# IEA

*Researching education, improving learning*



# WORKSHOP PORTFOLIO

## RESEARCH AND ANALYSIS UNIT (RANDA)

## OUR ORGANIZATION

The International Association for the Evaluation of Educational Achievement (IEA) is an international cooperative of national research institutions, governmental research agencies, scholars, and analysts working to research, understand, and improve education worldwide. As an independent and objective international research organization, IEA holds a unique position in educational research. We initiate and conduct high-quality, large-scale comparative studies of education systems across the world to better understand the policies and practices that foster educational progress, measuring the skills students need to succeed in school and society. Our collaborative network of scholars, researchers, policy analysts, and technical experts from many independent research centers and government research institutions around the world allows us to use sophisticated and accurate research techniques, develop innovative assessment tools and methods, and share our knowledge to build capacity. IEA expertise embraces many aspects of international large-scale assessments (ILSAs) in education, including data management, organization, administration, sampling and data analysis.

## PROFESSIONAL DEVELOPMENT WORKSHOPS AT IEA

Large-scale assessments in education have become a well-established means of providing researchers and policymakers with high-quality data. They enable researchers to explore the strengths and weaknesses of education systems and to identify areas of concern and action. However, assessment relies on the rigorous implementation of standardized procedures for data collection, and complex methodologies requiring sound knowledge for correct data analysis and data interpretation practices.

This has encouraged IEA to provide professional development workshops and consultancy, as well as support researchers who are engaged in analyzing and interpreting the results of large-scale assessments. The workshops are conducted on a regular basis at international research conferences, often in collaboration with the IERI Institute (www.ierinstitute.org). IEA also provides workshops that are tailored to suit the specific needs and expectations of our clients if required.

## TARGET AUDIENCES

IEA workshops are designed to meet the needs of all interested in learning about the fundamentals of large-scale assessment. Participants will acquire and enhance understanding and expertise surrounding the implementation of large-scale assessment as well as gain practical experience in statistical data analysis and scientific writing. Our dedicated workshops offer you and your organization or research team opportunities to develop or extend your knowledge and skills in these areas. They are continually developed to cater to various audiences and cover a large variety of topics, responding quickly to the latest research possibilities. All our workshops are conducted by experienced IEA staff or renowned external experts.

## WORKSHOP STRUCTURE AND METHODS

Each workshop combines lectures and tutorials with opportunities for participants to apply and practice what they have learned. Experienced instructors are on hand to provide guidance and advice to participants, and encourage exchange and collaboration. Every participant that completes one of our workshops will receive a certificate.

## CONTACT US

For a list of upcoming events, and more detailed information on all aspects of our workshops, please use the following contact information:

- E-mail: randa@iea-hamburg.de
- Tel: +49 40 48500 658

You are invited to check our website www.iea.nl for the latest information about our workshops. We will be happy to discuss what we can offer, and help you with your training requirements.

# Overview of the Workshops

| THEMATIC AREA | COURSE TITLE | REQUIRED KNOWLEDGE | LANGUAGE OF INSTRUCTION | DURATION (DAYS) | COURSE LEVEL | COURSE NO. | PAGE |
|---|---|---|---|---|---|---|---|
| Statistical Methods | Introduction to Quantitative Analysis | Familiarity with mathematical notation and calculation | English, German | 4 | Basic | WS.1.1 | 5 |
| | Secondary Analysis with Large-scale Assessment Data | Basic statistics, Basic knowledge of SPSS | English, German, French, Spanish, Arabic | 4 | Basic | WS.1.2 | 6 |
| | Multilevel Modeling (MLM) with Large-scale Assessment Data | Inferential statistics, SPSS | English, German | 2 - 4 | Advanced | WS.2.1 | 7 |
| | Structural Equation Modeling (SEM) with Large-scale Assessment Data Using Mplus | Inferential statistics | English, German | 2 - 4 | Advanced | WS.2.2 | 8 |
| | Multilevel Structural Equation Modeling (MSEM) with Large-scale Assessment Data Using Mplus | Inferential statistics | English, German | 2 - 4 | Advanced | WS.2.3 | 9 |
| | Measurement Invariance Testing for Cross-Cultural Comparisons | Inferential statistics and latent trait analysis | English | 2 - 4 | Advanced | WS.2.4 | 10 |
| | Item Response Theory (IRT) for Proficiency Estimates | Inferential statistics | English, Spanish | 4 | Advanced | WS.2.5 | 11 |
| ILSA: Methods, Survey Design, and Implementation | Cross-National Comparative Surveys in Education: Models and Methods | Basic statistics | English, German | 4 | Basic | WS.3.1 | 12 |
| | Application and Interpretation of Complex Quantitative Methods in Large-scale Assessments | Basic statistics | English, German | 4 | Basic | WS.3.2 | 13 |
| | Assessment Literacy: Item Development and Test Design | None | English | 4 | Basic | WS.3.3 | 14 |
| | Complex Sampling in Large-scale Assessments in Education | Basic statistics | English, German | 3 - 5 | Intermediate | WS.3.4 | 15 |
| | Survey Operation Procedures Module I: Within-Institution Sampling and Test Administration | None | English, German | 2 | Basic | WS.3.5.1 | 16 |
| | Survey Operation Procedures Module II: Manual Data Entry, Online Data Capture, and Verification | None | English, German | 2 | Basic | WS.3.5.2 | 17 |
| Writing and Publishing | Writing Academic Papers Based on the Analysis of Data from Large-scale Assessment | Statistical analysis of LSA data, SPSS, IDB Analyzer* | English, German | 4 | Intermediate | WS.4.1 | 18 |
| | Writing Thematic Reports Based on the Analysis of Data from Large-scale Assessment | Statistical analysis of LSA data, SPSS, IDB Analyzer* | English, German | 4 | Intermediate | WS.4.2 | 19 |
| | Writing Policy Briefs Based on the Analysis of Data from Large-scale Assessment | Statistical analysis of LSA data, SPSS, IDB Analyzer* | English, German | 4 | Intermediate | WS.4.3 | 20 |

* For information about software tools, see page 21

## WS.1
# Statistical Methods (Basic)
## WS.1.1 Introduction to Quantitative Analysis

### OBJECTIVE

This workshop aims to provide the statistical knowledge and skills necessary to understand the basics of quantitative analysis, run simple analyses, and establish the foundations for participation in more advanced workshops.

### DESCRIPTION

The course begins with an introduction to basic statistics, reviewing the theory and use of statistical measures such as percentages, averages, and frequency, and statistical concepts like standard error, significance, and hypothesis testing. Analytical examples are conducted using example data and SPSS, software which is common for data analysis in educational, social, health sciences, and marketing research. The emphasis is on presenting and summarizing data as graphs or in tables, and on the correct and meaningful interpretation of descriptive and inferential statistics.

### TARGET AUDIENCE AND REQUIREMENTS

Participants should have an interest in the objectives and aims of empirical analysis and hypotheses testing. Basic knowledge of mathematical language and calculations is a prerequisite to understanding statistical concepts for data analysis. Some knowledge of descriptive statistical methods is helpful but is not necessarily required.

### SOFTWARE USED

SPSS

| Language of instruction | English, or German |
|---|---|
| Duration | 4 days |
| Course Level | Basic |
| Course Number | WS.1.1 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will:

- Understand the fundamental statistics used to analyze large data sets;
- Recognize the potential of statistical analysis and develop a critical understanding of the applications and limitations of quantitative methods; and
- Be capable of conducting, interpreting, and presenting basic analyses of large data sets.

# WS.1
# Statistical Methods (Basic)
## WS.1.2  Secondary Analysis with Large-scale Assessment Data

### OBJECTIVE

This workshop aims to provide an overview of the objectives and theoretical frameworks underlying IEA studies, including test and sample designs, their implications for analysis, and the most appropriate analytic methods. Specialized software introduced during the course will enable the development and implementation of self-designed analysis plans.

### DESCRIPTION

The workshop briefly reviews the materials and documentation of selected IEA studies, such as the Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS). These include international reports, encyclopedias, technical reports, user guides, and theoretical frameworks. The complexities of the sampling and survey design of IEA studies are discussed in detail. The core of this course is practical training in how to analyze data from IEA studies using the IEA IDB Analyzer software. It handles all issues related to the analysis of large-scale assessment data. This software is provided, together with other course materials.

### TARGET AUDIENCE AND REQUIREMENTS

The workshop addresses the needs of researchers who have an understanding of elementary statistical methods and want to conduct secondary analysis of large-scale assessment data. Basic familiarity with SPSS is expected.

### SOFTWARE USED

SPSS and IDB Analyzer (available to download from www.iea.nl)

| Language of instruction | English, German, French, Spanish, or Arabic |
|---|---|
| Duration | 4 days |
| Course Level | Basic |
| Course Number | WS.1.2 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Comprehend the conceptual and theoretical underpinnings of IEA studies;
- Understand the sampling design and data structure of IEA databases, and their implications for secondary analysis;
- Retrieve IEA databases, international reports, technical documentation, and questionnaires from the IEA website;
- Use the IEA IDB Analyzer for data preparation and statistical analysis;
- Develop an analysis plan, taking into consideration specific requirements of data; and
- Implement basic cross-national analyses of IEA data, and interpret and present the results.

## WS.2
# Statistical Methods (Advanced)
## WS.2.1 Multilevel Modeling (MLM) with Large-scale Assessment Data

### OBJECTIVE

Multilevel modeling (MLM) reflects the hierarchical structure of education systems and the clustered structure of the data. MLM usually provides more reliable and less biased results than traditional analysis methods for clustered data.

This workshop covers the basic theory of MLM and its application, focusing particularly on the features specific to large-scale assessement data. Participants will also gain basic practical experience of the application of two-level and three-level models to large-scale assessment data.

### DESCRIPTION

The workshop begins with a methodological introduction to MLM and its underlying assumptions. Further, practical training offers an opportunity to practice multilevel analysis with Mplus using IEA data. The course considers methodological concepts related to the complex study and sampling design of large-scale assessments, and provides advice on selecting the most appropriate approach to multilevel modeling for analyzing large-scale assessment data.

### TARGET AUDIENCE AND REQUIREMENTS

Workshop participants will require some prior knowledge of inferential statistics (such as regression, correlation, and variance analysis). Familiarity with SPSS or other statistical software, and their application to large-scale data, is expected. Knowledge of Mplus and familiarity with syntax based analysis is an advantage.

### SOFTWARE USED

SPSS and Mplus (HLM Program)

| Language of instruction | English, or German |
|---|---|
| Duration | 2 to 4* days |
| Course Level | Advanced |
| Course Number | WS.2.1 |

*Additional options:

SPSS data preparation training, providing an opportunity to learn more about preparing data for analysis with Mplus.

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Understand the theoretical principals and assumptions associated with MLM;
- Understand the methodological implications related to the complex study design of large-scale assessments;
- Specify appropriate MLM models, considering the complex design of IEA studies;
- Conduct two-level and three-level model analyses using the Mplus software; and
- Interpret and present results of MLM analyses, with a focus on educational research and policy.

# WS.2
# Statistical Methods (Advanced)
## WS.2.2 Structural Equation Modeling (SEM) with Large-scale Assessment Data Using Mplus

## OBJECTIVE

Education research aims to provide evidence on psychological and environmental conditions that are related to learning processes. This approach creates challenges related to proper measurement and analysis of concepts that are not directly observable (such as student motivation, or learning environment). In structural equation modeling (SEM), the observable indicators are combined into one factor to reflect the latent (not directly observable) psychological or sociological phenomena. SEM usually provides more precise parameter estimators than analysis with manifest (observable) indicators. In addition, it allows for analysis of the relationships between two or more latent constructs.

This workshop is designed to introduce participants to SEM theory and its applications, focusing on the features particular to large-scale assessment data in general, with an emphasis on IEA studies. Participants will gain practical experience in applying SEM with Mplus to large-scale assessment data.

## DESCRIPTION

The workshop begins with a methodological introduction to SEM and its underlying assumptions. Applications of Mplus (including model specification, estimation, and interpretation) are discussed, using IEA data as examples. The course considers methodological concepts related to the complex study and sampling design of large-scale assessments, and provides advice on selecting the most appropriate approach to latent modeling for analyzing large-scale assessment data.

## TARGET AUDIENCE AND REQUIREMENTS

Workshop participants will require sound knowledge of basic statistics to understand the theory and conduct structural equation modeling. Specifically, the workshop builds on prior knowledge of inferential statistics (such as regression, correlation and factor analysis). Familiarity with SPSS or other statistical software, as well as with large-scale data, is expected. Knowledge of Mplus and familiarity with syntax-based analysis is an advantage.

## SOFTWARE USED

Mplus

| Language of instruction | English, or German |
|---|---|
| Duration | 2 to 4* days |
| Course Level | Advanced |
| Course Number | WS.2.2 |

* Additional options:

Option 1: SPSS data preparation training, providing an opportunity to learn more about preparing data for analysis with Mplus

Option 2: Applying SEM to large-scale assessment data (for example, testing measurement invariance).

## EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Understand the theoretical principles and assumptions associated with SEM;
- Understand methodological implications related to the complex study design of large-scale assessments;
- Specify SEM models using Mplus;
- Perform SEM, considering the complex design of IEA studies; and
- Interpret and present results of SEM analyses, with an emphasis on educational research and policy.

## WS.2
# Statistical Methods (Advanced)
## WS.2.3  Multilevel Structural Equation Modeling (MSEM) with Large-scale Assessment Data Using Mplus

### OBJECTIVE

In structural equation modeling (SEM), the observable (manifest) indicators can be combined into one factor to reflect the latent (not directly observable) psychological or sociological phenomena associated with education processes. SEM can be used to analyze the relationships between latent constructs, and usually provides less biased parameter estimators than analysis with manifest (observable) indicators. Multilevel modeling (MLM) reflects the hierarchical structure of education systems and the clustered structure of the data. Combining MLM with the latent modeling approach is assumed to provide less biased results than the manifest MLM approach, particularly with respect to cross-level interaction effects. Random effects can be used as predictors, as well as dependent variables.

This workshop provides an introduction to the theory and application of multilevel structural equation modeling (MSEM), focusing on features particular to large-scale assessment data in general, with an emphasis on IEA studies. Participants will gain practical experience in applying SEM using Mplus to large-scale assessment data.

### DESCRIPTION

The workshop begins with a methodological introduction to MSEM and its underlying assumptions. The second part uses IEA data to provide practical examples of model specification and estimation using Mplus, and considers how such models may be interpreted. The course considers methodological concepts related to the complex study and sampling design of large-scale assessments, and provides advice on selecting the most appropriate approach to latent multilevel modeling for analyzing large-scale assessment data.

### TARGET AUDIENCE AND REQUIREMENTS

MSEM is based on multilevel and structural equation modeling, thus basic understanding of both approaches is necessary. Participants are advised to take courses WS.2.1 and WS.2.2 before enrolling in this workshop. The workshop begins with a brief recap of these two methods. Sound knowledge of inferential statistics (such as regression, factor, and variance analysis methods) is required. Participants should be familiar with using SPSS or other statistical software to analyze large-scale data. Knowledge of Mplus and familiarity with syntax based analysis is an advantage.

### SOFTWARE USED

Mplus

| Language of instruction | English, or German |
|---|---|
| Duration | 2 to 4* days |
| Course Level | Advanced |
| Course Number | WS.2.3 |

*Additional options:

Option 1: SPSS data preparation training, providing an opportunity to learn more about preparing data for analysis with Mplus

Option 2: Basic introduction to SEM

Option 3: Introduction to MLM

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Understand the theoretical principles and assumptions associated with MSEM;
- Specify MSEM models using Mplus;
- Perform MSEM, considering the complex design of IEA studies;and
- Interpret and present results of MSEM analyses, with an emphasis on educational research and policy.

# WS.2
# Statistical Methods (Advanced)
## WS.2.4  Measurement Invariance Testing for Cross-Cultural Comparisons

## OBJECTIVE

Latent (not directly observable) constructs used to analyze psychological and sociological phenomena are subject to group specific differences, a property that is highly relevant in cross-country comparison. To ensure that any international comparison is valid, the measurement invariance of a scale used to create a comparative index needs to be established using correlation or regression analysis. Measurement invariance testing enables the researcher to empirically validate the claim that the latent constructs are comparable across the analyzed countries.

The workshop aims to equip participants with a fundamental understanding of the applications of measurement invariance testing in cross-cultural research. The course covers procedures within the latent traits framework for more than two groups, and comprehensively reviews both continuous and categorical approaches using multiple-group confirmatory factor analysis (MG-CFA).

## DESCRIPTION

This workshop provides an overview of measurement invariance levels (configural, metric, scalar, and/or strict), introducing model identification procedures for cases where many groups are compared at different levels of measurement invariance. For model comparisons, the Satorra-Bentler (SB) and significance difference tests (DIFFTEST), and their implementation using Mplus, will be discussed and illustrated. The workshop provides practical training in applying measurement invariance testing to large-scale assessment data.

## TARGET AUDIENCE AND REQUIREMENTS

This workshop is well suited for participants who want to develop their knowledge of measurement invariance. Sound understanding of inferential statistics and latent trait analysis (namely factor analysis, or structural equation modeling) is required. Prior knowledge of the software is an asset, but not necessarily required.

## SOFTWARE USED

Mplus and R

| Language of instruction | English |
|---|---|
| Duration | 2 to 4* days |
| Course Level | Advanced |
| Course Number | WS.2.4 |

\* Additional options:

Option 1: SPSS data preparation training providing the opportunity to learn in detail the required data preparation for analysis with Mplus

Option 2: Introduction to SEM

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### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Understand the fundamental need to measure invariance;
- Test measurement invariance by applying Mplus (and Mplus Automation) to large-scale assessment data sets;
- Read and interpret the results of measurement invariance analyses using Mplus; and
- Report the results of measurement invariance testing in a publishable format.

## WS.2
# Statistical Methods (Advanced)
## WS.2.5 Item Response Theory (IRT) for Proficiency Estimates

### OBJECTIVE

The workshop aims to provide a theoretical overview of the different item response theory models used to calibrate multiple-choice and constructed response items. Participants will learn about the methodology used to produce proficiency estimates within the latent traits framework and gain practical experience in estimation procedures using common IRT software (such as the PARSCALE and DESI packages).

### DESCRIPTION

This workshop introduces different item response theory models, covering (1) 1-, 2-, and 3-parameter logistics models for multiple-choice items and (2) graded response and partial credit models for constructed response items.

During this workshop, participants will learn about estimating item and person parameters using different item response theory models. The course covers principles of population modeling and proficiency estimation, and the procedures and techniques for carrying out population modeling, multiple imputations for generating plausible values, and their applications for large-scale assessment. Participants will learn how PARSCALE and DESI software can be used to estimate parameters, and receive practical training in estimating item and person parameters, and computing plausible values.

### TARGET AUDIENCE AND REQUIREMENTS

This workshop is designed for participants with a sound understanding of inferential statistics and latent trait analysis (factor analysis, or structural equation modeling). Prior knowledge of the software is an asset, but not necessarily required.

### SOFTWARE USED

PARSCALE and DESI (the DESI program is available by email request: contact desi@ets.org)

| Language of instruction | English, or Spanish |
|---|---|
| Duration | 4 days |
| Course Level | Advanced |
| Course Number | WS.2.5 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Understand the fundamentals of IRT;
- Differentiate IRT models and their uses;
- Estimate proficiency scores using different IRT models with PARSCALE;
- Understand how PARSCALE generates item and person parameter estimations;
- Estimate plausible value using DESI; and
- Interpret the results generated by PARSCALE and DESI.

## WS.3
# ILSA: Methods, Survey Design, and Implementation
## WS.3.1 Cross-National Comparative Surveys in Education:  Models and Methods

### OBJECTIVE

This workshop aims to provide an overview of major contemporary comparative international studies in education. Participants will develop knowledge of the specific characteristics and challenges of these studies, enabling them to understand, classify, and evaluate related publications.

### DESCRIPTION

After providing an overview of contemporary large-scale assessments and all involved stakeholders, various study designs will be presented and their challenges discussed. Topics include cross-sectional versus longitudinal designs, standardization of tests and procedures, test designs (rotated matrix designs, scaling, and how to derive test scores), questionnaire development, invariance, and sampling designs. The workshop also examines relevant analysis methods, the interpretation of analysis results, and how these are reported. Participants will learn about the possibilities and limitations of international comparative research, and become familiar with the strengths and weaknesses dominating the discourse on large-scale assessment in education. While lectures dominate this workshop, participants will also be able to work on specific topics, on their own or in small groups.

### TARGET AUDIENCE AND REQUIREMENTS

Participants should have an understanding of the objectives and aims of quantitative empirical studies. Working knowledge of basic statistical methods is helpful.

### SOFTWARE USED

None

| Language of instruction | English, or German |
|---|---|
| Duration | 4 days |
| Course Level | Basic |
| Course Number | WS.3.1 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will:

- Acquire comprehensive knowledge of contemporary large-scale assessments in education, encompassing their design, methods, procedures, challenges, and limitations;
- Be able to interpret and critically reflect on research publications concerned with large-scale assessment in education; and
- Understand the statistical methods used to analyze the data from education surveys.

## WS.3
# ILSA: Methods, Survey Design, and Implementation
## WS.3.2 Applications and Interpretation of Complex Quantitative Methods in Large-scale Assessments

### OBJECTIVE

Methodological knowledge is essential to understand and critically discuss or evaluate research that relies on a broad repertoire of quantitative methods. This workshop aims to provide an elementary understanding of the statistical methods used in educational research.

### DESCRIPTION

The workshop focuses on the methodological and thematic approaches underpinning quantitative empirical research, reflecting on their value and limitations. While the course emphasizes the preconditions, scope of application, and interpretation of statistical analysis outcomes, participants will also be familiarized with the mathematical foundations of specific statistical analysis methods, using practical examples. A major part of the workshop is dedicated to the active examination of contemporary contributions to quantitative educational research, with a primary focus on international large-scale assessments in education, such as the Trends in International Mathematics and Science Study (TIMSS), Progress in International Reading Literacy Study (PIRLS), and Programme for International Student Assessment (PISA). Participants will acquire detailed knowledge of such studies, and learn more about the opportunities and limitations of national and international comparative research.

To practically reinforce this knowledge, participants will work individually or in small groups to prepare poster or PowerPoint presentations on self-selected relevant topics, which they will present to the group.

### TARGET AUDIENCE AND REQUIREMENTS

This workshop is designed for participants who have a working knowledge of basic statistical concepts.

### SOFTWARE USED

Office

| Language of instruction | English, or German |
|---|---|
| Duration | 4 days |
| Course Level | Basic |
| Course Number | WS.3.2 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will:

- Be able to interpret and critically discuss publications in the area of quantitative educational research;
- Understand the specifics of the complex sample surveys that are usually applied in large-scale assessment;
- Understand the statistical methods used to analyze data from education surveys; and
- Develop an appreciation of the potential of quantitative analysis of large-scale assessment data, and a critical understanding of the application and limitations of relevant methods.

## WS.3
# ILSA: Methods, Survey Design, and Implementation
## WS.3.3 Assessment Literacy: Item Development and Test Design

### OBJECTIVE

This workshop aims to increase participants' assessment literacy by providing a general working knowledge of assessment design and the skills necessary to work with teams who are interpreting frameworks and blueprints, producing items, and analyzing test statistics.

### DESCRIPTION

The course begins with an introduction to modern assessment theory and definitions of some assessment terminology. The course encourages consideration of: students' location on a developmental continuum; the difference between item difficulty and cognition; maximizing validity and reliability; quality improvement of test items; and common item design errors. The course concludes with a consideration of basic test level statistics using Classical Test Theory. The emphasis is on techniques for commissioning assessments that test higher order thinking skills and developing a deeper knowledge of the language of assessment specialists. The course incorporates many practical sessions that give participants an opportunity to try out techniques learned in presentation sessions.

### TARGET AUDIENCE AND REQUIREMENTS

Participants should be currently (or planning to become) involved in the design and development of test items and assessments, and will likely have responsibility for leading teams or projects producing tests and analyzing the results. Previous experience in assessment development would be an advantage, but the course is designed for those moving from a single discipline area into a more generic, higher responsibility role.

### SOFTWARE USED

Spreadsheets and basic calculation tools

| Language of instruction | English |
|---|---|
| Duration | 4 days |
| Course Level | Basic |
| Course Number | WS.3.3 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will:

- Understand the essentials of leading the design and development of high-quality assessments;
- Be better prepared to review assessments and test level data with teams of technical experts; and
- Be confident in driving for more effective assessment design and recognizing when this has been delivered.

## WS.3
# ILSA: Methods, Survey Design, and Implementation
## WS.3.4 Complex Sampling in Large-scale Assessments in Education

### OBJECTIVE

This workshop is designed to familiarize participants with all aspects of the sampling methodology applied in large-scale educational surveys.

### DESCRIPTION

Participants will learn about cluster sampling, computing sampling weights, stratification, bias, and precision, including the implications for analysis and interpretation.

The workshop combines lectures and practical training, allowing participants to apply what they have learned about the development of sampling designs and statistical significance testing. The workshop begins with a review of sampling theory and its underlying concepts, including different sampling methods, stratification, and clustering. Practical examples are used to demonstrate the technical selection process. Participants will become familiar with how to compute sampling weights and the need for their use. The course will also address specific methods of variance estimation, providing an introduction to jackknife and balanced repeated replication techniques. The last part of the workshop is dedicated to statistical significance testing. Participants can opt to take an additional module on experimental sampling.

### TARGET AUDIENCE AND REQUIREMENTS

The workshop is designed for researchers interested in statistical sampling and the secondary analysis of large-scale assessment data. Researchers involved in implementing sample surveys will also benefit. Participants are expected to have a basic working knowledge of statistics.

### SOFTWARE USED

Excel

| Language of instruction | English, or German |
|---|---|
| Duration | 3 to 5 days |
| Course Level | Basic |
| Course Number | WS.3.4 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Understand the basic concepts and the logic of statistical sampling;
- Understand the critical determinants when designing a cross-national comparative survey;
- Understand the implications for analysis and interpretation;
- Develop an optimal sampling design addressing specific objectives and conditions;
- Estimate population parameters and their standard errors while accounting for the complex design features;  and
- Carry out cross-national and cross-comparative analysis of IEA data.

## WS.3
# ILSA: Methods, Survey Design, and Implementation
## WS.3.5 Survey Operation Procedures

This workshop is designed to support the professional development of people working on large-scale education surveys. By providing practical guidance, the course considers factors affecting survey results, and the potential value and limitations of the data collected. The workshop examines the procedures that ensure the collection of high-quality data, embracing all operational steps needed during the data collection process and for optimum data management.

The course comprises two independent modules covering the main aspects of survey operations: Within-Institution Sampling and Test Administration (Module I) and Manual Data Entry, Online Data Capture, and Verification (Module II). The content of the workshop can be customized to reflect the participants' interests, survey content and other related requirements, in close cooperation with the survey stakeholders.

### WS.3.5.1  Survey Operation Procedures Module I: Within-Institution Sampling and Test Administration

#### DESCRIPTION

This module focuses on the procedures and instruments needed to handle sampling within institutions (for example, students or classes within schools) and test administration, both tailored to the specific survey requirements.  As information may be collected at different stages of a survey, a common challenge of any study is to link different data sources, such as the information identifying an individual (e.g., gender and birth date) with the completed instruments. This module outlines potential solutions for mapping and linking all sources of information. The module begins by describing the sample design, and examines methods of sampling selection, usually within primary sampling units (namely within institutions, schools, or households). Participants will become familiar with:

- Solutions for compiling sampling frames (such as lists of eligible participants within the institution or household, including sampling-relevant information);
- Development of tracking forms for sampled units or individuals;
- Creation of hierarchical ID systems in order to map/relate the participants at different levels (for example, principals, teachers, classes, students, parents, or members of a household); and
- Assignment of IDs and survey instruments to the participants.

The second part of the module describes how to organize the test administration. It addresses:

- Communication strategies for making contact with institutions or individuals to obtain permission for test administration, how to inform them about the implications of the survey, and how to keep material confidential;
- Arrangement of test sessions in institutions or households and timing of test sessions;
- Responsibilities of test administrators, and how to train them;

- Documentation of test administration information (such as absences, exclusion and return status of survey instruments, timing of sessions, and required administration records).

> #### EXPECTED OUTCOMES FOR PARTICIPANTS
> After the workshop, participants will be able to:
> - Handle software designed for within-institution sampling;
> - Conduct test administration (or teach their staff to conduct these tasks).

#### TARGET AUDIENCE AND REQUIREMENTS

The course is for professionals that are responsible for operational procedures and data management of educational surveys. Participants should be familiar with the framework, general design, and goals of the survey considered.

#### SOFTWARE USED

IEA has developed the software WinW3S as a management tool covering all operational stages presented in this module. If the survey uses WinW3S, all training will be supported by this software. If procedures do not use WinW3S, the course will provide templates for communication, training plans, and forms for documentation and monitoring. The module includes practical experience in using MS Excel®, MS Word® and IEA WinW3S. All software documentation is provided as part of the course.

| Language of instruction | English, or German |
|---|---|
| Duration | 2 days |
| Course Level | Basic |
| Course Number | WS.3.5.1 |

## WS.3
# ILSA: Methods, Survey Design, and Implementation
## WS.3.5.2 Survey Operation Procedures Module II: Manual Data Entry, Online Data Capture, and Verification

### DESCRIPTION

This module describes the challenges and solutions related to both the large-scale capture of responses from paper survey instruments and computer-based assessment. The course describes necessary procedures and caveats, and suggests ways to optimize data quality. The first part of this module is concerned with manual data entry. It describes:

- How to organize the data entry of related survey instruments using a hierarchical ID system;
- The use of identification variables (for respondents, data entry staff, and scorers);
- The coding of different types of missing data;
- The capture of scored open-ended questions/constructed response items;
- The coding of open-ended questions (such as occupational information); and
- How to organize data entry working within a team.

The second part of this module presents how instruments can be administered online. It describes:

- The advantages of computer-based assessment;
- Potential implications and requirements of computer-based assessment; and
- How to administer computer-based assessment.

The third part of this module focuses on data verification. It presents ways to detect:

- Wrongly captured values (for example validation checks during data entry, and double data entry);
- Duplicate IDs or mismatched IDs in respect of linkage between different survey instruments following a hierarchical ID system (see also Module I); and
- Mismatches between test administration information from all sampled participants, and the availability of data (see also Module i).

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Enter data (or instruct their staff how to enter data);
- Use software for manual data entry and online data collection; and
- Manage and verify the captured data.

### TARGET AUDIENCE AND REQUIREMENTS

The course is for professionals that are responsible for operational procedures and data management of educational surveys. Participants should be familiar with the framework, general design, and goals of the survey considered.

### SOFTWARE USED

IEA DME is a software tool enabling manual data capture in a relational database, using international and national codebooks. It facilitates extensive verification and easy user management. IEA OSS meets all demands for online data capture. The training modules are fully supported by the appropriate software, and all software documentation is provided as part of the course. The module includes practical experience in using MS Excel®, MS Word®, IEA DME, and IEA OSS. All software documentation is provided as part of the course.

| Language of instruction | English, or German |
|---|---|
| Duration | 2 days |
| Course Level | Basic |
| Course Number | WS.3.5.2 |

## WS.4
# Writing and Publishing
## WS.4.1 Writing Academic Papers Based on the Analysis of Data from Large-scale Assessments

### OBJECTIVE

Publishing work in accredited journals is a daunting task for many researchers. Using data from IEA studies, this workshop provides guidance on how to present research data from large-scale assessments, teaching the skills required to effectively prepare high-quality academic publications.

### DESCRIPTION

The workshop begins with an overview of all steps involved in writing an academic paper: starting from conceptualizing a research project, through preparing well-crafted manuscripts, to the submission, review, and resubmission process. The second part of the workshop reviews in detail the main steps involved in writing an academic paper: including defining the topic, drafting a research question, conducting a literature review, constructing an argument, developing an analysis plan, interpreting and reporting results, and writing the introduction and conclusions. Participants are encouraged to choose the topic for the research paper based on their personal interests and expertise. The workshop provides practical advice and training, and participants can select to work on their own or in small groups.

This workshop provides a practical guide for researchers interested in preparing research publications. For optimal efficiency and benefit, participants are asked to provide information on their chosen research topics prior to the workshop, so content can be aligned to their research interests. Experienced instructors will provide detailed advice and feedback, enabling participants to amend their proposals during the workshop. After the workshop, participants can submit draft versions of their academic papers for advice for final review and tips.

### TARGET AUDIENCE AND REQUIREMENTS

This workshop is for researchers interested in writing academic papers based on the analysis of data from IEA studies. Participants should be familiar with basic statistical analysis of large-scale assessment data, and any software used.

### SOFTWARE USED

SPSS and IDB Analyzer (available to download www.iea.nl)

| Language of instruction | English, or German |
|---|---|
| Duration | 4 days |
| Course Level | Intermediate |
| Course Number | WS.4.1 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Understand the steps involved in publishing in peer-reviewed academic journals;
- Develop the structure of their academic papers;
- Establish and carry out an analysis plan;
- Describe and interpret the results of their analyses to answer the research questions; and
- Develop a written argument and draft an academic paper.

## WS.4
# Writing and Publishing
## WS.4.2 Writing Thematic Reports Based on the Analysis of Data from Large-scale Assessments

### OBJECTIVE

This workshop provides participants with the analytical and conceptual tools necessary for writing effective thematic reports based on the data from IEA studies. The course examines the challenges surrounding translating empirical data into concise scientific texts.

### DESCRIPTION

The workshop reviews the steps involved in producing a thematic report. These include identifying the target audience, determining the outline structure and chapter contents for the report, formulating meaningful objectives for each chapter, establishing adequate analysis plans, and undertaking and interpreting the relevant analyses. Supported by the workshop instructors, participants will work in small groups to (1) formulate research questions, (2) determine the optimum statistical analysis methods needed to address the research questions, (3) run preliminary analyses, and (4) interpret the results. Group presentations will encourage constructive discussion.

This workshop provides practical guidance on preparing a good thematic report. For optimal efficiency and benefit, participants are asked to provide information on their chosen research topics prior to the workshop, so content can be aligned to their research interests. Experienced instructors will provide detailed advice and feedback, enabling participants to amend their proposals during the workshop. After the workshop, participants can submit draft versions of their academic papers for advice, review, and feedback.

### TARGET AUDIENCE AND REQUIREMENTS

This workshop is for researchers interested in the in-depth secondary analysis of IEA data. Participants should be familiar with basic statistical analysis of large-scale assessment data, and any software used.

### SOFTWARE USED

SPSS and IDB Analyzer (available to download www.iea.nl)

| Language of instruction | English, or German |
|---|---|
| Duration | 4 days |
| Course Level | Intermediate |
| Course Number | WS.4.2 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Formulate relevant research questions that can be answered using data from IEA studies;
- Develop and undertake an analysis plan;
- Describe and interpret the results of their analyses, according to the objectives set for each chapter/section of the report; and
- Design and implement a plan for writing a thematic report.

## WS.4
# Writing and Publishing
## WS.4.3 Writing Policy Briefs Based on the Analysis of Data from Large-scale Assessments

### OBJECTIVE

This workshop provides participants with the analytical and conceptual tools for writing effective policy briefs based on the analysis of data from IEA studies.

### DESCRIPTION

The workshop begins with reviewing the main steps for producing a policy brief: identifying the target audience, discussing policy-relevant topics, formulating meaningful research questions, setting adequate analysis plans, and running and interpreting the corresponding analyses. It then focuses on the identification and implementation of an adequate communication strategy for delivering a policy message to the target audience. The topics for these policy briefs will be chosen by the participants, reflecting their own educational research interests. The workshop concludes with practical training for participants in producing a policy brief, independently or as a group project.

This workshop provides a practical guide to preparing a good policy brief. For optimal efficiency and benefit, participants are asked to provide information on their chosen research topics prior to the workshop, so content can be aligned to their research interests. Experienced instructors will provide detailed advice and feedback, enabling participants to amend their proposals during the workshop. After the workshop, participants can submit draft versions of their policy briefs for review and feedback.

### TARGET AUDIENCE AND REQUIREMENTS

This workshop is for researchers interested in using analysis of IEA data to inform policymakers. Participants should be familiar with basic statistical analysis of large-scale assessment data and any software used.

### SOFTWARE USED

SPSS and IDB Analyzer (available to download www.iea.nl)

| Language of instruction | English, or German |
|---|---|
| Duration | 4 days |
| Course Level | Intermediate |
| Course Number | WS.4.3 |

### EXPECTED OUTCOMES FOR PARTICIPANTS

After the workshop, participants will be able to:

- Identify and use adequate communication strategies for their  policy briefs, including target audience identification, choice of  language, graphical methods, information selection, and how to convey the policy implications of the results of the analysis;
- Formulate relevant policy questions that can be answered using data from IEA studies;
- Establish and undertake a relevant analysis plan;
- Interpret the results of their analyses in order to answer their specific research questions; and
- Develop and implement a plan for writing a policy brief.

# Glossary of Software Terms Used in the Document

| | |
|---|---|
| **DESI** | Direct Estimation Software Interactive, a software tool developed by Educational Testing Service for analyzing data from large-scale assessments, available by email request from desi@ets.org |
| **DME** | Data Management Expert, an application enabling manual data capture in a relational database, using international and national codebooks; it was developed by the IEA (www.iea.nl), is not publicly available, and will be distributed during the respective workshop |
| **HLM PROGRAM** | Hierarchical Linear and Nonlinear Modeling program, suitable for use with data from any research field that have a hierarchical structure, available from Scientific Software International at www.ssicentral.com |
| **IDB ANALYZER** | International Database Analyzer, a free software tool developed by the IEA for combining and analyzing data from IEA studies as well as data from most other large-scale assessments or surveys, available from www.iea.nl |
| **MPLUS** | A statistical modeling program with a wide choice of models, estimators, and algorithms, available from Muthén & Muthén at www.statmodel.com |
| **OSS** | Online Survey System, a program for gathering online data; it was developed by the IEA (www.iea.nl), is not publicly available, and will be distributed during the respective workshop |
| **PARSCALE** | A software tool designed specifically for polytomous IRT analysis, available from Scientific Software International at www.ssicentral.com |
| **R** | A free and open-source software language and environment for statistical computing and graphics available at www.r-project.org |
| **SPSS** | Statistical Package for the Social Sciences, a general statistical analysis program presently distributed by IBM under the name of "IBM SPSS Statistics" available at www.ibm.com/products/spss-statistics |
| **WINW3S** | Windows Within-School Sampling Software, a sampling software developed by the IEA (www.iea.nl); it is not publicly available and will be distributed during the respective workshop |

# Our Experts
## Some of the experts who conduct our workshops:

**AGNES STANCEL-PIĄTAK**
**DEPUTY HEAD OF RESEARCH, ANALYSIS AND SAMPLING UNIT, IEA HAMBURG**

For the past 10 years, Dr Stancel-Piątak has been applying MLM, SEM, and other complex methods to large-scale assessment data to analyze social inequities and effectiveness of education systems. She delivers multiple workshops on applied complex methods to international audiences on an annual basis.

**ANDRÉS SANDOVAL-HERNÁNDEZ**
**LECTURER IN EDUCATIONAL RESEARCH, UNIVERSITY OF BATH**

Andrés Sandoval-Hernández, PhD, has more than 15 years of experience working with international large-scale assessments, particularly in the areas of analysis and dissemination. His research work is on comparative analyses of educational systems using large-scale assessment data with a focus on educational inequalities.

**ANGELA HINSON QUICK**
**DIRECTOR, CENTER FOR EDUCATION SERVICES, RTI**

Angela H. Quick, PhD, frequently serves as a strategist for school and district transformation. She designs and conducts educator training, aligns programs with desired outcomes, and uses data to support outcomes for increasing educator efficacy.

**DAVID RUTKOWSKI**
**ASSOCIATE PROFESSOR, INDIANA UNIVERSITY AND PROFESSOR II, UNIVERSITY OF OSLO**

In his research, David Rutkowski, PhD, focuses on education policy, international large-scale assessment, and the valid comparison of heterogeneous populations. He has authored numerous papers and manuscripts on educational assessment and is currently editing the *IEA Compass: Briefs in Education* series.

**EUGENIO GONZALEZ**
**PRINCIPAL RESEARCH MANAGER, ETS, IERI DIRECTOR**

Eugenio Gonzalez, PhD, has experience in designing large-scale assessments and is familiar with all aspects of data analysis. Throughout his career, he has conducted multiple training seminars with the objective of providing information on the underlying statistical methodology and use of large-scale assessments. He holds a technical lead position and is a computer programmer responsible for building several data analysis tools. He is co-editor in chief of *Large-scale Assessments in Education*.

**FALK BRESE**
**SENIOR RESEARCH ANALYST, RESEARCH AND ANALYSIS UNIT, IEA HAMBURG**

Mr Brese frequently conducts workshops focused on analyzing international large-scale assessment data. He coordinates and runs complimentary analyses for IEA study releases and provides support to researchers related to analyzing and utilizing international large-scale assessment data.

**KATHERINE MCKNIGHT**
**SENIOR RESEARCH SCIENTIST, EDUCATION AND WORKFORCE DEVELOPMENT DIVISION, RTI**

Katherine McKnight, PhD, conducts research, program evaluation and workshops that support educators in improving teaching and learning within the United States and internationally. Areas of expertise include quantitative methods, research design, measurement, and educator effectiveness.

**LESLIE RUTKOWSKI**
**ASSOCIATE PROFESSOR, INDIANA UNIVERSITY**

Leslie Rutkowski, PhD, has expertise in latent variable modeling and cross-cultural measurement. Her research in the field of international assessment methods spans a decade and includes one book and many scientific papers. She teaches quantitative methods courses and workshops around the world to practicing researchers and PhD students, and is the editor of the *IEA Research for Education Series* published by Springer.

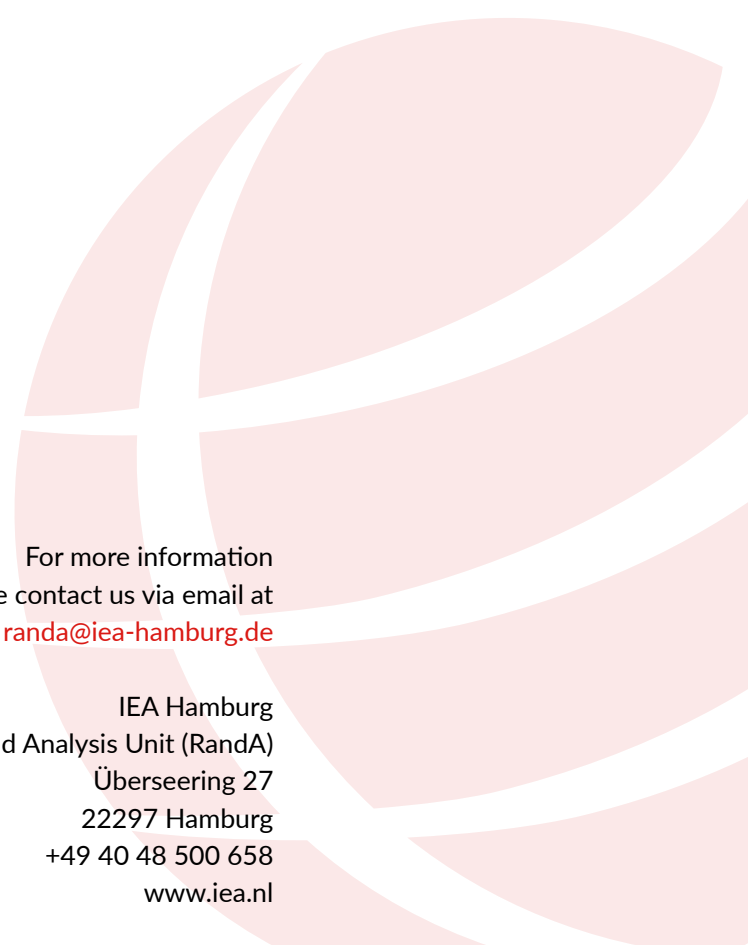**NADINE TWELE**
**ASSOCIATE RESEARCH ANALYST, IEA HAMBURG**

Ms Twele has ample experience in the analysis of large-scale survey data and has delivered workshops on basic and advanced statistical methods such as multilevel modeling for different audiences worldwide. She is also interested in applying mixed methods approaches.

**OLIVER NEUSCHMIDT**
**CO-HEAD OF INTERNATIONAL STUDIES UNIT, IEA HAMBURG**

Dr Neuschmidt has extensive experience in processing and analyzing large-scale assessment data. He supervises data processing activities for a number of international assessments and conducts consulting and training activities related to survey implementation and evaluation.

**SABINE MEINCK**
**HEAD OF RESEARCH, ANALYSIS & SAMPLING UNIT, IEA HAMBURG**

For the last decade, Dr Meinck has been involved in aspects regarding sampling and statistical data analysis for nearly all contemporary international large-scale assessments in education. Her main research interest lies in methodological challenges of complex survey data. She has designed and conducted   multiple workshops to international audiences on these varied topics and is associate editor of the journal, *Large-scale Assessments in Education*.