Scale Construction and Application in Social Science Research

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Course Syllabus:

1. Factor analysis: A modeling basis of measuring instrument construction and application in the social sciences:
   - Latent variables as theoretical concepts of relevance in empirical social research;
   - The classical common (linear) factor model;
   - The distinction between exploratory and confirmatory factor analysis, and its importance in instrument construction and application.

2. Classical test theory: A theoretically and practically useful framework for developing and revising measuring instruments in empirical social studies:
   - The classical test theory (CTT) decomposition of observed score;
   - Reliability of measuring instruments;
   - Validity of psychometric scales.

3. An introduction to latent variable modeling (LVM) and the LVM software Mplus:
   - What LVM is, and why it is of special relevance in the instrument construction and application process;
   - The LVM software Mplus – A brief introduction to its syntax.
   - Exploratory and confirmatory factor analysis with Mplus – An introduction.

4. Measuring instrument development with (approximately) continuous scale components:
   - Examining underlying structure, unidimensionality, and its importance in social science applications;
   - Assessing the possibility of constructing and developing subscales from a multidimensional measuring instrument.

5. Scale development with categorical items in empirical social science studies:
   - Latent structure examination for a multi-component measuring instrument;
   - Scale construction, development, and revision with missing data, violations of the assumption of missing at random (MAR), and nesting effects.

6. Construction of initial measuring instrument versions in social research – categorical and continuous items or components:
   - Selection from an available item pool;
   - Evaluation of inter-item and item-total (adjusted item-total) interrelationships.

7. Scale revision for enhancing measuring instrument quality in social science studies. Reliability and validity and how to enhance them:
   - Coefficient alpha, what it is, and what it is not;
   - Revisions for reliability improvement;
   - Validity improvement due to revision.

8. Essential unidimensionality of multi-component measuring instruments in social research:
    - What essential unidimensionality is and how to quantify it;
    - The bi-factor model and its relevance in examining essential unidimensionality of measuring instruments.

9. Psychometric analyses for general structure scales (multidimensional scales) in social science studies:
    - Measuring multiple underlying constructs, and reliability of multidimensional scales;
    - Second order measuring instruments and why they are important in empirical research.

10. Practical issues in measuring instrument construction, development, revision, and application in social science research:
    - What can go wrong in the process of instrument construction, development, and application, and how to fix it;
    - Validity, reliability, and finite mixtures – what we need to do when facing (unobserved) population heterogeneity in empirical research.

11. Scale construction and development with data from nationally representative social studies (large-scale/complex sampling design studies):
    - What are nationally representative studies and why they are becoming increasingly relevant in empirical social research;
    - Psychometrics with nationally representative studies in applied social research.

12. Optimal shortening of social research scales and its applications:
    - Why it is important to be in a position to shorten an original measuring instrument;
    - Optimal scale shortening based on the concept of maximal reliability.

13. Extensions and limitations of the instrument construction, development, and revision process in social science research:
    - What to watch out for when trying to generalize findings from scale construction, revision, application, and related modeling efforts;
    - When can we trust scale construction and application analyses and modeling;
    - Finite mixture modeling as a main avenue for future measuring instrument construction, development, and applications in social science research;

14. Conclusion.

Learning outcomes: By taking this course, the participants will acquire

-- ***knowledge***

- of a set of statistical methods that are useful in their research involving scale construction, development, revision, and application in the social sciences;
- of the relevance of routine examination of the latent structure of measuring instruments under consideration, as well as of their reliability and validity;
- of statistical approaches to handle missing values and possible nesting (clustering, hierarchical) effects in the context of SCD;
- of the bases of the frameworks of classical test theory and factor analysis that are essential for SCD, and how to use them for the aims of SCD;

-- skills

- to examine the latent structure of an initial, putative, or tentative measuring instrument, or of an earlier developed scale by other researchers that is available in their field;
- to interpret in detail the associated statistical results;
- to enhance validity and reliability of initial scale versions, and where desirable and feasible to obtain unidimensional subscales from them evaluating (possibly multiple) single latent constructs of theoretical and empirical importance in a given subject-matter domain;

-- general competence

- to assess the applicability of statistical methods important for empirical research across various settings related to scale construction, development, revision and application in the social sciences;
- to benefit from the quantitative approach to social research as relevant for SCD;
- to become sufficiently familiar with the highly popular and widely circulated statistical package Mplus and its use for the aims of SCD.

In terms of possible pre-requisites, some basic statistical knowledge will be beneficial, for example as obtained in an introductory statistics course, including in particular knowledge of basic statistics such as mean, variance, standard deviation, correlation, and linear regression. Familiarity with Mplus is not a prerequisite, nor is statistics knowledge beyond introductory level; the course will discuss in sufficient detail the needed statistical concepts and their relationships, as well as the applications of Mplus, associated command files, and the interpretation of the results obtained thereby.

Textbooks (chronological order):

Raykov, T., & Marcoulides, G. A. (2011). *Introduction to psychometric theory.* New York: Taylor & Francis.

Raykov, T., & Marcoulides, G. A. (2018). *A course in item response theory and modeling with Stata.* College Station, TX: Stata Press.

Additional readings (copies provided to attendees):

Raykov, T. (2023). Psychometric Scale Evaluation Using Structural Equation and Latent Variable Modeling. In R. Hoyle (Ed.), *Handbook of Structural Equation Modeling* (Second Edition; Chapter 25). New York: Guilford Press (in press).

Raykov, T. (2012). Scale Construction and Development Using Structural Equation Modeling. In R. Hoyle (Ed.), *Handbook of Structural Equation Modeling* (First Edition) (pp. 472-492). New York: Guilford Press.

In addition, copies of multiple published research articles by the instructor and colleagues will be provided to the participants in this course (incl. the Handbooks of Structural Equation Modeling chapters, 2012 and 2023), along with the data files used throughout it. Furthermore, thorough lecture notes (copies of a 450-page lecture notes volume) containing all presented slides during the course, with elaborated discussions, will be made available to the course participants. Access to the full version of Mplus will be provided by the host University for the duration of the course.