55% for the regression coefficient of the skill and 20% for that of the covariate). EAP, EBM, and RFS performed better, producing only small bias in some conditions. However, only PV and SEM performed well in all scenarios and emerged as the clearly superior options. We recommend that researchers use SEM, and preferably PV, in studies on incremental power of socio-emotional skills.



### **P4.3: Socio-emotional skills and labour market outcomes: New evidence using the Canadian longitudinal PIAAC study.**

**Authors** Ashley Pullman (*University of Ottawa, Canada*) & Ross Finnie (*University of Ottawa, Canada*)

**Presenter** Ashley Pullman (*University of Ottawa, Canada*)

**Abstract** National workforce policy that focuses on skill development often targets cognitive skills, such as literacy and numeracy; however, socio-emotional skills may be equally important and mutually beneficial to a range of employment outcomes. To understand the policy-relevance of socio-emotional skills, as well as how they relate to cognitive skills, we present an analysis of their relationship with employment, earnings, and workplace activities using administrative-linked longitudinal data from a nationally representative sample of adults in Canada. To measure socio-emotional skills, we employ the Big Five Inventory, which captures individual differences in level of openness, conscientiousness, extraversion, agreeableness, and emotional stability. We examine how these skills relate to employment and earnings both before and after accounting for individual characteristics, educational attainment, and cognitive skill level overall and by gender, age, and immigration background. Further analysis also demonstrates if and how the returns to socio-emotional skills differ among high, mid, and low earnings individuals. The final part of the study considers how socio-emotional skills relate to the probability of engaging in various workplace activities both before and after controlling for a range of individual characteristics. The findings show that socio-emotional skills clearly contribute to labour market outcomes, even when accounting for individual characteristics, education, and cognitive skill level. People in Canada who have high conscientiousness scores are more likely to be employed and earn more. Emotional stability is also positively related to earnings, especially among men. Extraversion is positively related to earnings for young adults and higher engagement in productive workplace activities for the entire sample. Although individuals with high openness scores earn less, they are more likely to engage in a range of constructive workplace activities. Finally, people with high agreeableness scores earn less – an earnings penalty that is particularly pronounced among high earners. Although there is overlap in both cognitive and socio-emotional skills, our research demonstrates how there are also separate advantages that merit policy, research, and social advancement.



## Individual Paper Session V

Thursday, March 24<sup>th</sup>, 2022; 3.50 pm – 5.20 pm

### Paper Session: Measures to master challenges of the 21<sup>st</sup> century

**Chair** Mariya Brussevich (*International Monetary Fund, USA*)

#### Presentations

- » **P5.1: Automation and human capital investment.**  
Authors: Sidharth Rony (*Royal Holloway University of London, UK*) & Arnaud Chevalier (*Royal Holloway University of London, UK*)
- » **P5.2: Who will bear the brunt of lockdown policies? Evidence from tele-workability measures across countries.**  
Authors: Mariya Brussevich (*International Monetary Fund, USA*), Era Dabla-Norris (*International Monetary Fund, USA*) & Salma Khalid (*International Monetary Fund, USA*)
- » **P5.3: Using cognitive skills of ordinary citizens to predict preparedness for pandemic: Lessons from PIAAC**  
Authors: Chong Ho Yu (*Azusa Pacific University, USA*), David Zizhong Xiao (*University of Maryland, USA*) & Jolia Awadallah (*Alliant International School of Psychology, USA*)

### P5.1: Automation and human capital investment.

**Authors** Sidharth Rony (*Royal Holloway University of London, UK*) & Arnaud Chevalier (*Royal Holloway University of London, UK*)

**Presenter** Sidharth Rony (*Royal Holloway University of London, UK*)

**Abstract** Automation has an ambiguous impact on labor market by creating demand for some skills and destroying some others. Over the years, multiple measures of automation have been developed to analyse its overall impact on labor market, but the effect automation has on training decision remains an empirical question. In this study, we look at the risk of automation from the perspective of a worker and identifies its relationship with workers' decision to invest in their human capital. We classify the risk of automation based on tasks and technology and identify the variation in workers' decision. All occupation can be divided into tasks which can be automated and cannot be automated. When the tasks done by the worker is used to estimate the automation risk, it is termed as individual level automation measure. When occupation of the worker is used to estimate automation risk, it is termed as occupation level automation. As a second classification, we use exposure to technology of tasks. Different types of technology have different impacts on the same task and hence the occupation. Robots automate manual tasks. Software automates routine information processing. AI automates routine information processing, identifying patterns in the information and makes predictions. The paper also highlights the importance of country of residence in workers' decision in human capital investment. Using five measures of automation and workers' information from PIAAC survey for

12 countries, with different penetration of technology, we investigate the relationship between specific automation measures and training decisions. We use the Technological Readiness from World Economic Forum as measure for rate of adoption of technology in different countries. We find that the effect of automation on training is sensitive to the measure of automation used. When measured by individual or occupational level automation, automation reduces the incidence of training. However, while relying on technology based measure of automation, workers affected by older technologies (Robot, Software) receive less training with automation, while workers affected by newer technologies (AI) receive more training with automation. We find the trends to remain same for workers of different age groups and skill levels.

### **P5.2: Who will bear the brunt of lockdown policies? Evidence from tele-workability measures across countries.**

**Authors** Mariya Brussevich (*International Monetary Fund, USA*), Era Dabla-Norris (*International Monetary Fund, USA*) & Salma Khalid (*International Monetary Fund, USA*)

**Presenter** Mariya Brussevich (*International Monetary Fund, USA*)

**Abstract** Lockdowns imposed around the world to contain the spread of the COVID-19 pandemic are having a differential impact on economic activity and jobs owing to differences in the ability to work remotely. Using PIAAC data, this paper constructs a new index of the feasibility to work from home to investigate what types of jobs are most at risk for 35 advanced and emerging market economies. Cross-country heterogeneity in the ability to work remotely reflects differential access to and use of technology, sectoral mix, and occupational selection. Workers least likely to work remotely also tend to be young, without a college education, working for non-standard contracts, employed in smaller firms, and those at the bottom of the earnings distribution, suggesting that the pandemic could exacerbate inequality. We estimate that over 97.3 million workers, equivalent to about 15 percent of the workforce, are at high risk of layoffs and furlough from lockdowns across the countries in our sample. Policies should account for demographic and distributional considerations both during the crisis and in its aftermath.

### **P5.3: Using cognitive skills of ordinary citizens to predict preparedness for pandemic: Lessons from PIAAC.**

**Authors** Chong Ho Yu (*Azusa Pacific University, USA*), David Zizhong Xiao (*University of Maryland, USA*), & Jolia Awadallah (*Alliant International School of Psychology, USA*)

**Presenter** Chong Ho Yu (*Azusa Pacific University, USA*)

**Abstract** 2019 Global Health Security Index (GHSI) rated the USA as the most prepared country for pandemic out of 195 countries (score=83.5 out of 100) due to its high-quality laboratories and scientists, strategic national stockpile, and emergency distribution and communication plans. Other developed countries are also ranked high on the list. Since the outbreak of COVID19, it has been obvious that GHSI failed to predict sky-rocketing confirmed cases and deaths by high-ranking countries, such as the USA and the UK. It is the conjecture of the research team that in addition to the availability of cutting-edge technologies and expertise provided by elites, the capability of discernment among

ordinary citizens also plays a crucial role in containing a pandemic. By merging the pandemic data compiled by Worldometer and the PIAAC data collected by OECD, the research team is intended to find out whether the intellectual quality of ordinary citizens, including basic literacy, basic numeracy, problem-solving skills, engagement in knowledge acquisition (e.g., attending workshops and seminars, use complex mathematical equations or read scholarly publications for work), open-mindedness/motivation for ongoing learning (e.g., read a lot daily, enjoy finding/learning new things daily), communication with others (e.g., sharing information with coworkers, participating in discussions on the internet) ...etc. could be utilized to build a better predictive model for anti-pandemic performance. It was argued that people whose employment requires complicated skills and people who enjoy learning new things are more likely to be complicit with COVID-19 guidelines than people whose employment requires lower education, research, and training levels. Although the data sourced from multiple countries with large samples, only summarized data by country were utilized ( $n = 36$ ). In addition to traditional OLS regression modeling, generalized regression analysis and Bayesian regression analysis were employed for triangulation. The merit of generalized regression modeling is its capability of avoiding overfit and collinearity, especially when the number of predictors exceeds the number of observations. Bayesianism treats probability as the degree of belief informed by the evidence, rather than relying on p values. In this case, the Bayesian approach is useful for modeling small-sample data.

## Individual Paper Session VI

Friday, March 25<sup>th</sup>, 2022; 11.00 am – 12.30 pm

### Paper Session: PIAAC skills assessment

**Chair** Anouk Zabal (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

#### Presentations

- » **P6.1: The impact of text characteristics on gender differences in adults' literacy skills.**  
Authors: Ai Miyamoto (*University of Freiburg, Germany*), Britta Gauly & Anouk Zabal (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)
- » **P6.2: Statistical literacy assessment – necessity and framework.**  
Author: Tanja Ihden (*IMC University of Applied Sciences Krems, Austria*)
- » **P6.3: What makes mathematics difficult for adults? The role of reading components in solving math items.**  
Authors: Nadine Cruz Neri, Jenny Wagner & Jan Retelsdorf (*University of Hamburg, Germany*)
- » **P6.4: PIAAC's Survey of Adult Skills and low literacy / functional illiteracy.**  
Authors: Aleksandar Bulajić (*TU Kaiserslautern, Germany; University of Belgrade, Serbia*), Réka Vágvölgyi (*TU Kaiserslautern, Germany*), Kirstin Bergström (*TU Kaiserslautern, Germany*) & Thomas Lachmann (*TU Kaiserslautern, Germany*)

### P6.1: The impact of text characteristics on gender differences in adults' literacy skills.

**Authors** Ai Miyamoto (*University of Freiburg, Germany*), Britta Gauly & Anouk Zabal (*GESIS – Leibniz-Institute for the Social Sciences, Germany*)

**Presenter** Ai Miyamoto (*University of Freiburg, Germany*)

**Abstract** Empirical evidence suggests gender differences in literacy skills in favor of girls during adolescence. However, whether these gender differences continue to exist during adulthood is still a topic of discussion. Previous studies found only a small to non-existent gender differences in adults' literacy skills. Moreover, some studies on school students suggest that the extent to which female and male students differ in their literacy skills also depend on text characteristics. For example, as females tend to read more during leisure time, which typically includes prose and continuous texts, they score better on those. However, so far, only a few studies have examined the role of text characteristics in gender differences in literacy skills among adults, and those findings are still inconclusive. In this study, we use data from the German sample of the Programme for the International Assessment of Adult Competencies (PIAAC) in 2012 and investigate the impact of three different types of text characteristics on gender differences in adults' literacy skills: text format, text topics, and the gender typicality of text. Because not all participants in PIAAC worked on literacy items, we focus on data from a subsample of

individuals who worked on the same set of literacy items with two levels of text difficulty (medium difficulty and high difficulty). That left us with 2,080 adults in total (50% female) between 16 and 65 years of age. We used logistic regressions with performance on the literacy items (binary indicator: correct versus incorrect/no response) as the dependent variable while also taking into account participants' age, education, and cultural capital. Our first preliminary results revealed that females tend to show lower literacy scores for non-continuous and mixed texts than males, whereas there were no gender differences for continuous texts and females tend to have lower literacy scores for texts with male-typical content compared to males. Our findings bring first insights into the variability of gender differences in literacy skills across different text characteristics.

## P6.2: Statistical literacy assessment – necessity and framework.

**Author** Tanja Ihden (*IMC University of Applied Sciences Krems, Austria*)

**Presenter** Tanja Ihden (*IMC University of Applied Sciences Krems, Austria*)

**Abstract** While the need for statistical literacy of the population is no longer in doubt, the next step is to ascertain a status quo. After election campaigns during Brexit, political discussions about the crime of refugees or the handling of statistical indicators in the context of the corona crisis suggest deficits in dealing with basic statistical competencies, the hypothesis of a poor statistical literacy of the population should be tested empirically. While tests on statistical literacy are already being developed and used by students, there is a lack of comparable instruments for recording basic statistical competencies of the general population, which is increasingly confronted with statistical statements in their everyday life and has to derive a variety of different decisions from them. There are already initial attempts to record the statistical literacy of a population, but a coordinated approach seems necessary. A uniform definition of the term statistical literacy as well as a framework are necessary and will be discussed here.

## P6.3: What makes mathematics difficult for adults? The role of reading components in solving math items.

**Authors** Nadine Cruz Neri, Jenny Wagner & Jan Retelsdorf (*University of Hamburg, Germany*)

**Presenter** Nadine Cruz Neri (*University of Hamburg, Germany*)

**Abstract** Theoretical and empirical background: While mathematics become more important in modern societies, all countries participating in the PIAAC study have a considerable number of adults with mathematical deficits. Although it is theoretically and empirically known that reading comprehension plays a significant role in mathematics performance, it remains unclear how specific reading components skills and item characteristics are associated with adults' mathematics performance. Investigating the interaction effects of reading components and item characteristics beyond the school context may be crucial to understand why a considerable number of adults show deficits in their reading and mathematical skills. Aims: The aim of this study was to investigate (1) reading components skills (printed vocabulary, sentence processing, passage comprehension), (2) characteristics of mathematics items (picture/table, complex verbs, number of prepositions, lexical density), and (3) possible interaction effects thereof on adults'

mathematics performance, (4) while controlling for adults' gender and migratory background. Methods: The sample stem from German participants of PIAAC and consisted of 368 German adults (age:  $M = 50.45$ ; 59% female). Reliabilities for the measurements ranged from .86 to .98. To test the hypotheses, we applied three logistic multilevel models for each reading component, respectively. Results: First, our results showed positive main effects of adults' reading components skills on performance. Second, while participants showed higher performance on mathematics items presented with an informational picture or an assistance-providing table, the use of complex verbs was linked to lower performance. Furthermore, lower mathematics performance was associated with an increasing number of prepositions and lexical density in the items. Third, most existing interaction effects of sentence processing and passage comprehension with item characteristics on mathematics performance did not hold when controlling for gender and migratory background. Regarding the model with passage comprehension, participants with higher passage comprehension scored significantly lower on items with an increasing number of prepositions, while scoring significantly higher on items with increasing lexical density. Discussion: Implications to support adults with low reading skills may include enhancing their reading component skills and adapting mathematics items by reducing linguistic complexity.

#### **P6.4: PIAAC's survey of adult skills and low literacy / functional illiteracy.**

**Authors** Aleksandar Bulajić (*TU Kaiserslautern, Germany; University of Belgrade, Serbia*), Réka Vágvölgyi (*TU Kaiserslautern, Germany*), Kirstin Bergström (*TU Kaiserslautern, Germany*) & Thomas Lachmann (*TU Kaiserslautern, Germany*)

**Presenter** Aleksandar Bulajić (*TU Kaiserslautern, Germany; University of Belgrade, Serbia*)

**Abstract** From the beginning of the second half of the 20th century, the concept of literacy underwent significant changes. Officially introduced as a global issue at the UNESCO's Conference in Tehran in 1946, literacy began to be understood in a wider socio-economic context. Functional illiteracy (FI) as a new concept introduced by UNESCO (1978), was spurred by the growing needs of industrial progress and in recognition of the inadequacy of basic education to provide an adequate level of literacy skills needed for accelerated socio-economic development (Bulajić et al., 2019). "Rediscovering" of illiteracy in industrialized countries (Goffinet & Damme, 1990, p. 4), as a form of skill and wider societal incompetence, led to the need to operationalise the meaning of functionality and address it at the cognitive, policy and educational level. After UNESCO proposed a more operational distinction between primary and functional illiteracy, an increasing number of research including large-scale studies (e.g. German Level-One Study [Grotlüschen et al., 2020]) started examining FI or low literacy (a more contemporary term) from a cognitive, neuropsychological, educational (e.g. ABE) and policy level. PIAAC's Survey of Adult Skills (SAS) assesses literacy skills on a 500 point scale divided on the 6 proficiency levels corresponding to particular point ranges (OECD, 2019). The authors of the proposed manuscript/presentation draw on the methods and results of a number of previous experimental cognitive/neuropsychological, as well as large-scale studies, to argue that SAS' Literacy Level 1 (OECD, 2019) corresponds to FI. A number of categorical arguments based on most recent operational definitions (e.g. Bulajić et al., 2019; Vágvölgyi et al.,

2016; Vágvölgyi et al., 2021), as well as quantitative-based comparisons between SAS and other large-scale studies are offered. In order to confirm and further develop diagnostic precision of SAS for the determining of the level of functional illiteracy and low literacy, the authors address several possible adjustments in SAS and offer their perspective on adapting the testing methodology and content (e.g. adding short phonological awareness tasks) for SAS for this purpose.



## Individual Paper Session VII

Friday, March 25<sup>th</sup>, 2022; 1.50 pm – 3.20 pm

### Paper Session: Skill use and skill mismatch

**Chair** Corinna Kleinert (*Leibniz Institute for Educational Trajectories, IflBi, Bamberg*)

#### Presentations

- » **P7.1: Examining PIAAC-L to examine skill loss among adults with VET.**  
Authors: Huacong Liu (*Shanghai Jiaotong University, China*), Steve Reder (*Portland State University, USA*) & Frank Fernandez (*University of Florida, USA*)
- » **P7.2: Non-conventional pathways and credential accumulation behaviours in postsecondary education in Canada: Statistical portrait and evaluation of labour market outcomes.**  
Authors: Xavier St-Denis (*Institut National de la Recherche Scientifique, Canada*), Yacine Boujija (*Université de Montréal, Canada*) & Stephen Sartor (*University of Western Ontario, Canada*)
- » **P7.3: Getting it right: Identifying literacy and numeracy skill mismatch in OECD countries using the job analysis method.**  
Authors: Sandra Pérez Rodriguez (*Maastricht University, The Netherlands*), Rolf van der Velden (*ROA, Maastricht University, The Netherlands*), Tim Huijts (*ROA, Maastricht University, The Netherlands*) & Babs Jacobs (*ROA, Maastricht University, The Netherlands*)
- » **P7.4: Measuring numeracy skills mismatch with PIAAC data.**  
Authors: Tina Dulam (*HU University of Applied Sciences Utrecht & Utrecht University, The Netherlands*) & Kees Hoogland (*HU University of Applied Sciences Utrecht, The Netherlands*)

### P7.1: Examining PIAAC-L to examine skill loss among adults with VET.

**Authors** Huacong Liu (*Shanghai Jiaotong University, China*), Stephen Reder (*Portland State University, USA*) & Frank Fernandez (*University of Florida, USA*)

**Presenter** Huacong Liu (*Shanghai Jiaotong University, China*)

**Abstract** Previous literature found that vocational education may facilitate school to work transition at labor-market entry, but over the life-cycle, vocational programs may lead to lower adaptability to technological and structural change, therefore faster depreciation rate of human capital among vocationally educated individuals (e.g. Hanushek et al. 2017; Woessmann 2019). For instance, using the Swiss Labor Force Survey, Weber (2014) finds that in Switzerland, human capital depreciation rates are higher for vocational education (“skill-specific”) than for academic education (“concept-based”). These studies often use wage changes to estimate human capital depreciation rather than direct measures of skills, therefore they do not address why human capital depreciation rates differ across individuals with different types of education. In addition to focusing on skill formation, policymakers and researchers should consider skill loss or the potential for



workers to lose skill over time. Using data from Germany's PIAAC-L study, we focus on addressing two research questions: Do skills evolve differently among individuals with vocational education and training (VET) than with general education? How do skill practices at work and at home affect skill changes of individuals with VET vs. general education? We use ordinary least squares estimation to analyze cases with non-missing data in the 2012 and 2015 survey waves. We regress literacy skill as assessed in 2015 on 2012 literacy and key independent variables (e.g., age, VET). In the full version of the paper, we examine multiple measures of skill use, including skill use at work and skill use at home. Based on our findings, we discuss the importance of supporting skill use and preventing skill loss across the life course.

### **P7.2: Non-conventional pathways and credential accumulation behaviours in postsecondary education in Canada: Statistical portrait and evaluation of labour market outcomes.**

**Authors** Xavier St-Denis (*Institut National de la Recherche Scientifique, Canada*), Yacine Boujija (*Université de Montréal, Canada*) & Stephen Sartor (*University of Western Ontario, Canada*)

**Presenter** Xavier St-Denis (*Institut National de la Recherche Scientifique, Canada*)

**Abstract** This study uses the Longitudinal and International Study of Adults (LISA), a longitudinal survey including all Canadian respondents to the PIAAC, to explore the educational trajectories and credential accumulation behaviours of Canadians who participate in postsecondary education. We also evaluate the skills and labour market outcomes for those who engage in conventional (linear) and non-conventional pathways in postsecondary education. Little is known about the differences in short- and long-term outcomes between students who follow conventional education pathways and those who do not. This is especially true to the extent that non-conventional pathways are likely to involve a return to schooling later in life, gaps of non-participation to postsecondary education between degrees, and reverse transfer pathways (the attainment of a second degree at a level below the first degree). The LISA helps to address the limitations of prior literature to the extent that it includes the full postsecondary education history of respondents, in addition to all PIAAC survey variables. This data is also integrated with personal income tax data since 1982. This additional set of longitudinal and administrative data sources will contribute to the detailed evaluation of labour market outcomes such as earnings and labour force attachment as a complement to the information available in the survey data. Preliminary results provide evidence that people persist in postsecondary education throughout the life course much beyond their mid 20s. Our main contribution is an exploration of the full and complete postsecondary education history that extends throughout individuals' life course, which enables us to describe the range of postsecondary pathways and evaluate their association with particular labour market outcomes such as income, skill use, and skill mismatch. We also investigate the role played by family background in these dynamics. Our analysis is enhanced by a linkage to detailed data on the income of the parents of LISA respondents. Finally, we explore the interaction between cognitive skills and different types of pathways in postsecondary education.

### P7.3: Getting it right: Identifying literacy and numeracy skill mismatch in OECD countries using the job analysis method.

**Author** Sandra Pérez Rodriguez (*Maastricht University, The Netherlands*), Rolf van der Velden (*ROA, Maastricht University, The Netherlands*), Tim Huijts (*ROA, Maastricht University, The Netherlands*) & Babs Jacobs (*ROA, Maastricht University, The Netherlands*)

**Presenter** Sandra Pérez Rodriguez (*Maastricht University, The Netherlands*)

**Abstract** Skill mismatches have large negative effects on productivity, job satisfaction, and other outcomes. To design an optimal skills policy, governments need to rely on accurate data on the incidence of skill mismatches. The Programme of the International Assessment of Adult Competences (PIAAC) is currently the most important data source providing excellent and unparalleled information for a large number of countries on the possessed literacy and numeracy skills of workers, but countries lack equivalent information on the required skills in those domains. Hence, it has been complicated to use the data to objectively identify skill mismatches in these areas. In this paper, we use the Job Analysis Method (JAM) to assess the required skill levels of literacy and numeracy for all 4-digit ISCO08 unit groups of occupations in the same metric as was used in PIAAC. JAM is often considered the 'gold standard' in mismatch research. It involves the use of occupational experts to rate the skill requirements in the different occupations. Using JAM to identify required skill levels for literacy and numeracy as measured in PIAAC has never been done before, and the paper thus presents the first results on the incidence of skill shortages and skill surpluses in these key information-processing skills across different OECD countries and across different occupations and sectors. We provide estimates for the proportions of well-matched, overskilled and underskilled workers per country, and compare these with estimates based on alternative methods. We also compare JAM with other methods in explaining wage differentials, as well as job satisfaction. We finalise by discussing the policy implications of the JAM in contrast to already existing methods.

### P7.4: Measuring numeracy skills mismatch with PIAAC data.

**Authors** Tina Dulam (*HU University of Applied Sciences Utrecht & Utrecht University, The Netherlands*) & Kees Hoogland (*HU University of Applied Sciences Utrecht, The Netherlands*)

**Presenter** Tina Dulam (*HU University of Applied Sciences Utrecht & Utrecht University, The Netherlands*)

**Abstract** Numeracy is gaining importance worldwide as one of the crucial basic skills for adults to cope with the digitalised and technologised 21st-century society. Having an adequate numeracy level will increasingly determine the successful participation of individuals in their roles as citizens and professionals. The aim of this study is to inform national policymakers on lifelong learning especially regarding numeracy and the mismatch of skills. We assess the incidence of numeracy skills mismatch for several countries that participated in the first cycle of the PIAAC survey. To do so, we apply the method of Brun-Schammé and Rey (2021), according to which a person is overskilled if the proficiency score is higher than one standard deviation above the median and underskilled if the score is lower than one standard deviation below the median of the corresponding two-digit occupation classification and training profile. Furthermore, we use the PIAAC data, to explore the potential determinants of being mismatched by studying 1) at micro-level

the relationship between mismatch and the educational background, labour market entry, age, and the use of numeracy skills, and 2) at macro-level the relationship between mismatch and the education system. To do the latter, we make use of indices on the tracking and vocational orientation system of countries. These indices were constructed by Bol and Werfhorst (2017) with data from the OECD and UNESCO. We aim to apply the same technique, slightly adapted, using the second cycle PIAAC data in the forthcoming years to see how numeracy mismatch develops over time and to support policy making on numeracy education to reduce this type of mismatch.

## Individual Paper Session VIII

Friday, March 25<sup>th</sup>, 2022; 1.50 pm – 3.20 pm

### Paper Session: Motivation to learn and lifelong learning

**Chair** Julia Gorges (*Philipps-University Marburg, Germany*)

#### Presentations

- » **P8.1: Motivation to learn and multilingualism across the adult life stages in the USA.**  
Authors: Shalini Sahoo (*University of Maryland, USA*), Takashi Yamashita (*University of Maryland, USA*), Roberto Millar (*The Hilltop Institute, USA*) & Phyllis Cummins (*Miami University, USA*)
- » **P8.2: Motivation to learn by age, education, and literacy skills among working-age adults in the USA.**  
Authors: Takashi Yamashita (*University of Maryland, USA*), Thomas Smith (*Northern Illinois University, USA*), Shalini Sahoo (*University of Maryland, USA*) & Phyllis Cummins (*Miami University, USA*)
- » **P8.3: Job tasks and cognitive skill accumulation.**  
Author: Qinyi Liu (*University of International Business and Economics, China*)

### P8.1: Motivation to learn and multilingualism across the adult life stages in the USA.

**Authors** Shalini Sahoo (*University of Maryland, USA*), Takashi Yamashita (*University of Maryland, USA*), Roberto Millar (*The Hilltop Institute, USA*) & Phyllis Cummins (*Miami University, USA*)

**Presenter** Shalini Sahoo (*University of Maryland, USA*)

**Abstract** Lifelong learning, or continuing education over the life course, has become necessary to navigate the rapidly changing technological landscape in the USA. Motivation to learn (MtL) is essential for facilitating lifelong learning participation. Over the last two decades, the percentage of American adults age 18 years and older who are multilingual nearly doubled from 9% to 17%. Yet, little is known about the associations between being multilingual and MtL across the life stages. Drawing from the adult education participation theoretical model, the goal of the current study was to investigate whether multilingualism is linked with MtL across the adult life stages. Nationally representative data came from the 2012/2014/2017 Program for International Assessment of Adult Competencies (PIAAC) USA restricted use file (RUF). Using a previously validated latent MtL construct, structural equation models were estimated by four age groups – 25-34 ( $n = 2,310$ ); 35-44 ( $n = 1,610$ ); 45-54 ( $n = 1,670$ ); and 55 and older ( $n = 2,620$ ). Results showed that being multilingual was associated with greater MtL among younger age groups, including ages 25-34 ( $b = 0.20$ ,  $p = 0.01$ ) and 35-44 ( $b = 0.28$ ,  $p < 0.001$ ), after adjusting for the demographic, socioeconomic and health characteristics of individuals. Multilingualism was not associated with MtL among older age groups, including 45-55

( $b = 0.06$ ,  $p = 0.50$ ) and 55 and older ( $b = 0.13$ ,  $p = 0.19$ ). Findings suggest that MtL varies across life stages in multilingual adults. Factors including being multilingual with or without English as a first language may provide deeper insights into the relevance of language skills for lifelong learning. Since MtL is linked to lifelong learning, and in turn, life outcomes (e.g., income, job security), educational policies should consider targeting younger multilingual American adults. Subsequently, policies designed to enhance MtL of older adults, regardless of the language abilities, may need more attention given the possible economic impacts (e.g., increasing older workforce) by accounting for educational needs, and learning style preferences. Older adults who are looking to change career or employment often prefer a personal and interactive learning experience, as opposed to a digital experience.

### **P8.2: Motivation to learn by age, education, and literacy skills among working-age adults in the USA.**

**Authors** Takashi Yamashita (*University of Maryland, USA*), Thomas Smith (*Northern Illinois University, USA*), Shalini Sahoo (*University of Maryland, USA*) & Phyllis Cummins (*Miami University, USA*)

**Presenter** Takashi Yamashita (*University of Maryland, USA*)

**Abstract** Motivation to learn (MtL) is a prerequisite for adult education and training participation over the life course. In the U.S., only about half of adults participate in education and training. Also, adult populations have become demographically and socioeconomically more diverse across the global community. In the current literature, older age, lower educational attainment, and lower literacy proficiency arguably are the most important MtL determinants. However, little is known about MtL across sub-populations due to methodological limitations. Specifically, the most common psychometric approaches – multigroup confirmatory factor analysis and factorial invariance testing procedures – require numerous pairwise comparisons of estimated parameters (e.g., factor loading, intercept) from the measurement model. For example, even when comparing 10 sub-groups based on a simple one-factor model with three indicators, the invariance test may require up to 360 pairwise comparisons. Therefore, detailed sub-populations involving combinations of characteristics, such as older adults with lower educational attainment with limited literacy proficiency, and younger adults with higher educational attainment and high literacy proficiency, have been understudied in the context of MtL. The lack of information about the subpopulations is problematic when developing education programs and policies to reach out to diverse adult populations. This study developed a national profile of MtL by comparing 16 subpopulations that are defined by 5-year age intervals, education level, and literacy proficiency in the U.S. Data from adults aged between 25 and 65 years old were obtained from 2012/2014/2017 Program for International Assessment of Adult Competencies (PIAAC) restricted-use file ( $N = 8,400$ ). The alignment optimization method was employed to estimate subpopulation means of the PIAAC-based, 4-item latent MtL construct, which has been psychometrically validated in prior research. The alignment optimization method is a computer algorithm that identifies comparable measurement models, estimates the latent means, and conducts statistical significance tests for all combinations of sub-groups. Results showed that subpopulations with younger age, greater educational attainment, and higher literacy

proficiency showed significantly greater MtL. At the same time, results from this study highlighted the complexity of the intersections across MtL determining factors. More detailed results and implications for policy and practice are evaluated.

### P8.3: Job tasks and cognitive skill accumulation.

**Author** Qinyi Liu (*University of International Business and Economics, China*)

**Presenter** Qinyi Liu (*University of International Business and Economics, China*)

**Abstract** Learning-by-doing is an important channel of skill acquisition. This study investigates how an individual's cognitive skills can be improved through various tasks at work. It uses rich information on job tasks performed at the individual level to construct three measures of job task complexity: overall job complexity, analytical task intensity, and interactive task intensity. Controlling for task selection, the results show that both overall job task complexity and analytical tasks can contribute to the development of a worker's cognitive skills, while interactive tasks play a less significant role. Furthermore, complex job tasks can offset the aging effect of cognitive functioning. The findings have implications for work design, cognitive interventions, and retirement policies.

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## Research Data Center PIAAC at GESIS

The **Research Data Center (RDC) PIAAC** makes research data accessible to the scientific community and offers advice to the users. The RDC PIAAC provides German and international datasets in the educational field focusing on the adult population, especially on the Programme for the International Assessment of Adult Competencies (PIAAC).

### Data

The RDC PIAAC offers data on PIAAC Germany (including extended samples), Longitudinal PIAAC Survey (2014, 2015, 2016), Non-cognitive PIAAC data (6 countries) and PIAAC or Log files (17 countries). For more information see <https://www.gesis.org/en/piaac/rdc/data>.

You can find an overview of existing PIAAC data worldwide here:

Maehler, D. B., & Konradt, I. (2020). Adult cognitive and non-cognitive skills: An overview of existing PIAAC data. In D. B. Maehler & B. Rammstedt (Eds.), Large-scale cognitive assessment: Analyzing PIAAC data (pp. 49-91). Cham: Springer International Publishing. doi: 10.1007/978-3-030-47515-4\_4

### Analyses

How to analyze PIAAC data? This information you will find here:

Maehler, D. B., & Rammstedt, B. (Eds.) (2020). Large-scale cognitive assessment: Analyzing PIAAC data. Cham: Springer International Publishing. doi: 10.1007/978-3-030-47515-4

Open Methodology: Contribute to and benefit from sustainability and replicability in PIAAC research! Publish your code (doi) or store your code to analyse PIAAC data by the RDC PIAAC. Please contact us for more information!

### Upcoming Workshops and Online Tutorials

- » Workshop: Analyzing PIAAC data with structural equation modeling in Mplus
- » Workshop: Analyzing PIAAC data using the R EdSurvey package
- » Online tutorial for the analysis of PIAAC data in Stata: A practical guide

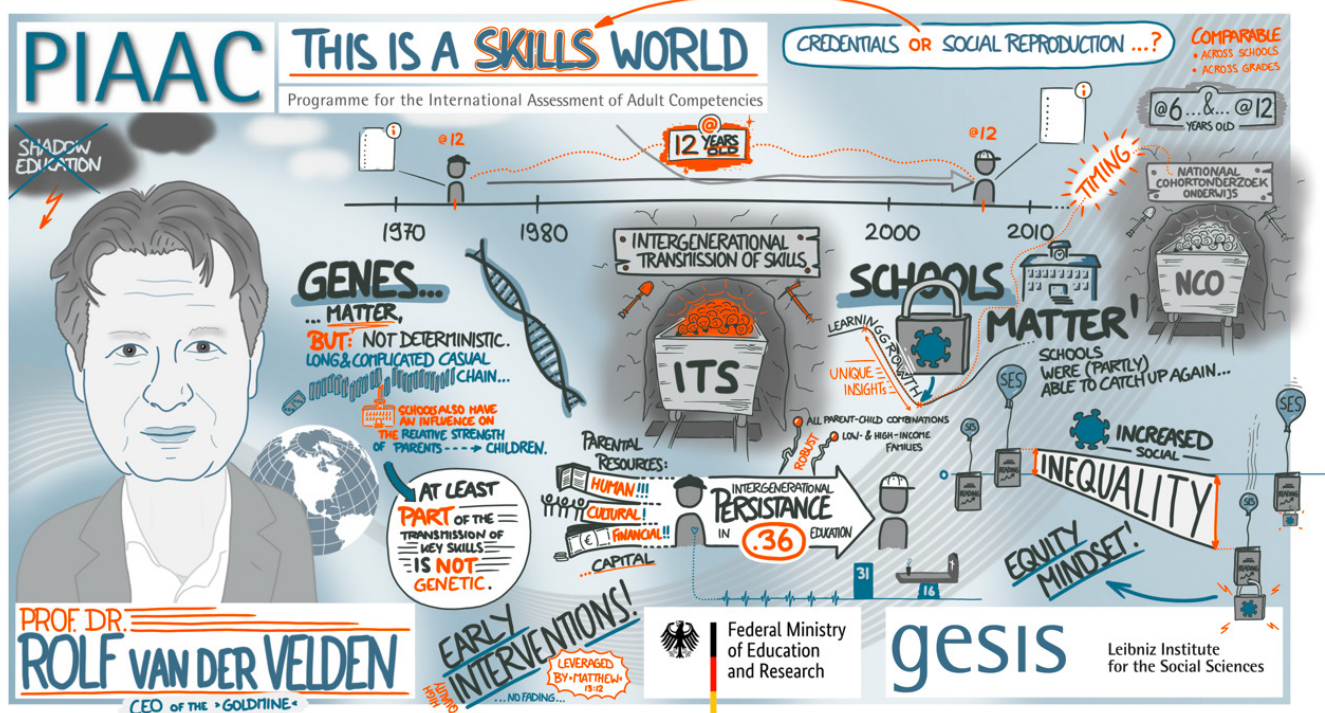
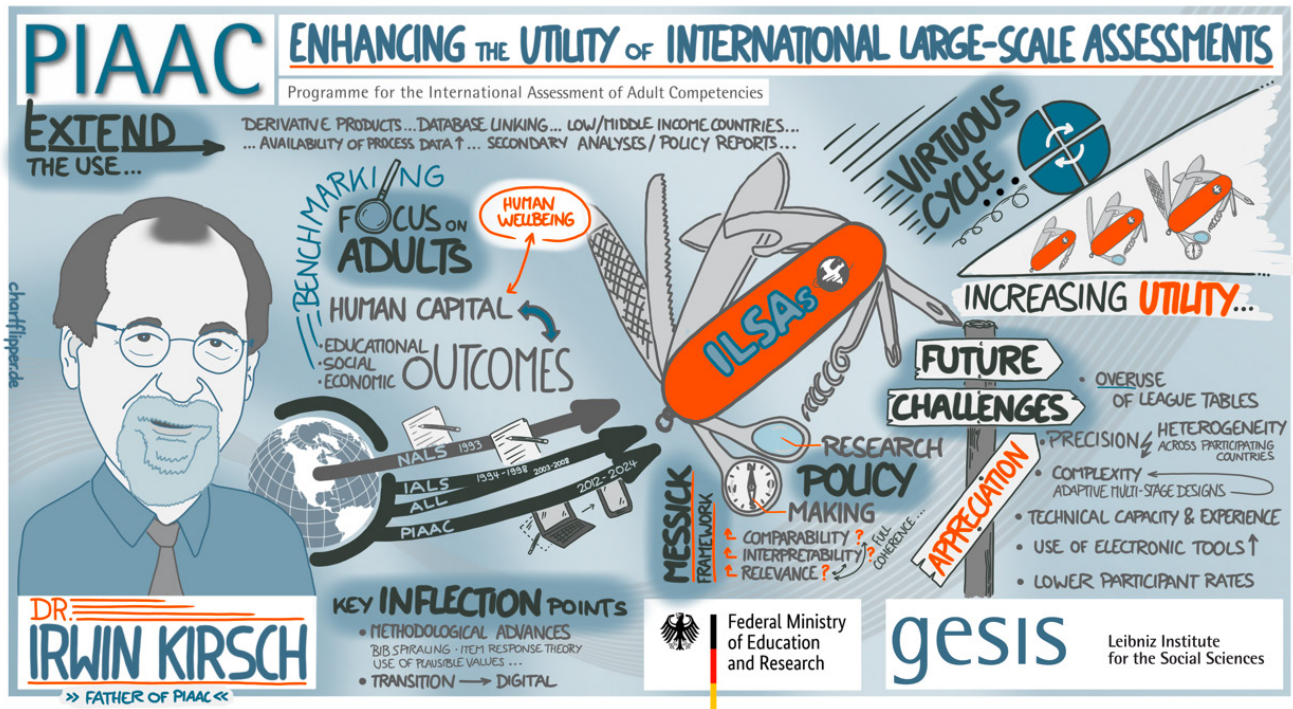
### Publications

Bibliography: Here you will find a summary of literature (2008–2021) based on PIAAC data <https://doi.org/10.21241/ssoar.77833>

OECD Reports: Here you get an overview of the international results on PIAAC <https://www.oecd.org/skills/piaac/publications/>

- » Contact: [fdz-piaac@gesis.org](mailto:fdz-piaac@gesis.org)

## Keynote Graphic Recording





## Contact

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