

## Section A: The questionnaire

items VD02-VD15 (Remote teaching)

items M21PRE-M35NOW (Metacognition)

items AA36PRE-AA45NOW (Self-Efficacy)

### RT (Remote Teaching)

*Screenshot of the original questions*

Cosa pensi della didattica in remoto erogata dal tuo corso di studi causa pandemia da COVID-19? \*

*Contrassegna solo un ovale.*

1    2    3    4    5

Per niente efficace      Del tutto efficace

	1	2	3	4	5	
not at all effective						completely effective

Come è cambiata la tua interazione con i tuoi compagni durante l'esperienza della didattica in remoto rispetto a quella in presenza? \*

*Contrassegna solo un ovale.*

1    2    3    4    5

Molto peggiorata      Molto migliorata

	1	2	3	4	5	
definitely worse						definitely better

### Items:

- VD02. What do you think of the remote teaching provided by your course of study due to the COVID-19 pandemic
- VD03. What do you think of the organization of teaching (timetables, exams) adopted by your course of study due to the COVID-19 pandemic?
- VD04. How has your general preparation changed during the remote teaching experience compared to the face-to-face one?
- VD05. How has your perception of the effectiveness of teachers changed during the remote teaching experience compared to the face-to-face one?
- VD06. How has the attitude of teachers changed towards your difficulties during the remote teaching experience compared to the face-to-face one?
- VD07. How has the clarity of the teachers in the presentation of the topics changed during the remote teaching experience compared to the face-to-face one?
- VD08. How has the ability of your teachers to stimulate interest in the subject changed during the teaching experience remotely compared to the face-to-face one?
- VD09. How has your interaction with teachers changed during the remote teaching experience compared to face-to-face?
- VD010. How has the study load required by your teachers changed during the remote teaching experience compared to the face-to-face one?

- VD011. How has your interaction with your peers changed during the remote teaching experience compared to the face-to-face one?
- VD012. How has your perception of the usefulness of studies changed during the remote teaching experience compared to the face-to-face one?
- VD013. How has your perception of job prospects changed during the remote teaching experience compared to the face-to-face one?
- VD014. How has your perception of the issues related to your course of study changed during the experience of remote teaching compared to the face-to-face one?
- VD015. How has your perception of your difficulties in completing the course changed during the remote teaching experience compared to the face-to-face one?

## METACOGNITION

### *Screenshot of the original questions*

Faccio dei riassunti delle cose più importanti \*

*Contrassegna solo un ovale per riga.*

	Per niente in accordo	Poco d'accordo	Abbastanza d'accordo	Molto d'accordo	Del tutto d'accordo
Prima della pandemia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adesso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	<i>Disagree</i>	<i>Somewhat agree</i>	<i>Agree</i>	Strongly agree
<i>Before pandemic (PRE)</i>					
<i>(NOW)</i>					

*List of the statements repeated twice: PRE and NOW*

- M21. I make summaries of the most important things
- M22. I look for similarities or differences between what I am studying and what I already know
- M23. I repeat the important things to know over and over
- M24. I wonder if I agree with what I read in the books or with what is explained in classroom
- M25. I check if I understand correctly what I am reading
- M26. I write down the most important concepts of a particular topic I study
- M27. I look for links between the different subjects I study
- M28. I review a topic several times if I want to learn it well
- M29. I try to get my own personal idea of the things I study
- M30. I check which part of a topic I'm studying isn't still so clear for me

M31. I make diagrams or maps of the most important topics

M32. I try to see how what I am studying relates to what I already know

M33. I often repeat the most important concepts to myself in order to memorize them better

M34. I try to criticize or question what I find in the books

M35. I try to make sure I understand what I am studying

## SE ( Self Efficacy)

### Screenshot of the original questions

Riesco sempre a risolvere problemi difficili se ci provo abbastanza seriamente \*

Contrassegna solo un ovale per riga.

	Per niente in accordo	Poco d'accordo	Abbastanza d'accordo	Molto d'accordo	Del tutto d'accordo
Prima della pandemia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adesso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	Disagree	Somewhat agree	Agree	Strongly agree
Before pandemic (PRE)					
(NOW)					

List of the statements repeated twice: PRE and NOW

AA36. I can always solve difficult problems if I try hard enough

AA37. If someone thwarts me, I can find a way to get what I want

AA38. It is easy for me to stick to my intentions and achieve my goals

AA39. I am confident that I can effectively deal with unexpected events

AA40. Thanks to my resources, I know how to handle unexpected situations

AA41. I can solve most problems if I put the necessary effort into them

AA42. I remain calm in dealing with difficulties because I can trust in my abilities to cope with them

AA43. When I face a problem, I usually find several solutions

AA44. If I'm "broken down", I can always think how to manage

AA45. No matter what happens to me, I can usually handle it

## Section B Confirmatory-Factor-Analysis

*Engineering students' evaluation of the online learning strategy carried on during the  
Emergency Remote Teaching (COVID-19)*

### *Metacognition PRE*

```
library(readxl)
DtM02PRE <- read_excel("DtM02PRE.xlsx")
View(DtM02PRE)
str(DtM02PRE)

## tibble [3,183 x 15] (S3: tbl_df/tbl/data.frame)
## $ M21PRE: num [1:3183] 3 4 1 3 2 1 3 4 3 3 ...
## $ M22PRE: num [1:3183] 3 3 3 2 2 4 2 4 3 3 ...
## $ M23PRE: num [1:3183] 3 3 3 4 5 4 2 4 3 1 ...
## $ M24PRE: num [1:3183] 3 5 3 1 2 4 2 3 2 3 ...
## $ M25PRE: num [1:3183] 3 5 3 3 4 4 2 4 3 2 ...
## $ M26PRE: num [1:3183] 3 4 3 4 5 5 3 4 4 3 ...
## $ M27PRE: num [1:3183] 3 3 2 3 2 4 3 4 3 2 ...
## $ M28PRE: num [1:3183] 3 3 3 4 5 4 2 4 4 1 ...
## $ M29PRE: num [1:3183] 3 2 2 3 4 4 3 4 2 2 ...
## $ M30PRE: num [1:3183] 3 3 3 4 1 4 3 4 3 2 ...
## $ M31PRE: num [1:3183] 3 4 4 5 2 2 3 2 4 2 ...
## $ M32PRE: num [1:3183] 3 3 2 4 2 4 3 4 2 2 ...
## $ M33PRE: num [1:3183] 3 2 3 4 5 4 3 4 3 2 ...
## $ M34PRE: num [1:3183] 3 1 2 1 2 3 3 3 1 1 ...
## $ M35PRE: num [1:3183] 3 4 3 5 5 4 3 4 2 2 ...

summary(DtM02PRE)

##   M21PRE   M22PRE   M23PRE   M24PRE
## Min.  :1.000  Min.  :1.000  Min.  :1.000  Min.  :1.000
## 1st Qu.:2.000  1st Qu.:2.000  1st Qu.:3.000  1st Qu.:2.000
## Median :3.000  Median :3.000  Median :3.000  Median :3.000
## Mean   :3.159  Mean   :3.132  Mean   :3.423  Mean   :3.095
## 3rd Qu.:4.000  3rd Qu.:4.000  3rd Qu.:4.000  3rd Qu.:4.000
## Max.   :5.000  Max.   :5.000  Max.   :5.000  Max.   :5.000
##   M25PRE   M26PRE   M27PRE   M28PRE   M29PRE
```

```

## Min. :1.000 Min. :1.000 Min. :1.00 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.00 1st Qu.:3.000 1st Qu.:3.000
## Median :4.000 Median :4.000 Median :3.00 Median :4.000 Median :3.000
## Mean   :3.753 Mean   :3.524 Mean   :3.19 Mean   :3.666 Mean   :3.292
## 3rd Qu.:5.000 3rd Qu.:4.000 3rd Qu.:4.00 3rd Qu.:4.000 3rd Qu.:4.000
## Max.   :5.000 Max.   :5.000 Max.   :5.00 Max.   :5.000 Max.   :5.000
##   M30PRE   M31PRE   M32PRE   M33PRE
## Min.   :1.000 Min.   :1.000 Min.   :1.000 Min.   :1.000
## 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000 1st Qu.:3.000
## Median :4.000 Median :3.000 Median :3.000 Median :3.000
## Mean   :3.669 Mean   :3.038 Mean   :3.255 Mean   :3.467
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000
## Max.   :5.000 Max.   :5.000 Max.   :5.000 Max.   :5.000
##   M34PRE   M35PRE
## Min.   :1.000 Min.   :1.000
## 1st Qu.:2.000 1st Qu.:3.000
## Median :2.000 Median :4.000
## Mean   :2.532 Mean   :3.766
## 3rd Qu.:3.000 3rd Qu.:4.000
## Max.   :5.000 Max.   :5.000

library(lavaan)

## This is lavaan 0.6-11
## lavaan is FREE software! Please report any bugs.

ModelCFAMPRE <- 'Estrazione conoscenza =~ M21PRE + M26PRE + M31PRE
Connessione conoscenza =~ M22PRE + M27PRE + M32PRE
Pratica conoscenza =~ M23PRE + M28PRE + M33PRE
Critica conoscenza =~ M24PRE + M29PRE + M34PRE
Controllo conoscenza =~ M25PRE + M30PRE + M35PRE'

fitModelCFAMPRE <- cfa(ModelCFAMPRE, data=DtM02PRE)
summary(fitModelCFAMPRE, fit.measures = TRUE)

## lavaan 0.6-11 ended normally after 44 iterations
##
## Estimator                ML
## Optimization method      NLMINB
## Number of model parameters      40
##
## Number of observations          3183
##
## Model Test User Model:
##
## Test statistic              1550.084
## Degrees of freedom           80
## P-value (Chi-square)         0.000
##
## Model Test Baseline Model:
##
## Test statistic              21737.525

```

```

## Degrees of freedom          105
## P-value                    0.000
##
## User Model versus Baseline Model:
##
## Comparative Fit Index (CFI)      0.932
## Tucker-Lewis Index (TLI)       0.911
##
## Loglikelihood and Information Criteria:
##
## Loglikelihood user model (H0)    -60690.338
## Loglikelihood unrestricted model (H1) -59915.296
##
## Akaike (AIC)                  121460.676
## Bayesian (BIC)                 121703.299
## Sample-size adjusted Bayesian (BIC) 121576.202
##
## Root Mean Square Error of Approximation:
##
## RMSEA                        0.076
## 90 Percent confidence interval - lower 0.073
## 90 Percent confidence interval - upper 0.079
## P-value RMSEA <= 0.05          0.000
##
## Standardized Root Mean Square Residual:
##
## SRMR                        0.048
##
## Parameter Estimates:
##
## Standard errors              Standard
## Information                   Expected
## Information saturated (h1) model Structured
##
## Latent Variables:
##           Estimate Std.Err z-value P(>|z|)
## Estrazioneconoscenza =~
## M21PRE          1.000
## M26PRE          0.917  0.026 35.398  0.000
## M31PRE          0.999  0.029 34.365  0.000
## Connessioneconoscenza =~
## M22PRE          1.000
## M27PRE          1.087  0.028 38.317  0.000
## M32PRE          1.162  0.028 41.882  0.000
## Praticaconoscenza =~
## M23PRE          1.000
## M28PRE          0.813  0.023 35.504  0.000
## M33PRE          1.005  0.025 40.491  0.000
## Criticaconoscenza =~
## M24PRE          1.000
## M29PRE          1.033  0.028 36.727  0.000

```

```

## M34PRE          0.963  0.028  34.258  0.000
## Controlloconoscenza =~
## M25PRE          1.000
## M30PRE          0.940  0.025  38.059  0.000
## M35PRE          0.986  0.024  40.445  0.000
##
## Covariances:
##              Estimate Std.Err z-value P(>|z|)
## Estrazioneconoscenza ~~
## Connescncscnz    0.326  0.018  17.932  0.000
## Praticaconsenz   0.434  0.022  20.100  0.000
## Criticaconsenz   0.267  0.018  14.700  0.000
## Controllcscnz    0.343  0.018  19.112  0.000
## Connessioneconoscenza ~~
## Praticaconsenz   0.361  0.017  20.725  0.000
## Criticaconsenz   0.480  0.020  24.610  0.000
## Controllcscnz    0.386  0.016  23.596  0.000
## Praticaconoscenza ~~
## Criticaconsenz   0.334  0.018  18.919  0.000
## Controllcscnz    0.491  0.019  25.606  0.000
## Criticaconoscenza ~~
## Controllcscnz    0.387  0.017  23.025  0.000
##
## Variances:
##              Estimate Std.Err z-value P(>|z|)
## .M21PRE          0.696  0.026  26.913  0.000
## .M26PRE          0.529  0.021  25.577  0.000
## .M31PRE          0.817  0.028  28.931  0.000
## .M22PRE          0.600  0.017  34.392  0.000
## .M27PRE          0.475  0.015  31.480  0.000
## .M32PRE          0.256  0.012  22.088  0.000
## .M23PRE          0.538  0.019  29.023  0.000
## .M28PRE          0.552  0.017  33.034  0.000
## .M33PRE          0.425  0.016  25.997  0.000
## .M24PRE          0.595  0.019  31.724  0.000
## .M29PRE          0.452  0.016  28.229  0.000
## .M34PRE          0.574  0.018  32.062  0.000
## .M25PRE          0.412  0.013  30.933  0.000
## .M30PRE          0.425  0.013  32.278  0.000
## .M35PRE          0.349  0.012  29.544  0.000
## Estrazincscnz   0.871  0.040  21.760  0.000
## Connescncscnz   0.559  0.026  21.189  0.000
## Praticaconsenz   0.723  0.031  23.102  0.000
## Criticaconsenz   0.591  0.028  21.020  0.000
## Controllcscnz    0.520  0.023  23.028  0.000

```

### Metacognition NOW

```
DtM02NOW <- read_excel("DtM02NOW.xlsx")
```

```
View(DtM02NOW)
```

```
str(DtM02NOW)
```

```
## tibble [3,183 x 15] (S3: tbl_df/tbl/data.frame)
## $ M21NOW: num [1:3183] 3 2 1 4 5 1 4 4 5 5 ...
## $ M22NOW: num [1:3183] 3 3 3 3 2 4 4 4 4 5 ...
## $ M23NOW: num [1:3183] 3 4 3 5 5 4 4 4 4 5 ...
## $ M24NOW: num [1:3183] 3 5 3 1 2 5 3 3 2 5 ...
## $ M25NOW: num [1:3183] 3 5 3 4 4 5 3 4 3 4 ...
## $ M26NOW: num [1:3183] 3 4 3 5 5 5 5 4 4 5 ...
## $ M27NOW: num [1:3183] 3 3 2 3 5 4 4 4 3 5 ...
## $ M28NOW: num [1:3183] 3 3 3 5 5 5 4 4 4 5 ...
## $ M29NOW: num [1:3183] 3 2 2 3 4 3 3 4 3 4 ...
## $ M30NOW: num [1:3183] 3 3 3 4 5 3 4 4 3 4 ...
## $ M31NOW: num [1:3183] 3 4 4 5 2 2 4 2 4 4 ...
## $ M32NOW: num [1:3183] 3 3 2 4 2 4 3 4 2 4 ...
## $ M33NOW: num [1:3183] 3 2 3 4 5 4 4 4 3 4 ...
## $ M34NOW: num [1:3183] 3 1 2 1 2 2 4 3 1 4 ...
## $ M35NOW: num [1:3183] 3 4 3 5 5 3 4 4 3 5 ...
```

```
summary(DtM02NOW)
```

```
##   M21NOW   M22NOW   M23NOW   M24NOW   M25NOW
## Min. :1.000 Min. :1.0 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:3.0 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000
## Median :4.000 Median :3.0 Median :4.000 Median :3.000 Median :4.000
## Mean   :3.391 Mean   :3.3 Mean   :3.546 Mean   :3.218 Mean   :3.905
## 3rd Qu.:4.000 3rd Qu.:4.0 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:5.000
## Max.   :5.000 Max.   :5.0 Max.   :5.000 Max.   :5.000 Max.   :5.000
##   M26NOW   M27NOW   M28NOW   M29NOW
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:3.000
## Median :4.000 Median :3.000 Median :4.000 Median :3.000
## Mean   :3.721 Mean   :3.354 Mean   :3.876 Mean   :3.393
## 3rd Qu.:5.000 3rd Qu.:4.000 3rd Qu.:5.000 3rd Qu.:4.000
## Max.   :5.000 Max.   :5.000 Max.   :5.000 Max.   :5.000
##   M30NOW   M31NOW   M32NOW   M33NOW
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000 1st Qu.:3.000
## Median :4.000 Median :3.000 Median :3.000 Median :4.000
## Mean   :3.806 Mean   :3.211 Mean   :3.383 Mean   :3.573
## 3rd Qu.:5.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000
## Max.   :5.000 Max.   :5.000 Max.   :5.000 Max.   :5.000
##   M34NOW   M35NOW
## Min. :1.000 Min. :1.000
## 1st Qu.:2.000 1st Qu.:3.000
## Median :2.000 Median :4.000
## Mean   :2.606 Mean   :3.888
## 3rd Qu.:3.000 3rd Qu.:5.000
## Max.   :5.000 Max.   :5.000
```

```
library(lavaan)
```

```
ModelCFAMNOW <- 'Estrazione conoscenza =~ M21NOW + M26NOW + M31NOW
Connessione conoscenza =~ M22NOW + M27NOW + M32NOW'
```



Pratica conoscenza =~ M23NOW + M28NOW + M33NOW  
Critica conoscenza =~ M24NOW + M29NOW + M34NOW  
Controllo conoscenza =~ M25NOW + M30NOW + M35NOW'

```
fitModelCFAMNOW<-cfa(ModelCFAMNOW, data=DtM02NOW)
```

```
summary(fitModelCFAMNOW, fit.measures = TRUE)
```

```
## lavaan 0.6-11 ended normally after 41 iterations
##
## Estimator ML
## Optimization method NLMINB
## Number of model parameters 40
##
## Number of observations 3183
##
## Model Test User Model:
##
## Test statistic 1573.121
## Degrees of freedom 80
## P-value (Chi-square) 0.000
##
## Model Test Baseline Model:
##
## Test statistic 21604.362
## Degrees of freedom 105
## P-value 0.000
##
## User Model versus Baseline Model:
##
## Comparative Fit Index (CFI) 0.931
## Tucker-Lewis Index (TLI) 0.909
##
## Loglikelihood and Information Criteria:
##
## Loglikelihood user model (H0) -61068.229
## Loglikelihood unrestricted model (H1) -60281.668
##
## Akaike (AIC) 122216.457
## Bayesian (BIC) 122459.081
## Sample-size adjusted Bayesian (BIC) 122331.984
##
## Root Mean Square Error of Approximation:
##
## RMSEA 0.077
## 90 Percent confidence interval - lower 0.073
## 90 Percent confidence interval - upper 0.080
## P-value RMSEA <= 0.05 0.000
##
## Standardized Root Mean Square Residual:
##
## SRMR 0.048
```

```

##
## Parameter Estimates:
##
## Standard errors          Standard
## Information             Expected
## Information saturated (h1) model   Structured
##
## Latent Variables:
##           Estimate Std.Err z-value P(>|z|)
## Estrazioneconoscenza =~
## M21NOW          1.000
## M26NOW          0.885  0.025 35.354  0.000
## M31NOW          1.025  0.030 34.520  0.000
## Connessioneconoscenza =~
## M22NOW          1.000
## M27NOW          1.112  0.029 38.407  0.000
## M32NOW          1.167  0.028 41.579  0.000
## Praticaconoscenza =~
## M23NOW          1.000
## M28NOW          0.784  0.022 35.181  0.000
## M33NOW          1.040  0.025 40.870  0.000
## Criticaconoscenza =~
## M24NOW          1.000
## M29NOW          1.074  0.030 36.302  0.000
## M34NOW          1.031  0.030 33.941  0.000
## Controlloconoscenza =~
## M25NOW          1.000
## M30NOW          0.930  0.025 37.320  0.000
## M35NOW          1.021  0.025 40.333  0.000
##
## Covariances:
##           Estimate Std.Err z-value P(>|z|)
## Estrazioneconoscenza ~~
## Connessncnszcz      0.307  0.018 16.960  0.000
## Praticaconscnz      0.414  0.021 19.432  0.000
## Criticaconscnz      0.272  0.018 14.736  0.000
## Controllcnszcz      0.329  0.018 18.668  0.000
## Connessioneconoscenza ~~
## Praticaconscnz      0.344  0.017 20.121  0.000
## Criticaconscnz      0.487  0.020 24.359  0.000
## Controllcnszcz      0.359  0.016 22.893  0.000
## Praticaconoscenza ~~
## Criticaconscnz      0.326  0.018 18.632  0.000
## Controllcnszcz      0.459  0.018 25.075  0.000
## Criticaconoscenza ~~
## Controllcnszcz      0.375  0.017 22.657  0.000
##
## Variances:
##           Estimate Std.Err z-value P(>|z|)
## .M21NOW          0.686  0.026 26.217  0.000
## .M26NOW          0.525  0.020 25.909  0.000

```

##	.M31NOW	0.872	0.030	28.685	0.000
##	.M22NOW	0.608	0.018	34.294	0.000
##	.M27NOW	0.486	0.016	30.988	0.000
##	.M32NOW	0.269	0.012	22.302	0.000
##	.M23NOW	0.534	0.018	29.058	0.000
##	.M28NOW	0.522	0.016	33.254	0.000
##	.M33NOW	0.395	0.016	24.178	0.000
##	.M24NOW	0.668	0.020	32.920	0.000
##	.M29NOW	0.453	0.016	27.679	0.000
##	.M34NOW	0.623	0.020	31.900	0.000
##	.M25NOW	0.394	0.013	30.542	0.000
##	.M30NOW	0.416	0.013	32.309	0.000
##	.M35NOW	0.342	0.012	28.554	0.000
##	Estrazincscnz	0.898	0.041	21.977	0.000
##	Connesscncscnz	0.565	0.027	21.136	0.000
##	Praticaconscnz	0.710	0.031	23.020	0.000
##	Criticaconscnz	0.589	0.029	20.273	0.000
##	Controllcncscnz	0.497	0.022	22.922	0.000

## Section C – Cronbach's alpha statistic METACOGNITION and SELF-EFFICACY

*Engineering students' evaluation of the online learning strategy carried on during the*

*Emergency Remote Teaching (COVID-19)*

METACOGNITION PRE and NOW

```
library(readxl)
```

```
DtM02PRE <- read_excel("DtM02PRE.xlsx")
```

```
View(DtM02PRE)
```

```
str(DtM02PRE)
```

```
## tibble [3,183 x 15] (S3: tbl_df/tbl/data.frame)
```

```
## $ M21PRE: num [1:3183] 3 4 1 3 2 1 3 4 3 3 ...
```

```
## $ M22PRE: num [1:3183] 3 3 3 2 2 4 2 4 3 3 ...
```

```
## $ M23PRE: num [1:3183] 3 3 3 4 5 4 2 4 3 1 ...
```

```
## $ M24PRE: num [1:3183] 3 5 3 1 2 4 2 3 2 3 ...
```

```
## $ M25PRE: num [1:3183] 3 5 3 3 4 4 2 4 3 2 ...
```

```
## $ M26PRE: num [1:3183] 3 4 3 4 5 5 3 4 4 3 ...
```

```
## $ M27PRE: num [1:3183] 3 3 2 3 2 4 3 4 3 2 ...
```

```
## $ M28PRE: num [1:3183] 3 3 3 4 5 4 2 4 4 1 ...
```

```
## $ M29PRE: num [1:3183] 3 2 2 3 4 4 3 4 2 2 ...
```

```
## $ M30PRE: num [1:3183] 3 3 3 4 1 4 3 4 3 2 ...
```

```
## $ M31PRE: num [1:3183] 3 4 4 5 2 2 3 2 4 2 ...
```

```
## $ M32PRE: num [1:3183] 3 3 2 4 2 4 3 4 2 2 ...
```

```
## $ M33PRE: num [1:3183] 3 2 3 4 5 4 3 4 3 2 ...
```

```
## $ M34PRE: num [1:3183] 3 1 2 1 2 3 3 3 1 1 ...
```

```
## $ M35PRE: num [1:3183] 3 4 3 5 5 4 3 4 2 2 ...
```

```
summary(DtM02PRE)
```

```
## M21PRE M22PRE M23PRE M24PRE
```

```
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
```

```
## 1st Qu.:2.000 1st Qu.:2.000 1st Qu.:3.000 1st Qu.:2.000
```

```
## Median :3.000 Median :3.000 Median :3.000 Median :3.000
```

```
## Mean :3.159 Mean :3.132 Mean :3.423 Mean :3.095
```

```
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000
```

```
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000
```

```
## M25PRE M26PRE M27PRE M28PRE M29PRE
```

```
## Min. :1.000 Min. :1.000 Min. :1.00 Min. :1.000 Min. :1.000
```

```
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.00 1st Qu.:3.000 1st Qu.:3.000
```

```
## Median :4.000 Median :4.000 Median :3.00 Median :4.000 Median :3.000
```

```
## Mean :3.753 Mean :3.524 Mean :3.19 Mean :3.666 Mean :3.292
```

```
## 3rd Qu.:5.000 3rd Qu.:4.000 3rd Qu.:4.00 3rd Qu.:4.000 3rd Qu.:4.000
```

```

## Max. :5.000 Max. :5.000 Max. :5.00 Max. :5.000 Max. :5.000
## M30PRE M31PRE M32PRE M33PRE
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000 1st Qu.:3.000
## Median :4.000 Median :3.000 Median :3.000 Median :3.000
## Mean :3.669 Mean :3.038 Mean :3.255 Mean :3.467
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000
## M34PRE M35PRE
## Min. :1.000 Min. :1.000
## 1st Qu.:2.000 1st Qu.:3.000
## Median :2.000 Median :4.000
## Mean :2.532 Mean :3.766
## 3rd Qu.:3.000 3rd Qu.:4.000
## Max. :5.000 Max. :5.000

```

```

library(psych)
psych::alpha(DtM02PRE)

```

```

##
## Reliability analysis
## Call: psych::alpha(x = DtM02PRE)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.89 0.9 0.92 0.37 8.8 0.0028 3.3 0.68 0.37
##
## lower alpha upper 95% confidence boundaries
## 0.89 0.89 0.9
##

```

```

## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M21PRE 0.89 0.90 0.91 0.38 8.7 0.0028 0.013 0.39
## M22PRE 0.89 0.89 0.91 0.37 8.2 0.0030 0.016 0.38
## M23PRE 0.89 0.89 0.91 0.37 8.2 0.0030 0.015 0.38
## M24PRE 0.89 0.89 0.91 0.37 8.2 0.0030 0.015 0.37
## M25PRE 0.88 0.89 0.91 0.36 8.0 0.0030 0.015 0.35
## M26PRE 0.89 0.89 0.91 0.37 8.2 0.0030 0.016 0.38
## M27PRE 0.88 0.89 0.91 0.36 8.0 0.0030 0.015 0.37
## M28PRE 0.89 0.89 0.91 0.37 8.1 0.0030 0.015 0.37
## M29PRE 0.89 0.89 0.91 0.37 8.1 0.0030 0.015 0.37
## M30PRE 0.88 0.89 0.91 0.36 8.0 0.0031 0.016 0.37
## M31PRE 0.89 0.90 0.91 0.38 8.7 0.0028 0.013 0.39
## M32PRE 0.88 0.89 0.90 0.36 7.8 0.0031 0.014 0.37
## M33PRE 0.89 0.89 0.91 0.37 8.2 0.0030 0.015 0.37
## M34PRE 0.89 0.89 0.91 0.37 8.4 0.0029 0.014 0.38
## M35PRE 0.88 0.89 0.91 0.36 8.0 0.0030 0.015 0.37
##

```

```

## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M21PRE 3183 0.54 0.51 0.47 0.44 3.2 1.25
## M22PRE 3183 0.64 0.64 0.61 0.58 3.1 1.08

```

```

## M23PRE 3183 0.63 0.63 0.60 0.56 3.4 1.12
## M24PRE 3183 0.63 0.63 0.60 0.56 3.1 1.09
## M25PRE 3183 0.68 0.69 0.67 0.62 3.8 0.97
## M26PRE 3183 0.64 0.63 0.60 0.57 3.5 1.12
## M27PRE 3183 0.67 0.68 0.66 0.61 3.2 1.07
## M28PRE 3183 0.66 0.67 0.64 0.60 3.7 1.01
## M29PRE 3183 0.65 0.66 0.64 0.59 3.3 1.04
## M30PRE 3183 0.68 0.70 0.67 0.63 3.7 0.94
## M31PRE 3183 0.53 0.50 0.46 0.43 3.0 1.30
## M32PRE 3183 0.74 0.75 0.74 0.69 3.3 1.01
## M33PRE 3183 0.64 0.64 0.62 0.57 3.5 1.07
## M34PRE 3183 0.58 0.58 0.55 0.50 2.5 1.06
## M35PRE 3183 0.68 0.70 0.67 0.63 3.8 0.92
##
## Non missing response frequency for each item
##      1  2  3  4  5 miss
## M21PRE 0.11 0.19 0.29 0.22 0.18  0
## M22PRE 0.08 0.18 0.40 0.23 0.12  0
## M23PRE 0.05 0.15 0.32 0.27 0.20  0
## M24PRE 0.08 0.21 0.38 0.22 0.12  0
## M25PRE 0.02 0.07 0.31 0.35 0.25  0
## M26PRE 0.05 0.13 0.30 0.29 0.23  0
## M27PRE 0.05 0.20 0.39 0.22 0.14  0
## M28PRE 0.03 0.09 0.31 0.34 0.23  0
## M29PRE 0.04 0.16 0.40 0.25 0.15  0
## M30PRE 0.02 0.07 0.34 0.36 0.21  0
## M31PRE 0.15 0.22 0.26 0.20 0.17  0
## M32PRE 0.04 0.16 0.43 0.25 0.12  0
## M33PRE 0.04 0.13 0.34 0.29 0.20  0
## M34PRE 0.16 0.38 0.30 0.11 0.06  0
## M35PRE 0.01 0.05 0.34 0.36 0.24  0

```

```

library(readxl)
DtM02NOW <- read_excel("DtM02NOW.xlsx")
View(DtM02NOW)
str(DtM02NOW)

## tibble [3,183 × 15] (S3: tbl_df/tbl/data.frame)
## $ M21NOW: num [1:3183] 3 2 1 4 5 1 4 4 5 5 ...
## $ M22NOW: num [1:3183] 3 3 3 3 2 4 4 4 4 5 ...
## $ M23NOW: num [1:3183] 3 4 3 5 5 4 4 4 4 5 ...
## $ M24NOW: num [1:3183] 3 5 3 1 2 5 3 3 2 5 ...
## $ M25NOW: num [1:3183] 3 5 3 4 4 5 3 4 3 4 ...
## $ M26NOW: num [1:3183] 3 4 3 5 5 5 5 4 4 5 ...
## $ M27NOW: num [1:3183] 3 3 2 3 5 4 4 4 3 5 ...
## $ M28NOW: num [1:3183] 3 3 3 5 5 5 4 4 4 5 ...
## $ M29NOW: num [1:3183] 3 2 2 3 4 3 3 4 3 4 ...
## $ M30NOW: num [1:3183] 3 3 3 4 5 3 4 4 3 4 ...
## $ M31NOW: num [1:3183] 3 4 4 5 2 2 4 2 4 4 ...
## $ M32NOW: num [1:3183] 3 3 2 4 2 4 3 4 2 4 ...
## $ M33NOW: num [1:3183] 3 2 3 4 5 4 4 4 3 4 ...

```

```
## $ M34NOW: num [1:3183] 3 1 2 1 2 2 4 3 1 4 ...
```

```
## $ M35NOW: num [1:3183] 3 4 3 5 5 3 4 4 3 5 ...
```

```
summary(DtM02NOw)
```

```
## M21NOW M22NOW M23NOW M24NOW M25NOW
```

```
## Min. :1.000 Min. :1.0 Min. :1.000 Min. :1.000 Min. :1.000
```

```
## 1st Qu.:3.000 1st Qu.:3.0 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000
```

```
## Median :4.000 Median :3.0 Median :4.000 Median :3.000 Median :4.000
```

```
## Mean :3.391 Mean :3.3 Mean :3.546 Mean :3.218 Mean :3.905
```

```
## 3rd Qu.:4.000 3rd Qu.:4.0 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:5.000
```

```
## Max. :5.000 Max. :5.0 Max. :5.000 Max. :5.000 Max. :5.000
```

```
## M26NOW M27NOW M28NOW M29NOW
```

```
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
```

```
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:3.000
```

```
## Median :4.000 Median :3.000 Median :4.000 Median :3.000
```

```
## Mean :3.721 Mean :3.354 Mean :3.876 Mean :3.393
```

```
## 3rd Qu.:5.000 3rd Qu.:4.000 3rd Qu.:5.000 3rd Qu.:4.000
```

```
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000
```

```
## M30NOW M31NOW M32NOW M33NOW
```

```
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
```

```
## 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000 1st Qu.:3.000
```

```
## Median :4.000 Median :3.000 Median :3.000 Median :4.000
```

```
## Mean :3.806 Mean :3.211 Mean :3.383 Mean :3.573
```

```
## 3rd Qu.:5.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000
```

```
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000
```

```
## M34NOW M35NOW
```

```
## Min. :1.000 Min. :1.000
```

```
## 1st Qu.:2.000 1st Qu.:3.000
```

```
## Median :2.000 Median :4.000
```

```
## Mean :2.606 Mean :3.888
```

```
## 3rd Qu.:3.000 3rd Qu.:5.000
```

```
## Max. :5.000 Max. :5.000
```

```
library(psych)
```

```
psych::alpha(DtM02NOw)
```

```
##
```

```
## Reliability analysis
```

```
## Call: psych::alpha(x = DtM02NOw)
```

```
##
```

```
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
```

```
## 0.89 0.9 0.91 0.36 8.5 0.0029 3.5 0.68 0.35
```

```
##
```

```
## lower alpha upper 95% confidence boundaries
```

```
## 0.88 0.89 0.9
```

```
##
```

```
## Reliability if an item is dropped:
```

```
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
```

```
## M21NOW 0.89 0.89 0.91 0.38 8.4 0.0029 0.014 0.38
```

```
## M22NOW 0.88 0.89 0.91 0.36 8.0 0.0031 0.016 0.37
```

```
## M23NOW 0.88 0.89 0.91 0.36 8.0 0.0031 0.016 0.37
```

```

## M24NOW 0.88 0.89 0.91 0.36 8.0 0.0031 0.016 0.35
## M25NOW 0.88 0.89 0.91 0.36 7.8 0.0031 0.016 0.34
## M26NOW 0.88 0.89 0.91 0.36 8.0 0.0031 0.016 0.37
## M27NOW 0.88 0.89 0.91 0.36 7.8 0.0031 0.015 0.35
## M28NOW 0.88 0.89 0.91 0.36 7.8 0.0031 0.016 0.35
## M29NOW 0.88 0.89 0.91 0.36 7.8 0.0031 0.015 0.35
## M30NOW 0.88 0.89 0.91 0.36 7.8 0.0031 0.016 0.34
## M31NOW 0.89 0.89 0.91 0.38 8.5 0.0029 0.014 0.38
## M32NOW 0.88 0.88 0.90 0.35 7.6 0.0032 0.014 0.34
## M33NOW 0.88 0.89 0.90 0.36 7.9 0.0031 0.015 0.35
## M34NOW 0.88 0.89 0.91 0.37 8.1 0.0031 0.015 0.37
## M35NOW 0.88 0.89 0.91 0.36 7.7 0.0031 0.015 0.33
##

```

```
## Item statistics
```

```

##      n raw.r std.r r.cor r.drop mean  sd
## M21NOW 3183 0.54 0.51 0.48 0.44 3.4 1.26
## M22NOW 3183 0.64 0.64 0.60 0.57 3.3 1.08
## M23NOW 3183 0.62 0.62 0.59 0.54 3.5 1.12
## M24NOW 3183 0.62 0.62 0.58 0.54 3.2 1.12
## M25NOW 3183 0.66 0.68 0.65 0.60 3.9 0.94
## M26NOW 3183 0.63 0.61 0.58 0.55 3.7 1.11
## M27NOW 3183 0.67 0.67 0.65 0.60 3.4 1.09
## M28NOW 3183 0.65 0.67 0.64 0.59 3.9 0.98
## M29NOW 3183 0.67 0.68 0.65 0.61 3.4 1.06
## M30NOW 3183 0.67 0.69 0.66 0.62 3.8 0.92
## M31NOW 3183 0.53 0.49 0.45 0.42 3.2 1.35
## M32NOW 3183 0.73 0.74 0.73 0.68 3.4 1.02
## M33NOW 3183 0.64 0.64 0.62 0.57 3.6 1.08
## M34NOW 3183 0.60 0.60 0.56 0.52 2.6 1.12
## M35NOW 3183 0.68 0.69 0.67 0.62 3.9 0.93
##

```

```
## Non missing response frequency for each item
```

```

##      1 2 3 4 5 miss
## M21NOW 0.10 0.15 0.24 0.28 0.23 0
## M22NOW 0.06 0.14 0.38 0.27 0.15 0
## M23NOW 0.05 0.13 0.29 0.30 0.23 0
## M24NOW 0.07 0.18 0.35 0.25 0.15 0
## M25NOW 0.01 0.06 0.26 0.37 0.31 0
## M26NOW 0.04 0.10 0.25 0.31 0.29 0
## M27NOW 0.04 0.17 0.35 0.26 0.18 0
## M28NOW 0.02 0.06 0.26 0.35 0.31 0
## M29NOW 0.04 0.15 0.36 0.27 0.18 0
## M30NOW 0.01 0.06 0.29 0.39 0.25 0
## M31NOW 0.13 0.19 0.22 0.22 0.23 0
## M32NOW 0.04 0.13 0.40 0.28 0.16 0
## M33NOW 0.04 0.12 0.31 0.30 0.23 0
## M34NOW 0.15 0.36 0.29 0.11 0.08 0
## M35NOW 0.01 0.05 0.28 0.36 0.30 0

```

```
DtM02F1PRE<-DtM02PRE [_c("M21PRE","M26PRE","M31PRE")]
```



#F1= knowledge extraction

DtM02F1PRE

## # A tibble: 3,183 x 3

## M21PRE M26PRE M31PRE

## <dbl> <dbl> <dbl>

## 1 3 3 3

## 2 4 4 4

## 3 1 3 4

## 4 3 4 5

## 5 2 5 2

## 6 1 5 2

## 7 3 3 3

## 8 4 4 2

## 9 3 4 4

## 10 3 3 2

## # ... with 3,173 more rows

psych::alpha(DtM02F1PRE)

##

## Reliability analysis

## Call: psych::alpha(x = DtM02F1PRE)

##

## raw\_alpha std.alpha G6(smc) average\_r S/N ase mean sd median\_r

## 0.79 0.79 0.71 0.55 3.7 0.0065 3.2 1 0.55

##

## lower alpha upper 95% confidence boundaries

## 0.77 0.79 0.8

##

## Reliability if an item is dropped:

## raw\_alpha std.alpha G6(smc) average\_r S/N alpha se var.r med.r

## M21PRE 0.68 0.68 0.52 0.52 2.2 0.0112 NA 0.52

## M26PRE 0.74 0.74 0.59 0.59 2.8 0.0093 NA 0.59

## M31PRE 0.71 0.71 0.55 0.55 2.5 0.0103 NA 0.55

##

## Item statistics

## n raw.r std.r r.cor r.drop mean sd

## M21PRE 3183 0.85 0.85 0.74 0.65 3.2 1.3

## M26PRE 3183 0.81 0.82 0.68 0.60 3.5 1.1

## M31PRE 3183 0.85 0.84 0.71 0.63 3.0 1.3

##

## Non missing response frequency for each item

## 1 2 3 4 5 miss

## M21PRE 0.11 0.19 0.29 0.22 0.18 0

## M26PRE 0.05 0.13 0.30 0.29 0.23 0

## M31PRE 0.15 0.22 0.26 0.20 0.17 0

DtM02F2PRE<-DtM02PRE [,c("M22PRE","M27PRE","M32PRE")]

#F2= knowledge networking

DtM02F2PRE

```
## # A tibble: 3,183 x 3
##   M22PRE M27PRE M32PRE
##   <dbl> <dbl> <dbl>
## 1     3     3     3
## 2     3     3     3
## 3     3     2     2
## 4     2     3     4
## 5     2     2     2
## 6     4     4     4
## 7     2     3     3
## 8     4     4     4
## 9     3     3     2
## 10    3     2     2
## # ... with 3,173 more rows
```

psych::alpha(DtM02F2PRE)

```
##
## Reliability analysis
## Call: psych::alpha(x = DtM02F2PRE)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.81 0.81 0.75 0.59 4.4 0.0058 3.2 0.9 0.61
##
## lower alpha upper 95% confidence boundaries
## 0.8 0.81 0.82
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M22PRE 0.79 0.79 0.66 0.66 3.9 0.0073 NA 0.66
## M27PRE 0.76 0.76 0.61 0.61 3.1 0.0086 NA 0.61
## M32PRE 0.68 0.68 0.52 0.52 2.1 0.0113 NA 0.52
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M22PRE 3183 0.83 0.83 0.68 0.62 3.1 1.1
## M27PRE 3183 0.85 0.85 0.73 0.65 3.2 1.1
## M32PRE 3183 0.88 0.88 0.81 0.73 3.3 1.0
##
## Non missing response frequency for each item
## 1 2 3 4 5 miss
## M22PRE 0.08 0.18 0.40 0.23 0.12 0
## M27PRE 0.05 0.20 0.39 0.22 0.14 0
## M32PRE 0.04 0.16 0.43 0.25 0.12 0
```

DtM02F3PRE<-DtM02PRE [,c("M23PRE","M28PRE","M33PRE")]

#F3=knowledge practice

DtM02F3PRE

```
## # A tibble: 3,183 x 3
##   M23PRE M28PRE M33PRE
##   <dbl> <dbl> <dbl>
## 1     3     3     3
## 2     3     3     2
## 3     3     3     3
## 4     4     4     4
## 5     5     5     5
## 6     4     4     4
## 7     2     2     3
## 8     4     4     4
## 9     3     4     3
## 10    1     1     2
## # ... with 3,173 more rows
```

psych::alpha(DtM02F3PRE)

```
##
## Reliability analysis
## Call: psych::alpha(x = DtM02F3PRE)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.78 0.78 0.72 0.54 3.5 0.0067 3.5 0.89 0.5
##
## lower alpha upper 95% confidence boundaries
## 0.77 0.78 0.79
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M23PRE 0.67 0.67 0.50 0.50 2.0 0.0117 NA 0.50
## M28PRE 0.80 0.80 0.67 0.67 4.0 0.0071 NA 0.67
## M33PRE 0.62 0.62 0.45 0.45 1.6 0.0134 NA 0.45
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M23PRE 3183 0.86 0.85 0.75 0.65 3.4 1.1
## M28PRE 3183 0.77 0.78 0.58 0.52 3.7 1.0
## M33PRE 3183 0.87 0.87 0.79 0.69 3.5 1.1
##
## Non missing response frequency for each item
## 1 2 3 4 5 miss
## M23PRE 0.05 0.15 0.32 0.27 0.20 0
## M28PRE 0.03 0.09 0.31 0.34 0.23 0
## M33PRE 0.04 0.13 0.34 0.29 0.20 0
```

DtM02F4PRE<-DtM02PRE [,c("M24PRE","M29PRE","M34PRE")]

*F4= knowledge critique*

DtM02F4PRE

```

## # A tibble: 3,183 x 3
##   M24PRE M29PRE M34PRE
##   <dbl> <dbl> <dbl>
## 1     3     3     3
## 2     5     2     1
## 3     3     2     2
## 4     1     3     1
## 5     2     4     2
## 6     4     4     3
## 7     2     3     3
## 8     3     4     3
## 9     2     2     1
## 10    3     2     1
## # ... with 3,173 more rows

psych::alpha(DtM02F4PRE)

##
## Reliability analysis
## Call: psych::alpha(x = DtM02F4PRE)
##
##   raw_alpha std.alpha G6(smc) average_r S/N   ase mean   sd median_r
##   0.77    0.77    0.69    0.53 3.3 0.0071  3 0.88    0.53
##
## lower alpha upper   95% confidence boundaries
## 0.75 0.77 0.78
##
## Reliability if an item is dropped:
##   raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M24PRE    0.70    0.70  0.53    0.53 2.3  0.011  NA 0.53
## M29PRE    0.70    0.70  0.54    0.54 2.3  0.011  NA 0.54
## M34PRE    0.67    0.67  0.50    0.50 2.0  0.012  NA 0.50
##
## Item statistics
##   n raw.r std.r r.cor r.drop mean sd
## M24PRE 3183 0.83 0.82 0.68 0.60 3.1 1.1
## M29PRE 3183 0.82 0.82 0.68 0.59 3.3 1.0
## M34PRE 3183 0.83 0.84 0.71 0.62 2.5 1.1
##
## Non missing response frequency for each item
##   1 2 3 4 5 miss
## M24PRE 0.08 0.21 0.38 0.22 0.12 0
## M29PRE 0.04 0.16 0.40 0.25 0.15 0
## M34PRE 0.16 0.38 0.30 0.11 0.06 0

```

```
DtM02F5PRE<-DtM02PRE [,c("M25PRE","M30PRE","M35PRE")]
```

*#F5=knowledge monitoring*

```
DtM02F5PRE
```

```

## # A tibble: 3,183 x 3
##   M25PRE M30PRE M35PRE

```

```

## <dbl> <dbl> <dbl>
## 1 3 3 3
## 2 5 3 4
## 3 3 3 3
## 4 3 4 5
## 5 4 1 5
## 6 4 4 4
## 7 2 3 3
## 8 4 4 4
## 9 3 3 2
## 10 2 2 2
## # ... with 3,173 more rows

psych::alpha(DtM02F5PRE)

##
## Reliability analysis
## Call: psych::alpha(x = DtM02F5PRE)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.79 0.79 0.72 0.55 3.7 0.0065 3.7 0.79 0.54
##
## lower alpha upper 95% confidence boundaries
## 0.77 0.79 0.8
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M25PRE 0.70 0.70 0.54 0.54 2.3 0.0107 NA 0.54
## M30PRE 0.76 0.76 0.62 0.62 3.2 0.0084 NA 0.62
## M35PRE 0.67 0.67 0.51 0.51 2.0 0.0116 NA 0.51
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M25PRE 3183 0.85 0.84 0.73 0.64 3.8 0.97
## M30PRE 3183 0.81 0.81 0.65 0.58 3.7 0.94
## M35PRE 3183 0.85 0.86 0.75 0.66 3.8 0.92
##
## Non missing response frequency for each item
## 1 2 3 4 5 miss
## M25PRE 0.02 0.07 0.31 0.35 0.25 0
## M30PRE 0.02 0.07 0.34 0.36 0.21 0
## M35PRE 0.01 0.05 0.34 0.36 0.24 0

DtM02F1NOW<-DtM02NOW [,c("M21NOW","M26NOW","M31NOW")]

#F1= knowledge extraction

DtM02F1NOW

## # A tibble: 3,183 x 3
## M21NOW M26NOW M31NOW
## <dbl> <dbl> <dbl>
## 1 3 3 3

```

```

## 2 2 4 4
## 3 1 3 4
## 4 4 5 5
## 5 5 5 2
## 6 1 5 2
## 7 4 5 4
## 8 4 4 2
## 9 5 4 4
## 10 5 5 4
## # ... with 3,173 more rows

psych::alpha(DtM02F1NOW)

##
## Reliability analysis
## Call: psych::alpha(x = DtM02F1NOW)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.79 0.79 0.71 0.55 3.7 0.0065 3.4 1 0.55
##
## lower alpha upper 95% confidence boundaries
## 0.77 0.79 0.8
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M21NOW 0.68 0.69 0.52 0.52 2.2 0.0111 NA 0.52
## M26NOW 0.74 0.74 0.58 0.58 2.8 0.0093 NA 0.58
## M31NOW 0.71 0.71 0.55 0.55 2.5 0.0102 NA 0.55
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M21NOW 3183 0.85 0.85 0.74 0.65 3.4 1.3
## M26NOW 3183 0.81 0.83 0.68 0.60 3.7 1.1
## M31NOW 3183 0.85 0.84 0.71 0.63 3.2 1.3
##
## Non missing response frequency for each item
## 1 2 3 4 5 miss
## M21NOW 0.10 0.15 0.24 0.28 0.23 0
## M26NOW 0.04 0.10 0.25 0.31 0.29 0
## M31NOW 0.13 0.19 0.22 0.22 0.23 0

DtM02F2NOW<-DtM02NOW [,c("M22NOW","M27NOW","M32NOW")]

#F2= knowledge networking
DtM02F2NOW

## # A tibble: 3,183 x 3
## M22NOW M27NOW M32NOW
## <dbl> <dbl> <dbl>
## 1 3 3 3
## 2 3 3 3
## 3 3 2 2

```

```

## 4 3 3 4
## 5 2 5 2
## 6 4 4 4
## 7 4 4 3
## 8 4 4 4
## 9 4 3 2
## 10 5 5 4
## # ... with 3,173 more rows

psych::alpha(DtM02F2NOW)

##
## Reliability analysis
## Call: psych::alpha(x = DtM02F2NOW)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.81 0.82 0.75 0.6 4.4 0.0058 3.3 0.91 0.6
##
## lower alpha upper 95% confidence boundaries
## 0.8 0.81 0.83
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M22NOW 0.80 0.80 0.66 0.66 3.9 0.0072 NA 0.66
## M27NOW 0.75 0.75 0.60 0.60 3.1 0.0088 NA 0.60
## M32NOW 0.68 0.68 0.52 0.52 2.2 0.0112 NA 0.52
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M22NOW 3183 0.83 0.83 0.68 0.62 3.3 1.1
## M27NOW 3183 0.85 0.85 0.74 0.66 3.4 1.1
## M32NOW 3183 0.88 0.88 0.81 0.73 3.4 1.0
##
## Non missing response frequency for each item
## 1 2 3 4 5 miss
## M22NOW 0.06 0.14 0.38 0.27 0.15 0
## M27NOW 0.04 0.17 0.35 0.26 0.18 0
## M32NOW 0.04 0.13 0.40 0.28 0.16 0

DtM02F3NOW<-DtM02NOW [,c("M23NOW","M28NOW","M33NOW")]

#F3= knowledge practice
DtM02F3NOW

## # A tibble: 3,183 x 3
## M23NOW M28NOW M33NOW
## <dbl> <dbl> <dbl>
## 1 3 3 3
## 2 4 3 2
## 3 3 3 3
## 4 5 5 4

```

```

## 5 5 5 5
## 6 4 5 4
## 7 4 4 4
## 8 4 4 4
## 9 4 4 3
## 10 5 5 4
## # ... with 3,173 more rows

psych::alpha(DtM02F3NOW)

##
## Reliability analysis
## Call: psych::alpha(x = DtM02F3NOW)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.78 0.78 0.72 0.54 3.6 0.0066 3.7 0.88 0.52
##
## lower alpha upper 95% confidence boundaries
## 0.77 0.78 0.8
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M23NOW 0.68 0.68 0.52 0.52 2.1 0.0114 NA 0.52
## M28NOW 0.80 0.80 0.67 0.67 4.1 0.0069 NA 0.67
## M33NOW 0.61 0.61 0.44 0.44 1.6 0.0137 NA 0.44
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M23NOW 3183 0.86 0.85 0.74 0.65 3.5 1.12
## M28NOW 3183 0.76 0.78 0.58 0.52 3.9 0.98
## M33NOW 3183 0.88 0.87 0.80 0.71 3.6 1.08
##
## Non missing response frequency for each item
## 1 2 3 4 5 miss
## M23NOW 0.05 0.13 0.29 0.30 0.23 0
## M28NOW 0.02 0.06 0.26 0.35 0.31 0
## M33NOW 0.04 0.12 0.31 0.30 0.23 0

DtM02F4NOW<-DtM02NOW [,c("M24NOW","M29NOW","M34NOW")]

#F4= knowledge critique
DtM02F4NOW

## # A tibble: 3,183 x 3
## M24NOW M29NOW M34NOW
## <dbl> <dbl> <dbl>
## 1 3 3 3
## 2 5 2 1
## 3 3 2 2
## 4 1 3 1
## 5 2 4 2
## 6 5 3 2

```



```

## 7 3 3 4
## 8 3 4 3
## 9 2 3 1
## 10 5 4 4
## # ... with 3,173 more rows

psych::alpha(DtM02F4NOW)

##
## Reliability analysis
## Call: psych::alpha(x = DtM02F4NOW)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.77 0.77 0.69 0.53 3.3 0.0071 3.1 0.91 0.55
##
## lower alpha upper 95% confidence boundaries
## 0.76 0.77 0.78
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M24NOW 0.71 0.71 0.55 0.55 2.4 0.010 NA 0.55
## M29NOW 0.71 0.71 0.55 0.55 2.4 0.010 NA 0.55
## M34NOW 0.66 0.66 0.49 0.49 1.9 0.012 NA 0.49
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M24NOW 3183 0.82 0.82 0.67 0.59 3.2 1.1
## M29NOW 3183 0.81 0.82 0.67 0.59 3.4 1.1
## M34NOW 3183 0.85 0.84 0.72 0.63 2.6 1.1
##
## Non missing response frequency for each item
## 1 2 3 4 5 miss
## M24NOW 0.07 0.18 0.35 0.25 0.15 0
## M29NOW 0.04 0.15 0.36 0.27 0.18 0
## M34NOW 0.15 0.36 0.29 0.11 0.08 0

```

```
DtM02F5NOW<-DtM02NOWw [,c("M25NOW","M30NOW","M35NOW")]
```

*#F5= knowledge monitoring*

```
DtM02F5NOW
```

```

## # A tibble: 3,183 × 3
## M25NOW M30NOW M35NOW
## <dbl> <dbl> <dbl>
## 1 3 3 3
## 2 5 3 4
## 3 3 3 3
## 4 4 4 5
## 5 4 5 5
## 6 5 3 3
## 7 3 4 4
## 8 4 4 4

```

```
## 9 3 3 3
## 10 4 4 5
## # ... with 3,173 more rows

psych::alpha(DtM02F5NOW)

##
## Reliability analysis
## Call: psych::alpha(x = DtM02F5NOW)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.79 0.79 0.72 0.55 3.7 0.0066 3.9 0.78 0.53
##
## lower alpha upper 95% confidence boundaries
## 0.77 0.79 0.8
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## M25NOW 0.69 0.69 0.53 0.53 2.2 0.0110 NA 0.53
## M30NOW 0.77 0.77 0.62 0.62 3.3 0.0082 NA 0.62
## M35NOW 0.67 0.67 0.50 0.50 2.0 0.0117 NA 0.50
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## M25NOW 3183 0.85 0.85 0.73 0.65 3.9 0.94
## M30NOW 3183 0.81 0.81 0.64 0.57 3.8 0.92
## M35NOW 3183 0.86 0.86 0.75 0.66 3.9 0.93
##
## Non missing response frequency for each item
## 1 2 3 4 5 miss
## M25NOW 0.01 0.06 0.26 0.37 0.31 0
## M30NOW 0.01 0.06 0.29 0.39 0.25 0
## M35NOW 0.01 0.05 0.28 0.36 0.30 0
```

## SELF-EFFICACY PRE and NOW

```
library(readxl)
DtAA02PRE <- read_excel("DtAA02PRE.xlsx")
View(DtAA02PRE)

str(DtAA02PRE)

## tibble [3,183 × 10] (S3: tbl_df/tbl/data.frame)
## $ AA36PRE: num [1:3183] 3 4 3 5 5 4 3 4 2 2 ...
## $ AA37PRE: num [1:3183] 3 2 3 4 3 3 2 4 2 2 ...
```

```
## $ AA38PRE: num [1:3183] 3 4 3 2 5 4 2 4 1 2 ...
## $ AA39PRE: num [1:3183] 3 3 3 4 1 4 2 4 1 3 ...
## $ AA40PRE: num [1:3183] 3 2 3 3 2 4 2 4 2 3 ...
## $ AA41PRE: num [1:3183] 3 4 4 5 2 4 2 4 3 3 ...
## $ AA42PRE: num [1:3183] 3 3 4 4 2 3 2 4 3 2 ...
## $ AA43PRE: num [1:3183] 3 4 2 3 3 3 2 4 2 3 ...
## $ AA44PRE: num [1:3183] 3 3 3 4 2 3 3 4 3 2 ...
## $ AA45PRE: num [1:3183] 3 3 3 4 3 4 3 4 3 2 ...
```

```
summary(DtAA02PRE)
```

```
## AA36PRE AA37PRE AA38PRE AA39PRE AA40PRE
## Min. :1.000 Min. :1.00 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:3.00 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:3.000
## Median :3.000 Median :3.00 Median :3.000 Median :3.000 Median :3.000
## Mean :3.401 Mean :3.11 Mean :3.206 Mean :3.199 Mean :3.193
## 3rd Qu.:4.000 3rd Qu.:4.00 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000
## Max. :5.000 Max. :5.00 Max. :5.000 Max. :5.000 Max. :5.000
## AA41PRE AA42PRE AA43PRE AA44PRE
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000
## Median :4.000 Median :3.000 Median :3.000 Median :3.000
## Mean :3.557 Mean :3.167 Mean :2.983 Mean :3.079
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.000 3rd Qu.:4.000
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000
## AA45PRE
## Min. :1.000
## 1st Qu.:3.000
## Median :3.000
## Mean :3.072
## 3rd Qu.:4.000
## Max. :5.000
```

```
library(psych)
```

```
psych::alpha(DtAA02PRE)
```

```
##
## Reliability analysis
## Call: psych::alpha(x = DtAA02PRE)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.93 0.93 0.93 0.56 13 0.0019 3.2 0.74 0.54
##
## lower alpha upper 95% confidence boundaries
## 0.92 0.93 0.93
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## AA36PRE 0.92 0.92 0.92 0.57 12 0.0020 0.0057 0.58
## AA37PRE 0.93 0.93 0.92 0.58 12 0.0020 0.0052 0.58
## AA38PRE 0.92 0.92 0.92 0.57 12 0.0021 0.0065 0.58
## AA39PRE 0.92 0.92 0.91 0.55 11 0.0022 0.0048 0.54
## AA40PRE 0.92 0.92 0.91 0.55 11 0.0022 0.0046 0.54
```

```

## AA41PRE 0.92 0.92 0.92 0.56 11 0.0022 0.0066 0.54
## AA42PRE 0.92 0.92 0.92 0.56 11 0.0022 0.0060 0.54
## AA43PRE 0.92 0.92 0.92 0.56 12 0.0021 0.0062 0.56
## AA44PRE 0.92 0.92 0.92 0.56 11 0.0022 0.0057 0.54
## AA45PRE 0.92 0.92 0.92 0.55 11 0.0022 0.0054 0.54
##
## Item statistics
##      n raw.r std.r r.cor r.drop mean sd
## AA36PRE 3183 0.72 0.72 0.68 0.65 3.4 0.98
## AA37PRE 3183 0.69 0.69 0.64 0.61 3.1 0.96
## AA38PRE 3183 0.75 0.75 0.71 0.69 3.2 0.99
## AA39PRE 3183 0.84 0.83 0.83 0.79 3.2 0.98
## AA40PRE 3183 0.83 0.83 0.83 0.79 3.2 0.94
## AA41PRE 3183 0.80 0.80 0.78 0.75 3.6 0.94
## AA42PRE 3183 0.79 0.79 0.76 0.73 3.2 1.02
## AA43PRE 3183 0.76 0.76 0.72 0.70 3.0 0.92
## AA44PRE 3183 0.78 0.78 0.76 0.73 3.1 0.92
## AA45PRE 3183 0.81 0.81 0.79 0.76 3.1 0.92
##
## Non missing response frequency for each item
##      1 2 3 4 5 miss
## AA36PRE 0.03 0.13 0.39 0.31 0.14 0
## AA37PRE 0.04 0.20 0.45 0.22 0.09 0
## AA38PRE 0.04 0.19 0.41 0.25 0.11 0
## AA39PRE 0.04 0.18 0.43 0.24 0.11 0
## AA40PRE 0.03 0.16 0.48 0.23 0.10 0
## AA41PRE 0.02 0.09 0.38 0.34 0.17 0
## AA42PRE 0.05 0.20 0.40 0.25 0.11 0
## AA43PRE 0.03 0.26 0.46 0.18 0.07 0
## AA44PRE 0.04 0.20 0.48 0.22 0.07 0
## AA45PRE 0.04 0.20 0.49 0.19 0.08 0

```

```

library(readxl)
DtAA02NOW <- read_excel("DtAA02NOW.xlsx")
View(DtAA02NOW)

```

```

str(DtAA02NOW)

## tibble [3,183 × 10] (S3: tbl_df/tbl/data.frame)
## $ AA36NOW: num [1:3183] 2 2 3 5 5 4 4 4 2 5 ...
## $ AA37NOW: num [1:3183] 3 2 3 4 3 2 3 4 2 5 ...
## $ AA38NOW: num [1:3183] 2 2 3 2 5 2 3 4 1 5 ...
## $ AA39NOW: num [1:3183] 3 2 3 4 5 3 3 4 1 5 ...
## $ AA40NOW: num [1:3183] 3 2 3 3 5 3 3 4 2 5 ...
## $ AA41NOW: num [1:3183] 3 3 4 5 5 2 3 4 3 5 ...
## $ AA42NOW: num [1:3183] 3 2 4 4 4 4 3 4 3 5 ...
## $ AA43NOW: num [1:3183] 3 2 2 4 3 3 2 4 2 5 ...
## $ AA44NOW: num [1:3183] 3 2 3 4 2 3 3 4 3 5 ...
## $ AA45NOW: num [1:3183] 3 3 3 4 3 4 3 4 3 5 ...

```

```

summary(DtAA02NOW)

```

```

## AA36NOW AA37NOW AA38NOW AA39NOW
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:2.000 1st Qu.:2.000
## Median :3.000 Median :3.000 Median :3.000 Median :3.000
## Mean :3.405 Mean :3.092 Mean :3.055 Mean :3.112
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000
## AA40NOW AA41NOW AA42NOW AA43NOW
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:2.000
## Median :3.000 Median :4.000 Median :3.000 Median :3.000
## Mean :3.189 Mean :3.548 Mean :3.089 Mean :2.953
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.000
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000
## AA44NOW AA45NOW
## Min. :1.000 Min. :1.000
## 1st Qu.:2.000 1st Qu.:2.000
## Median :3.000 Median :3.000
## Mean :3.026 Mean :3.008
## 3rd Qu.:4.000 3rd Qu.:4.000
## Max. :5.000 Max. :5.000

```

*library*(psych)

psych::alpha(DtAA02NOW)

```

##
## Reliability analysis
## Call: psych::alpha(x = DtAA02NOW)
##
## raw_alpha std.alpha G6(smc) average_r S/N ase mean sd median_r
## 0.93 0.93 0.93 0.58 14 0.0018 3.1 0.8 0.57
##
## lower alpha upper 95% confidence boundaries
## 0.93 0.93 0.94
##
## Reliability if an item is dropped:
## raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r med.r
## AA36NOW 0.93 0.93 0.93 0.59 13 0.0019 0.0062 0.60
## AA37NOW 0.93 0.93 0.93 0.60 13 0.0018 0.0045 0.60
## AA38NOW 0.93 0.93 0.93 0.58 13 0.0019 0.0066 0.60
## AA39NOW 0.92 0.92 0.92 0.57 12 0.0021 0.0049 0.56
## AA40NOW 0.92 0.92 0.92 0.57 12 0.0021 0.0047 0.55
## AA41NOW 0.92 0.92 0.92 0.57 12 0.0020 0.0066 0.55
## AA42NOW 0.92 0.92 0.92 0.57 12 0.0020 0.0058 0.56
## AA43NOW 0.93 0.93 0.92 0.58 12 0.0020 0.0065 0.57
## AA44NOW 0.92 0.92 0.92 0.58 12 0.0020 0.0059 0.56
## AA45NOW 0.92 0.92 0.92 0.57 12 0.0021 0.0054 0.55
##
## Item statistics
## n raw.r std.r r.cor r.drop mean sd
## AA36NOW 3183 0.74 0.74 0.71 0.68 3.4 1.01
## AA37NOW 3183 0.68 0.68 0.62 0.60 3.1 0.97

```

```

## AA38NOW 3183 0.76 0.76 0.72 0.69 3.1 1.07
## AA39NOW 3183 0.84 0.84 0.83 0.79 3.1 1.10
## AA40NOW 3183 0.84 0.84 0.83 0.80 3.2 1.01
## AA41NOW 3183 0.81 0.81 0.79 0.76 3.5 0.99
## AA42NOW 3183 0.81 0.81 0.78 0.76 3.1 1.10
## AA43NOW 3183 0.77 0.77 0.74 0.71 3.0 0.96
## AA44NOW 3183 0.79 0.79 0.76 0.73 3.0 0.98
## AA45NOW 3183 0.83 0.83 0.81 0.78 3.0 0.98
##
## Non missing response frequency for each item
##      1  2  3  4  5 miss
## AA36NOW 0.03 0.15 0.36 0.31 0.15  0
## AA37NOW 0.04 0.22 0.44 0.21 0.09  0
## AA38NOW 0.07 0.23 0.37 0.22 0.10  0
## AA39NOW 0.07 0.21 0.37 0.23 0.12  0
## AA40NOW 0.05 0.18 0.41 0.25 0.11  0
## AA41NOW 0.03 0.11 0.35 0.33 0.19  0
## AA42NOW 0.07 0.22 0.35 0.23 0.11  0
## AA43NOW 0.04 0.29 0.42 0.17 0.08  0
## AA44NOW 0.06 0.22 0.44 0.21 0.08  0
## AA45NOW 0.06 0.22 0.45 0.19 0.08  0

```

## Section D Factor-Analysis

*Engineering students' evaluation of the online learning strategy carried on during the*

*Emergency Remote Teaching (COVID-19)*

*Self-Efficacy PRE*

```

library(readxl)
DtAA02PRE <- read_excel("DtAA02PRE.xlsx")
View(DtAA02PRE)

#Esplorazione iniziale
str(DtAA02PRE)

## tibble [3,183 × 10] (S3: tbl_df/tbl/data.frame)
## $ AA36PRE: num [1:3183] 3 4 3 5 5 4 3 4 2 2 ...
## $ AA37PRE: num [1:3183] 3 2 3 4 3 3 2 4 2 2 ...
## $ AA38PRE: num [1:3183] 3 4 3 2 5 4 2 4 1 2 ...
## $ AA39PRE: num [1:3183] 3 3 3 4 1 4 2 4 1 3 ...
## $ AA40PRE: num [1:3183] 3 2 3 3 2 4 2 4 2 3 ...
## $ AA41PRE: num [1:3183] 3 4 4 5 2 4 2 4 3 3 ...
## $ AA42PRE: num [1:3183] 3 3 4 4 2 3 2 4 3 2 ...
## $ AA43PRE: num [1:3183] 3 4 2 3 3 3 2 4 2 3 ...
## $ AA44PRE: num [1:3183] 3 3 3 4 2 3 3 4 3 2 ...
## $ AA45PRE: num [1:3183] 3 3 3 4 3 4 3 4 3 2 ...

summary(DtAA02PRE)

```

```

## AA36PRE AA37PRE AA38PRE AA39PRE AA40PRE
## Min. :1.000 Min. :1.00 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:3.00 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:3.000
## Median :3.000 Median :3.00 Median :3.000 Median :3.000 Median :3.000
## Mean :3.401 Mean :3.11 Mean :3.206 Mean :3.199 Mean :3.193
## 3rd Qu.:4.000 3rd Qu.:4.00 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000
## Max. :5.000 Max. :5.00 Max. :5.000 Max. :5.000 Max. :5.000
## AA41PRE AA42PRE AA43PRE AA44PRE
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000
## Median :4.000 Median :3.000 Median :3.000 Median :3.000
## Mean :3.557 Mean :3.167 Mean :2.983 Mean :3.079
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.000 3rd Qu.:4.000
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000
## AA45PRE
## Min. :1.000
## 1st Qu.:3.000
## Median :3.000
## Mean :3.072
## 3rd Qu.:4.000
## Max. :5.000

```

```

library(corpcor)
library(GPArotation)
library(psych)

```

```

DtAA02PREMatrix<-cor(DtAA02PRE)
round(DtAA02PREMatrix, 2)

```

```

## AA36PRE AA37PRE AA38PRE AA39PRE AA40PRE AA41PRE AA42PRE AA43PRE AA44PRE
## AA36PRE 1.00 0.53 0.54 0.53 0.51 0.63 0.47 0.47 0.46
## AA37PRE 0.53 1.00 0.50 0.50 0.49 0.50 0.45 0.47 0.46
## AA38PRE 0.54 0.50 1.00 0.62 0.58 0.58 0.52 0.48 0.50
## AA39PRE 0.53 0.50 0.62 1.00 0.79 0.64 0.64 0.54 0.59
## AA40PRE 0.51 0.49 0.58 0.79 1.00 0.63 0.63 0.58 0.62
## AA41PRE 0.63 0.50 0.58 0.64 0.63 1.00 0.59 0.54 0.54
## AA42PRE 0.47 0.45 0.52 0.64 0.63 0.59 1.00 0.58 0.61
## AA43PRE 0.47 0.47 0.48 0.54 0.58 0.54 0.58 1.00 0.65
## AA44PRE 0.46 0.46 0.50 0.59 0.62 0.54 0.61 0.65 1.00
## AA45PRE 0.47 0.47 0.52 0.64 0.67 0.58 0.64 0.61 0.68
## AA45PRE
## AA36PRE 0.47
## AA37PRE 0.47
## AA38PRE 0.52
## AA39PRE 0.64
## AA40PRE 0.67
## AA41PRE 0.58
## AA42PRE 0.64
## AA43PRE 0.61
## AA44PRE 0.68
## AA45PRE 1.00

```

```
cortest.bartlett(DtAA02PREMatrix, n=3183)
```

```
## $chisq
## [1] 19987.51
##
## $p.value
## [1] 0
##
## $df
## [1] 45
```

```
KMO(DtAA02PRE)
```

```
## Kaiser-Meyer-Olkin factor adequacy
## Call: KMO(r = DtAA02PRE)
## Overall MSA = 0.94
## MSA for each item =
## AA36PRE AA37PRE AA38PRE AA39PRE AA40PRE AA41PRE AA42PRE AA43PRE AA44PRE AA45PRE
E
## 0.93 0.96 0.96 0.92 0.92 0.95 0.96 0.95 0.94 0.95
```

```
det(cor(DtAA02PRE))
```

```
## [1] 0.001855379
```

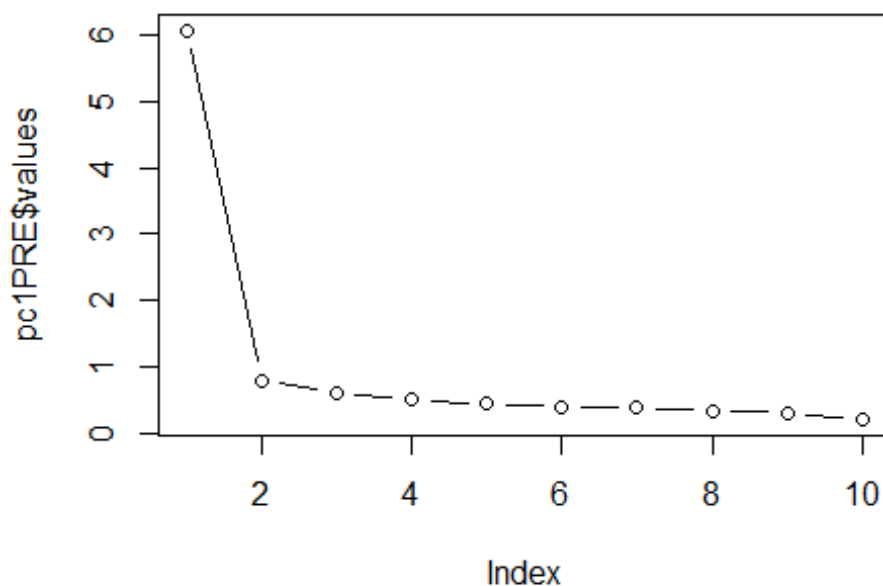
```
pc1PRE<-principal(DtAA02PRE, nfactors=length(DtAA02PRE), rotate = "none")
pc1PRE
```

```
## Principal Components Analysis
## Call: principal(r = DtAA02PRE, nfactors = length(DtAA02PRE), rotate = "none")
## Standardized loadings (pattern matrix) based upon correlation matrix
##      PC1 PC2 PC3 PC4 PC5 PC6 PC7 PC8 PC9 PC10 h2    u2
## AA36PRE 0.71 0.48 0.09 -0.37 -0.06 -0.08 0.15 0.28 0.08 0.02 1 1.1e-16
## AA37PRE 0.68 0.39 0.38 0.46 -0.16 0.05 -0.02 -0.05 -0.03 0.00 1 -2.0e-15
## AA38PRE 0.75 0.25 -0.24 0.14 0.54 0.09 0.02 -0.04 0.04 0.03 1 -2.2e-16
## AA39PRE 0.84 -0.03 -0.33 0.14 -0.13 -0.16 -0.09 0.12 -0.05 -0.32 1 4.4e-16
## AA40PRE 0.84 -0.12 -0.28 0.12 -0.16 -0.22 -0.09 0.06 -0.04 0.32 1 3.3e-16
## AA41PRE 0.80 0.20 -0.09 -0.29 -0.13 0.05 -0.08 -0.42 -0.11 -0.01 1 -1.1e-15
## AA42PRE 0.79 -0.22 -0.06 -0.04 -0.11 0.52 -0.08 0.16 -0.02 0.03 1 6.7e-16
## AA43PRE 0.76 -0.24 0.37 -0.14 0.18 -0.14 -0.39 0.03 0.10 -0.02 1 2.2e-16
## AA44PRE 0.79 -0.32 0.22 -0.04 0.13 -0.08 0.29 0.02 -0.35 -0.02 1 6.7e-16
## AA45PRE 0.81 -0.29 0.04 0.05 -0.06 -0.02 0.29 -0.14 0.38 -0.02 1 1.1e-16
##      com
## AA36PRE 3.0
## AA37PRE 3.3
## AA38PRE 2.5
## AA39PRE 1.9
## AA40PRE 1.9
## AA41PRE 2.2
## AA42PRE 2.1
```



```
## AA43PRE 2.7
## AA44PRE 2.4
## AA45PRE 2.1
##
##          PC1 PC2 PC3 PC4 PC5 PC6 PC7 PC8 PC9 PC10
## SS loadings    6.07 0.79 0.60 0.51 0.44 0.39 0.37 0.33 0.30 0.20
## Proportion Var  0.61 0.08 0.06 0.05 0.04 0.04 0.04 0.03 0.03 0.02
## Cumulative Var  0.61 0.69 0.75 0.80 0.84 0.88 0.92 0.95 0.98 1.00
## Proportion Explained 0.61 0.08 0.06 0.05 0.04 0.04 0.04 0.03 0.03 0.02
## Cumulative Proportion 0.61 0.69 0.75 0.80 0.84 0.88 0.92 0.95 0.98 1.00
##
## Mean item complexity = 2.4
## Test of the hypothesis that 10 components are sufficient.
##
## The root mean square of the residuals (RMSR) is 0
## with the empirical chi square 0 with prob < NA
##
## Fit based upon off diagonal values = 1

plot(pc1PRE$values, type= "b")
```



```
pc2PRE<-principal(DtAA02PRE, nfactors = 1, rotate = "none")
pc2PRE

## Principal Components Analysis
## Call: principal(r = DtAA02PRE, nfactors = 1, rotate = "none")
## Standardized loadings (pattern matrix) based upon correlation matrix
##      PC1  h2  u2 com
## AA36PRE 0.71 0.51 0.49 1
## AA37PRE 0.68 0.46 0.54 1
## AA38PRE 0.75 0.56 0.44 1
## AA39PRE 0.84 0.71 0.29 1
```

```
## AA40PRE 0.84 0.71 0.29 1
## AA41PRE 0.80 0.65 0.35 1
## AA42PRE 0.79 0.63 0.37 1
## AA43PRE 0.76 0.58 0.42 1
## AA44PRE 0.79 0.62 0.38 1
## AA45PRE 0.81 0.66 0.34 1
##
##          PC1
## SS loadings  6.07
## Proportion Var 0.61
##
## Mean item complexity = 1
## Test of the hypothesis that 1 component is sufficient.
##
## The root mean square of the residuals (RMSR) is 0.06
## with the empirical chi square 1154.56 with prob < 8.6e-220
##
## Fit based upon off diagonal values = 0.99
```