**Analyzing Rating Data Course Description**

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**Course Title:** Analyzing Rating Data Using Many-Facet Rasch Measurement and Multilevel Rater Modelling Approaches

**Description**

In performance assessment settings, raters use measurement tools such as rating scales or scoring rubrics to evaluate students' performances or products. Raters assign their ratings based upon information that they gather and synthesize as they examine each performance or product. However, by virtue of their being human, raters unavoidably introduce error (rater effects) into the assessment process.

Data analysts have employed a variety of approaches for analyzing raters' ratings in an attempt to detect and measure the impact of rater effects such as leniency/severity, central tendency, and halo effect on the ratings. Using the output from these analyses, administrators in charge of monitoring quality control for assessment systems obtain detailed, practical information about how various "facets" (e.g., students, raters, rating criteria) of their assessment systems are performing. They can use that information to help them determine to what extent their systems are under statistical control and to initiate meaningful changes in an effort to improve their systems.

This course is designed to introduce participants to two approaches for analyzing rating data: a many-facet Rasch measurement (MFRM) approach, and a multilevel rater model (MRM) approach:

The **MFRM approach** models the probabilities of ordered-category ratings in terms of parameters for students, raters, rating criteria, and any other "facets" of the assessment setting that may be relevant, such as student or rater background variables. Technically, the dependent variable in this type of analysis is the logistic transformations of the ordered-category ratings, while other facets of the assessment setting function as independent variables.

The **MRM approach** recasts MFRM within the multilevel modeling framework so as to better account for the hierarchical nature of the data and to allow for the simultaneous estimation of multiple model parameters and covariates of interest. In its most basic formulation, the MRM can be expressed as a two-level, mixed-effects model in which the random intercept represents student proficiency and fixed effects represent item difficulty and rater severity. This model can be extended to include additional random effects and/or covariates of interest.

The course will include two segments. During the first training segment, participants will learn how to use a many-facet Rasch measurement (MFRM) approach to analyze rating data. Topics we will cover in this segment include the following:

- The role of raters and their influence in open-ended assessments
- Rater effects that can influence ratings
- Statistical approaches that researchers have used to analyze rating data and characterize rater performance

- The conceptual and mathematical foundations of many-facet Rasch measurement
- Group-level and individual-level questions that a MFRM analysis can answer
- Creating a data file for a MFRM analysis
- Preparing a specification file for a MFRM analysis
- Running MFRM analyses and reformatting output
- Creating judging plans
- Making sense of output from MFRM analyses
- MFRM anchoring procedures for equating
- Strategies for resolving disconnected subsets issues
- Conducting bias interaction analyses
- Hybrid MFRM models and their uses

During the second training segment, participants will learn how to use a multilevel rater model (MRM) approach to analyze rating data. Topics we will cover in this segment include the following:

- Conceptual and mathematical foundations of the multilevel model framework
- Reformulating a MFRM model as a multilevel rater model
- Preparing the data files for a multilevel analysis
- Constructing the MDM (multivariate data matrix)
- Running MRM analyses using the HLM v. 7.03 software package
- Interpreting output from MRM analyses
- Extending the MRM by including additional random effects and/or covariates of interest
- Carrying out differential facet functioning analyses in the multilevel context

**Prerequisite Skills or Knowledge Needed for Course Participation**

The target course participants are researchers, statisticians, data analysts, and advanced graduate students who want to learn how to use many-facet Rasch measurement and multilevel approaches for analyzing rating data.

This course requires that participants have had prior experience running regression analyses and analyses of variance and interpreting results from those analyses.

Having a basic understanding of the conceptual and mathematical foundations of Rasch measurement would be helpful but not required, as would prior experience using Rasch measurement analysis software.  Similarly, having a basic understanding of the conceptual and mathematical foundations of hierarchical linear modeling would be helpful but not required, as would prior experience using hierarchical linear modeling software.

**Computer Hardware and Software Needed for Course Participation**

Each participant in this training will need to bring a personal computer that is running the Windows 7, 8 or 10 operating system.

For the MFRM training segment, participants will be using Microsoft Word and Excel to create their data files. Therefore, participants will need to have these two applications previously installed on their computers.

To analyze data using a MFRM approach, participants will be running Minifac (Linacre, 2017), the demonstration version of the Facets for Windows computer program. Participants can download Minifac free of charge from this website: http://www.winsteps.com/minifac.htm

For the MRM training segment, participants will be using the Statistical Package for the Social Sciences (SPSS) to prepare data files for running their multilevel analyses. Therefore, participants will need to have SPSS (version 18 or later) loaded on their computers. For those who do not have it, IBM offers a free 14-day trial version of IBM SPSS (IBM Corp., 2017) that participants can download from the IBM website to use during the training: https://www.ibm.com/account/reg/us-en/signup?formid=urx-19774

To analyze data using a MRM approach, participants will be running the student version of HLM v. 7.03 for Window (Raudenbush, Bryk, & Congdon, 2013). Participants can download the student version of HLM v. 7.03 free of charge from this website:  http://www.ssicentral.com/hlm/student.html

**Course Format**

The course will include lecture components, discussion, and plenty of individual and small-group hands-on activities so that participants can practice creating specification files, preparing data, running analyses, and interpreting the results from their analyses.

**Learning Objectives**

In this course, participants will work toward acquiring the following knowledge, skills, and understandings:

- Knowledge of different types of rater effects
- Knowledge of the conceptual and mathematical foundations of MFRM and MRM approaches for analyzing rating data
- Knowledge of the advantages and disadvantages of using MFRM and MRM approaches for analyzing rating data
- Knowledge of the kinds of group-level and individual-level questions that researchers and practitioners can address using MFRM and MRM approaches
- Knowledge of the kinds of information found in output from MFRM and MRM analyses
- An understanding of the role of raters in open-ended assessments
- An understanding of how raters can influence ratings
- An understanding of how researchers can use MFRM and MRM approaches to analyze rating data in order to help establish quality control over an assessment system
- An understanding of how MFRM and MRM approaches for analyzing rating data differ and when each type of approach is most appropriately used
- Skill in creating judging plans
- Skill in creating specification files for MFRM and MRM analyses
- Skill in preparing data files for MFRM and MRM analyses
- Skill in constructing multivariate data matrices
- Skill in running analyses of rating data using the Minifac (Linacre, 2017) and HLM v. 7.03  for Windows (Raudenbush, Bryk, & Congdon, 2013) computer software packages
- Skill in printing and reformatting output from MFRM and MRM analyses
- Skill in interpreting the various statistical indices that appear in output from MFRM and MRM analyses

- Skill in troubleshooting when analyses will not run

## References

IBM Corp. (2017).  IBM SPSS Statistics for Windows (Version 25)[Computer software]. Armonk, NY: IBM Corp.

> **Note**:  If participants do not already have SPSS on their computers, they will be able to download a free 14-day trial version of IBM SPSS Statistics to use during the training: https://www.ibm.com/account/reg/us-en/signup?formid=urx-19774

Linacre, J. M. (2017). Minifac (Evaluation, student, and demonstration version of Facets for Windows)[Computer software]. Minnetonka, MN: SWREG, Inc.

> **Note**:  Minifac is free. Participants can download it from this website: http://www.winsteps.com/minifac.htm

Raudenbush, S. W., Bryk, A. S., & Congdon, R. (2013). HLM 7.03 for Windows (Student version)[Computer software]. Skokie, IL:  Scientific Software International, Inc.

> **Note**:  Participants can download the free student version of HLM v. 7.03 for Windows from this website: http://www.ssicentral.com/hlm/student.html