

Development and Validation of Psychometric Instrument to Measure Change in Habits of Mind of Transformative Learners

Results of Data Analysis

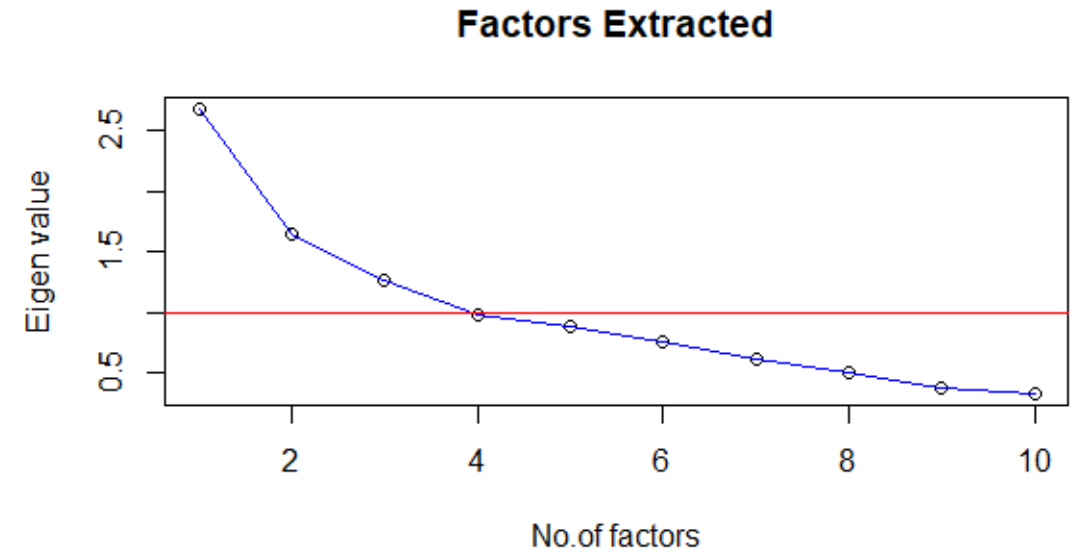
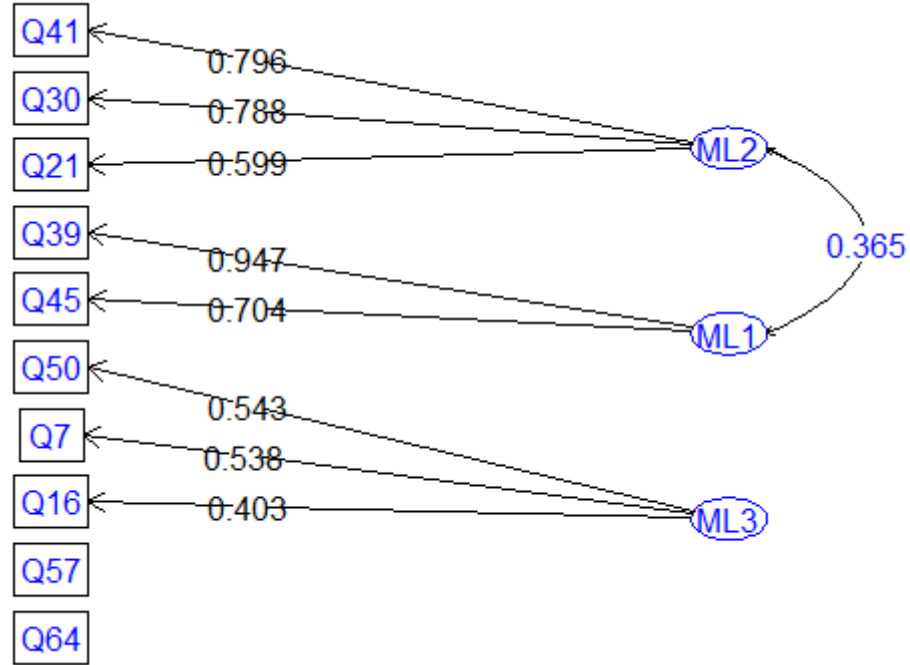
Exploratory Factor Analysis (EFA)

Method:

- RStudio (IDE) + R language (psych and GPArotation packages)
- MLE extraction with Oblimin rotation
- 0.5 as cutoff for factor loadings
- Average variance explained by retained factors is above 50% in all cases

Six habits of mind: 11 factors, 39 items

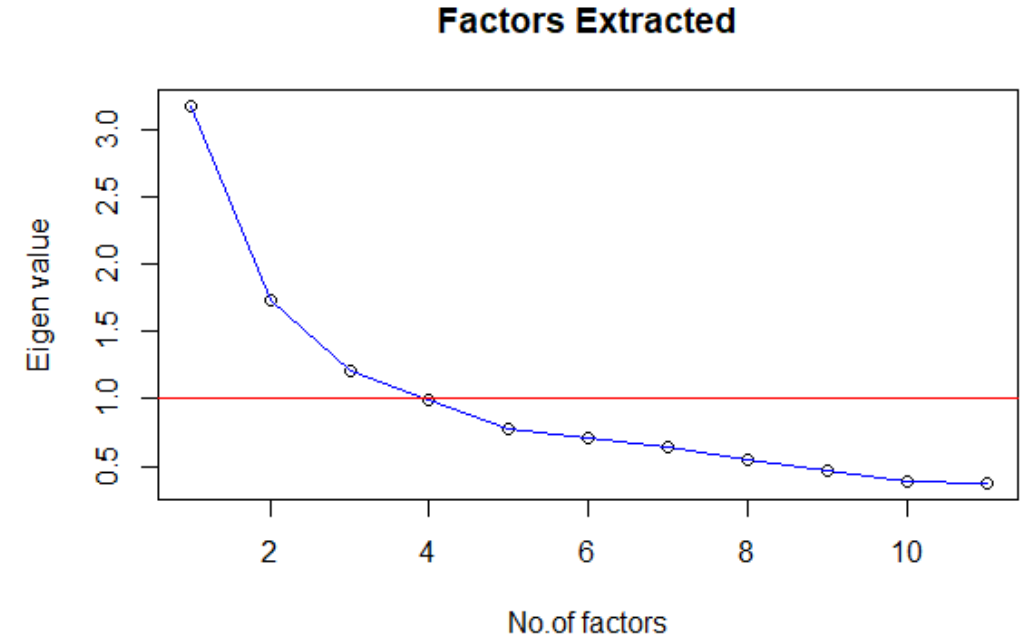
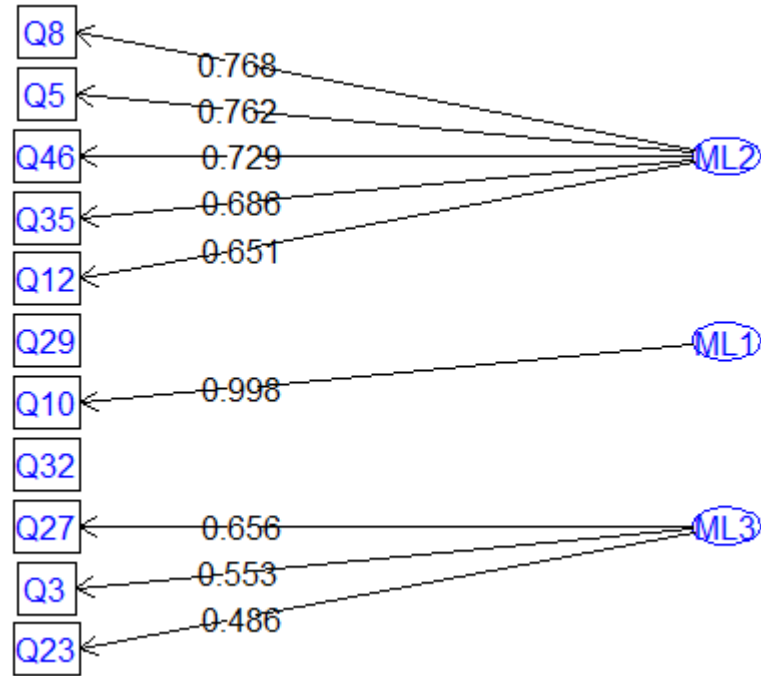
- Aesthetic: 2 factors (3+2 items)
- Epistemic: 1 factor (5 items)
- Moral-Ethical: 2 factors (5 + 4 items)
- Philosophical: 2 factors (3+2 items)
- Psychological: 2 factors (4 + 5 items)
- Sociolinguistic: 2 factors (3 + 3 items)



EFA: Aesthetic Habits of Mind

2 factors (3 + 2 items): retained after testing reliability and validity

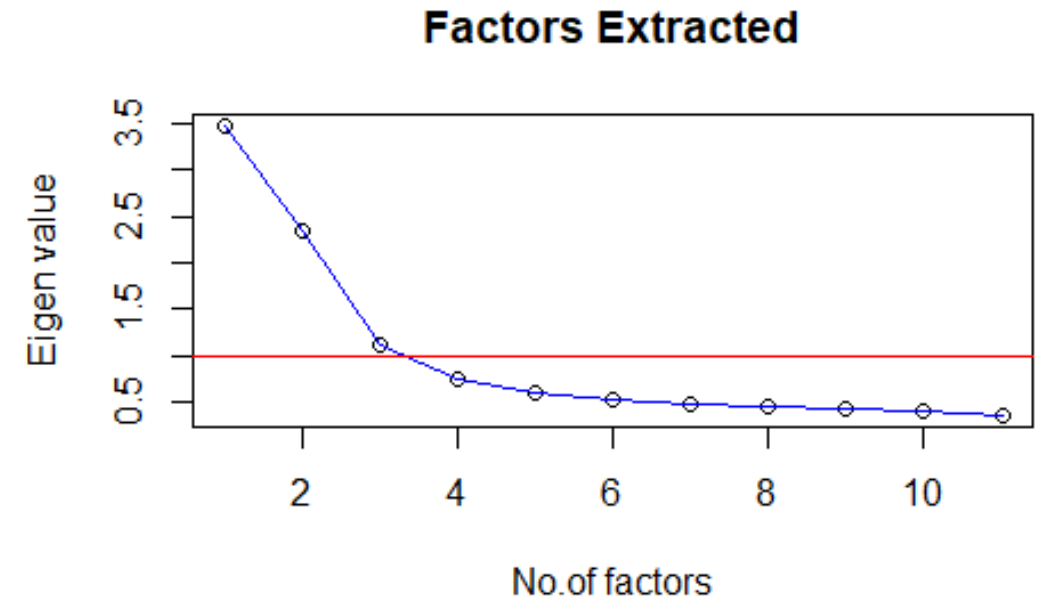
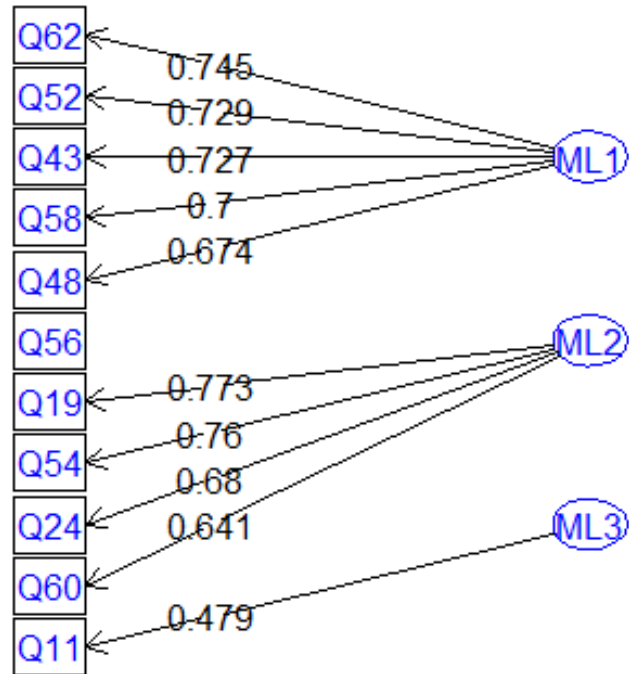
Gain in total variance explained: 0.408 to 0.602



EFA: Epistemic Habits of Mind

1 factor (5 items): retained after testing reliability and validity

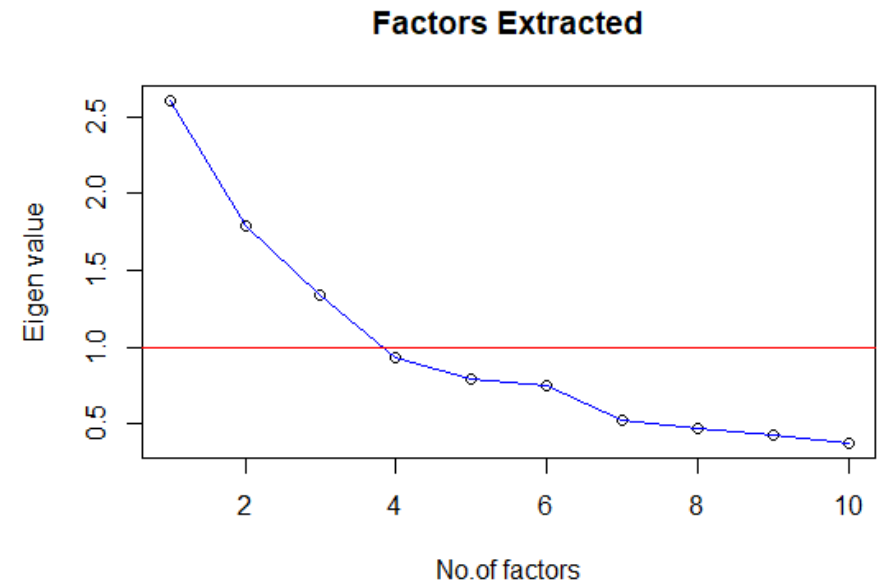
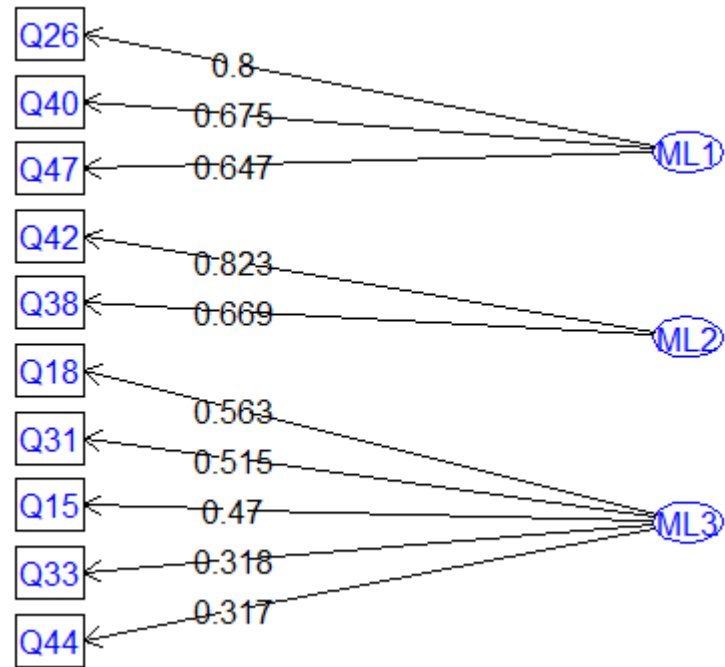
Gain in total variance explained: 0.434 to 0.519



EFA: Moral-Ethical Habits of Mind

2 factors, 5 + 4 items: retained after testing reliability and validity

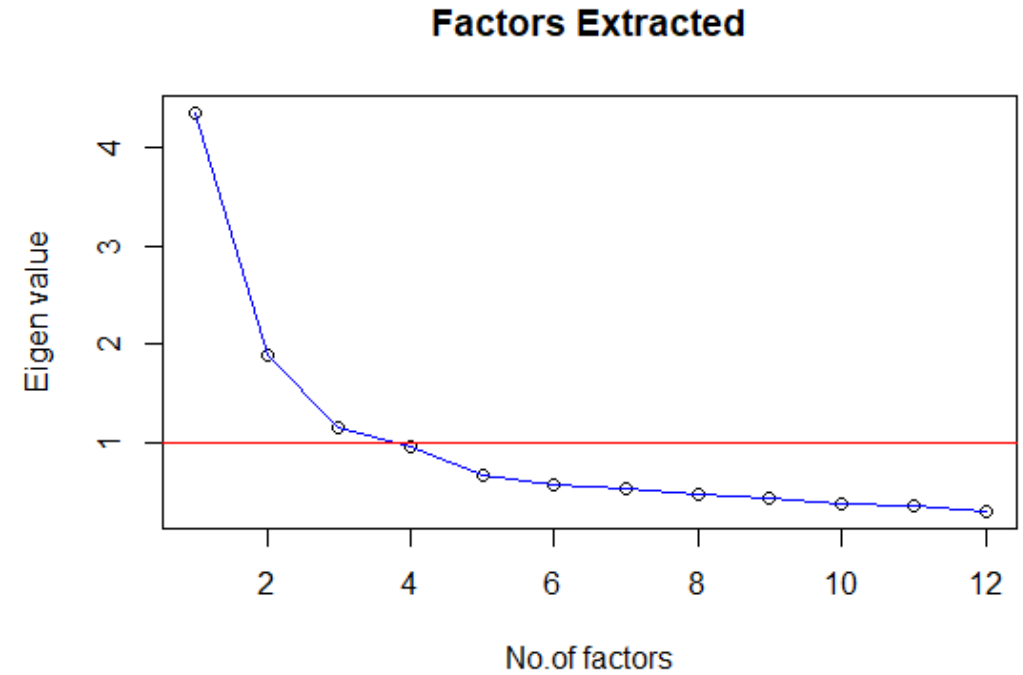
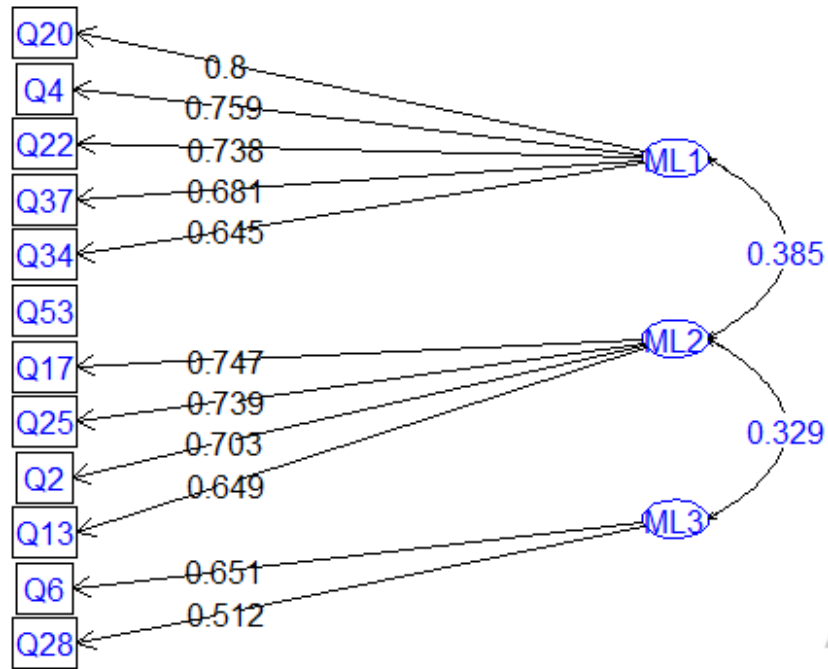
Gain in total variance explained: 0.473 to 0.515



EFA: Philosophical Habits of Mind

2 factors (3+2 items): retained after testing reliability and validity

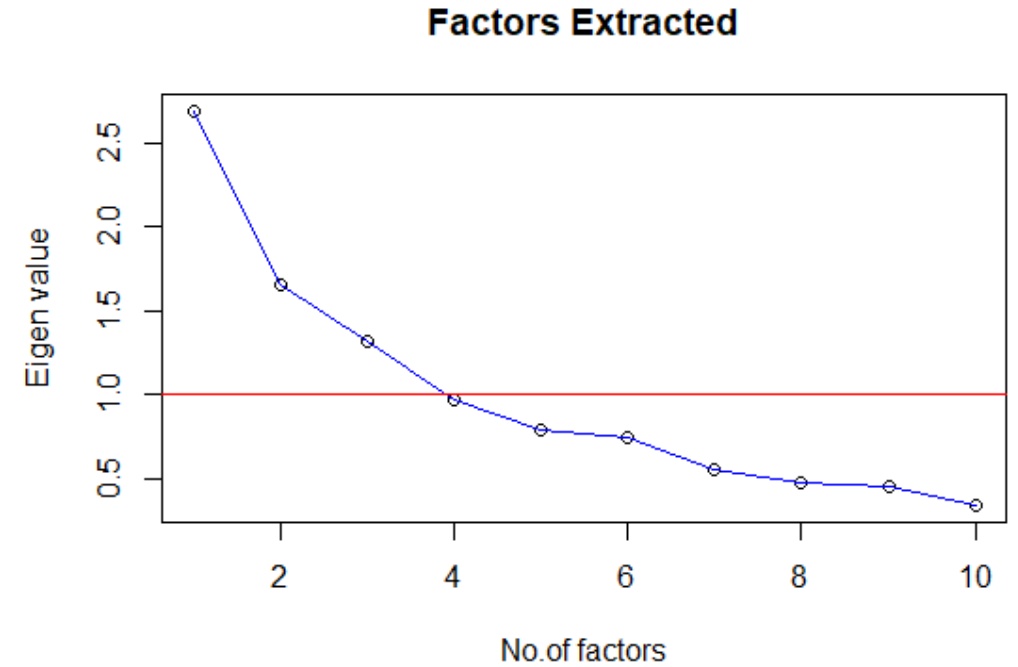
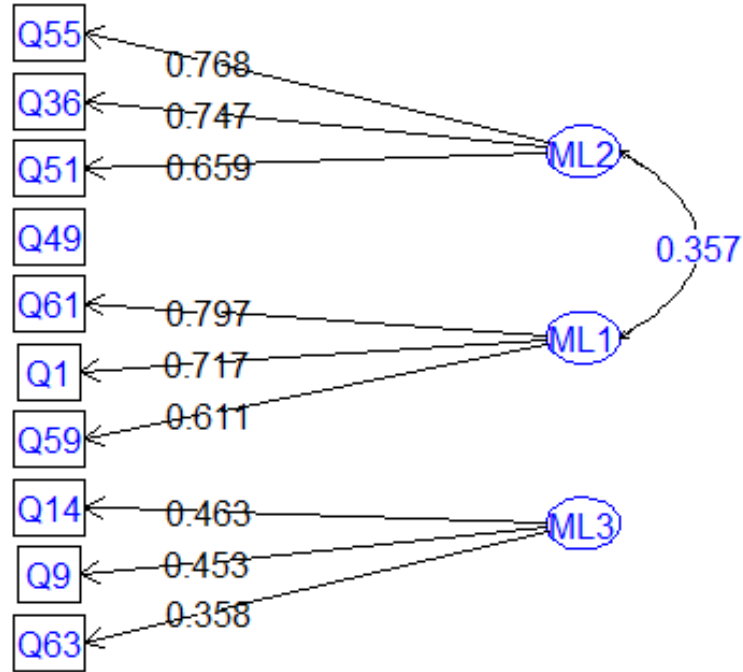
Gain in total variance explained: 0.401 to 0.56



EFA: Psychological Habits of Mind

2 factors (4 + 5 items): retained after testing reliability and validity

Gain in total variance explained: 0.471 to 0.532



EFA: Sociolinguistic Habits of Mind

2 factors (3 + 3 items): retained after testing reliability and validity

Gain in total variance explained: 0.389 to 0.518

Confirmatory Factor Analysis (CFA)

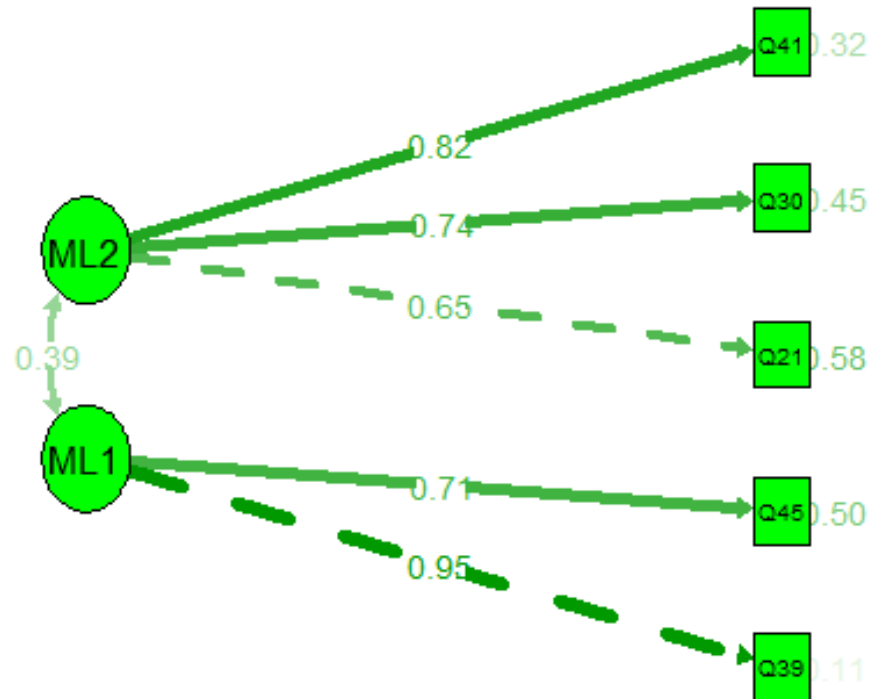
Tools and techniques:

- RStudio (IDE) + R language (lavaan, semPlot and semTools packages)
- Model fit measures, reliability and validity analysis

Six habits of mind: 11 factors, 39 items

- Aesthetic: 2 factors (3+2 items)
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- Philosophical: 2 factors (3+2 items)
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CFA: Aesthetic Habits of Mind

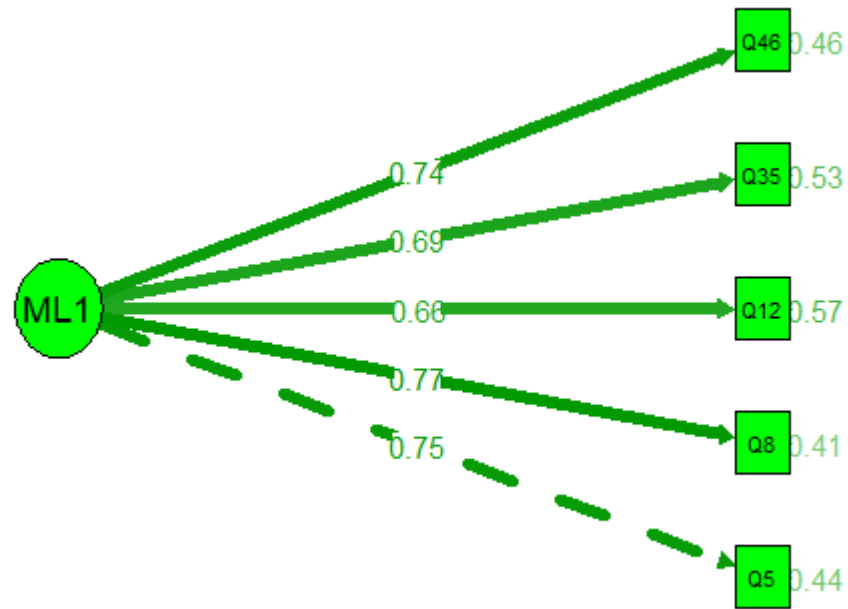


ML1 = Q39 + Q45

ML2 = Q21 + Q30 + Q41

Fitness Measure	Value
npar	11
Chi Square value	6.2733
df	4
CMIN/df	1.5683
pvalue	0.1796
CFI	0.9954
RMSEA	0.0422
TLI	0.9885
SRMR	0.0296
NNFI	0.9885
AGFI	0.971

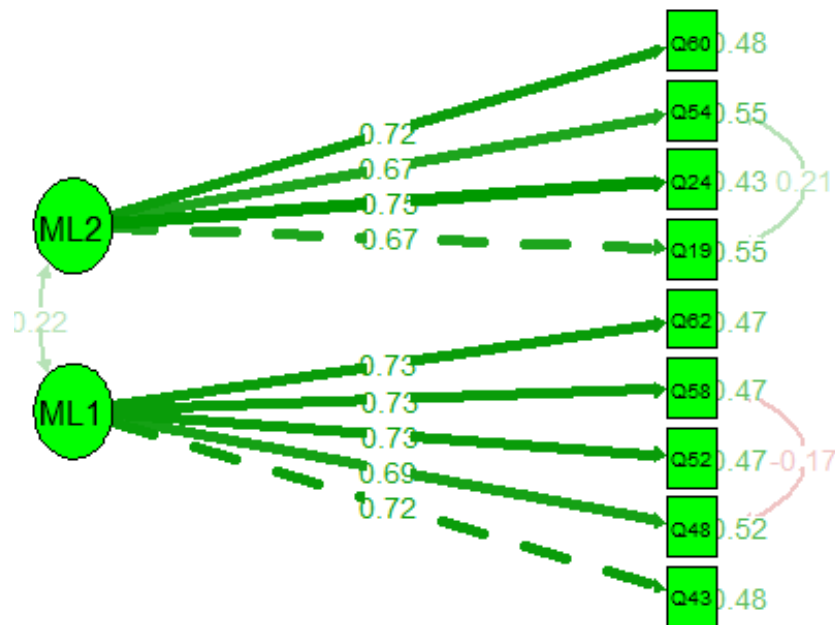
CFA: Epistemic Habits of Mind



$$ML1 = Q5 + Q8 + Q12 + Q35 + Q46$$

Fitness Measure	Value
npar	10
Chi Square value	11.6112
df	5
CMIN/df	2.3222
pvalue	0.0405
CFI	0.9886
RMSEA	0.0643
TLI	0.9772
SRMR	0.0240
NNFI	0.9772
AGFI	0.959

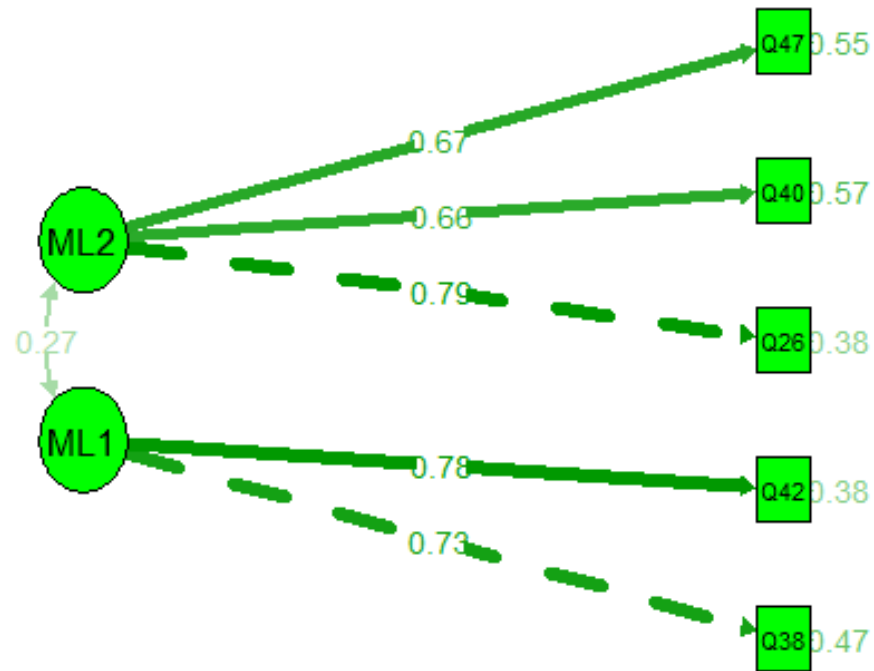
CFA: Moral-Ethical Habits of Mind



ML1 = Q43 + Q48 + Q52 + Q58 + Q62 Q48 ~~ Q58
 ML2 = Q19 + Q24 + Q54 + Q60 Q19 ~~ Q54

Fitness Measure	Value
npar	21
Chi Square value	28.02
df	24
CMIN/df	1.1674
pvalue	0.2591
CFI	0.9958
RMSEA	0.0229
TLI	0.9937
SRMR	0.0384
NNFI	0.9937
AGFI	0.965

CFA: Philosophical Habits of Mind

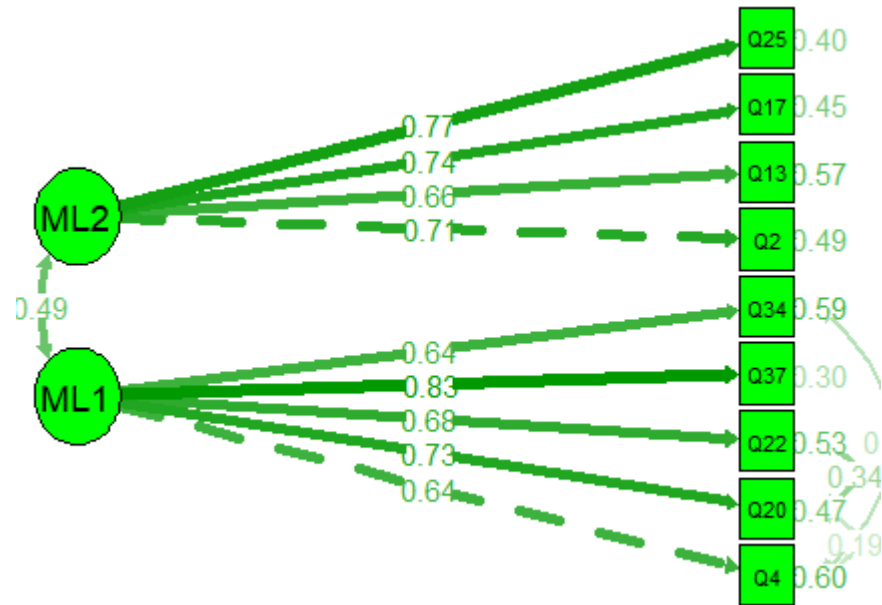


$$ML1 = Q38 + Q42$$

$$ML2 = Q26 + Q40 + Q47$$

Fitness Measure	Value
npar	11
Chi Square value	7.3251
df	4
CMIN/df	1.8312
pvalue	0.1196
CFI	0.9906
RMSEA	0.0510
TLI	0.9767
SRMR	0.0276
NNFI	0.9767
AGFI	0.967

CFA: Psychological Habits of Mind

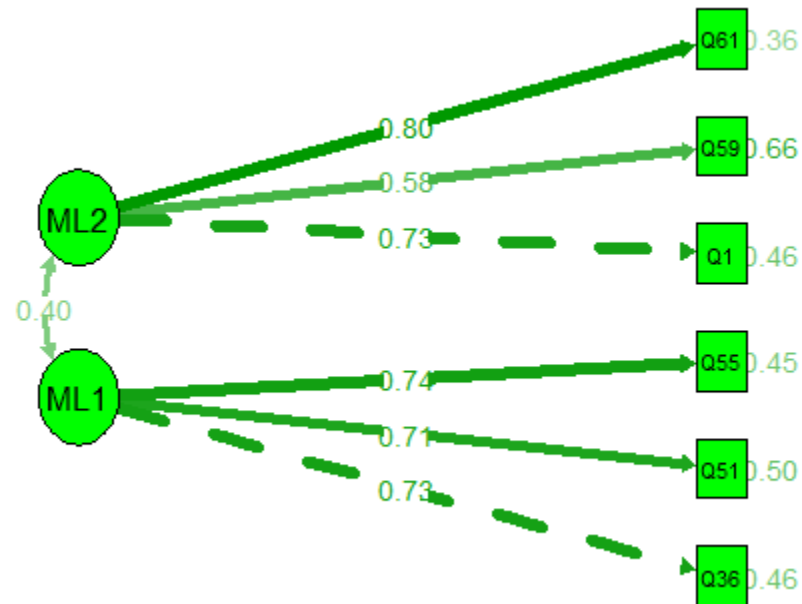


ML1 = Q4 + Q20 + Q22 + Q37 + Q34
ML2 = Q2 + Q13 + Q17 + Q25

Q20 ~~ Q22
Q4 ~~ Q34
Q4 ~~ Q20

Fitness Measure	Value
npar	22
Chi Square value	41.188
df	23
CMIN/df	1.790
pvalue	0.0112
CFI	0.9840
RMSEA	0.0497
TLI	0.975
SRMR	0.0394
NNFI	0.9750
AGFI	0.947

CFA: Sociolinguistic Habits of Mind



$$ML1 = Q36 + Q51 + Q55$$

$$ML2 = Q1 + Q59 + Q61$$

Fitness Measure	Value
npar	13
Chi Square value	13.9522
df	8
CMIN/df	1.7440
pvalue	0.08301
CFI	0.9883
RMSEA	0.04829
TLI	0.9781
SRMR	0.02304
NNFI	0.97816
AGFI	0.964



Scale Goodness Measures

Reliability and Validity

Reliability Scores

Factor Code	Constituents	Factor Name	Cronbach's Alpha	McDonald's Omega
AES_1	Q21, Q30, Q41	Concept of Beauty	0.777	0.790
AES_2	Q39, Q45	Societal Inference of Beauty	0.798	0.803
EPI	Q5,Q8,Q12,Q35,Q46	Epistemic Habits of Mind	0.836	0.839
MEL_1	Q43,Q48,Q52,Q58,Q62	Personal Moral-Ethical Locus of Control	0.837	0.851
MEL_2	Q19, Q24, Q60, Q54	Conscious Social Behaviour	0.805	0.773
PHI_1	Q47, Q40, Q26	Transcendental View	0.744	0.749
PHI_2	Q38, Q42	Personal Philosophy	0.725	0.728
PSY_1	Q2, Q13, Q17, Q25	Understanding of Inner Fears	0.812	0.813
PSY_2	Q4, Q20, Q22, Q34, Q37	Concept of Self	0.850	0.788
SLN_1	Q36, Q51, Q55	Concept of Social Power	0.772	0.773
SLN_2	Q1, Q59, Q61	Sociolinguistic Traps	0.741	0.743

Convergent Validity

Factor Code	Constituents	Factor Name	AVE	Total AVE
AES_1	Q21, Q30, Q41	Concept of Beauty	0.5651281	0.6139842
AES_2	Q39, Q45	Societal Inference of Beauty	0.6737507	
EPI	Q5,Q8,Q12,Q35,Q46	Epistemic Habits of Mind	0.5157143	0.5157143
MEL_1	Q43,Q48,Q52,Q58,Q62	Personal Moral-Ethical Locus of Control	0.5163172	0.5040347
MEL_2	Q19, Q24, Q60, Q54	Conscious Social Behaviour	0.4907981	
PHI_1	Q47, Q40, Q26	Transcendental View	0.5009844	0.5288288
PHI_2	Q38, Q42	Personal Philosophy	0.5739360	
PSY_1	Q2, Q13, Q17, Q25	Understanding of Inner Fears	0.5225171	0.5079093
PSY_2	Q4, Q20, Q22, Q34, Q37	Concept of Self	0.4988926	
SLN_1	Q36, Q51, Q55	Concept of Social Power	0.5330683	0.5137076
SLN_2	Q1, Q59, Q61	Sociolinguistic Traps	0.4934375	

Discriminant Validity

HTMT Ratio Matrix											
	AES_1	AES_2	EPI	MEL_1	MEL_2	PHI_1	PHI_2	PSY_1	PSY_2	SLN_1	SLN_2
AES_1	-										
AES_2	0.413849	-									
EPI	0.586999	0.176362	-								
MEL_1	-0.0734	0.18321	-0.13806	-							
MEL_2	-0.08054	-0.10424	-0.03502	0.196894	-						
PHI_1	0.342407	0.23573	0.063022	-0.14686	-0.22522	-					
PHI_2	0.348283	0.255862	0.301613	-0.17323	-0.13741	0.296583	-				
PSY_1	0.359583	0.075932	0.245182	-0.35622	-0.08905	0.053222	0.24472	-			
PSY_2	0.19675	-0.00183	0.263089	-0.03711	0.167632	-0.08821	0.416316	0.441136	-		
SLN_1	0.069533	0.181202	0.038433	0.482591	0.312163	0.044099	0.170861	-0.19141	0.205077	-	
SLN_2	-0.0405	0.046143	-0.03117	0.212556	0.468821	-0.15917	0.008489	0.035085	0.361662	0.40197	-

All HTMT Ratios are less than **0.85**, thereby implying good discriminant validity