

REIMS sample analysis

Nathan Alexander

2024-06-03

Set up MPlusAutomation

```
install.packages("devtools")
library(devtools)

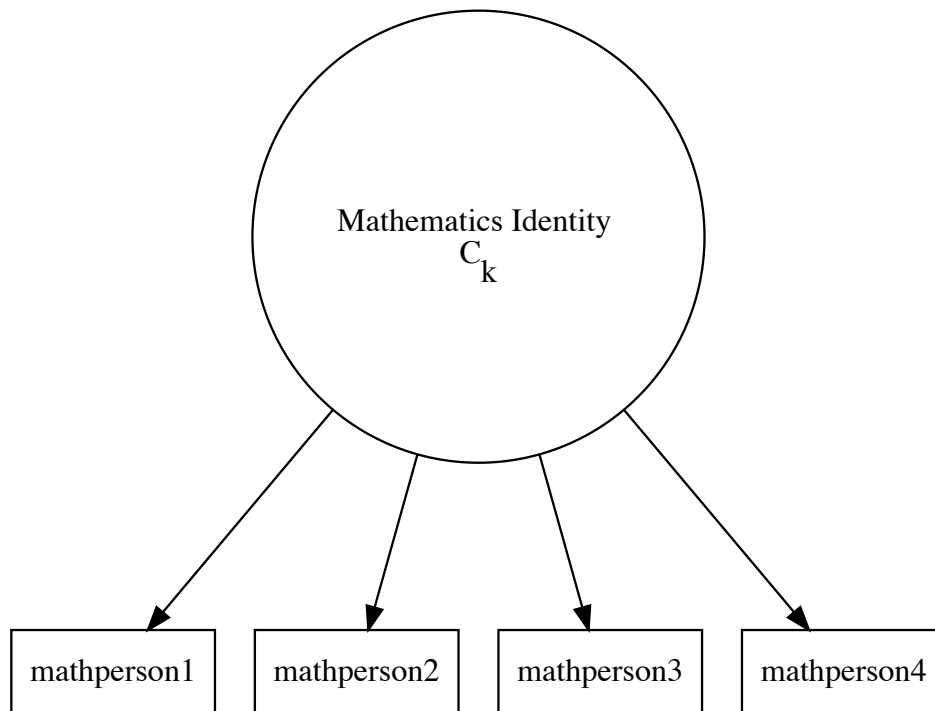
install_github("michaelhallquist/MplusAutomation")
```

Load packages

```
## Version: 1.2
## We work hard to write this free software. Please help us get credit by citing:
##
## Hallquist, M. N. & Wiley, J. F. (2018). MplusAutomation: An R Package for Facilitating Large-Scale L
##
## -- see citation("MplusAutomation").

## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.4      v readr      2.1.5
## v forcats    1.0.0      v stringr    1.5.1
## v ggplot2     3.5.0      v tibble     3.2.1
## v lubridate  1.9.3      v tidyr      1.3.1
## v purrr       1.0.2
## -- Conflicts ----- tidyverse_conflicts() --
## x tidyr::extract() masks MplusAutomation::extract()
## x dplyr::filter()  masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
## here() starts at /Users/nathanalexander/Dropbox/Projects/immerse
##
## here() starts at /Users/nathanalexander/Dropbox/Projects/immerse
```

Model



Data

```
# set data
reims <- read_csv(here("data", "reims_clean.csv"))

## New names:
## Rows: 103 Columns: 57
## -- Column specification
## ----- Delimiter: "," dbl
## (57): groupflag, age, sex, race, mathperson1, mathperson2, mathperson3, ...
## i Use 'spec()' to retrieve the full column specification for this data. i
## Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## * 'belongrace...19' -> 'belongrace'
```

```
# inspect data
reims

## # A tibble: 103 x 57
##   groupflag age sex race mathperson1 mathperson2 mathperson3 mathperson4
##   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1         1  18    2    6         0         0         0         0
## 2         1  22    2    1         0         0         0         0
## 3         1  20    1    7         1         1         1         1
## 4         1  20    1    3         1         1         1         1
## 5         1  18    1    4         0         0         0         1
## 6         1  18    2    6         0         0         0         0
```

```
## 7      1    19    1    6          0          0          0          0
## 8      1    23    2    4          0          0          0          0
## 9      1    37    2    3          0          0          0          0
## 10     1    27    2    6          0          0          0          0
## # i 93 more rows
## # i 49 more variables: dislikemathclass <dbl>, pursuestem <dbl>,
## #   boysbetter <dbl>, learnrace <dbl>, racegroups <dbl>, knowrace <dbl>,
## #   connectrace1 <dbl>, affectrace <dbl>, proudrace <dbl>, mixrace <dbl>,
## #   unclarrace <dbl>, connectrace2 <dbl>, dontknowrace <dbl>,
## #   belongrace <dbl>, understandrace <dbl>, talkrace <dbl>, priderace <dbl>,
## #   avoidrace <dbl>, practicerace <dbl>, playotherrace <dbl>, ...
```

```
summary(reims)
```

```
##      groupflag          age          sex          race
## Min.   :0.0000   Min.   :14.00   Min.   :1.00   Min.   :1.00
## 1st Qu.:1.0000   1st Qu.:18.00   1st Qu.:1.00   1st Qu.:3.00
## Median :1.0000   Median :20.00   Median :2.00   Median :4.00
## Mean   :0.8835   Mean   :20.82   Mean   :1.65   Mean   :3.99
## 3rd Qu.:1.0000   3rd Qu.:21.00   3rd Qu.:2.00   3rd Qu.:6.00
## Max.   :1.0000   Max.   :47.00   Max.   :3.00   Max.   :7.00
## mathperson1  mathperson2  mathperson3  mathperson4
## Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
## 1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000
## Median :1.0000   Median :1.0000   Median :1.0000   Median :1.0000
## Mean   :0.5922   Mean   :0.5631   Mean   :0.5146   Mean   :0.5146
## 3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
## Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
## dislikemathclass  pursuestem  boysbetter  learnrace
## Min.   :0.0000   Min.   :0.0000   Min.   :0.00000   Min.   :0.0000
## 1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.00000   1st Qu.:0.0000
## Median :0.0000   Median :1.0000   Median :0.00000   Median :0.0000
## Mean   :0.2524   Mean   :0.5534   Mean   :0.07767   Mean   :0.4078
## 3rd Qu.:0.5000   3rd Qu.:1.0000   3rd Qu.:0.00000   3rd Qu.:1.0000
## Max.   :1.0000   Max.   :1.0000   Max.   :1.00000   Max.   :1.0000
## racegroups      knowrace      connectrace1  affectrace
## Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
## 1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:1.0000   1st Qu.:0.0000
## Median :0.0000   Median :1.0000   Median :1.0000   Median :0.0000
## Mean   :0.3301   Mean   :0.6311   Mean   :0.8641   Mean   :0.4563
## 3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
## Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
## proudrace      mixrace      unclarrace      connectrace2
## Min.   :0.0000   Min.   :0.00000   Min.   :0.0000   Min.   :0.0000
## 1st Qu.:1.0000   1st Qu.:0.00000   1st Qu.:0.0000   1st Qu.:0.0000
## Median :1.0000   Median :0.00000   Median :0.0000   Median :1.0000
## Mean   :0.8252   Mean   :0.08738   Mean   :0.2427   Mean   :0.6602
## 3rd Qu.:1.0000   3rd Qu.:0.00000   3rd Qu.:0.0000   3rd Qu.:1.0000
## Max.   :1.0000   Max.   :1.00000   Max.   :1.0000   Max.   :1.0000
## dontknowrace   belongrace   understandrace   talkrace
## Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
## 1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000
## Median :0.0000   Median :1.0000   Median :1.0000   Median :0.0000
## Mean   :0.3107   Mean   :0.5146   Mean   :0.5437   Mean   :0.4563
```

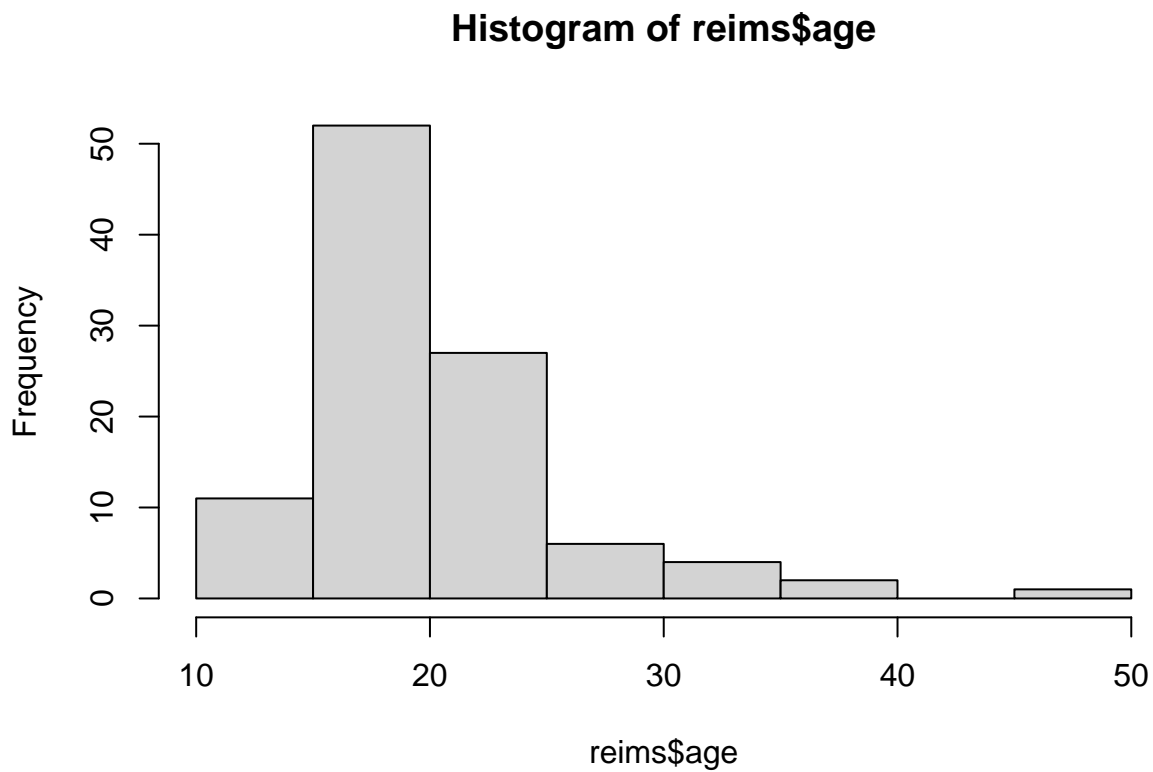
##	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:1.0000
##	Max. :1.0000	Max. :1.0000	Max. :1.0000	Max. :1.0000
##	priderace	avoidrace	practicerace	playotherrace
##	Min. :0.0000	Min. :0.00000	Min. :0.0000	Min. :0.000
##	1st Qu.:0.0000	1st Qu.:0.00000	1st Qu.:0.0000	1st Qu.:1.000
##	Median :1.0000	Median :0.00000	Median :1.0000	Median :1.000
##	Mean :0.5631	Mean :0.05825	Mean :0.5049	Mean :0.767
##	3rd Qu.:1.0000	3rd Qu.:0.00000	3rd Qu.:1.0000	3rd Qu.:1.000
##	Max. :1.0000	Max. :1.00000	Max. :1.0000	Max. :1.000
##	strongrace	enjoyotherrace	feelrace	racediscrimination
##	Min. :0.0000	Min. :0.0000	Min. :0.0000	Min. :0.0000
##	1st Qu.:0.0000	1st Qu.:1.0000	1st Qu.:0.0000	1st Qu.:0.0000
##	Median :1.0000	Median :1.0000	Median :1.0000	Median :0.0000
##	Mean :0.5049	Mean :0.8932	Mean :0.7184	Mean :0.4369
##	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:1.0000
##	Max. :1.0000	Max. :1.0000	Max. :1.0000	Max. :1.0000
##	academicability_peers	mathability_peers	activities	deciderules
##	Min. :0.0000	Min. :0.0000	Min. :0.000	Min. :0.0000
##	1st Qu.:0.0000	1st Qu.:0.0000	1st Qu.:0.000	1st Qu.:0.0000
##	Median :0.0000	Median :1.0000	Median :1.000	Median :0.0000
##	Mean :0.4854	Mean :0.5146	Mean :0.534	Mean :0.2039
##	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:1.000	3rd Qu.:0.0000
##	Max. :1.0000	Max. :1.0000	Max. :1.000	Max. :1.0000
##	makeadiff	adultcares	adultnotices	adultlistens
##	Min. :0.0000	Min. :0.0000	Min. :0.0000	Min. :0.000
##	1st Qu.:0.0000	1st Qu.:0.0000	1st Qu.:0.0000	1st Qu.:0.000
##	Median :0.0000	Median :1.0000	Median :0.0000	Median :1.000
##	Mean :0.4175	Mean :0.5437	Mean :0.4951	Mean :0.699
##	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:1.000
##	Max. :1.0000	Max. :1.0000	Max. :1.0000	Max. :1.000
##	adultpraise	adultmybest	adultmysuccess	mtchmematter
##	Min. :0.0000	Min. :0.0000	Min. :0.0000	Min. :0.0000
##	1st Qu.:0.0000	1st Qu.:0.0000	1st Qu.:0.0000	1st Qu.:0.0000
##	Median :1.0000	Median :1.0000	Median :1.0000	Median :0.0000
##	Mean :0.6699	Mean :0.7087	Mean :0.7087	Mean :0.1456
##	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:1.0000	3rd Qu.:0.0000
##	Max. :1.0000	Max. :1.0000	Max. :1.0000	Max. :1.0000
##	mtchlowerstandards	mtchraceexpect	mtchtalkrace	mtchignorera
##	Min. :0.00000	Min. :0.00000	Min. :0.0000	Min. :0.0000
##	1st Qu.:0.00000	1st Qu.:0.00000	1st Qu.:0.0000	1st Qu.:0.0000
##	Median :0.00000	Median :0.00000	Median :0.0000	Median :0.0000
##	Mean :0.05825	Mean :0.05825	Mean :0.2524	Mean :0.1748
##	3rd Qu.:0.00000	3rd Qu.:0.00000	3rd Qu.:0.5000	3rd Qu.:0.0000
##	Max. :1.00000	Max. :1.00000	Max. :1.0000	Max. :1.0000
##	mtchvalues	mtchrespect	mtchfair	mtchsuccess
##	Min. :0.000	Min. :0.0000	Min. :0.000	Min. :0.0000
##	1st Qu.:1.000	1st Qu.:1.0000	1st Qu.:1.000	1st Qu.:1.0000
##	Median :1.000	Median :1.0000	Median :1.000	Median :1.0000
##	Mean :0.835	Mean :0.8641	Mean :0.835	Mean :0.8155
##	3rd Qu.:1.000	3rd Qu.:1.0000	3rd Qu.:1.000	3rd Qu.:1.0000
##	Max. :1.000	Max. :1.0000	Max. :1.000	Max. :1.0000
##	mtchmistakesok	mtchbiased	mtchmadeinteresting	mtchgendrbias
##	Min. :0.0000	Min. :0.0000	Min. :0.0000	Min. :0.00000
##	1st Qu.:1.0000	1st Qu.:0.0000	1st Qu.:0.0000	1st Qu.:0.00000

```
## Median :1.0000 Median :0.0000 Median :1.0000 Median :0.00000
## Mean :0.8252 Mean :0.1845 Mean :0.6602 Mean :0.06796
## 3rd Qu.:1.0000 3rd Qu.:0.0000 3rd Qu.:1.0000 3rd Qu.:0.00000
## Max. :1.0000 Max. :1.0000 Max. :1.0000 Max. :1.00000
## mtchmadeeasy
## Min. :0.0000
## 1st Qu.:0.0000
## Median :1.0000
## Mean :0.5922
## 3rd Qu.:1.0000
## Max. :1.0000
```

```
# view distribution of indicator variables
table(reims$groupflag)
```

```
##
## 0 1
## 12 91
```

```
hist(reims$age)
```



```
table(reims$sex)
```

```
##
## 1 2 3
## 37 65 1
```

```
table(reims$race)
```

```
##  
##  1  2  3  4  5  6  7  
## 23  1 12 29  1 30  7
```

```
# subset data  
reims1 <- reims %>%  
  select(mathperson1, mathperson2, mathperson3, mathperson4) %>%  
  rename(m1 = mathperson1,  
         m2 = mathperson2,  
         m3 = mathperson3,  
         m4 = mathperson4)  
  
head(reims1, n=10)
```

```
## # A tibble: 10 x 4  
##       m1     m2     m3     m4  
##   <dbl> <dbl> <dbl> <dbl>  
## 1     0     0     0     0  
## 2     0     0     0     0  
## 3     1     1     1     1  
## 4     1     1     1     1  
## 5     0     0     0     1  
## 6     0     0     0     0  
## 7     0     0     0     0  
## 8     0     0     0     0  
## 9     0     0     0     0  
## 10    0     0     0     0
```

```
## add ids and covariates; tell mplus that what we are
```

```
# use the reorder function to get the variables that you want to model in the output.
```

```
input <- mplusObject(  
  TITLE = "REIMS Mathematics Identity Model",  
  VARIABLE = "categorical = m1 m2 m3 m4;  
  usevar = m1-m4;  
  classes = c(3);",  
  
  ANALYSIS =  
    "estimator = mlr;  
    type = mixture;",  
  
  OUTPUT = "tech11 tech14;",  
  
  PLOT = "type = plot3;  
    series = m1-m4(*);",  
  
  usevariables = colnames(reims1),  
  rdata = reims1)
```

```

output <- mplusModeler(input,
  dataout = here("mplus", "reims1.dat"),
  modelout = here("mplus", "reims1.inp"),
  check = T, run = T, hashfilename = F)

## When hashfilename = FALSE, writeData cannot be 'ifmissing', setting to 'always'

## The following lines are not empty and do not end in a : or ;.
## 2: REIMS Mathematics Identity Model

## Rerun with parseMplus(add = TRUE) to add semicolons to all lines

## The file(s)
## 'reims1.dat'
## currently exist(s) and will be overwritten

## No PROPORTION OF DATA PRESENT sections found within COVARIANCE COVERAGE OF DATA output.

Take a look at the item probability plot:

source(here("plot_lca.txt")) # custom function created by Dina to plot our lsa output

##
## Attaching package: 'reshape2'

## The following object is masked from 'package:tidyr':
##
## smiths

##
## Attaching package: 'cowplot'

## The following object is masked from 'package:lubridate':
##
## stamp

model <- readModels(here("mplus", "reims1.out")) # read in output

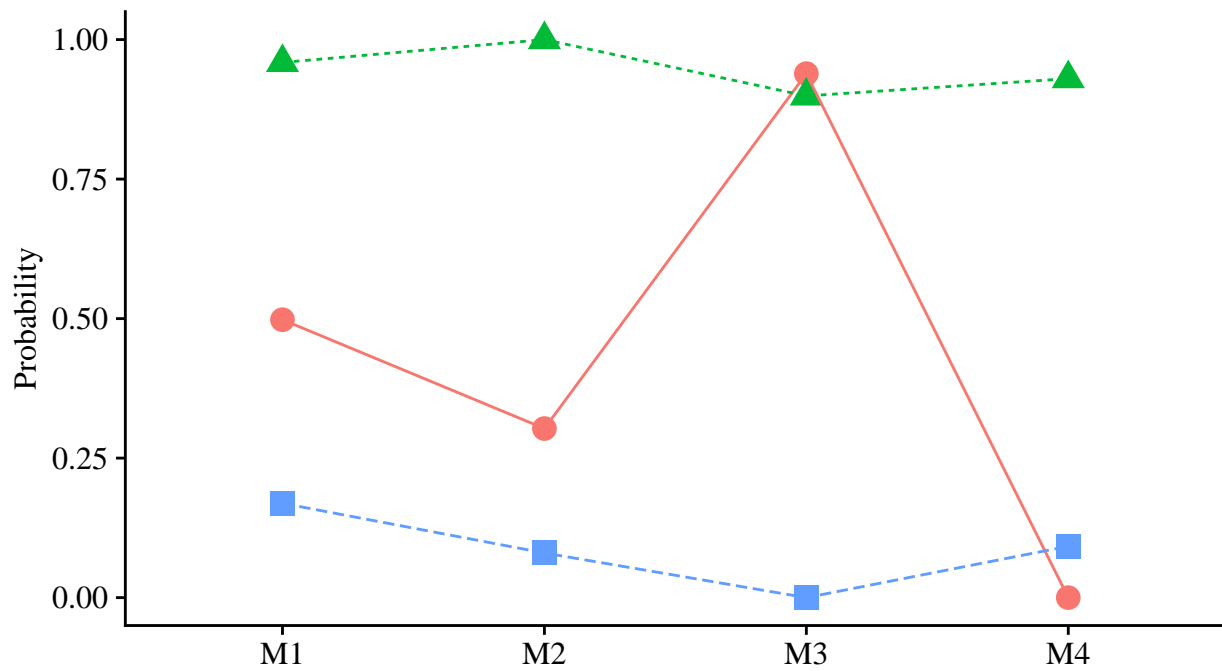
## No PROPORTION OF DATA PRESENT sections found within COVARIANCE COVERAGE OF DATA output.

plot_lca(model_name = model) # there is an error with the non atomic measure columns

```

REIMS Mathematics Identity Model Probability Plot

● Class 1 (5.92%) ▲ Class 2 (51.07%) ■ Class 3 (43.01%)



Show probability plot of data and then observe the different classes.

This file is based on resources provided at the Institute of Mixture Modeling for Equity-Oriented Researchers, Scholars, and Educators (2024). IMMERSE In-Person Training Workshop (IES No. 305B220021). Institute of Education Sciences. <https://immerse-ucsb.github.io/pre-training>