VERSION 9.1 MPLUS LANGUAGE ADDENDUM

In this addendum, changes introduced in Version 9.1 are described. They include new features and corrections to minor problems that have been found since the release of Version 9 in October 2025.

Following are the new features in Version 9.1:

- Two new methods are introduced for exploratory factor analysis (EFA). Second-order exploratory factor analysis (SEFA) allows first-order EFA to be combined with a second-order factor. Direct effects second-order exploratory factor analysis (DSEFA) offers a better bi-factor analysis than current methods. These new methods are described in Asparouhov & Muthén (2026a) and Muthén & Asparouhov (2026).
- New output format for ESEM that shows the EFA factors side by side as in TYPE=EFA.
- Improved estimation for short time series (small cluster sizes) using DSEM2, RDSEM2, and DSEM3 (Asparouhov, 2026).
- Random residual variances and covariances added for DSEM3 (Asparouhov & Muthén, 2026b).
- Non-Random AR on level 2 in DSEM3 (Asparouhov & Muthén, 2026b).
- Simultaneous updating algorithm for both levels in DSEM3 (Asparouhov & Muthén, 2026b).
- MODEL setting added to the MODEL option for measurement invariance testing to request the MODEL commands for the measurement invariance models being tested.

NEW EXPLORATORY FACTOR ANALYSIS ROTATIONS

Two new settings for ESEM models have been added to the ROTATION option of the ANALYSIS command. Both use a Geomin prior. The new methods are described in Asparouhov & Muthén (2026a) and Muthén & Asparouhov (2026). The ROTATION option is described on pages 678-682 of the Mplus User's Guide which is available on the website.

The SEFA setting allows a first-order EFA to be combined with a second-order factor. The ROTATION option for the SEFA setting is specified as follows:

```
ROTATION =  SEFA;
```

The SEFA setting can have two arguments. The first one referred to as v is for the Geomin prior variance for which the default is 0.1. The second one referred to as epsilon is for controlling penalty smoothness for which the default is 0.01. To change the defaults, specify

```
ROTATION = SEFA (.2 .001);
```

where v is .2 and epsilon is .001. The argument v can be specified with or without the argument epsilon.

The DSEFA setting is for a direct effects second-order EFA which offers a better bi-factor EFA than current methods. The ROTATION option for the DSEFA setting is specified as follows:

ROTATION = DSEFA;

The DSEFA setting can have three arguments. The first one referred to as v is for a Geomin prior variance for which the default is 0.1. The second one referred to as v2 is for a ALF (0 v2) prior variance for the direct effects for which the default is 1. The third one is epsilon for controlling penalty smoothness for which the default is 0.01. To change the defaults, specify

ROTATION = SEFA (.2 1.1 .001);

where v is .2, the ALF (0 v2) prior variance is 1.1, and epsilon is .001. The arguments can be specified as v, v v2, or v v2 epsilon.

MODEL OPTION FOR MEAUREMENT INVARIANCE TESTING

The MODEL option of the ANALYSIS command is used to automatically test multiple group models and single-group longitudinal models for measurement invariance. The MODEL option is described in the Version 8.9, 8.10 and 8.11 Mplus Language Addendum on the website with the Mplus User's Guide. A new setting referred to as MODEL has been added to the MODEL option. This setting is used to request the MODEL input commands for the measurement models being estimated. These MODEL commands are useful starting points for testing partial measurement invariance and for adding a structural part to the measurement model.

The MODEL setting is specified in parentheses following the measurement models specified in the MODEL option. Following is an example of how the MODEL setting is specified:

MODEL = CONFIGURAL METRIC SCALAR (MODEL);

where MODEL in parentheses following the measurement models specifies that the MODEL commands for the configural, metric, and scalar models will be printed in the output after the results.

REFERENCES

Asparouhov, T. (2026). Recent methodological advances in Mplus. Presentation at the June 2026 M3 Conference in New York City.

Asparouhov, T. & Muthén, B. (2026a). A unification of second-order and bi-factor EFA. Forthcoming in Structural Equation Modeling.

Asparouhov, T. & Muthén, B. (2026b). Three-level dynamic structural equation modeling. Structural Equation Modeling, 33, 281–309.

Muthén, B. & Asparouhov, T. (2026). Using Mplus to do exploratory factor analysis: An overview of the state of the art. Mplus Web Paper No. 1. www.statmodel.com.