SAGE

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1   Intro

1.1   Import Libraries

```r
library(tidyverse)
library(tidymodels)
library(ggpubr)
library(sjPlot)
theme_set(theme_pubr())

#for statistics
library(car)
library(lme4)
library(lmerTest)

# for EFA
library(psych) #Main FA work
library(corrplot)
library(nFactors) #Help with number of factors to extract
library(FactoMineR) #Additional functions
library(parameters)
library(lavaan) #For CFA
```

1.2   Summary

Import -> Tidy Data -> Transform into what we want -> Analyze

1.2.1   EFA process

1. Calculate the Kaiser-Meyer-Olkin (KMO) values for every item. If any items have a KMO below the cutoff value, then the item with the lowest value is removed and the step is repeated. KMO values above 0.6 are kept, though above 0.8 are preferred. KMO measures the suitability for factor analysis by estimating the proportion of variance among all observed variables.
2. Check whether the items can be factored using Bartlett's test of sphericity. A low p-score indicates that factor analysis can be performed. Compares the correlation matrix to the identity matrix (checks whether there are correlations)
3. Calculate the EFA model using factoring and a specified number of factors.
4. Calculate the commonalities, which are the proportion of the item's variance explained by the factors. If any item is below the cutoff (<0.2), then the item with the lowest value is dropped and then restart at Step 1.
5. Calculate the item loadings. If there are items that fail to load to any factor, then remove the item with the smallest max loading and then restart at Step 1.

6. Create a model for the CFA by placing each item onto the factor that contains the item's largest loading. If any items load equally onto more than one factor, then add to all factors where this is the case.
7. Fit this model using Confirmatory Factor Analysis to the original data and extract a fit statistic (Akaike information criterion, or similar) to be used as a comparison for the ideal number of factors.
8. Change the number of factors and repeat the above steps.
9. Plot the fit statistic vs the number of factors. The model with the local minimum index is the preferred model.

2 Data Prep

2.1 Import Data

```
raw_df <- read.csv(file = "./ExportedFiles/SAGE_Raw.csv")
```
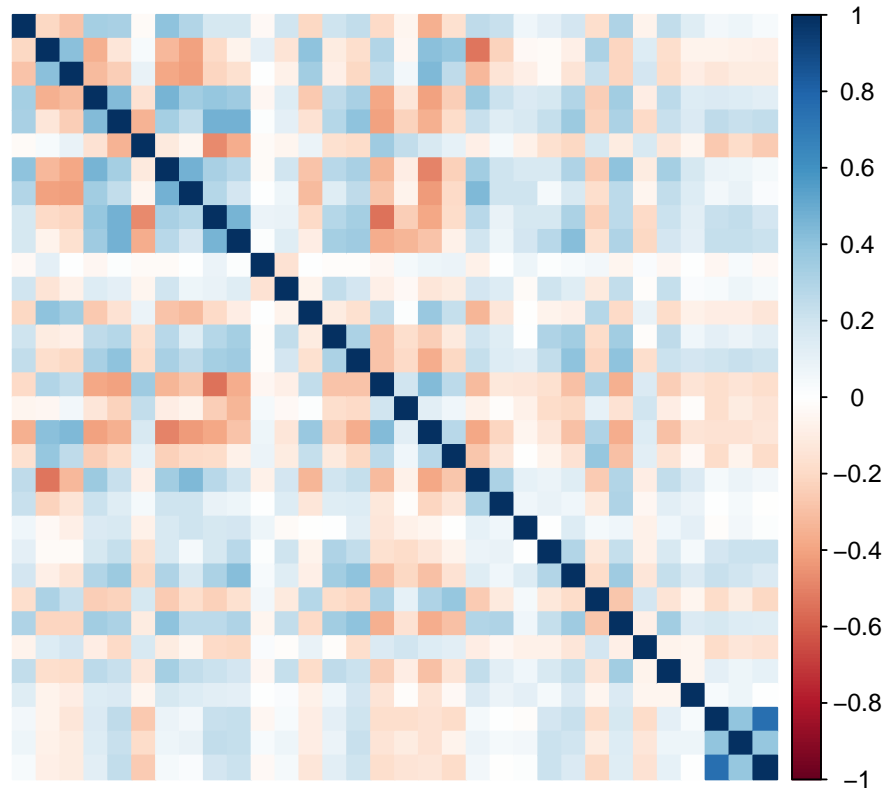
2.2 Process Data

Columns 1, 2, 54, 55 (intervention) are course information Columns 3 - 34 are the questions from SAGE Columns 35 - 53 are demographics questions

```
dat <- raw_df[,3:34]
set.seed(42)
df_split <- initial_split(raw_df, prop = 0.5)
train_data <- training(df_split)
test_data <- testing(df_split)
```

3 EFA

3.1 Correlations

```
M = cor(dat)
corrplot(M, method = 'color', tl.pos='n')
```

3.2 KMO Test

- 0.00 to 0.49 unacceptable
- 0.50 to 0.59 miserable
- 0.60 to 0.69 mediocre
- 0.70 to 0.79 middling
- 0.80 to 0.89 meritorious
- 0.90 to 1.00 marvelous

```
KMO(dat)
```

```
## Kaiser-Meyer-Olkin factor adequacy
## Call: KMO(r = dat)
## Overall MSA =  0.91
## MSA for each item =
##                                         When.I.work.in.a.group..I.do.higher.quality.work.
##                                                                                      0.93
##                                       When.I.work.in.a.group..I.end.up.doing.most.of.the.work.
##                                                                                      0.87
##                                  The.work.takes.more.time.to.complete.when.I.work.with.other.students.
##                                                                                      0.93
##                                      My.group.members.help.explain.things.that.I.do.not.understand.
##                                                                                      0.95
##                                          When.I.work.in.a.group..I.am.able.to.share.my.ideas.
##                                                                                      0.94
##                                     My.group.members.make.me.feel.that.I.am.not.as.smart.as.they.are.
##                                                                                      0.88
##                                 The.material.is.easier.to.understand.when.I.work.with.other.students.
##                                                                                      0.94
```

```
##                               The.workload.is.usually.less.when.I.work.with.other.students.
##                                                                                         0.92
##                                                         My.group.members.respect.my.opinions.
##                                                                                         0.91
##                                            I.feel.I.am.part.of.what.is.going.on.in.the.group.
##                                                                                         0.93
##                           I.prefer.when.one.student.regularly.takes.on.a.leadership.role.
##                                                                                         0.55
##                            I.prefer.when.the.leadership.role.rotates.between.students.
##                                                                                         0.86
##                                               I.do.not.think.a.group.grade.is.fair.
##                                                                                         0.94
##                                 I.try.to.make.sure.my.group.members.learn.the.material.
##                                                                                         0.93
##                                 I.learn.to.work.with.students.who.are.different.from.me.
##                                                                                         0.95
##                                    My.group.members.do.not.care.about.my.feelings.
##                                                                                         0.93
##                                      I.let.the.other.students.do.most.of.the.work.
##                                                                                         0.89
##                                      I.feel.working.in.groups.is.a.waste.of.time.
##                                                                                         0.95
##                             I.have.to.work.with.students.who.are.not.as.smart.as.I.am.
##                                                                                         0.91
##                           When.I.work.with.other.students.the.work.is.divided.equally.
##                                                                                         0.91
##                        We.cannot.complete.the.assignment.unless.everyone.contributes.
##                                                                                         0.88
##                                   I.prefer.to.take.on.tasks.that.I.m.already.good.at.
##                                                                                         0.78
##                        I.prefer.to.take.on.tasks.that.will.help.me.better.learn.the.material.
##                                                                                         0.91
##                                I.also.learn.when.I.teach.the.material.to.my.group.members.
##                                                                                         0.93
##                   I.become.frustrated.when.my.group.members.do.not.understand.the.material.
##                                                                                         0.93
##                             Everyone.s.ideas.are.needed.if.we.are.going.to.be.successful.
##                                                                                         0.92
##               When.I.work.with.other.students..we.spend.too.much.time.talking.about.other.things.
##                                                                                         0.87
##                 My.group.did.higher.quality.work.when.my.group.members.worked.on.tasks.together.
##                                                                                         0.91
## My.group.did.higher.quality.work.when.group.members.worked.on.different.tasks.at.the.same.time.
##                                                                                         0.82
##    You.have.a.certain.amount.of.physics.intelligence..and.you.can.t.really.do.much.to.change.it.
##                                                                                         0.73
##                         Your.physics.intelligence.is.something.about.you.that.you.can.change.
##                                                                                         0.91
##        You.can.learn.new.things..but.you.can.t.really.change.your.basic.physics.intelligence.
##                                                                                         0.71
```

```r
dat <- dat[, KMO(dat)$MSAi>0.6]
```

3.3   Bartlett's Test of Sphericity

```
cortest.bartlett(dat)
```

```
## $chisq
## [1] 11396.19
##
## $p.value
## [1] 0
##
## $df
## [1] 465
```

3.4   Scree Plot

```
ev <- eigen(M)
ev$values
```

```
##   [1] 7.3116232 2.6028414 1.7870438 1.5517266 1.2405477 1.0768273 1.0348560
##   [8] 0.9694283 0.9545786 0.9031255 0.8509518 0.8297582 0.7570119 0.7333450
##  [15] 0.7006816 0.6811850 0.6608574 0.6319138 0.6229019 0.6049351 0.5871973
##  [22] 0.5802351 0.5415617 0.5302511 0.5190530 0.4776188 0.4498368 0.4198294
##  [29] 0.4020717 0.3834987 0.3715396 0.2311666
```

```
scree(dat)
```
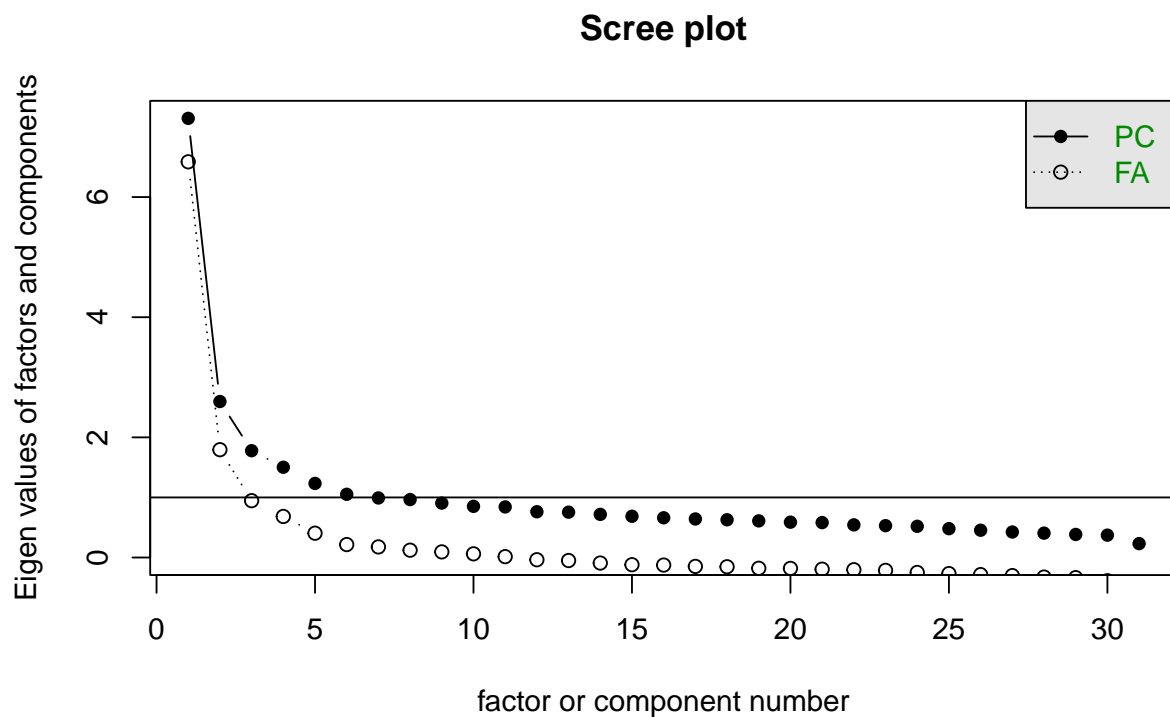
Scree plot


```
fa.parallel(dat, fa="fa")
```

Parallel Analysis Scree Plots
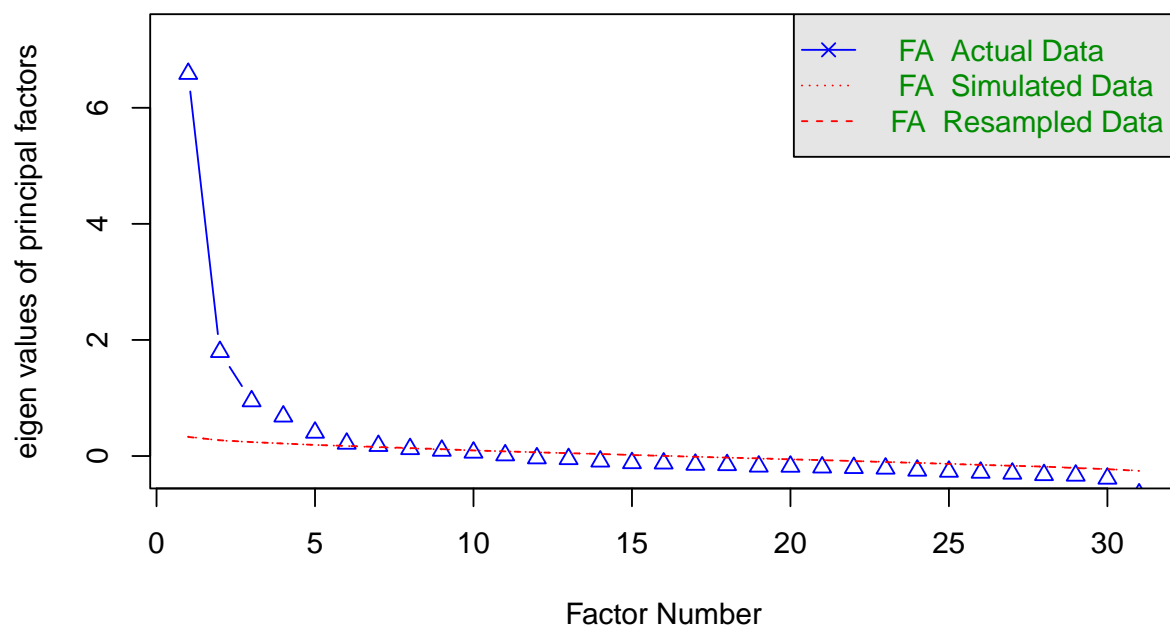

```
## Parallel analysis suggests that the number of factors =  7  and the number of components =  NA
```

3.5 EFA loop

Uses the training data set

```r
for (Nfacs in 3:9){
  df <- train_data[,3:34]
  loadings_test = TRUE
  while (loadings_test) {
    communs_test = TRUE
    while (communs_test){
      df <- df[, KMO(df)$MSAi>0.6]
      if (cortest.bartlett(df)$p.value > 0.05){print("Bartlett test failed")}
      df.efa <- fa(df, nfactors = Nfacs, rotate = "oblimin")
      if (min(abs(df.efa$communality))<0.2) {
        df <- df[, -c(which.min(abs(df.efa$communality)))]
      }
      else {
        communs_test = FALSE
      }
    }
    cutoff <- 0.1
    Lambda <- unclass(df.efa$loadings)
    p <- nrow(Lambda)
    fx <- setNames(Lambda, NULL)
    fx[abs(Lambda) < cutoff] <- NA_real_
    fx <- as.data.frame(fx)
    fx$max <- do.call(pmax, c(abs(fx), na.rm = TRUE))
```

```r
    if (min(fx$max)<0.3) {
      df <- df[, -which.min(fx$max)]
    }
    else {
      loadings_test = FALSE
      }
  }
  str <- paste0("cfa.fit",Nfacs)
  model <- efa_to_cfa(df.efa)
  cfa.fit <- cfa(model = model, data = test_data)
  assign(str,cfa.fit)
}
```

3.6 CFA

Now we need to compare the CFA outputs of each and determine which is the optimal model

```r
anova(cfa.fit3, cfa.fit4, cfa.fit5, cfa.fit6, cfa.fit7, cfa.fit8, cfa.fit9)
```

```
##
## Chi-Squared Difference Test
##
##           Df   AIC   BIC  Chisq Chisq diff    RMSEA Df diff Pr(>Chisq)
## cfa.fit9 217 16786 17156 664.47
## cfa.fit3 227 16194 16412 987.94     323.47 0.221835      10  < 2.2e-16 ***
## cfa.fit7 231 16534 16841 669.47    -318.47 0.000000       4          1
## cfa.fit6 260 17198 17487 845.15     175.68 0.089107      29  < 2.2e-16 ***
## cfa.fit5 265 17333 17600 877.51      32.36 0.092685       5  5.040e-06 ***
## cfa.fit4 269 17402 17652 955.27      77.76 0.170144       4  5.187e-16 ***
## cfa.fit8 271 18594 18951 770.80    -184.47 0.000000       2          1
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

From this, both 7 and 9 factors are near equivalent with n=7 to have a lower AIC and n=9 to have a lower Chisq.

```r
df.efa <- fa(dat, nfactors = 7, rotate = "oblimin")
df.efa$loadings
```

```
##
## Loadings:
##                                                                     MR1
## When.I.work.in.a.group..I.do.higher.quality.work.                  0.4
## When.I.work.in.a.group..I.end.up.doing.most.of.the.work.          -0.1
## The.work.takes.more.time.to.complete.when.I.work.with.other.students. -0.5
## My.group.members.help.explain.things.that.I.do.not.understand.     0.3
## When.I.work.in.a.group..I.am.able.to.share.my.ideas.               0.2
## My.group.members.make.me.feel.that.I.am.not.as.smart.as.they.are.  0.1
## The.material.is.easier.to.understand.when.I.work.with.other.students. 0.6
## The.workload.is.usually.less.when.I.work.with.other.students.      0.5
## My.group.members.respect.my.opinions.
## I.feel.I.am.part.of.what.is.going.on.in.the.group.
## I.prefer.when.the.leadership.role.rotates.between.students.
## I.do.not.think.a.group.grade.is.fair.                             -0.2
## I.try.to.make.sure.my.group.members.learn.the.material.
```

```
## I.learn.to.work.with.students.who.are.different.from.me.                                    0.13
## My.group.members.do.not.care.about.my.feelings.
## I.let.the.other.students.do.most.of.the.work.
## I.feel.working.in.groups.is.a.waste.of.time.                                               -0.5
## I.have.to.work.with.students.who.are.not.as.smart.as.I.am.
## When.I.work.with.other.students.the.work.is.divided.equally.
## We.cannot.complete.the.assignment.unless.everyone.contributes.
## I.prefer.to.take.on.tasks.that.I.m.already.good.at.                                          0.14
## I.prefer.to.take.on.tasks.that.will.help.me.better.learn.the.material.                      -0.1
## I.also.learn.when.I.teach.the.material.to.my.group.members.                                  0.1
## I.become.frustrated.when.my.group.members.do.not.understand.the.material.
## Everyone.s.ideas.are.needed.if.we.are.going.to.be.successful.                                0.15
## When.I.work.with.other.students..we.spend.too.much.time.talking.about.other.things.
## My.group.did.higher.quality.work.when.my.group.members.worked.on.tasks.together.            0.33
## My.group.did.higher.quality.work.when.group.members.worked.on.different.tasks.at.the.same.time.
## You.have.a.certain.amount.of.physics.intelligence..and.you.can.t.really.do.much.to.change.it.
## Your.physics.intelligence.is.something.about.you.that.you.can.change.
## You.can.learn.new.things..but.you.can.t.really.change.your.basic.physics.intelligence.
##                                                                                             MR4
## When.I.work.in.a.group..I.do.higher.quality.work.                                          -0.1
## When.I.work.in.a.group..I.end.up.doing.most.of.the.work.
## The.work.takes.more.time.to.complete.when.I.work.with.other.students.
## My.group.members.help.explain.things.that.I.do.not.understand.                               0.1
## When.I.work.in.a.group..I.am.able.to.share.my.ideas.                                         0.3
## My.group.members.make.me.feel.that.I.am.not.as.smart.as.they.are.                           -0.6
## The.material.is.easier.to.understand.when.I.work.with.other.students.
## The.workload.is.usually.less.when.I.work.with.other.students.
## My.group.members.respect.my.opinions.                                                        0.7
## I.feel.I.am.part.of.what.is.going.on.in.the.group.                                           0.48
## I.prefer.when.the.leadership.role.rotates.between.students.
## I.do.not.think.a.group.grade.is.fair.
## I.try.to.make.sure.my.group.members.learn.the.material.                                      0.1
## I.learn.to.work.with.students.who.are.different.from.me.
## My.group.members.do.not.care.about.my.feelings.                                             -0.5
## I.let.the.other.students.do.most.of.the.work.                                               -0.3
## I.feel.working.in.groups.is.a.waste.of.time.                                                -0.14
## I.have.to.work.with.students.who.are.not.as.smart.as.I.am.
## When.I.work.with.other.students.the.work.is.divided.equally.
## We.cannot.complete.the.assignment.unless.everyone.contributes.                              -0.15
## I.prefer.to.take.on.tasks.that.I.m.already.good.at.                                          0.15
## I.prefer.to.take.on.tasks.that.will.help.me.better.learn.the.material.
## I.also.learn.when.I.teach.the.material.to.my.group.members.                                  0.18
## I.become.frustrated.when.my.group.members.do.not.understand.the.material.                   -0.1
## Everyone.s.ideas.are.needed.if.we.are.going.to.be.successful.
## When.I.work.with.other.students..we.spend.too.much.time.talking.about.other.things.         -0.18
## My.group.did.higher.quality.work.when.my.group.members.worked.on.tasks.together.
## My.group.did.higher.quality.work.when.group.members.worked.on.different.tasks.at.the.same.time.
## You.have.a.certain.amount.of.physics.intelligence..and.you.can.t.really.do.much.to.change.it.
## Your.physics.intelligence.is.something.about.you.that.you.can.change.
## You.can.learn.new.things..but.you.can.t.really.change.your.basic.physics.intelligence.
##                                                                                             MR2
## When.I.work.in.a.group..I.do.higher.quality.work.
## When.I.work.in.a.group..I.end.up.doing.most.of.the.work.
## The.work.takes.more.time.to.complete.when.I.work.with.other.students.
```

```
## My.group.members.help.explain.things.that.I.do.not.understand.
## When.I.work.in.a.group..I.am.able.to.share.my.ideas.
## My.group.members.make.me.feel.that.I.am.not.as.smart.as.they.are.
## The.material.is.easier.to.understand.when.I.work.with.other.students.
## The.workload.is.usually.less.when.I.work.with.other.students.
## My.group.members.respect.my.opinions.
## I.feel.I.am.part.of.what.is.going.on.in.the.group.
## I.prefer.when.the.leadership.role.rotates.between.students.
## I.do.not.think.a.group.grade.is.fair.
## I.try.to.make.sure.my.group.members.learn.the.material.
## I.learn.to.work.with.students.who.are.different.from.me.                        0.1(
## My.group.members.do.not.care.about.my.feelings.
## I.let.the.other.students.do.most.of.the.work.
## I.feel.working.in.groups.is.a.waste.of.time.
## I.have.to.work.with.students.who.are.not.as.smart.as.I.am.
## When.I.work.with.other.students.the.work.is.divided.equally.
## We.cannot.complete.the.assignment.unless.everyone.contributes.
## I.prefer.to.take.on.tasks.that.I.m.already.good.at.
## I.prefer.to.take.on.tasks.that.will.help.me.better.learn.the.material.          0.1(
## I.also.learn.when.I.teach.the.material.to.my.group.members.
## I.become.frustrated.when.my.group.members.do.not.understand.the.material.
## Everyone.s.ideas.are.needed.if.we.are.going.to.be.successful.
## When.I.work.with.other.students..we.spend.too.much.time.talking.about.other.things.
## My.group.did.higher.quality.work.when.my.group.members.worked.on.tasks.together.
## My.group.did.higher.quality.work.when.group.members.worked.on.different.tasks.at.the.same.time.
## You.have.a.certain.amount.of.physics.intelligence..and.you.can.t.really.do.much.to.change.it.  0.84
## Your.physics.intelligence.is.something.about.you.that.you.can.change.            0.4:
## You.can.learn.new.things..but.you.can.t.really.change.your.basic.physics.intelligence.         0.8(
##                                                                                 MR6
## When.I.work.in.a.group..I.do.higher.quality.work.
## When.I.work.in.a.group..I.end.up.doing.most.of.the.work.                        -0.5
## The.work.takes.more.time.to.complete.when.I.work.with.other.students.
## My.group.members.help.explain.things.that.I.do.not.understand.                  0.1!
## When.I.work.in.a.group..I.am.able.to.share.my.ideas.
## My.group.members.make.me.feel.that.I.am.not.as.smart.as.they.are.
## The.material.is.easier.to.understand.when.I.work.with.other.students.
## The.workload.is.usually.less.when.I.work.with.other.students.                   0.2!
## My.group.members.respect.my.opinions.
## I.feel.I.am.part.of.what.is.going.on.in.the.group.
## I.prefer.when.the.leadership.role.rotates.between.students.                     0.1(
## I.do.not.think.a.group.grade.is.fair.                                           -0.2(
## I.try.to.make.sure.my.group.members.learn.the.material.
## I.learn.to.work.with.students.who.are.different.from.me.
## My.group.members.do.not.care.about.my.feelings.                                 -0.1(
## I.let.the.other.students.do.most.of.the.work.
## I.feel.working.in.groups.is.a.waste.of.time.
## I.have.to.work.with.students.who.are.not.as.smart.as.I.am.                      -0.1:
## When.I.work.with.other.students.the.work.is.divided.equally.                    0.7!
## We.cannot.complete.the.assignment.unless.everyone.contributes.                  0.3!
## I.prefer.to.take.on.tasks.that.I.m.already.good.at.
## I.prefer.to.take.on.tasks.that.will.help.me.better.learn.the.material.
## I.also.learn.when.I.teach.the.material.to.my.group.members.                     -0.1(
## I.become.frustrated.when.my.group.members.do.not.understand.the.material.
## Everyone.s.ideas.are.needed.if.we.are.going.to.be.successful.
```

```
## When.I.work.with.other.students..we.spend.too.much.time.talking.about.other.things.
## My.group.did.higher.quality.work.when.my.group.members.worked.on.tasks.together.
## My.group.did.higher.quality.work.when.group.members.worked.on.different.tasks.at.the.same.time.
## You.have.a.certain.amount.of.physics.intelligence..and.you.can.t.really.do.much.to.change.it.
## Your.physics.intelligence.is.something.about.you.that.you.can.change.
## You.can.learn.new.things..but.you.can.t.really.change.your.basic.physics.intelligence.
##                                                                                               MR5
## When.I.work.in.a.group..I.do.higher.quality.work.                                            0.15
## When.I.work.in.a.group..I.end.up.doing.most.of.the.work.
## The.work.takes.more.time.to.complete.when.I.work.with.other.students.                        0.17
## My.group.members.help.explain.things.that.I.do.not.understand.
## When.I.work.in.a.group..I.am.able.to.share.my.ideas.
## My.group.members.make.me.feel.that.I.am.not.as.smart.as.they.are.
## The.material.is.easier.to.understand.when.I.work.with.other.students.                        0.13
## The.workload.is.usually.less.when.I.work.with.other.students.
## My.group.members.respect.my.opinions.
## I.feel.I.am.part.of.what.is.going.on.in.the.group.                                           0.11
## I.prefer.when.the.leadership.role.rotates.between.students.                                  0.43
## I.do.not.think.a.group.grade.is.fair.
## I.try.to.make.sure.my.group.members.learn.the.material.                                      0.47
## I.learn.to.work.with.students.who.are.different.from.me.                                     0.13
## My.group.members.do.not.care.about.my.feelings.
## I.let.the.other.students.do.most.of.the.work.
## I.feel.working.in.groups.is.a.waste.of.time.
## I.have.to.work.with.students.who.are.not.as.smart.as.I.am.
## When.I.work.with.other.students.the.work.is.divided.equally.
## We.cannot.complete.the.assignment.unless.everyone.contributes.                               0.15
## I.prefer.to.take.on.tasks.that.I.m.already.good.at.                                         -0.10
## I.prefer.to.take.on.tasks.that.will.help.me.better.learn.the.material.                       0.30
## I.also.learn.when.I.teach.the.material.to.my.group.members.                                  0.19
## I.become.frustrated.when.my.group.members.do.not.understand.the.material.
## Everyone.s.ideas.are.needed.if.we.are.going.to.be.successful.                                0.35
## When.I.work.with.other.students..we.spend.too.much.time.talking.about.other.things.          0.15
## My.group.did.higher.quality.work.when.my.group.members.worked.on.tasks.together.             0.41
## My.group.did.higher.quality.work.when.group.members.worked.on.different.tasks.at.the.same.time. -0.15
## You.have.a.certain.amount.of.physics.intelligence..and.you.can.t.really.do.much.to.change.it.
## Your.physics.intelligence.is.something.about.you.that.you.can.change.
## You.can.learn.new.things..but.you.can.t.really.change.your.basic.physics.intelligence.
##                                                                                               MR3
## When.I.work.in.a.group..I.do.higher.quality.work.
## When.I.work.in.a.group..I.end.up.doing.most.of.the.work.                                     0.20
## The.work.takes.more.time.to.complete.when.I.work.with.other.students.                        0.13
## My.group.members.help.explain.things.that.I.do.not.understand.
## When.I.work.in.a.group..I.am.able.to.share.my.ideas.
## My.group.members.make.me.feel.that.I.am.not.as.smart.as.they.are.
## The.material.is.easier.to.understand.when.I.work.with.other.students.
## The.workload.is.usually.less.when.I.work.with.other.students.                                0.13
## My.group.members.respect.my.opinions.
## I.feel.I.am.part.of.what.is.going.on.in.the.group.
## I.prefer.when.the.leadership.role.rotates.between.students.
## I.do.not.think.a.group.grade.is.fair.                                                        0.19
## I.try.to.make.sure.my.group.members.learn.the.material.
## I.learn.to.work.with.students.who.are.different.from.me.                                    -0.10
## My.group.members.do.not.care.about.my.feelings.                                              0.17
```

```
## I.let.the.other.students.do.most.of.the.work.
## I.feel.working.in.groups.is.a.waste.of.time.                                              0.1(
## I.have.to.work.with.students.who.are.not.as.smart.as.I.am.                                 0.49
## When.I.work.with.other.students.the.work.is.divided.equally.
## We.cannot.complete.the.assignment.unless.everyone.contributes.
## I.prefer.to.take.on.tasks.that.I.m.already.good.at.                                        0.2:
## I.prefer.to.take.on.tasks.that.will.help.me.better.learn.the.material.
## I.also.learn.when.I.teach.the.material.to.my.group.members.
## I.become.frustrated.when.my.group.members.do.not.understand.the.material.                  0.5(
## Everyone.s.ideas.are.needed.if.we.are.going.to.be.successful.                             -0.2:
## When.I.work.with.other.students..we.spend.too.much.time.talking.about.other.things.        0.1'
## My.group.did.higher.quality.work.when.my.group.members.worked.on.tasks.together.
## My.group.did.higher.quality.work.when.group.members.worked.on.different.tasks.at.the.same.time.
## You.have.a.certain.amount.of.physics.intelligence..and.you.can.t.really.do.much.to.change.it.
## Your.physics.intelligence.is.something.about.you.that.you.can.change.
## You.can.learn.new.things..but.you.can.t.really.change.your.basic.physics.intelligence.
##                                                                                           MR7
## When.I.work.in.a.group..I.do.higher.quality.work.                                          0.1:
## When.I.work.in.a.group..I.end.up.doing.most.of.the.work.                                   0.1:
## The.work.takes.more.time.to.complete.when.I.work.with.other.students.
## My.group.members.help.explain.things.that.I.do.not.understand.                             0.1:
## When.I.work.in.a.group..I.am.able.to.share.my.ideas.                                       0.2:
## My.group.members.make.me.feel.that.I.am.not.as.smart.as.they.are.
## The.material.is.easier.to.understand.when.I.work.with.other.students.
## The.workload.is.usually.less.when.I.work.with.other.students.
## My.group.members.respect.my.opinions.
## I.feel.I.am.part.of.what.is.going.on.in.the.group.                                         0.2'
## I.prefer.when.the.leadership.role.rotates.between.students.
## I.do.not.think.a.group.grade.is.fair.                                                      0.1:
## I.try.to.make.sure.my.group.members.learn.the.material.
## I.learn.to.work.with.students.who.are.different.from.me.                                    0.38
## My.group.members.do.not.care.about.my.feelings.
## I.let.the.other.students.do.most.of.the.work.                                             -0.14
## I.feel.working.in.groups.is.a.waste.of.time.
## I.have.to.work.with.students.who.are.not.as.smart.as.I.am.
## When.I.work.with.other.students.the.work.is.divided.equally.
## We.cannot.complete.the.assignment.unless.everyone.contributes.                             0.15
## I.prefer.to.take.on.tasks.that.I.m.already.good.at.                                        0.2:
## I.prefer.to.take.on.tasks.that.will.help.me.better.learn.the.material.                     0.14
## I.also.learn.when.I.teach.the.material.to.my.group.members.                                0.33
## I.become.frustrated.when.my.group.members.do.not.understand.the.material.
## Everyone.s.ideas.are.needed.if.we.are.going.to.be.successful.                              0.2(
## When.I.work.with.other.students..we.spend.too.much.time.talking.about.other.things.       -0.14
## My.group.did.higher.quality.work.when.my.group.members.worked.on.tasks.together.          -0.1!
## My.group.did.higher.quality.work.when.group.members.worked.on.different.tasks.at.the.same.time. 0.3(
## You.have.a.certain.amount.of.physics.intelligence..and.you.can.t.really.do.much.to.change.it.
## Your.physics.intelligence.is.something.about.you.that.you.can.change.                      0.1:
## You.can.learn.new.things..but.you.can.t.really.change.your.basic.physics.intelligence.
##
##                   MR1   MR4   MR2   MR6   MR5   MR3   MR7
## SS loadings      1.944 2.010 1.800 1.284 1.121 0.939 0.881
## Proportion Var   0.063 0.065 0.058 0.041 0.036 0.030 0.028
## Cumulative Var   0.063 0.128 0.186 0.227 0.263 0.293 0.322
```

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