Appendix A. R code for test

```
#########################################################################################################
#                    Kuandik and Aikorkem EI Project                          #
#########################################################################################################

# clear global environ.
rm(list=ls())

##### set wd ####
setwd("/Users/user/Desktop/Current Projects/Kuandik and Aikorkem")                          #
getwd()
# dat<-read.csv("C:/Users/Zhapparova_a/Desktop/surveyANAEI/dataclean_surveyEI.csv", sep = ";")

#### Install package management and packages ####
if (!require("pacman")){install.packages("pacman", dependencies = TRUE)
  library(tidyverse)
}

#### Install and load all necessary packages for the analysis in this script ####
pacman::p_load(psych, foreign, readxl, lavaan, lme4, misty, semTools, manymore)

citation("misty")
citation("lavaan")
citation("semTools")

#### Download original data ####
dir()
dat <- read_xlsx("datSurveyEI (2).xlsx", sheet = "dat1")
dim(dat)                                                    # 682 67
head(dat)
str(dat)
colnames(dat)
dat$`17t`

# Cleaned data to replicate
# dat <- read.csv("dataclean_surveyEI.csv", sep = ";")

#### Explore Cleaned Data ####
dim(dat)    # 682 70
colnames(dat)
# Notes on threat to valdity check of data:
# 1. Items with very similar meaning were explored:

# (a) 3-20, and (b) 21-23: When the difference between them was a total of 5 or 6, those cases were removed.
attributes(dat$Age) <- list(mycomment = "Age in years")
attributes(dat$Grade) <- list(mycomment = "School Grade")
attributes(dat$Region_eng) <- list(mycomment = "School Grade")
attributes(dat$City_District_eng) <- list(mycomment = "City or District")
attributes(dat$`city/district`) <- list(mycomment = "district = rural, city = urban origin of student")

attributes(dat$Gender) <- list(mycomment = "1 = male, 2 = female")
attributes(dat$School_full) <- list(mycomment = "School name")
attributes(dat$School_id) <- list(mycomment = "Unique anon. school ID")
colnames(dat)

################################### Understanding Own Emotions ###################################  VP
# I7t + I8k + I14t + I18k + I22k + I26t + I31k + I35k + I41k + I45k
attributes(dat$`7t`) <- list(mycomment = "I always know why I like or dislike a certain person.")
```

```
attributes(dat$`8k`) <- list(mycomment = "When I get angry, I may not notice it myself.")
attributes(dat$`14t`) <- list(mycomment = "When I get angry, I always know why.")
attributes(dat$`18k`) <- list(mycomment = "I find it difficult to express how I feel about someone.")
attributes(dat$`22k`) <- list(mycomment = "Sometimes I don't know why I'm happy or sad.")
attributes(dat$`26t`) <- list(mycomment = "I always know if I'm happy or sad.")
attributes(dat$`31k`) <- list(mycomment = "To me, feeling guilty or ashamed is the same thing.")
attributes(dat$`35k`) <- list(mycomment = "I don't know how to tell my friends about my feelings.")
attributes(dat$`41k`) <- list(mycomment = "I get happy or sad for no reason.")
attributes(dat$`45k`) <- list(mycomment = "I have feelings I don't know the names of.")

######################################### Managing Own Emotions ###################################### VU
# I4t + I12k + I25t + I28t + I33k + I37t
attributes(dat$`4t`) <- list(mycomment = "If I'm sad, I know what to do to make me happy")
attributes(dat$`12k`) <- list(mycomment = "If I have to hurry or if I am scolded, I cannot pull myself together and do what needs to be done.")
attributes(dat$`25t`) <- list(mycomment = "I can make sure that my mood is good for a very long time.")
attributes(dat$`28t`) <- list(mycomment = "If I am angry, I know how to calm down.")
attributes(dat$`33k`) <- list(mycomment = "When I'm in a bad mood, there's nothing I can do about it.")
attributes(dat$`37t`) <- list(mycomment = "I can control my mood.")

###################################### Understanding Other's Emotions ################################ MP
# I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t + I38k + I42k + I46k
attributes(dat$`1t`) <- list(mycomment = "I always see when my loved ones are upset, even if they hide it")
attributes(dat$`3t`) <- list(mycomment = "I can tell by a person's face what mood they are in")
attributes(dat$`11t`) <- list(mycomment = "I understand without any words the mood of my best friend")
attributes(dat$`13t`) <- list(mycomment = "I understand other people's facial expressions and gestures well")
attributes(dat$`20t`) <- list(mycomment = "Looking at a person, I can easily understand what mood he is in")
attributes(dat$`27t`) <- list(mycomment = "If someone hides their feelings, I notice it")
attributes(dat$`29t`) <- list(mycomment = "You can tell by the voice what mood a person is in")
attributes(dat$`32t`) <- list(mycomment = "I can guess exactly how my friends feel")
attributes(dat$`34t`) <- list(mycomment = "If you carefully follow the expression on a person's face, you can understand how he feels.")
attributes(dat$`38k`) <- list(mycomment = "If my friend or an adult gets angry with me, sometimes I don't notice it right away")
attributes(dat$`42k`) <- list(mycomment = "I can't guess how the mood of adults or my friends will change.")
attributes(dat$`46k`) <- list(mycomment = "I don't understand why some people resent me")

######################################### Managing Other's Emotions ################################### MU
# I2k + I5k + I9t + I15t + I17t + I24t + I30k + I36t + I40k + I44k
attributes(dat$`2k`) <- list(mycomment = "If someone is offended by me, I do not know how to make peace with him.")
attributes(dat$`5k`) <- list(mycomment = "I am unable to cheer up or anger my friend.")
attributes(dat$`9t`) <- list(mycomment = "I can cheer up my friends.")
attributes(dat$`15t`) <- list(mycomment = "I can comfort a person who is sad.")
attributes(dat$`17t`) <- list(mycomment = "I can comfort my parents and friends when they are sad or worried.")
attributes(dat$`24t`) <- list(mycomment = "If I want, I can make someone angry.")
attributes(dat$`30k`) <- list(mycomment = "I can't change other people's moods.")
attributes(dat$`36t`) <- list(mycomment = "When my friend tells me about his grief, I can comfort him.")
attributes(dat$`40k`) <- list(mycomment = "If my friend is crying, I don't know what to do.")
attributes(dat$`44k`) <- list(mycomment = "It happens that I want to help a friend, comfort him, but he does not understand this.")

############################################ Controlling Expressions ################################## VE
# I6k + I10k + I16k + I19t + I21t + I23t + I39k
attributes(dat$`6k`) <- list(mycomment = "When I get angry, I can't help but say whatever I think.")
attributes(dat$`10k`) <- list(mycomment = "When I tell something to my mother or a friend, I often speak very loudly and wave my arms.")
attributes(dat$`16k`) <- list(mycomment = "Adults think that I laugh and cry too often.")
attributes(dat$`19t`) <- list(mycomment = "If I feel embarrassed when talking to strangers, I can hide it.")
attributes(dat$`21t`) <- list(mycomment = "I always know what my facial expression is, and I can control it.")
attributes(dat$`23t`) <- list(mycomment = "If I really need to, I can control the expression on my face.")
attributes(dat$`39k`) <- list(mycomment = "Relatives can always guess by my voice what my mood is.")

################################### Correct names with letter ######################################
colnames(dat)[10:55] <- paste("I", colnames(dat)[10:55], sep = "")
head(dat)
```

```
##################################### Missing Data Analysis ########################################
head(dat)  # just remove the two first students
dim(dat)
dat <- dat[-c(1:2),]
dim(dat)    # 680
# Check NAs
sum(apply(dat, 2, FUN = function(x)sum(is.na(x))))  # No NAs

################################### Threat-to-Validity Check #######################################
which(colnames(dat) == "I1t")     # 10
which(colnames(dat) == "I46k")    # 55

# Check the ordinal responses for existence of exact same responses
sort(apply(dat[, 10:55], 1, FUN = function(x)sd(x)))                    # Some level of variance exists for all case

# Check for extent of repeated responses (above 80%, 46 items: 46*.80, no instances of 36)
list.of.tables <- apply(dat[, 10:55], 1, FUN = function(x)table(x))

# Use 'regular expressions' to scan the list
36/46*100
lapply(list.of.tables, FUN = function(x)max(x > 36))                    # Identify instances of repeatedness above 36
unlist(lapply(list.of.tables, FUN = function(x)max(x > 36))    ) == 1
sum(unlist(lapply(list.of.tables, FUN = function(x)max(x > 36))    ) == 1)                  # 22 cases to remove
logic.remove.repeaters <- !unlist(lapply(list.of.tables, FUN = function(x)max(x > 36))    ) == 1
dim(dat)                  # 680 70
length(logic.remove.repeaters)    # 680
dat <- dat[logic.remove.repeaters, ]
dim(dat)                  # 658 after removal of 80% plus repeaters

##################################### New Descriptives #############################################
attributes(dat$Age) <- list(mycomment = "Age in years")
attributes(dat$Grade) <- list(mycomment = "School Grade")
attributes(dat$Region_eng) <- list(mycomment = "Region")
attributes(dat$City_District_eng) <- list(mycomment = "City or District")
attributes(dat$`city/district`) <- list(mycomment = "district = rural, city = urban origin of student")
attributes(dat$Gender) <- list(mycomment = "1 = male, 2 = female")
attributes(dat$School_full) <- list(mycomment = "School name")
attributes(dat$School_id) <- list(mycomment = "Unique anon. school ID")

psych::describe(dat$Age)
table(dat$Gender)  # 1 = male, 2 = female
246/658*100
416/658*100
table(dat$Grade)
round(table(dat$Grade) / 658 *100, 1)
table(dat$`city/district`)

table(dat$k1r2) # 447 Kazakh, 211 Russian
table(dat$k1r2) / sum(table(dat$k1r2)) * 100  # 67.9% Kazakh language, 32.1% Russian language

############################## Intra-Class Correlation Coefficients ################################
table(dat$School_id)
table(dat$Region_eng)
table(dat$City_District_eng)
table(dat$`city/district`)
table(dat$School_id)
length(table(dat$School_id) )   # 12 schools
options(scipen = 9999)
```

```
######## All descriptives #######
apply(dat[,10:55], 2, FUN = function(x)table(x))
apply(dat[,10:55], 2, FUN = function(x)psych::describe(x))

round(sort(apply(dat[,10:55], 2, FUN = function(x)misty::multilevel.icc(x, dat$School_id))), 3)    # Item ICCs range between 0 and 4%. This is low and multi-level modelling not necessary

########### Understanding Own Emotions #############
# I7t + I8k + I14t + I18k + I22k + I26t + I31k + I35k + I41k + I45k
dfx <- apply(dat[,c("I7t", "I8k", "I14t", "I18k", "I22k", "I26t", "I31k", "I35k", "I41k", "I45k")], 2, FUN = function(x)table(x))
write.csv(t(dfx), "UOE.csv",row.names = F)
apply(dat[,c("I7t", "I8k", "I14t", "I18k", "I22k", "I26t", "I31k", "I35k", "I41k", "I45k")], 2, FUN = function(x)psych::describe(x))
round(apply(dat[,c("I7t", "I8k", "I14t", "I18k", "I22k", "I26t", "I31k", "I35k", "I41k", "I45k")], 2, FUN = function(x)misty::multilevel.icc(x, dat$School_id)), 3)

############## Managing Own Emotions ###############
# I4t + I12k + I25t + I28t + I33k + I37t
dfx <- apply(dat[,c("I4t", "I12k", "I25t", "I28t", "I33k", "I37t")], 2, FUN = function(x)table(x))
write.csv(t(dfx), "MOE.csv",row.names = F)
apply(dat[,c("I4t", "I12k", "I25t", "I28t", "I33k", "I37t")], 2, FUN = function(x)psych::describe(x))
round(apply(dat[,c("I4t", "I12k", "I25t", "I28t", "I33k", "I37t")], 2, FUN = function(x)misty::multilevel.icc(x, dat$School_id)), 3)

######### Understanding Other's Emotions ###########
# I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t + I38k + I42k + I46k
dfx <- apply(dat[,c("I1t", "I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t", "I38k", "I42k", "I46k")], 2, FUN = function(x)table(x))
write.csv(t(dfx), "UOthE.csv",row.names = F)
apply(dat[,c("I1t", "I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t", "I38k", "I42k", "I46k")], 2, FUN = function(x)psych::describe(x))
round(apply(dat[,c("I1t", "I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t", "I38k", "I42k", "I46k")], 2, FUN = function(x)misty::multilevel.icc(x, dat$School_id)), 3)

########### Managing Other's Emotions ##############
# I2k + I5k + I9t + I15t + I17t + I24t + I30k + I36t + I40k + I44k
dfx <- apply(dat[,c("I2k", "I5k", "I9t", "I15t", "I17t", "I24t", "I30k", "I36t", "I40k", "I44k")], 2, FUN = function(x)table(x))
write.csv(t(dfx), "MOthE.csv",row.names = F)
apply(dat[,c("I2k", "I5k", "I9t", "I15t", "I17t", "I24t", "I30k", "I36t", "I40k", "I44k")], 2, FUN = function(x)psych::describe(x))
round(apply(dat[,c("I2k", "I5k", "I9t", "I15t", "I17t", "I24t", "I30k", "I36t", "I40k", "I44k")], 2, FUN = function(x)misty::multilevel.icc(x, dat$School_id)), 3)

######### Controlling own Expressions ##############
# I6k + I10k + I16k + I19t + I21t + I23t + I39k
dfx <- apply(dat[,c("I6k", "I10k", "I16k", "I19t", "I21t", "I23t", "I39k")], 2, FUN = function(x)table(x))
write.csv(t(dfx), "COE.csv",row.names = F)
apply(dat[,c("I6k", "I10k", "I16k", "I19t", "I21t", "I23t", "I39k")], 2, FUN = function(x)psych::describe(x))
round(apply(dat[,c("I6k", "I10k", "I16k", "I19t", "I21t", "I23t", "I39k")], 2, FUN = function(x)misty::multilevel.icc(x, dat$School_id)), 3)

############################################## Skewness ################################################
sort(abs(sort(apply(dat[, 10:55], 2, FUN = function(x)psych::skew(x)))))                    # All under absolute value of 2

################################### Dimensionality Analysis ##########################################
colnames(dat)[10:55]
# Model 1: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t + I38k + I42k + I46k
          Subscale_MU =~  I2k + I5k + I9t + I15t + I17t + I24t + I30k + I36t + I40k + I44k
          Subscale_VE =~  I6k + I10k + I16k + I19t + I21t + I23t + I39k
          Subscale_VP =~  I7t + I8k + I14t + I18k + I22k + I26t + I31k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I12k + I25t + I28t + I33k + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                 # CFI = .604, RMSEA = .063, SRMR = .103,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")            # gammaHat = .86
```

```
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:45, 96:105) ,c(1,2,3,7,11)]

#          lhs op       rhs pvalue std.all
# 1  Subscale_MP =~       I1t  0.000   0.369 +'ve                          # Understanding others emotions
# 2  Subscale_MP =~       I3t  0.000   0.545 +'ve
# 3  Subscale_MP =~      I11t  0.000   0.605 +'ve
# 4  Subscale_MP =~      I13t  0.000   0.573 +'ve
# 5  Subscale_MP =~      I20t  0.000   0.651 +'ve
# 6  Subscale_MP =~      I27t  0.000   0.578 +'ve
# 7  Subscale_MP =~      I29t  0.000   0.594 +'ve
# 8  Subscale_MP =~      I32t  0.000   0.542 +'ve
# 9  Subscale_MP =~      I34t  0.000   0.626 +'ve
# 10 Subscale_MP =~      I38k  0.277  -0.046 * "If my friend or an adult gets angry with me, sometimes I don't notice it right away"
# 11 Subscale_MP =~      I42k  0.726  -0.015 * "I can't guess how the mood of adults or my friends will change"
# 12 Subscale_MP =~      I46k  0.000  -0.201 * "I don't understand why some people resent me"

# 13 Subscale_MU =~       I2k  0.000   0.249 -'ve worded                    # Managing others emotions
# 14 Subscale_MU =~       I5k  0.000   0.181 -'ve worded
# 15 Subscale_MU =~       I9t  0.000   0.477
# 16 Subscale_MU =~      I15t  0.000   0.705
# 17 Subscale_MU =~      I17t  0.000   0.661
# 18 Subscale_MU =~      I24t  0.146   0.063
# 19 Subscale_MU =~      I30k  0.000   0.318 -'ve worded
# 20 Subscale_MU =~      I36t  0.000   0.727
# 21 Subscale_MU =~      I40k  0.000   0.398 -'ve worded
# 22 Subscale_MU =~      I44k  0.913  -0.005 -'ve worded

# 23 Subscale_VE =~      I6k  0.661   0.020 -'ve worded                    # Controlling own expressions
# 24 Subscale_VE =~     I10k  0.974   0.001 -'ve worded
# 25 Subscale_VE =~     I16k  0.944   0.003 -'ve worded
# 26 Subscale_VE =~     I19t  0.000  -0.261
# 27 Subscale_VE =~     I21t  0.000  -0.620                    Note: "I always know what my facial expression is, and I can control it"
# 28 Subscale_VE =~     I23t  0.000  -0.600
# 29 Subscale_VE =~     I39k  0.000   0.298 -'ve worded

# 30 Subscale_VP =~     I7t  0.085   0.078                    # Understanding own emotions
# 31 Subscale_VP =~      I8k  0.000  -0.364 -'ve worded
# 32 Subscale_VP =~     I14t  0.006  -0.125
# 33 Subscale_VP =~     I18k  0.000  -0.481 -'ve worded
# 34 Subscale_VP =~     I22k  0.000  -0.622 -'ve worded
# 35 Subscale_VP =~     I26t  0.012  -0.115
# 36 Subscale_VP =~     I31k  0.000  -0.219 -'ve worded
# 37 Subscale_VP =~     I35k  0.000  -0.418 -'ve worded
# 38 Subscale_VP =~     I41k  0.000  -0.598 -'ve worded
# 39 Subscale_VP =~     I45k  0.000  -0.502 -'ve worded

# 40 Subscale_VU =~      I4t  0.000   0.502                    # Managing own emotions
# 41 Subscale_VU =~     I12k  0.000   0.200 -'ve worded
# 42 Subscale_VU =~     I25t  0.000   0.552
# 43 Subscale_VU =~     I28t  0.000   0.589
# 44 Subscale_VU =~     I33k  0.000   0.387 -'ve worded
# 45 Subscale_VU =~     I37t  0.000   0.640

#### Inter-Factor Correlations ####
# 96  Subscale_MP ~~ Subscale_MU  0.000   0.594
# 97  Subscale_MP ~~ Subscale_VE  0.000  -0.670
# 98  Subscale_MP ~~ Subscale_VP  0.000   0.280
# 99  Subscale_MP ~~ Subscale_VU  0.000   0.403
# 100 Subscale_MU ~~ Subscale_VE  0.000  -0.539
```

```
# 101 Subscale_MU ~~ Subscale_VP  0.098  -0.087
# 102 Subscale_MU ~~ Subscale_VU  0.000   0.489
# 103 Subscale_VE ~~ Subscale_VP  0.560  -0.036
# 104 Subscale_VE ~~ Subscale_VU  0.000  -0.683
# 105 Subscale_VP ~~ Subscale_VU  0.000  -0.427

#############################################################################################################
# Note. Remove all negative items from all of the scales except VP scale. (for VP scale, swap 17t and 18k)

# Model 2: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I24t + I36t
          Subscale_VE =~  I19t + I21t + I23t
          Subscale_VP =~  I8k + I7t + I14t + I18k + I22k + I26t + I31k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .766, RMSEA = .061, SRMR = .097,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .908
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:31, 68:77) ,c(1,2,3,7,11)]

#          lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I1t  0.000   0.367
# 2  Subscale_MP =~        I3t  0.000   0.544
# 3  Subscale_MP =~       I11t  0.000   0.609
# 4  Subscale_MP =~       I13t  0.000   0.574
# 5  Subscale_MP =~       I20t  0.000   0.652
# 6  Subscale_MP =~       I27t  0.000   0.579
# 7  Subscale_MP =~       I29t  0.000   0.590
# 8  Subscale_MP =~       I32t  0.000   0.546
# 9  Subscale_MP =~       I34t  0.000   0.624

# 10 Subscale_MU =~        I9t  0.000   0.483
# 11 Subscale_MU =~       I15t  0.000   0.693
# 12 Subscale_MU =~       I17t  0.000   0.655
# 13 Subscale_MU =~       I24t  0.043   0.088
# 14 Subscale_MU =~       I36t  0.000   0.740

# 15 Subscale_VE =~       I19t  0.000   0.261
# 16 Subscale_VE =~       I21t  0.000   0.651
# 17 Subscale_VE =~       I23t  0.000   0.624

# 18 Subscale_VP =~        I8k  0.000   0.365
# 19 Subscale_VP =~        I7t  0.080  -0.080  *** negative so remove
# 20 Subscale_VP =~       I14t  0.008   0.122
# 21 Subscale_VP =~       I18k  0.000   0.470
# 22 Subscale_VP =~       I22k  0.000   0.632
# 23 Subscale_VP =~       I26t  0.023   0.105
# 24 Subscale_VP =~       I31k  0.000   0.212
# 25 Subscale_VP =~       I35k  0.000   0.399
# 26 Subscale_VP =~       I41k  0.000   0.614
# 27 Subscale_VP =~       I45k  0.000   0.500

# 28 Subscale_VU =~        I4t  0.000   0.484
# 29 Subscale_VU =~       I25t  0.000   0.553
# 30 Subscale_VU =~       I28t  0.000   0.589
# 31 Subscale_VU =~       I37t  0.000   0.665

# Inter-factor correlations
```

```
# 68 Subscale_MP ~~ Subscale_MU  0.000   0.647
# 69 Subscale_MP ~~ Subscale_VE  0.000   0.625
# 70 Subscale_MP ~~ Subscale_VP  0.000  -0.259
# 71 Subscale_MP ~~ Subscale_VU  0.000   0.474
# 72 Subscale_MU ~~ Subscale_VE  0.000   0.544
# 73 Subscale_MU ~~ Subscale_VP  0.735  -0.018
# 74 Subscale_MU ~~ Subscale_VU  0.000   0.512
# 75 Subscale_VE ~~ Subscale_VP  0.791  -0.016
# 76 Subscale_VE ~~ Subscale_VU  0.000   0.706
# 77 Subscale_VP ~~ Subscale_VU  0.000   0.308

# Model 3: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I24t + I36t
          Subscale_VE =~  I19t + I21t + I23t
          Subscale_VP =~  I8k + I14t + I18k + I22k + I26t + I31k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .784, RMSEA = .060, SRMR = .091,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .914
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:30, 66:75) ,c(1,2,3,7,11)]

#          lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I1t  0.000   0.367
# 2  Subscale_MP =~        I3t  0.000   0.544
# 3  Subscale_MP =~       I11t  0.000   0.609
# 4  Subscale_MP =~       I13t  0.000   0.573
# 5  Subscale_MP =~       I20t  0.000   0.653
# 6  Subscale_MP =~       I27t  0.000   0.579
# 7  Subscale_MP =~       I29t  0.000   0.590
# 8  Subscale_MP =~       I32t  0.000   0.546
# 9  Subscale_MP =~       I34t  0.000   0.624

# 10 Subscale_MU =~        I9t  0.000   0.483
# 11 Subscale_MU =~       I15t  0.000   0.693
# 12 Subscale_MU =~       I17t  0.000   0.655
# 13 Subscale_MU =~       I24t  0.044   0.088  *low so delete
# 14 Subscale_MU =~       I36t  0.000   0.740

# 15 Subscale_VE =~       I19t  0.000   0.260
# 16 Subscale_VE =~       I21t  0.000   0.652
# 17 Subscale_VE =~       I23t  0.000   0.624

# 18 Subscale_VP =~        I8k  0.000   0.368
# 19 Subscale_VP =~       I14t  0.003   0.136
# 20 Subscale_VP =~       I18k  0.000   0.470
# 21 Subscale_VP =~       I22k  0.000   0.629
# 22 Subscale_VP =~       I26t  0.009   0.119
# 23 Subscale_VP =~       I31k  0.000   0.211
# 24 Subscale_VP =~       I35k  0.000   0.403
# 25 Subscale_VP =~       I41k  0.000   0.612
# 26 Subscale_VP =~       I45k  0.000   0.499

# 27 Subscale_VU =~        I4t  0.000   0.484
# 28 Subscale_VU =~       I25t  0.000   0.553
# 29 Subscale_VU =~       I28t  0.000   0.589
# 30 Subscale_VU =~       I37t  0.000   0.665
```

```
# Inter-factor correlations
# 66 Subscale_MP ~~ Subscale_MU  0.000   0.647
# 67 Subscale_MP ~~ Subscale_VE  0.000   0.624
# 68 Subscale_MP ~~ Subscale_VP  0.000  -0.241
# 69 Subscale_MP ~~ Subscale_VU  0.000   0.474
# 70 Subscale_MU ~~ Subscale_VE  0.000   0.544
# 71 Subscale_MU ~~ Subscale_VP  0.943  -0.004
# 72 Subscale_MU ~~ Subscale_VU  0.000   0.512
# 73 Subscale_VE ~~ Subscale_VP  0.949   0.004
# 74 Subscale_VE ~~ Subscale_VU  0.000   0.706
# 75 Subscale_VP ~~ Subscale_VU  0.000   0.325

# Model 4: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VE =~  I19t + I21t + I23t
          Subscale_VP =~  I8k + I14t + I18k + I22k + I26t + I31k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .802, RMSEA = .059, SRMR = .089,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .920
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:29, 64:73) ,c(1,2,3,7,11)]

#          lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I1t  0.000   0.367
# 2  Subscale_MP =~        I3t  0.000   0.544
# 3  Subscale_MP =~       I11t  0.000   0.609
# 4  Subscale_MP =~       I13t  0.000   0.573
# 5  Subscale_MP =~       I20t  0.000   0.653
# 6  Subscale_MP =~       I27t  0.000   0.579
# 7  Subscale_MP =~       I29t  0.000   0.590
# 8  Subscale_MP =~       I32t  0.000   0.546
# 9  Subscale_MP =~       I34t  0.000   0.624

# 10 Subscale_MU =~        I9t  0.000   0.482
# 11 Subscale_MU =~       I15t  0.000   0.697
# 12 Subscale_MU =~       I17t  0.000   0.660
# 13 Subscale_MU =~       I36t  0.000   0.737

# 14 Subscale_VE =~       I19t  0.000   0.260
# 15 Subscale_VE =~       I21t  0.000   0.652
# 16 Subscale_VE =~       I23t  0.000   0.623

# 17 Subscale_VP =~        I8k  0.000   0.368
# 18 Subscale_VP =~       I14t  0.003   0.137
# 19 Subscale_VP =~       I18k  0.000   0.470
# 20 Subscale_VP =~       I22k  0.000   0.629
# 21 Subscale_VP =~       I26t  0.009   0.119  * remove
# 22 Subscale_VP =~       I31k  0.000   0.211
# 23 Subscale_VP =~       I35k  0.000   0.403
# 24 Subscale_VP =~       I41k  0.000   0.612
# 25 Subscale_VP =~       I45k  0.000   0.499

# 26 Subscale_VU =~        I4t  0.000   0.484
# 27 Subscale_VU =~       I25t  0.000   0.553
# 28 Subscale_VU =~       I28t  0.000   0.589
# 29 Subscale_VU =~       I37t  0.000   0.665
```

```
# Inter-factor corelations
# 64 Subscale_MP ~~ Subscale_MU  0.000   0.639
# 65 Subscale_MP ~~ Subscale_VE  0.000   0.624
# 66 Subscale_MP ~~ Subscale_VP  0.000  -0.241
# 67 Subscale_MP ~~ Subscale_VU  0.000   0.474
# 68 Subscale_MU ~~ Subscale_VE  0.000   0.538
# 69 Subscale_MU ~~ Subscale_VP  0.935   0.004
# 70 Subscale_MU ~~ Subscale_VU  0.000   0.512
# 71 Subscale_VE ~~ Subscale_VP  0.943   0.004
# 72 Subscale_VE ~~ Subscale_VU  0.000   0.706
# 73 Subscale_VP ~~ Subscale_VU  0.000   0.325

# Model 5: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VE =~  I19t + I21t + I23t
          Subscale_VP =~  I8k + I14t + I18k + I22k + I31k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .848, RMSEA = .052, SRMR = .071,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .939
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:28, 62:71) ,c(1,2,3,7,11)]

#           lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I1t  0.000   0.367
# 2  Subscale_MP =~        I3t  0.000   0.544
# 3  Subscale_MP =~       I11t  0.000   0.609
# 4  Subscale_MP =~       I13t  0.000   0.573
# 5  Subscale_MP =~       I20t  0.000   0.652
# 6  Subscale_MP =~       I27t  0.000   0.579
# 7  Subscale_MP =~       I29t  0.000   0.590
# 8  Subscale_MP =~       I32t  0.000   0.545
# 9  Subscale_MP =~       I34t  0.000   0.624

# 10 Subscale_MU =~        I9t  0.000   0.482
# 11 Subscale_MU =~       I15t  0.000   0.697
# 12 Subscale_MU =~       I17t  0.000   0.659
# 13 Subscale_MU =~       I36t  0.000   0.738

# 14 Subscale_VE =~       I19t  0.000   0.261
# 15 Subscale_VE =~       I21t  0.000   0.651
# 16 Subscale_VE =~       I23t  0.000   0.624

# 17 Subscale_VP =~        I8k  0.000   0.359
# 18 Subscale_VP =~       I14t  0.015   0.111  * remove
# 19 Subscale_VP =~       I18k  0.000   0.467
# 20 Subscale_VP =~       I22k  0.000   0.632
# 21 Subscale_VP =~       I31k  0.000   0.216
# 22 Subscale_VP =~       I35k  0.000   0.398
# 23 Subscale_VP =~       I41k  0.000   0.619
# 24 Subscale_VP =~       I45k  0.000   0.505

# 25 Subscale_VU =~        I4t  0.000   0.484
# 26 Subscale_VU =~       I25t  0.000   0.552
# 27 Subscale_VU =~       I28t  0.000   0.589
# 28 Subscale_VU =~       I37t  0.000   0.666

# Inter-factor
```

```
# 62 Subscale_MP ~~ Subscale_MU  0.000   0.639
# 63 Subscale_MP ~~ Subscale_VE  0.000   0.625
# 64 Subscale_MP ~~ Subscale_VP  0.000  -0.268  only one significant, MP~~VP, i.e., Understanding others emotions AND Understnading own
emotions.
# 65 Subscale_MP ~~ Subscale_VU  0.000   0.474
# 66 Subscale_MU ~~ Subscale_VE  0.000   0.538
# 67 Subscale_MU ~~ Subscale_VP  0.723  -0.019
# 68 Subscale_MU ~~ Subscale_VU  0.000   0.512
# 69 Subscale_VE ~~ Subscale_VP  0.629  -0.029
# 70 Subscale_VE ~~ Subscale_VU  0.000   0.706
# 71 Subscale_VP ~~ Subscale_VU  0.000   0.292

# Model 6: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VE =~  I19t + I21t + I23t
          Subscale_VP =~  I8k + I18k + I22k + I31k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .884, RMSEA = .046, SRMR = .053,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .953
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:27, 60:69) ,c(1,2,3,7,11)]

#           lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I1t  0.000   0.367
# 2  Subscale_MP =~        I3t  0.000   0.544
# 3  Subscale_MP =~       I11t  0.000   0.609
# 4  Subscale_MP =~       I13t  0.000   0.574
# 5  Subscale_MP =~       I20t  0.000   0.652
# 6  Subscale_MP =~       I27t  0.000   0.579
# 7  Subscale_MP =~       I29t  0.000   0.590
# 8  Subscale_MP =~       I32t  0.000   0.545
# 9  Subscale_MP =~       I34t  0.000   0.624

# 10 Subscale_MU =~        I9t  0.000   0.482
# 11 Subscale_MU =~       I15t  0.000   0.697
# 12 Subscale_MU =~       I17t  0.000   0.659
# 13 Subscale_MU =~       I36t  0.000   0.738

# 14 Subscale_VE =~       I19t  0.000   0.261
# 15 Subscale_VE =~       I21t  0.000   0.649
# 16 Subscale_VE =~       I23t  0.000   0.626

# 17 Subscale_VP =~        I8k  0.000   0.354
# 18 Subscale_VP =~       I18k  0.000   0.463
# 19 Subscale_VP =~       I22k  0.000   0.634
# 20 Subscale_VP =~       I31k  0.000   0.220 *remove
# 21 Subscale_VP =~       I35k  0.000   0.392
# 22 Subscale_VP =~       I41k  0.000   0.620
# 23 Subscale_VP =~       I45k  0.000   0.509

# 24 Subscale_VU =~        I4t  0.000   0.483
# 25 Subscale_VU =~       I25t  0.000   0.553
# 26 Subscale_VU =~       I28t  0.000   0.588
# 27 Subscale_VU =~       I37t  0.000   0.666

# Inter-factor
# 60 Subscale_MP ~~ Subscale_MU  0.000   0.639
```

```
# 61 Subscale_MP ~~ Subscale_VE  0.000   0.625
# 62 Subscale_MP ~~ Subscale_VP  0.000  -0.288
# 63 Subscale_MP ~~ Subscale_VU  0.000   0.474
# 64 Subscale_MU ~~ Subscale_VE  0.000   0.538
# 65 Subscale_MU ~~ Subscale_VP  0.530  -0.034
# 66 Subscale_MU ~~ Subscale_VU  0.000   0.512
# 67 Subscale_VE ~~ Subscale_VP  0.369  -0.054
# 68 Subscale_VE ~~ Subscale_VU  0.000   0.706
# 69 Subscale_VP ~~ Subscale_VU  0.000   0.272

# Model 7: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VE =~  I19t + I21t + I23t
          Subscale_VP =~  I8k + I18k + I22k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .886, RMSEA = .047, SRMR = .053,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .952
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:26, 58:67) ,c(1,2,3,7,11)]

#          lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I1t  0.000   0.367
# 2  Subscale_MP =~        I3t  0.000   0.544
# 3  Subscale_MP =~       I11t  0.000   0.609
# 4  Subscale_MP =~       I13t  0.000   0.573
# 5  Subscale_MP =~       I20t  0.000   0.652
# 6  Subscale_MP =~       I27t  0.000   0.579
# 7  Subscale_MP =~       I29t  0.000   0.590
# 8  Subscale_MP =~       I32t  0.000   0.545
# 9  Subscale_MP =~       I34t  0.000   0.624

# 10 Subscale_MU =~        I9t  0.000   0.482
# 11 Subscale_MU =~       I15t  0.000   0.697
# 12 Subscale_MU =~       I17t  0.000   0.659
# 13 Subscale_MU =~       I36t  0.000   0.738

# 14 Subscale_VE =~       I19t  0.000   0.261 * remove single item now... 8a, or remove entire factor 8b
# 15 Subscale_VE =~       I21t  0.000   0.650
# 16 Subscale_VE =~       I23t  0.000   0.625

# 17 Subscale_VP =~        I8k  0.000   0.347
# 18 Subscale_VP =~       I18k  0.000   0.457
# 19 Subscale_VP =~       I22k  0.000   0.642
# 20 Subscale_VP =~       I35k  0.000   0.381
# 21 Subscale_VP =~       I41k  0.000   0.627
# 22 Subscale_VP =~       I45k  0.000   0.505

# 23 Subscale_VU =~        I4t  0.000   0.483
# 24 Subscale_VU =~       I25t  0.000   0.553
# 25 Subscale_VU =~       I28t  0.000   0.588
# 26 Subscale_VU =~       I37t  0.000   0.667

# Inter-factor
# 58 Subscale_MP ~~ Subscale_MU  0.000   0.639
# 59 Subscale_MP ~~ Subscale_VE  0.000   0.625
# 60 Subscale_MP ~~ Subscale_VP  0.000  -0.285
# 61 Subscale_MP ~~ Subscale_VU  0.000   0.474
```

```
# 62 Subscale_MU ~~ Subscale_VE  0.000   0.538
# 63 Subscale_MU ~~ Subscale_VP  0.483  -0.038
# 64 Subscale_MU ~~ Subscale_VU  0.000   0.512
# 65 Subscale_VE ~~ Subscale_VP  0.431  -0.048
# 66 Subscale_VE ~~ Subscale_VU  0.000   0.706
# 67 Subscale_VP ~~ Subscale_VU  0.000   0.284

# Model 8a: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VE =~  I21t + I23t
          Subscale_VP =~  I8k + I18k + I22k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .893, RMSEA = .048, SRMR = .052,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .954
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:25, 56:65) ,c(1,2,3,7,11)]

#          lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I1t  0.000   0.368
# 2  Subscale_MP =~        I3t  0.000   0.545
# 3  Subscale_MP =~       I11t  0.000   0.609
# 4  Subscale_MP =~       I13t  0.000   0.572
# 5  Subscale_MP =~       I20t  0.000   0.652
# 6  Subscale_MP =~       I27t  0.000   0.580
# 7  Subscale_MP =~       I29t  0.000   0.589
# 8  Subscale_MP =~       I32t  0.000   0.547
# 9  Subscale_MP =~       I34t  0.000   0.624

# 10 Subscale_MU =~        I9t  0.000   0.482
# 11 Subscale_MU =~       I15t  0.000   0.698
# 12 Subscale_MU =~       I17t  0.000   0.660
# 13 Subscale_MU =~       I36t  0.000   0.737

# 14 Subscale_VE =~       I21t  0.000   0.688
# 15 Subscale_VE =~       I23t  0.000   0.612

# 16 Subscale_VP =~        I8k  0.000   0.347
# 17 Subscale_VP =~       I18k  0.000   0.456
# 18 Subscale_VP =~       I22k  0.000   0.641
# 19 Subscale_VP =~       I35k  0.000   0.380
# 20 Subscale_VP =~       I41k  0.000   0.627
# 21 Subscale_VP =~       I45k  0.000   0.506

# 22 Subscale_VU =~        I4t  0.000   0.484
# 23 Subscale_VU =~       I25t  0.000   0.557
# 24 Subscale_VU =~       I28t  0.000   0.583
# 25 Subscale_VU =~       I37t  0.000   0.667
# Inter-factor
# 56 Subscale_MP ~~ Subscale_MU  0.000   0.639
# 57 Subscale_MP ~~ Subscale_VE  0.000   0.585
# 58 Subscale_MP ~~ Subscale_VP  0.000  -0.285
# 59 Subscale_MP ~~ Subscale_VU  0.000   0.474
# 60 Subscale_MU ~~ Subscale_VE  0.000   0.513
# 61 Subscale_MU ~~ Subscale_VP  0.484  -0.038
# 62 Subscale_MU ~~ Subscale_VU  0.000   0.512
# 63 Subscale_VE ~~ Subscale_VP  0.885  -0.009
# 64 Subscale_VE ~~ Subscale_VU  0.000   0.704
```

```
# 65 Subscale_VP ~~ Subscale_VU  0.000   0.284

# Model 8b: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I8k + I18k + I22k + I35k + I41k + I45k
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "MLR")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .916, RMSEA = .043, SRMR = .050,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .965
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:23, 51:56) ,c(1,2,3,7,11)]

#          lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I1t  0.000   0.374
# 2  Subscale_MP =~        I3t  0.000   0.547
# 3  Subscale_MP =~       I11t  0.000   0.620
# 4  Subscale_MP =~       I13t  0.000   0.564
# 5  Subscale_MP =~       I20t  0.000   0.650
# 6  Subscale_MP =~       I27t  0.000   0.576
# 7  Subscale_MP =~       I29t  0.000   0.584
# 8  Subscale_MP =~       I32t  0.000   0.551
# 9  Subscale_MP =~       I34t  0.000   0.623

# 10 Subscale_MU =~        I9t  0.000   0.480
# 11 Subscale_MU =~       I15t  0.000   0.702
# 12 Subscale_MU =~       I17t  0.000   0.663
# 13 Subscale_MU =~       I36t  0.000   0.732

# 14 Subscale_VP =~        I8k  0.000   0.347  * negative and lowest loadings
# 15 Subscale_VP =~       I18k  0.000   0.456  * negative semantic
# 16 Subscale_VP =~       I22k  0.000   0.640  * negative semantic
# 17 Subscale_VP =~       I35k  0.000   0.381  * negative semantic
# 18 Subscale_VP =~       I41k  0.000   0.627  * negative semantic
# 19 Subscale_VP =~       I45k  0.000   0.507  * negative semantic,   understanding own emotions.

# 20 Subscale_VU =~        I4t  0.000   0.515
# 21 Subscale_VU =~       I25t  0.000   0.571
# 22 Subscale_VU =~       I28t  0.000   0.604
# 23 Subscale_VU =~       I37t  0.000   0.612

# Inter-factor
# 51 Subscale_MP ~~ Subscale_MU  0.000   0.639
# 52 Subscale_MP ~~ Subscale_VP  0.000  -0.285  Significant negative correlation between!!!!!!!
# 53 Subscale_MP ~~ Subscale_VU  0.000   0.474
# 54 Subscale_MU ~~ Subscale_VP  0.499  -0.036
# 55 Subscale_MU ~~ Subscale_VU  0.000   0.519
# 56 Subscale_VP ~~ Subscale_VU  0.000   0.293

# Scholars of instrument: D. V. Lyusin
# http://www.ipras.ru/cntnt/rus/dop_dokume/minisajty_/lusin-dmitriy-vladimirovich.html

#############################################################################################################
# Explore construct validity:

# Heterotrait-monotrait Rtio test. Should be less than .85 for each test.
semTools::htmt(model = EI.model, data = dat)

# S          bs_MP Sbs_MU Sbs_VE Sbs_VP Sbs_VU
```

```
# Subscale_MP 1.000   -   -     -    -
# Subscale_MU 0.641  1.000  -     -    -
# Subscale_VE 0.539  0.516  1.000  -    -
# Subscale_VP 0.257  0.089  0.147  1.000  -
# Subscale_VU 0.351  0.522  0.597  0.281  1.000

##########################################################################################################

##########################################################################################################
#                        Final test with positive VP items                              #
##########################################################################################################

# Model 8b: EI by subscales
EI.model <-  'Subscale_MP  =~ I1t + I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .928, RMSEA = .045, SRMR = .043,
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .968
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:20, 45:50) ,c(1,2,3,7,11)]
dim(dat)  # 658
#          lhs op        rhs pvalue std.all
# 1  Subscale_MP =~       I1t     0   0.361   * Understanding others emotions
# 2  Subscale_MP =~       I3t     0   0.549
# 3  Subscale_MP =~      I11t     0   0.627
# 4  Subscale_MP =~      I13t     0   0.574
# 5  Subscale_MP =~      I20t     0   0.654
# 6  Subscale_MP =~      I27t     0   0.573
# 7  Subscale_MP =~      I29t     0   0.570
# 8  Subscale_MP =~      I32t     0   0.548
# 9  Subscale_MP =~      I34t     0   0.623

# 10 Subscale_MU =~       I9t     0   0.482    * Managing others emotions
# 11 Subscale_MU =~      I15t     0   0.701
# 12 Subscale_MU =~      I17t     0   0.663
# 13 Subscale_MU =~      I36t     0   0.732

# 14 Subscale_VP =~       I7t     0   0.407    * Understanding own emotions
# 15 Subscale_VP =~      I14t     0   0.525
# 16 Subscale_VP =~      I26t     0   0.612

# 17 Subscale_VU =~       I4t     0   0.500    * Managing own emotions
# 18 Subscale_VU =~      I25t     0   0.580
# 19 Subscale_VU =~      I28t     0   0.582
# 20 Subscale_VU =~      I37t     0   0.637                                    * Note that VE, Controlling own expressions, is excluded to obtain fit

# Inter-factor correlations
# 45 Subscale_MP ~~ Subscale_MU     0   0.640
# 46 Subscale_MP ~~ Subscale_VP     0   0.690 With the semantically negative items actually included (though not here) for VP, the correlation here
was in fact negative and significant!
# 47 Subscale_MP ~~ Subscale_VU     0   0.476 Therefore, this is the more appropriate model.
# 48 Subscale_MU ~~ Subscale_VP     0   0.548
# 49 Subscale_MU ~~ Subscale_VU     0   0.518
# 50 Subscale_VP ~~ Subscale_VU     0   0.815

semTools::htmt(model = EI.model, data = dat)
```

```
#          Sbs_MP Sbs_MU Sbs_VP Sbs_VU
# Subscale_MP 1.000   -     -     -        * understanding others emotions
# Subscale_MU 0.641  1.000   -     -        * managing others emotions
# Subscale_VP 0.695  0.579  1.000   -        * understanding your own emotions
# Subscale_VU 0.351  0.522  0.757  1.000       * managing your own emotions
dim(dat)
table(dat$Age)
length(table(dat$School_full))

#########################################################################################################
#                                    FINAL MODEL                                    #
#########################################################################################################
# Model 8b: EI by subscales
EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
          Subscale_VU =~  I4t + I25t + I28t + I37t'

fit <- lavaan::cfa(EI.model, data = dat, std.lv = TRUE, estimator = "ML")
summary(fit, fit.measures = TRUE, standardized = T)                  # CFI = .928, RMSEA = .045, SRMR = .043,
stats::pchisq(348.473/146, df=1, lower.tail=FALSE)                   # .123
semTools::moreFitIndices(fit, fit.measures = "gammaHat")             # gammaHat = .969
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:19, 43:48) ,c(1,2,3,7,11)]

#          lhs op        rhs pvalue std.all
# 1  Subscale_MP =~        I3t      0   0.547
# 2  Subscale_MP =~       I11t      0   0.622
# 3  Subscale_MP =~       I13t      0   0.570
# 4  Subscale_MP =~       I20t      0   0.658
# 5  Subscale_MP =~       I27t      0   0.573
# 6  Subscale_MP =~       I29t      0   0.567
# 7  Subscale_MP =~       I32t      0   0.553
# 8  Subscale_MP =~       I34t      0   0.625

# 9  Subscale_MU =~        I9t      0   0.481
# 10 Subscale_MU =~       I15t      0   0.703
# 11 Subscale_MU =~       I17t      0   0.662
# 12 Subscale_MU =~       I36t      0   0.732

# 13 Subscale_VP =~        I7t      0   0.406  #
# 14 Subscale_VP =~       I14t      0   0.528  #
# 15 Subscale_VP =~       I26t      0   0.610  #

# 16 Subscale_VU =~        I4t      0   0.499  #
# 17 Subscale_VU =~       I25t      0   0.580  #
# 18 Subscale_VU =~       I28t      0   0.583  #
# 19 Subscale_VU =~       I37t      0   0.636  #
#
# 43 Subscale_MP ~~ Subscale_MU      0   0.639
# 44 Subscale_MP ~~ Subscale_VP      0   0.698
# 45 Subscale_MP ~~ Subscale_VU      0   0.485
# 46 Subscale_MU ~~ Subscale_VP      0   0.547
# 47 Subscale_MU ~~ Subscale_VU      0   0.517
# 48 Subscale_VP ~~ Subscale_VU      0   0.814
citation("semTools")
semTools::htmt(model = EI.model, data = dat)
#          Sbs_MP Sbs_MU Sbs_VP Sbs_VU
# Subscale_MP  1.000
# Subscale_MU  0.636  1.000
```

```
# Subscale_VP  0.744  0.579  1.000
# Subscale_VU  0.405  0.522  0.757  1.000
citation("TAM")

# Bootstrapped Confidence Intervals for main model
fit <- cfa(EI.model, data = dat, fixed.x = FALSE,
        se = "boot", bootstrap = 2000,
        iseed = 8970)
std <- standardizedSolution(fit)
print(std)

# WLSMV Variant
fit <- lavaan::cfa(EI.model, data = dat, std.lv=TRUE, estimator = "WLSMV", ordered = T)
summary(fit, fit.measures = TRUE, standardized = T)
stats::pchisq(446.095/146, df=1, lower.tail=FALSE)                  # 0.08046694
semTools::moreFitIndices(fit, fit.measures = "gammaHat.scaled")        # gammaHat = 0.954
std.estim <- parameterestimates(fit, standardized=TRUE)
std.estim[c(1:19, 43:48) ,c(1,2,3,7,11)]

# Calculating "omega"
head(dat)
df.var <- dat[, c("I7t","I14t","I26t")]
psych::omega(df.var)
psych::omega(df.var, poly = T)
df.var <- dat[, c("I4t","I25t","I28t","I37t")]
psych::omega(df.var)
psych::omega(df.var, poly = T)
df.var <- dat[, c("I3t","I11t","I13t","I20t","I27t","I29t","I32t","I34t")]
psych::omega(df.var)
psych::omega(df.var, poly = T)
df.var <- dat[, c("I9t","I15t","I17t","I36t")]
psych::omega(df.var)
psych::omega(df.var, poly = T)

#############################################################################################################
#                                Basic Descriptives                                  #
#############################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
          Subscale_VU =~  I4t + I25t + I28t + I37t'

# understanding other's emotions
round(mean(apply(dat[, c("I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t")], 1, FUN = function(x)sum(x/8))), 2)  # 1.86
round(sd(apply(dat[, c("I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t")], 1, FUN = function(x)sum(x/8))), 2)    # 0.55

# understanding own emotions
round(mean(apply(dat[, c("I7t", "I14t", "I26t")], 1, FUN = function(x)sum(x/3))), 2)  # 1.99
round(sd(apply(dat[, c("I7t", "I14t", "I26t")], 1, FUN = function(x)sum(x/3))), 2)    # 0.61

# managing other's emotions
round(mean(apply(dat[, c("I9t", "I15t", "I17t", "I36t")], 1, FUN = function(x)sum(x/4))), 2)  # 1.91
round(sd(apply(dat[, c("I9t", "I15t", "I17t", "I36t")], 1, FUN = function(x)sum(x/4))), 2)    # 0.65

# managing own's emotions
round(mean(apply(dat[, c("I4t", "I25t", "I28t", "I37t")], 1, FUN = function(x)sum(x/4))), 2)  # 1.77
round(sd(apply(dat[, c("I4t", "I25t", "I28t", "I37t")], 1, FUN = function(x)sum(x/4))), 2)    # 0.66
6332 + 9 + 49 + 85
#############################################################################################################
```

```
#                          Invariance Testing                                  #
################################################################################################################

################## By Gender ##############
# config
fit1 <- cfa(EI.model, data = dat, group = "Gender")
fit.summary<- summary(fit1, fit.measures=TRUE, standardized = T)

config.CFI <- fit.summary$fit[9]
config.RMSEA <- fit.summary$fit[17]
round(config.RMSEA, 2)                                          # 0.05, pass
config.gamma <- semTools::moreFitIndices(fit1, fit.measures = "gammaHat")
print(config.gamma)                                            # 0.958, pass

# metric
fit2 <- cfa(EI.model, data = dat, group = "Gender", group.equal = "loadings")
fit.summary <- summary(fit2, fit.measures=TRUE, standardized = T)
metric.CFI <- fit.summary$fit[9]
metric.gamma <- semTools::moreFitIndices(fit2, fit.measures = "gammaHat")
abs(config.CFI - metric.CFI)                                    # .0001270256, pass
abs(config.gamma - metric.gamma)                                    # 0.000, pass

# scalar
fit3 <- cfa(EI.model, data = dat, group = "Gender", group.equal = c("intercepts", "loadings"))
fit.summary<- summary(fit3, fit.measures=TRUE, standardized = T)
scalar.CFI <- fit.summary$fit[9]
scalar.gamma <- semTools::moreFitIndices(fit3, fit.measures = "gammaHat")
abs(metric.CFI - scalar.CFI)                                    # .004986732, pass
abs(metric.gamma - scalar.gamma)                                    # .002, pass

################## By Language ##############
# config
colnames(dat)

fit1 <- cfa(EI.model, data = dat, group = "k1r2")
fit.summary<- summary(fit1, fit.measures=TRUE, standardized = T)
config.CFI <- fit.summary$fit[9]
config.RMSEA <- fit.summary$fit[17]
round(config.RMSEA, 2)                                          # 0.05, pass
config.gamma <- semTools::moreFitIndices(fit1, fit.measures = "gammaHat")
print(config.gamma)                                            # 0.961, pass

# metric
fit2 <- cfa(EI.model, data = dat, group = "k1r2", group.equal = "loadings")
fit.summary <- summary(fit2, fit.measures=TRUE, standardized = T)
metric.CFI <- fit.summary$fit[9]
metric.gamma <- semTools::moreFitIndices(fit2, fit.measures = "gammaHat")
abs(config.CFI - metric.CFI)                                    # 0.0005285857, pass
abs(config.gamma - metric.gamma)                                    # 0.000, pass

# scalar
fit3 <- cfa(EI.model, data = dat, group = "k1r2", group.equal = c("intercepts", "loadings"))
fit.summary<- summary(fit3, fit.measures=TRUE, standardized = T)
scalar.CFI <- fit.summary$fit[9]
scalar.gamma <- semTools::moreFitIndices(fit3, fit.measures = "gammaHat")
abs(metric.CFI - scalar.CFI)                                    # 0.001252491, pass
abs(metric.gamma - scalar.gamma)                                    # 0.001, pass

################################################################################################################
################## GENDER Difference in MP: Understanding Other's Emotions ######################
```

```
#########################################################################################################
dat$Gender
dat$Gender <- car::recode(dat$Gender, "1 = 'male'; 2 = 'female'")
table(dat$Gender)

############# Observed differences #############
male.other.emo.tot <- apply(dat[dat$Gender == "male"   ,c("I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t")], 1, FUN = function(x)sum(x))
mean(male.other.emo.tot)    # 13.89256
female.other.emo.tot <- apply(dat[dat$Gender == "female"   ,c("I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t")], 1, FUN = function(x)sum(x))
mean(female.other.emo.tot)    # 15.50481

############## Latent differences ###############

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
          Subscale_VU =~  I4t + I25t + I28t + I37t

          I3t ~ 0*1

          Subscale_MP ~ c(male, female)*1

          diff := female - male'

fit4 <- cfa(EI.model, data = dat, group = "Gender", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = .201**, females higher for understanding own emotions

#########################################################################################################
########################### Difference in MU: Managing Other's Emotions ############################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
          Subscale_VU =~  I4t + I25t + I28t + I37t

          I9t ~ 0*1

          Subscale_MU ~ c(male, female)*1

          diff := female - male'

fit4 <- cfa(EI.model, data = dat, group = "Gender", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = -.007 ns, no difference

#########################################################################################################
########################### Difference in VP: Understanding Own Emotions ############################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
          Subscale_VU =~  I4t + I25t + I28t + I37t

          I7t ~ 0*1
```

```
        Subscale_VP ~ c(male, female)*1

        diff := female - male'

fit4 <- cfa(EI.model, data = dat, group = "Gender", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = .085 ns, no difference

#########################################################################################################
############################## Difference in VU: Managing Own Emotions ##################################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
        Subscale_MU =~  I9t + I15t + I17t + I36t
        Subscale_VP =~  I7t + I14t + I26t
        Subscale_VU =~  I4t + I25t + I28t + I37t

        I4t ~ 0*1

        Subscale_VU ~ c(male, female)*1

        diff := female - male'

fit4 <- cfa(EI.model, data = dat, group = "Gender", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = -0.211**, males higher for managing own emotions



#########################################################################################################
#################### GENDER Difference in MP: Understanding Other's Emotions ########################
#########################################################################################################
dat$Gender
dat$Gender <- car::recode(dat$Gender, "1 = 'male'; 2 = 'female'")
table(dat$Gender)

############# Observed differences #############
male.other.emo.tot <- apply(dat[dat$Gender == "male"   ,c("I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t")], 1, FUN = function(x)sum(x))
mean(male.other.emo.tot)    # 13.89256
female.other.emo.tot <- apply(dat[dat$Gender == "female"   ,c("I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t")], 1, FUN = function(x)sum(x))
mean(female.other.emo.tot)    # 15.50481

############## Latent differences ###############

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
        Subscale_MU =~  I9t + I15t + I17t + I36t
        Subscale_VP =~  I7t + I14t + I26t
        Subscale_VU =~  I4t + I25t + I28t + I37t

        I3t ~ 0*1

        Subscale_MP ~ c(male, female)*1

        diff := female - male'

fit4 <- cfa(EI.model, data = dat, group = "Gender", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
```

```
print(fit.summary)                                          # diff = .201**, females higher for understanding own emotions

#########################################################################################################
############################## Difference in MU: Managing Other's Emotions ##############################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
        Subscale_MU =~  I9t + I15t + I17t + I36t
        Subscale_VP =~  I7t + I14t + I26t
        Subscale_VU =~  I4t + I25t + I28t + I37t

        I9t ~ 0*1

        Subscale_MU ~ c(male, female)*1

        diff := female - male'

fit4 <- cfa(EI.model, data = dat, group = "Gender", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = -.007 ns, no difference

#########################################################################################################
############################## Difference in VP: Understanding Own Emotions #############################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
        Subscale_MU =~  I9t + I15t + I17t + I36t
        Subscale_VP =~  I7t + I14t + I26t
        Subscale_VU =~  I4t + I25t + I28t + I37t

        I7t ~ 0*1

        Subscale_VP ~ c(male, female)*1

        diff := female - male'

fit4 <- cfa(EI.model, data = dat, group = "Gender", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = .085 ns, no difference

#########################################################################################################
############################## Difference in VU: Managing Own Emotions ##################################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
        Subscale_MU =~  I9t + I15t + I17t + I36t
        Subscale_VP =~  I7t + I14t + I26t
        Subscale_VU =~  I4t + I25t + I28t + I37t

        I4t ~ 0*1

        Subscale_VU ~ c(male, female)*1

        diff := female - male'

fit4 <- cfa(EI.model, data = dat, group = "Gender", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
```

```
print(fit.summary)                                          # diff = -0.211**, males higher for managing own emotions

#########################################################################################################
#################### GENDER Difference in MP: Understanding Other's Emotions ######################
#########################################################################################################
dat$k1r2
dat$k1r2 <- car::recode(dat$k1r2, "1 = 'kaz'; 2 = 'rus'")
table(dat$k1r2)

############# Observed differences #############
kaz.other.emo.tot <- apply(dat[dat$k1r2 == "kaz"   ,c("I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t")], 1, FUN = function(x)sum(x))
mean(kaz.other.emo.tot)   # 15.00447
rus.other.emo.tot <- apply(dat[dat$k1r2 == "rus"   ,c("I3t", "I11t", "I13t", "I20t", "I27t", "I29t", "I32t", "I34t")], 1, FUN = function(x)sum(x))
mean(rus.other.emo.tot)   #  14.71564

############## Latent differences ###############

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
          Subscale_VU =~  I4t + I25t + I28t + I37t

          I3t ~ 0*1

          Subscale_MP ~ c(kaz, rus)*1

          diff := kaz - rus'

fit4 <- cfa(EI.model, data = dat, group = "k1r2", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = .0.055, Kaz higher for understanding own emotions

#########################################################################################################
########################### Difference in MU: Managing Other's Emotions ###########################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
          Subscale_VU =~  I4t + I25t + I28t + I37t

          I9t ~ 0*1

          Subscale_MU ~ c(kaz, rus)*1

          diff := kaz - rus'

fit4 <- cfa(EI.model, data = dat, group = "k1r2", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = -.007 ns, no difference

#########################################################################################################
########################### Difference in VP: Understanding Own Emotions ###########################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
          Subscale_MU =~  I9t + I15t + I17t + I36t
          Subscale_VP =~  I7t + I14t + I26t
```

```
        Subscale_VU =~  I4t + I25t + I28t + I37t

        I7t ~ 0*1

        Subscale_VP ~ c(kaz, rus)*1

        diff := kaz - rus'

fit4 <- cfa(EI.model, data = dat, group = "k1r2", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = .085 ns, no difference

#########################################################################################################
############################## Difference in VU: Managing Own Emotions ##################################
#########################################################################################################

EI.model <-  'Subscale_MP  =~ I3t + I11t + I13t + I20t + I27t + I29t + I32t + I34t
        Subscale_MU =~  I9t + I15t + I17t + I36t
        Subscale_VP =~  I7t + I14t + I26t
        Subscale_VU =~  I4t + I25t + I28t + I37t

        I4t ~ 0*1

        Subscale_VU ~ c(kaz, rus)*1

        diff := kaz - rus'

fit4 <- cfa(EI.model, data = dat, group = "k1r2", meanstructure = T)
summary(fit4)
fit.summary<- summary(fit4, fit.measures=TRUE, standardized = T)
print(fit.summary)                                          # diff = -0.211**, males higher for managing own emotions
## END ##
```