

Using Mplus To Do Exploratory Factor Analysis: An Overview of the State Of The Art

Bengt Muthén

Professor Emeritus, UCLA

Mplus: <https://www.statmodel.com>

bmuthen@statmodel.com

Tihomir Asparouhov

Mplus

Mplus Web Papers: No. 1

May 2026

We thank Thuy Nguyen and Noah Hastings for expert assistance and Herbert Marsh and Alexandre Morin for helpful comments.

This presentation shows how to use Mplus to do exploratory factor analysis in new ways. This is joint work with Tihomir Asparouhov. The topic of EFA may seem old but there are new things to say about it. A series of Mplus techniques for EFA have recently been developed that give better results and have more general applicability. These techniques are discussed in a variety of papers and presentations that also cover many other topics, making them less easy to find. Pulling from these sources, this presentation aims to give a concise overview of the EFA state of the art using Mplus.

New techniques are presented for the traditional EFA setting of analyzing a measurement instrument for one group at one timepoint. In addition, new EFA techniques are discussed where EFA is an alternative measurement model to CFA in structural equation modeling settings, in multi-group settings, and in settings with multiple timepoints.

The technical level of this presentation is kept to a minimum with a focus on model choices, Mplus inputs, and applications to real data. The presentation assumes some basic familiarity with EFA. Mplus Short Course Topic 1 on our website gives an introduction. There are of course many books that present the basics of EFA and some are given in the reference list of this presentation - see for instance the Fabrigar-Wegener book.

Outline

- EFA background: Slides 3-5
- EFA variations: 7-65
 - ESEM, PSEM: 8-20
 - Second-order, SEFA: 22-30
 - Bi-factor, DSEFA: 32-44
 - Target: 46-54
- EFA in an SEM setting: 67-82
 - MIMIC: 67-73
 - EFA/CFA on EFA/CFA: 75-82
- EFA in a multiple-group setting: 84-94
 - EFA alignment: 86-94
- EFA in a longitudinal setting: 96-122
 - EFA longitudinal invariance testing: 108-114
 - EFA longitudinal alignment: 116-120
 - EFA growth modeling: 122
- Further topics: 124
- EFA theory: 126-135

As the Outline shows, the presentation starts with a very brief background for EFA. Looking down the main bullets, the presentation is then structured as EFA variations, EFA expanded to an SEM setting, EFA for multiple groups, and EFA for multiple timepoints. This is followed by some further topics, a bit of EFA theory, and references.

Bullet 2: EFA variations considers the traditional setting of analyzing a measurement instrument for one group at one timepoint. This introduces techniques with the acronyms ESEM, PSEM, SEFA, and DSEFA. This represents a major part of the presentation.

Bullet 3: EFA in an SEM setting generalizes the traditional EFA setting to adding covariates and to replace the typical SEM CFA measurement model with an EFA measurement model.

Bullet 4: EFA in a multiple-group setting presents the ESEM approach for specifying configural, metric and scalar measurement invariance across groups while still in the EFA framework, not necessitating CFA. The EFA alignment approach called AESEM meets the need for group comparisons of factor means and variances when metric and scalar invariance fits poorly, only requiring configural invariance - while still in the EFA framework.

Bullet 5: EFA in a longitudinal setting discusses an ESEM approach for metric and scalar invariance that adds between-person random intercepts and within-person factors with auto regressions. Automated longitudinal measurement invariance testing is presented. EFA longitudinal alignment fills the need for longitudinal comparisons of factor means and variances when metric and scalar invariance fits poorly. EFA growth modeling uses a PSEM approach to allow the use of an EFA measurement model when studying a growth model.

Further topics, EFA theory, and references conclude the presentation.