COS-D419 Factor Analysis and Structural Equation Models 2023, Assignment 4

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Contents

The texts that reflect my understanding have been highlighted in red color.

1 Task description

The first section is task description, which is copied from the assignment5.rmd. It is for communicating with future "me". Please skip it.

1.1 Exercise 5.1

Specify and estimate the initial baseline models for the two groups.

Present a brief summary of the model fit and make the first step of the modification by including **(exceptionally, at the same time!)** all the four parameters known to be required for improving the model fit of both models.

Fine-tune the models step by step following the guidelines given in the lecture material, i.e., implement the modifications **(as usually, one change at a time)** testing and studying each step.

Present the final baseline models of each group and draw the graphs

2 Preparation

##Read in the data set:

Start by downloading the **two data files** from Moodle to your Project folder!

```r
#install the necessary pakages
if (!require("pacman")) install.packages("pacman")
pacman::p_load(here,
               expss,
               tidyverse,
               janitor,
               knitr,
               qualtRics,
               arules,
               arulesViz,
               sjlabelled,
               DT,
               stringr,
               labelled,
               ggstatsplot,
               ggcorplot)

library(tidyverse)
library(readr)

#This week's file name
latest.name1 <- "MBIELM1.CSV"
latest.name2 <- "MBISEC1.CSV"
#read in the data
mbi.elm <-  #elementary school
  read_csv(
    file.path(
      here(),
      'data',
      latest.name1
      )
    )

mbi.sec <- #secondary school
  read_csv(
    file.path(
      here(),
      'data',
      latest.name2
      )
    )
```

2.1 Write functions

To control length of reports, codes already shown in the previous homework were not showing in the current report. Yet they are available in .rmd report.

2.1.1 Write a function describing continuous data set

2.1.2 Write a function for histogram overlapping with density plot

2.1.3 Write a function to generate dot distribution plot

```
dot.dist <-
  function(data, type, title){
    data |>
      t() |>
      as.data.frame() %>%
      mutate(Item = rownames(.)) |>
      rowwise() |>
      mutate(Median = eval(parse(text = type))(V1:V580)) |>
      ggstatsplot::ggdotplotstats(
        point.args = list(color = "red", size = 3, shape = 13),
        xlab = paste(type, "ratings"),
        title = title,
        x = Median,
        y = Item
      )
    }
```

2.1.4

```
mycor <-
  function(data, cols, title){
  mbi.elm |>
      select(all_of(cols)) |>
      ggstatsplot::ggcorrmat(
        colors = c("#B2182B", "white", "#4D4D4D"),
        title = "(a) Items on emotional exhaustion,
        elementary school teacher",
        matrix.type  = "lower"
      )
    }
```

3 Inspect the data

3.1 Distribution

```
p.dist.elm <-
  corr.density(
    mbi.elm,
    fig.num = "1(a)",
    group = "elementary school teacher"
    )
p.dist.sec <-
```

```
  corr.density(
    mbi.sec,
    fig.num = "1(b)",
    group = "secondary school teacher"
    )
library(patchwork)
p.dist.elm/p.dist.sec
```

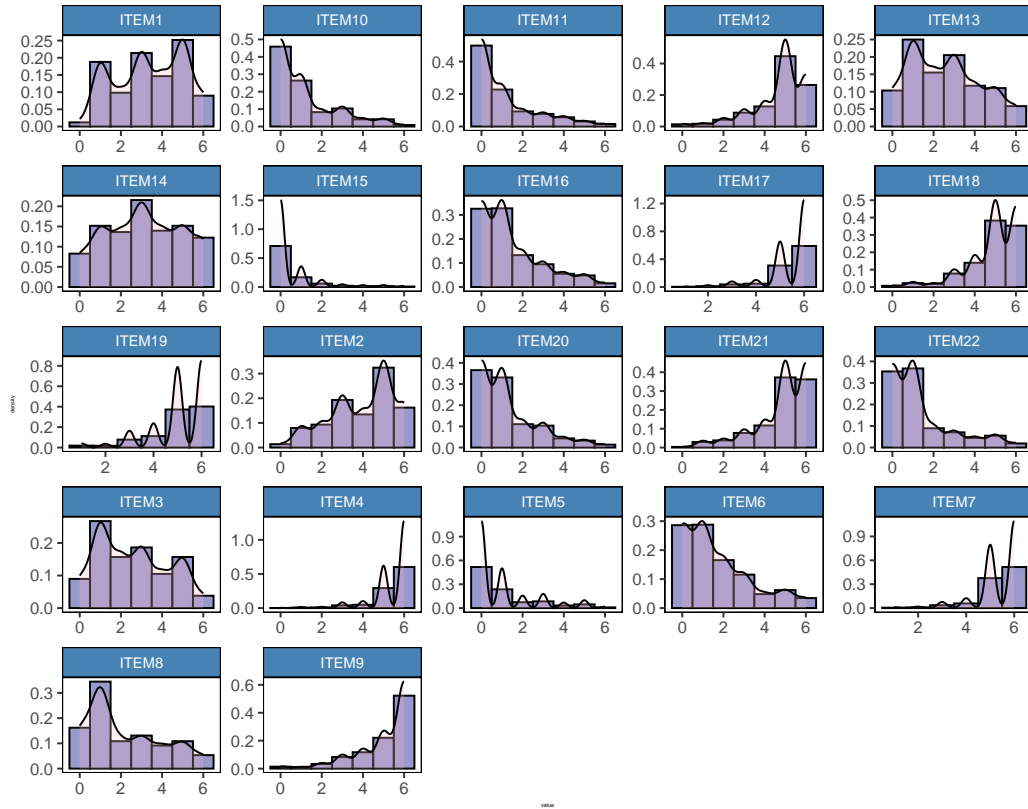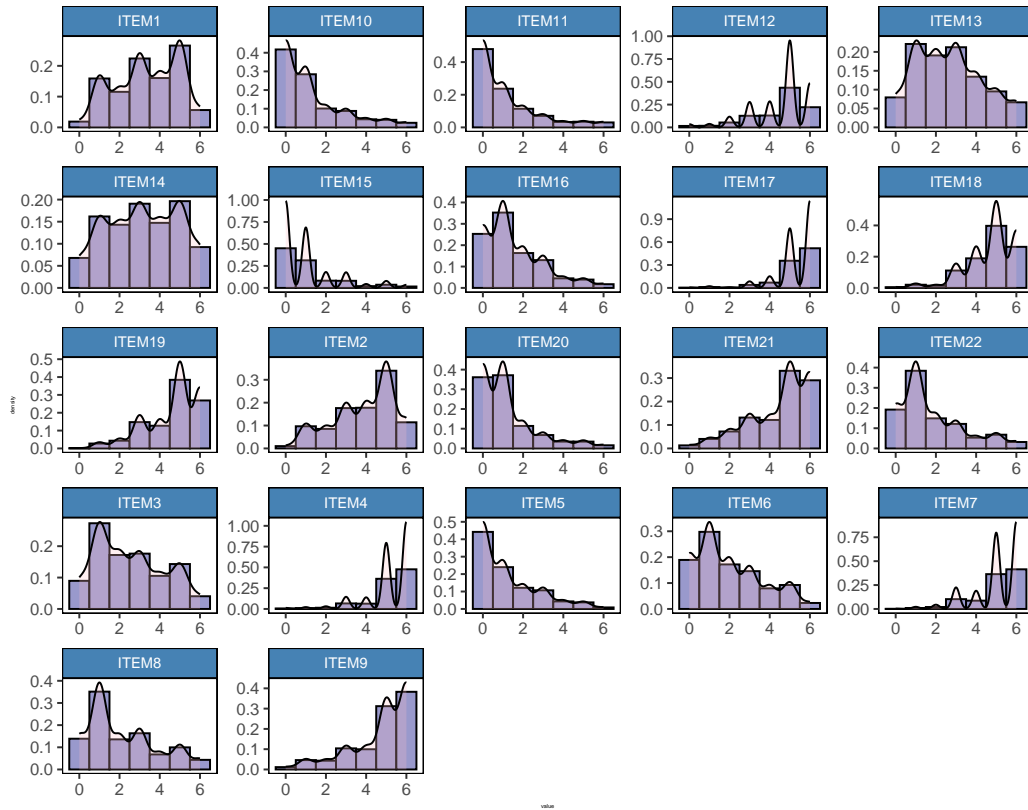**Figure 1(a) Distribution of selected items for elementary school teacher**

Figure 1(b) Distribution of selected items for secondary school teacher
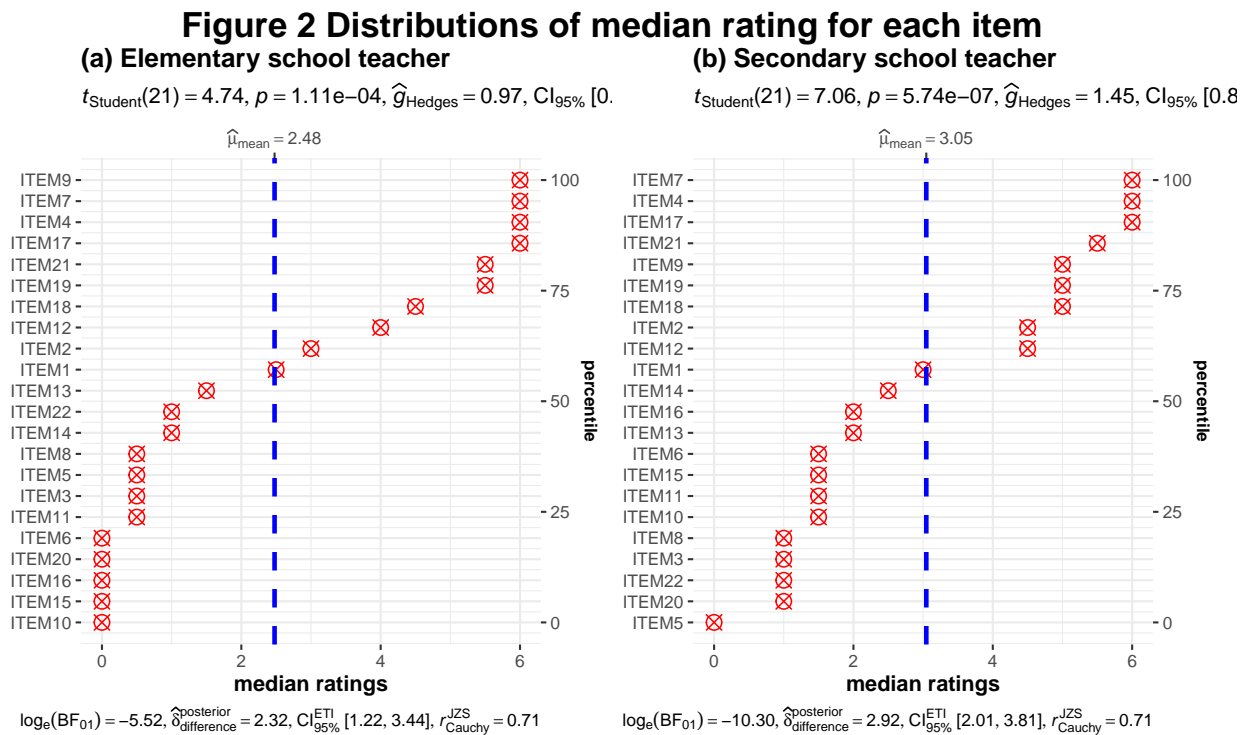

5

```
p.dot.elm <-
  dot.dist(
    data = mbi.elm,
    type = "median",
    title = "(a) Elementary school teacher"
    )
p.dot.sec <-
  dot.dist(
    data = mbi.sec,
    type = "median",
    title = "(b) Secondary school teacher"
    )

patchwork <- p.dot.elm|p.dot.sec
patchwork+plot_annotation(
    title =
      'Figure 2 Distributions of median rating for each item',
    theme =
      theme(plot.title =
              element_text(
                size = 16,
                face = "bold",
                vjust = -1.5,
                hjust =0.5)
          )
    )
```

Figure 2 Distributions of median rating for each item

(a) Elementary school teacher

$t_{\text{Student}}(21) = 4.74$, $p = 1.11\text{e}{-}04$, $\widehat{g}_{\text{Hedges}} = 0.97$, $\text{CI}_{95\%}$ [0.

(b) Secondary school teacher

$t_{\text{Student}}(21) = 7.06$, $p = 5.74\text{e}{-}07$, $\widehat{g}_{\text{Hedges}} = 1.45$, $\text{CI}_{95\%}$ [0.8

$\log_e(\text{BF}_{01}) = -5.52$, $\widehat{\delta}_{\text{difference}}^{\text{posterior}} = 2.32$, $\text{CI}_{95\%}^{\text{ETI}}$ [1.22, 3.44], $r_{\text{Cauchy}}^{\text{JZS}} = 0.71$

$\log_e(\text{BF}_{01}) = -10.30$, $\widehat{\delta}_{\text{difference}}^{\text{posterior}} = 2.92$, $\text{CI}_{95\%}^{\text{ETI}}$ [2.01, 3.81], $r_{\text{Cauchy}}^{\text{JZS}} = 0.71$

```r
fa.ee <- c("ITEM1", "ITEM3", "ITEM6", "ITEM8", "ITEM13", "ITEM14", "ITEM16", "ITEM20")
fa.dp <- c("ITEM5", "ITEM10", "ITEM11", "ITEM15", "ITEM22")
fa.pa <- c("ITEM4", "ITEM7", "ITEM9", "ITEM12", "ITEM17", "ITEM18", "ITEM19", "ITEM21")

p.cor.elm.ee <-
        mycor(
          data= mbi.elm,
          cols = fa.ee,
          "(a) Items on emotional exhaustion,
          elementary school teacher"
          )
p.cor.sec.ee <-
        mycor(
          data = mbi.sec,
          cols = fa.ee,
          "(b) Items on emotional exhaustion,
           secondary school teacher"
          )
p.cor.elm.dp <-
        mycor(
          data = mbi.elm,
          cols = fa.dp,
          "(c) Items on depersonalization,
           elementary school teacher"
          )
p.cor.sec.dp <-
        mycor(
          data = mbi.sec,
          cols = fa.dp,
          "(d) Items on depersonalization,
           secondary school teacher"
          )
p.cor.elm.pa <-
        mycor(
          data = mbi.elm,
          cols = fa.pa,
          "(e) Items on personal accomplishment,
          secondary school teacher"
          )
p.cor.sec.pa <-
        mycor(
          data = mbi.sec ,
          cols = fa.pa,
          "(f) Items on personal accomplishment,
           secondary school teacher"
          )
patchwork <-
  p.cor.elm.ee/p.cor.elm.dp/p.cor.elm.pa|p.cor.sec.ee/p.cor.sec.dp/p.cor.sec.pa

patchwork+
  plot_annotation(
    title =
      'Figure 3 Correlalogram for items on each factor for two groups of teachers',
```

```
theme =
  theme(plot.title =
          element_text(
            size = 16,
            face = "bold",
            vjust = -1.5,
            hjust =0.5)
        )
)
```

Figure 3 Correlalogram for items on each factor for two groups of teachers

**(a) Items on emotional exhaustion,
elementary school teacher**

X = non-significant at *p* < 0.05 (Adjustment: Holm)

**(a) Items on emotional exhaustion,
elementary school teacher**

X = non-significant at *p* < 0.05 (Adjustment: Holm)

**(a) Items on emotional exhaustion,
elementary school teacher**

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elementary school teacher**

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**(a) Items on emotional exhaustion,
elementary school teacher**

X = non-significant at *p* < 0.05 (Adjustment: Holm)

**(a) Items on emotional exhaustion,
elementary school teacher**

X = non-significant at *p* < 0.05 (Adjustment: Holm)