REIMS sample analysis

Nathan Alexander

2024-06-03

Set up `MPlusAutomation`

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

install_github("michaelhallquist/MplusAutomation")
```
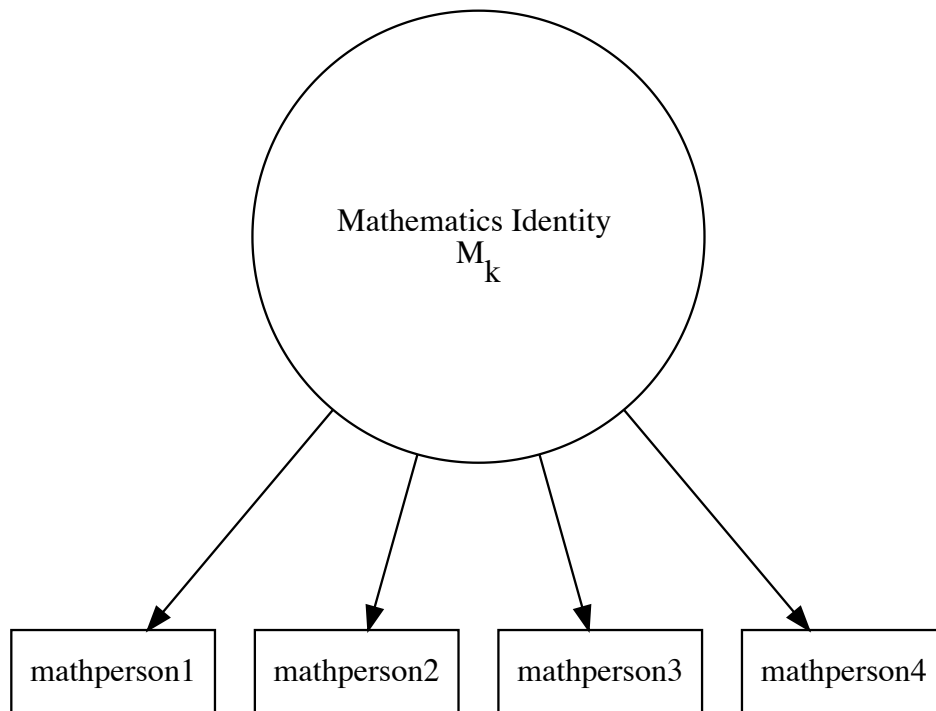
Load packages

```
## 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 La
##
## -- 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

Mathematics Identity
M_k

mathperson1 mathperson2 mathperson3 mathperson4

Data

```r
# 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'
```

```r
# 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>,
## #   unclearrace <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        unclearrace      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
```
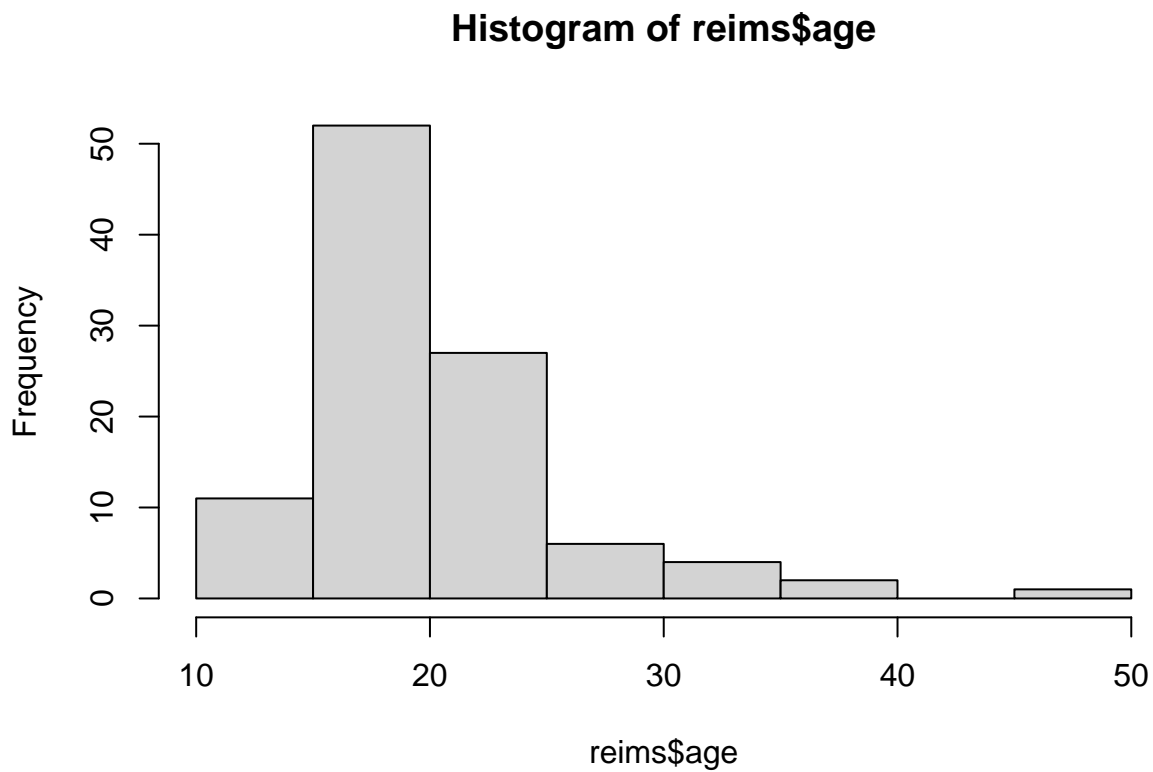
3

```
##    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      mtchignorerace
##    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 mtchgenderbias
##    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
```

4

```
##    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
```

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

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

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

Histogram of reims$age


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

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

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

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

```r
# 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
```

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

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

```r
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)
```

```r
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:

```r
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
```

```r
model <- readModels(here("mplus", "reims1.out")) # read in output
```
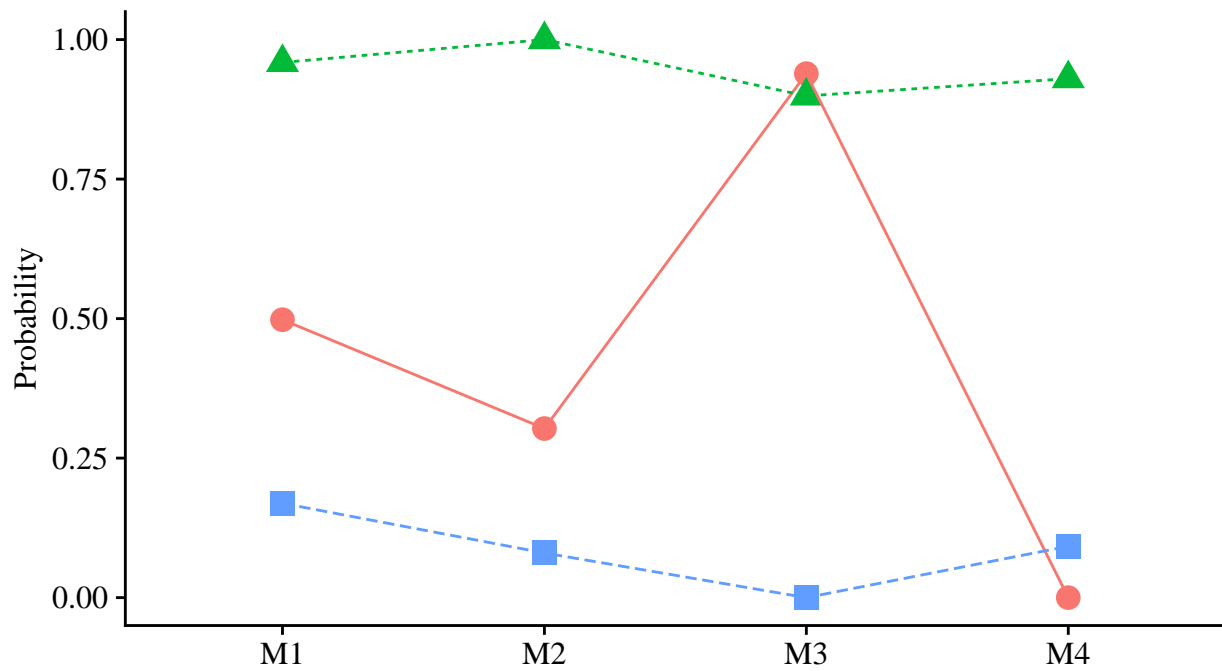
```
## No PROPORTION OF DATA PRESENT sections found within COVARIANCE COVERAGE OF DATA output.
```

```r
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.