

```
881 0 OUTPUT ACTIVATE DiscriminantValidityOutput.  
881 0 M> OUTPUT ACTIVATE DiscriminantValidityOutput.  
882 0 TITLE 'Discriminant Validity'.  
882 0 M> TITLE 'Discriminant Validity'.
```

Discriminant Validity

```
883 0
883 0 M>
884 0 GET DATA
884 0 M> GET DATA
885 0 /TYPE=TXT /FILE='D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Discriminant Validity\dataset.csv' /ENCODING='UTF8' /DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='''
885 0 M> /TYPE=TXT /FILE='D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Discriminant Validity\dataset.csv' /ENCODING='UTF8' /DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='''
886 0 /ARRANGEMENT=DELIMITED /FIRSTCASE=2
886 0 M> /ARRANGEMENT=DELIMITED /FIRSTCASE=2
887 0 /VARIABLES=
887 0 M> /VARIABLES=
888 0 school A8 sex A8 age F8.0 address A8 famsize A8 Pstatus A8 Medu F8.0 Fedu F8.0
888 0 M> school A8 sex A8 age F8.0 address A8 famsize A8 Pstatus A8 Medu F8.0 Fedu F8.0
889 0 Mjob A16 Fjob A16 reason A16 guardian A16 traveltime F8.0 studytime F8.0 failures F8.0
889 0 M> Mjob A16 Fjob A16 reason A16 guardian A16 traveltime F8.0 studytime F8.0 failures F8.0
890 0 schoolsup A8 famsup A8 paid A8 activities A8 nursery A8 higher A8 internet A8 romantic A8
890 0 M> schoolsup A8 famsup A8 paid A8 activities A8 nursery A8 higher A8 internet A8 romantic A8
891 0 famrel F8.0 freetime F8.0 goout F8.0 Dalc F8.0 Walc F8.0 health F8.0 absences F8.0 G1 F8.0 G2 F8.0 G3 F8.0.
891 0 M> famrel F8.0 freetime F8.0 goout F8.0 Dalc F8.0 Walc F8.0 health F8.0 absences F8.0 G1 F8.0 G2 F8.0 G3 F8.0.
892 0 DATASET NAME DiscriminantValidityData.
892 0 M> DATASET NAME DiscriminantValidityData.
893 0 COMPUTE subject_id=$CASENUM.
893 0 M> COMPUTE subject_id=$CASENUM.
894 0 COMPUTE Dalc_R=6-Dalc.
894 0 M> COMPUTE Dalc_R=6-Dalc.
895 0 COMPUTE Walc_R=6-Walc.
895 0 M> COMPUTE Walc_R=6-Walc.
```

Discriminant Validity

```
896 0 RECODE schoolsup famsup paid activities higher internet ('no'=0) ('yes'=1)
896 0 M> RECODE schoolsup famsup paid activities higher internet ('no'=0) ('yes'=1)
897 0 INTO schoolsup_b famsup_b paid_b activities_b higher_b internet_b.
897 0 M> INTO schoolsup_b famsup_b paid_b activities_b higher_b internet_b
.
898 0 EXECUTE.
898 0 M> EXECUTE.
899 0
899 0 M>
900 0 * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
900 0 M> * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
901 0 TITLE 'Discriminant Validity'.
901 0 M> TITLE 'Discriminant Validity'.
```

Discriminant Validity

```
902  0  SUBTITLE 'HTMT and latent-factor separation diagnostics'.  
902  0 M> SUBTITLE 'HTMT and latent-factor separation diagnostics'.
```

Discriminant Validity HTMT and latent-factor separation diagnostics

```

903  0  FACTOR /VARIABLES=G1 G2 G3 famrel freetime goout /MISSING=LISTWISE /A
NALYSIS=G1 G2 G3 famrel freetime goout
903  0 M>  FACTOR /VARIABLES=G1 G2 G3 famrel freetime goout /MISSING=LISTWISE
/ANALYSIS=G1 G2 G3 famrel freetime goout
904  0    /PRINT=INITIAL EXTRACTION KMO CORRELATION /PLOT=EIGEN
904  0 M>    /PRINT=INITIAL EXTRACTION KMO CORRELATION /PLOT=EIGEN
905  0    /CRITERIA=FACTORS(2) ITERATE(500) /EXTRACTION=PAF /ROTATION=NOROTATE
/METHOD=CORRELATION.
905  0 M>    /CRITERIA=FACTORS(2) ITERATE(500) /EXTRACTION=PAF /ROTATION=NOROT
ATE /METHOD=CORRELATION.

```

Factor Analysis

Notes

Output Created		18-JUL-2026 10:55:25
Comments		
Input	Data	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Discriminant Validity\dataset.csv
	Active Dataset	DiscriminantValidityData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	MISSING=EXCLUDE: User-defined missing values are treated as missing.
	Cases Used	LISTWISE: Statistics are based on cases with no missing values for any variable used.

Discriminant Validity
HTMT and latent-factor separation diagnostics

Notes

Syntax		FACTOR /VARIABLES=G1 G2 G3 famrel freetime goout /MISSING=LISTWISE /ANALYSIS=G1 G2 G3 famrel freetime goout /PRINT=INITIAL EXTRACTION KMO CORRELATION /PLOT=EIGEN /CRITERIA=FACTORS(2) ITERATE(500) /EXTRACTION=PAF /ROTATION=NOROTATE /METHOD=CORRELATIO N.
Resources	Processor Time	00:00:00.36
	Elapsed Time	00:00:00.40
	Maximum Memory Required	5704 (5.570K) bytes

[DiscriminantValidityData]

Correlation Matrix

		G1	G2	G3	famrel	freetime	goout
Correlation	G1	1.000	.865	.826	.049	-.094	-.074
	G2	.865	1.000	.919	.090	-.107	-.079
	G3	.826	.919	1.000	.063	-.123	-.088
	famrel	.049	.090	.063	1.000	.129	.090
	freetime	-.094	-.107	-.123	.129	1.000	.346
	goout	-.074	-.079	-.088	.090	.346	1.000

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.732
Bartlett's Test of Sphericity	Approx. Chi-Square	2220.632
	df	15
	Sig.	.000

Discriminant Validity
HTMT and latent-factor separation diagnostics

Communalities

	Initial	Extraction
G1	.755	.775
G2	.880	.966
G3	.849	.878
famrel	.034	.045
freetime	.140	.474
goout	.125	.252

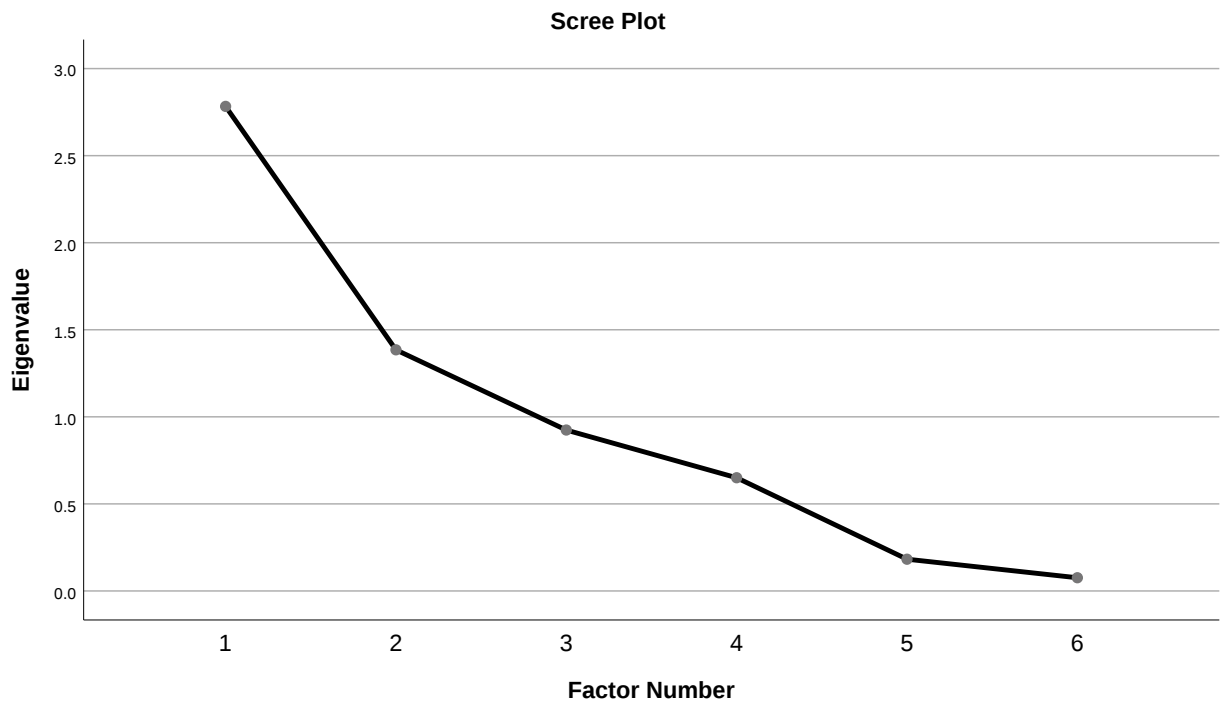
Extraction Method: Principal Axis Factoring.

Total Variance Explained

Factor	Total	Initial Eigenvalues		Extraction Sums of Squared Loadings		
		% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.783	46.381	46.381	2.650	44.166	44.166
2	1.385	23.080	69.461	.740	12.337	56.503
3	.924	15.402	84.863			
4	.650	10.835	95.698			
5	.182	3.038	98.736			
6	.076	1.264	100.000			

Extraction Method: Principal Axis Factoring.

Discriminant Validity
HTMT and latent-factor separation diagnostics



Factor Matrix^a

	Factor	
	1	2
G1	.879	.053
G2	.980	.070
G3	.936	.033
famrel	.061	.204
freetime	-.153	.671
goout	-.114	.489

Extraction Method: Principal Axis Factoring.

a. 2 factors extracted. 41 iterations required.

```

906  0  RELIABILITY /VARIABLES=G1 G2 G3 /SCALE('Academic measurement block')
ALL /MODEL=ALPHA /STATISTICS=DESCRIPTIVE SCALE CORR.
906  0  M> RELIABILITY /VARIABLES=G1 G2 G3 /SCALE('Academic measurement block
') ALL /MODEL=ALPHA /STATISTICS=DESCRIPTIVE SCALE CORR

```

Discriminant Validity
HTMT and latent-factor separation diagnostics

Reliability

Notes

Output Created		18-JUL-2026 10:55:25
Comments		
Input	Data	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Discriminant Validity\dataset.csv
	Active Dataset	DiscriminantValidityData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
	Matrix Input	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Discriminant Validity\discriminant_validi ty_spss_syntax.sps
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=G1 G2 G3 /SCALE('Academic measurement block') ALL /MODEL=ALPHA /STATISTICS=DESCRIPT IVE SCALE CORR.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.03

Scale: Academic measurement block

Discriminant Validity
HTMT and latent-factor separation diagnostics

Case Processing Summary

		N	%
Cases	Valid	649	100.0
	Excluded ^a	0	.0
	Total	649	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.951	.953	3

Item Statistics

	Mean	Std. Deviation	N
G1	11.40	2.745	649
G2	11.57	2.914	649
G3	11.91	3.231	649

Inter-Item Correlation Matrix

	G1	G2	G3
G1	1.000	.865	.826
G2	.865	1.000	.919
G3	.826	.919	1.000

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
34.88	72.251	8.500	3

```

907  0  RELIABILITY /VARIABLES=famrel freetime goout /SCALE('Social measureme
nt block') ALL /MODEL=ALPHA /STATISTICS=DESCRIPTIVE SC
ALE CORR.

```

Discriminant Validity
HTMT and latent-factor separation diagnostics

```
907 0 M> RELIABILITY /VARIABLES=famrel freetime goout /SCALE('Social measur
ement block') ALL /MODEL=ALPHA /STATISTICS=DESCRIPTIVE
SCALE CORR.
```

Reliability

Notes

Output Created		18-JUL-2026 10:55:25
Comments		
Input	Data	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Discriminant Validity\dataset.csv
	Active Dataset	DiscriminantValidityData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
	Matrix Input	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Discriminant Validity\discriminant_validi ty_spss_syntax.sps
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=famrel freetime goout /SCALE ('Social measurement block') ALL /MODEL=ALPHA /STATISTICS=DESCRIPT IVE SCALE CORR.
Resources	Processor Time	00:00:00.05
	Elapsed Time	00:00:00.05

Discriminant Validity
HTMT and latent-factor separation diagnostics

Scale: Social measurement block

Case Processing Summary

		N	%
Cases	Valid	649	100.0
	Excluded ^a	0	.0
	Total	649	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.419	.411	3

Item Statistics

	Mean	Std. Deviation	N
famrel	3.93	.956	649
freetime	3.18	1.051	649
goout	3.18	1.176	649

Inter-Item Correlation Matrix

	famrel	freetime	goout
famrel	1.000	.129	.090
freetime	.129	1.000	.346
goout	.090	.346	1.000

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
10.30	4.718	2.172	3

Discriminant Validity

HTMT and latent-factor separation diagnostics

```

908  0  CORRELATIONS /VARIABLES=G1 G2 G3 famrel freetime goout /PRINT=TWOTAIL
NOSIG /MISSING=PAIRWISE.
908  0 M> CORRELATIONS /VARIABLES=G1 G2 G3 famrel freetime goout /PRINT=TWOT
AIL NOSIG /MISSING=PAIRWISE.

```

Correlations

Notes

Output Created		18-JUL-2026 10:55:25
Comments		
Input	Data	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Discriminant Validity\dataset.csv
	Active Dataset	DiscriminantValidityData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=G1 G2 G3 famrel freetime goout /PRINT=TWOTAIL NOSIG /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.06

Discriminant Validity
HTMT and latent-factor separation diagnostics

Correlations

		G1	G2	G3	famrel	freetime	goout
G1	Pearson Correlation	1	.865**	.826**	.049	-.094*	-.074
	Sig. (2-tailed)		.000	.000	.214	.016	.059
	N	649	649	649	649	649	649
G2	Pearson Correlation	.865**	1	.919**	.090*	-.107**	-.079*
	Sig. (2-tailed)	.000		.000	.022	.007	.043
	N	649	649	649	649	649	649
G3	Pearson Correlation	.826**	.919**	1	.063	-.123**	-.088*
	Sig. (2-tailed)	.000	.000		.107	.002	.026
	N	649	649	649	649	649	649
famrel	Pearson Correlation	.049	.090*	.063	1	.129**	.090*
	Sig. (2-tailed)	.214	.022	.107		.001	.022
	N	649	649	649	649	649	649
freetime	Pearson Correlation	-.094*	-.107**	-.123**	.129**	1	.346**
	Sig. (2-tailed)	.016	.007	.002	.001		.000
	N	649	649	649	649	649	649
goout	Pearson Correlation	-.074	-.079*	-.088*	.090*	.346**	1
	Sig. (2-tailed)	.059	.043	.026	.022	.000	
	N	649	649	649	649	649	649

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

```

909 0 * END METHOD-SPECIFIC SPSS WORKFLOW.
909 0 M> * END METHOD-SPECIFIC SPSS WORKFLOW.
910 0
910 0 M>
911 0 SAVE OUTFILE='D:\DATA ANALYSIS\L Validity Factor Analysis and Scale T
esting\Discriminant Validity\SPSS_Output\sav\discrimin
ant-validity_spss_ready_data.sav' /COMPRESSED.
911 0 M> SAVE OUTFILE='D:\DATA ANALYSIS\L Validity Factor Analysis and Scal
e Testing\Discriminant Validity\SPSS_Output\sav\discri
minant-validity_spss_ready_data.sav' /COMPRESSED.
912 0
912 0 M>

```

Discriminant Validity
HTMT and latent-factor separation diagnostics

```
913 0 ECHO '=====
====='.
913 0 M> ECHO '=====
====='.
=====
914 0 ECHO 'DISCRIMINANT VALIDITY'.
914 0 M> ECHO 'DISCRIMINANT VALIDITY'.
DISCRIMINANT VALIDITY
915 0 ECHO 'Design: HTMT and latent-correlation separation for academic ver
sus social constructs.'.
915 0 M> ECHO 'Design: HTMT and latent-correlation separation for academic
versus social constructs.'.
Design: HTMT and latent-correlation separation for academic versus social cons
tructs.
916 0 ECHO 'Null hypothesis: The two constructs are not empirically disting
uishable.'.
916 0 M> ECHO 'Null hypothesis: The two constructs are not empirically dist
inguishable.'.
Null hypothesis: The two constructs are not empirically distinguishable.
917 0 ECHO 'Formula: HTMT=mean|r_heterotrait|/sqrt(mean|r_monotrait,A| mean
|r_monotrait,S|)'.
917 0 M> ECHO 'Formula: HTMT=mean|r_heterotrait|/sqrt(mean|r_monotrait,A| m
ean|r_monotrait,S|)'.
Formula: HTMT=mean|r_heterotrait|/sqrt(mean|r_monotrait,A| mean|r_monotrait,S|
).
918 0 ECHO 'Variables: G1, G2, G3, famrel, freetime, goout'.
918 0 M> ECHO 'Variables: G1, G2, G3, famrel, freetime, goout'.
Variables: G1, G2, G3, famrel, freetime, goout
919 0 ECHO 'Rows analyzed: 649'.
919 0 M> ECHO 'Rows analyzed: 649'.
Rows analyzed: 649
920 0 ECHO 'factor_correlation = -0.14469453186032052'.
920 0 M> ECHO 'factor_correlation = -0.14469453186032052'.
factor_correlation = -0.14469453186032052
921 0 ECHO 'fornell_larcker_margin = 0.37308689286090924'.
921 0 M> ECHO 'fornell_larcker_margin = 0.37308689286090924'.
fornell_larcker_margin = 0.37308689286090924
922 0 ECHO 'htmt = 0.21043104090296003'.
922 0 M> ECHO 'htmt = 0.21043104090296003'.
```

Discriminant Validity
HTMT and latent-factor separation diagnostics

```
htmt = 0.21043104090296003
923 0 ECHO 'sqrt_ave_academic = 0.934069241707824'.
923 0 M> ECHO 'sqrt_ave_academic = 0.934069241707824'.
sqrt_ave_academic = 0.934069241707824
924 0 ECHO 'sqrt_ave_social = 0.5177814247212298'.
924 0 M> ECHO 'sqrt_ave_social = 0.5177814247212298'.
sqrt_ave_social = 0.5177814247212298
925 0 ECHO 'Cross-check status: pass'.
925 0 M> ECHO 'Cross-check status: pass'.
Cross-check status: pass
926 0 ECHO '=====
====='.
926 0 M> ECHO '=====
====='.
=====
927 0
927 0 M>
928 0 OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\L Validity Factor Analysis and
Scale Testing\Discriminant Validity\SPSS_Output\spv\di
    discriminant-validity_spss_output.spv'.
928 0 M> OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\L Validity Factor Analysis a
nd Scale Testing\Discriminant Validity\SPSS_Output\spv
    \discriminant-validity_spss_output.spv'.
929 0 OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRI
NTSETTING
929 0 M> OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=
PRINTSETTING
```