

# Tutorial: Generalized Latent Variable Modeling

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## **Abstract**

Generalized linear mixed (or multilevel) models (GLMMs) are useful for panel data, cluster-randomized interventions, complex surveys with cluster-sampling, genetic studies, meta-analysis and many other applications. The random coefficients in GLMMs are latent variables representing between-cluster variability and inducing within-cluster correlations. Latent variables are also often used to represent true values of variables measured with error, e.g. depression (continuous) or social class (categorical). Measurement models specifying the relationship between measured and latent variables (factor, item response or latent class models) can form part of regression models, giving

structural equation models (SEMs), such as covariate measurement error models. SEMS can also be used to model dependence between different processes, for instance the response in a panel survey and attrition. Taking a unified view is beneficial since developments for one model-type are often applicable to other model-types and the same software can often be used to estimate seemingly different models. This tutorial will be structured in three parts:

1. generalized linear mixed models,
2. measurement models and
3. structural equation models.