Measurement Errors in Multivariate Measurement Scales

Assessing quality

Measurement quality is crucial. We propose a measurement framework:

\[ x = \mu + B\tau + \epsilon \]

where we have a relationship of true scores and observed variables with measurement errors.

The observed variables are best used in multivariate measurement scales

\[ u = A'x \]

where the weights are usually based on multivariate statistical analyses: factor analysis, regression analysis, discriminant analysis, or they can be chosen according to a theory.

Reliability and validity

To estimate the reliability of any linear measurement scale, we introduce a general method:

\[ \rho_u = \text{diag}(A'B\Phi B'A) \times \left[\text{diag}(A'\Sigma A)\right]^{-1} \]

Assumptions of the earlier methods have never been met in practice.

Our method can be used for both assessing and reducing the effects of the measurement errors to various statistical models to enhance reliability and validity.

References