

```
582 0 OUTPUT ACTIVATE ConstructValidityOutput.  
582 0 M> OUTPUT ACTIVATE ConstructValidityOutput.  
583 0 TITLE 'Construct Validity Evidence'.  
583 0 M> TITLE 'Construct Validity Evidence'.
```

Construct Validity Evidence

```
584 0
584 0 M>
585 0 GET DATA
585 0 M> GET DATA
586 0 /TYPE=TXT /FILE='D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Construct Validity\dataset.csv' /ENCODING='
      UTF8' /DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='''
586 0 M> /TYPE=TXT /FILE='D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Construct Validity\dataset.csv' /ENCODING='
      G='UTF8' /DELCASE=LINE /DELIMITERS=', ' /QUALIFIER='''
587 0 /ARRANGEMENT=DELIMITED /FIRSTCASE=2
587 0 M> /ARRANGEMENT=DELIMITED /FIRSTCASE=2
588 0 /VARIABLES=
588 0 M> /VARIABLES=
589 0 school A8 sex A8 age F8.0 address A8 famsize A8 Pstatus A8 Medu F8.0 Fedu F8.0
589 0 M> school A8 sex A8 age F8.0 address A8 famsize A8 Pstatus A8 Medu F8.0 Fedu F8.0
590 0 Mjob A16 Fjob A16 reason A16 guardian A16 traveltime F8.0 studytime F8.0 failures F8.0
590 0 M> Mjob A16 Fjob A16 reason A16 guardian A16 traveltime F8.0 studytime F8.0 failures F8.0
591 0 schoolsup A8 famsup A8 paid A8 activities A8 nursery A8 higher A8 internet A8 romantic A8
591 0 M> schoolsup A8 famsup A8 paid A8 activities A8 nursery A8 higher A8 internet A8 romantic A8
592 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.
592 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.
593 0 DATASET NAME ConstructValidityData.
593 0 M> DATASET NAME ConstructValidityData.
594 0 COMPUTE subject_id=$CASENUM.
594 0 M> COMPUTE subject_id=$CASENUM.
595 0 COMPUTE Dalc_R=6-Dalc.
595 0 M> COMPUTE Dalc_R=6-Dalc.
596 0 COMPUTE Walc_R=6-Walc.
596 0 M> COMPUTE Walc_R=6-Walc.
```

Construct Validity Evidence

```
597 0 RECODE schoolsup famsup paid activities higher internet ('no'=0) ('yes'=1)
597 0 M> RECODE schoolsup famsup paid activities higher internet ('no'=0) ('yes'=1)
598 0 INTO schoolsup_b famsup_b paid_b activities_b higher_b internet_b.
598 0 M> INTO schoolsup_b famsup_b paid_b activities_b higher_b internet_b
.
599 0 EXECUTE.
599 0 M> EXECUTE.
600 0
600 0 M>
601 0 * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
601 0 M> * BEGIN METHOD-SPECIFIC SPSS WORKFLOW.
602 0 TITLE 'Construct Validity Evidence'.
602 0 M> TITLE 'Construct Validity Evidence'.
```

Construct Validity Evidence

```
603 0 SUBTITLE 'Convergent discriminant and criterion evidence'.  
603 0 M> SUBTITLE 'Convergent discriminant and criterion evidence'.
```

Construct Validity Evidence
Convergent discriminant and criterion evidence

```

604  0  FACTOR /VARIABLES=G1 G2 G3 famrel freetime goout /MISSING=LISTWISE /A
NALYSIS=G1 G2 G3 famrel freetime goout
604  0 M>  FACTOR /VARIABLES=G1 G2 G3 famrel freetime goout /MISSING=LISTWISE
/ANALYSIS=G1 G2 G3 famrel freetime goout
605  0    /PRINT=INITIAL EXTRACTION KMO CORRELATION /PLOT=EIGEN
605  0 M>    /PRINT=INITIAL EXTRACTION KMO CORRELATION /PLOT=EIGEN
606  0    /CRITERIA=FACTORS(2) ITERATE(500) /EXTRACTION=PAF /ROTATION=NOROTATE
/METHOD=CORRELATION.
606  0 M>    /CRITERIA=FACTORS(2) ITERATE(500) /EXTRACTION=PAF /ROTATION=NOROT
ATE /METHOD=CORRELATION.

```

Factor Analysis

Notes

Output Created		18-JUL-2026 10:54:42
Comments		
Input	Data	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Construct Validity\dataset.csv
	Active Dataset	ConstructValidityData
	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.

Construct Validity Evidence
Convergent discriminant and criterion evidence

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	00:00:00.33
	Elapsed Time	00:00:00.30
	Maximum Memory Required	5704 (5.570K) bytes

[ConstructValidityData]

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

Construct Validity Evidence
Convergent discriminant and criterion evidence

Communalities

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

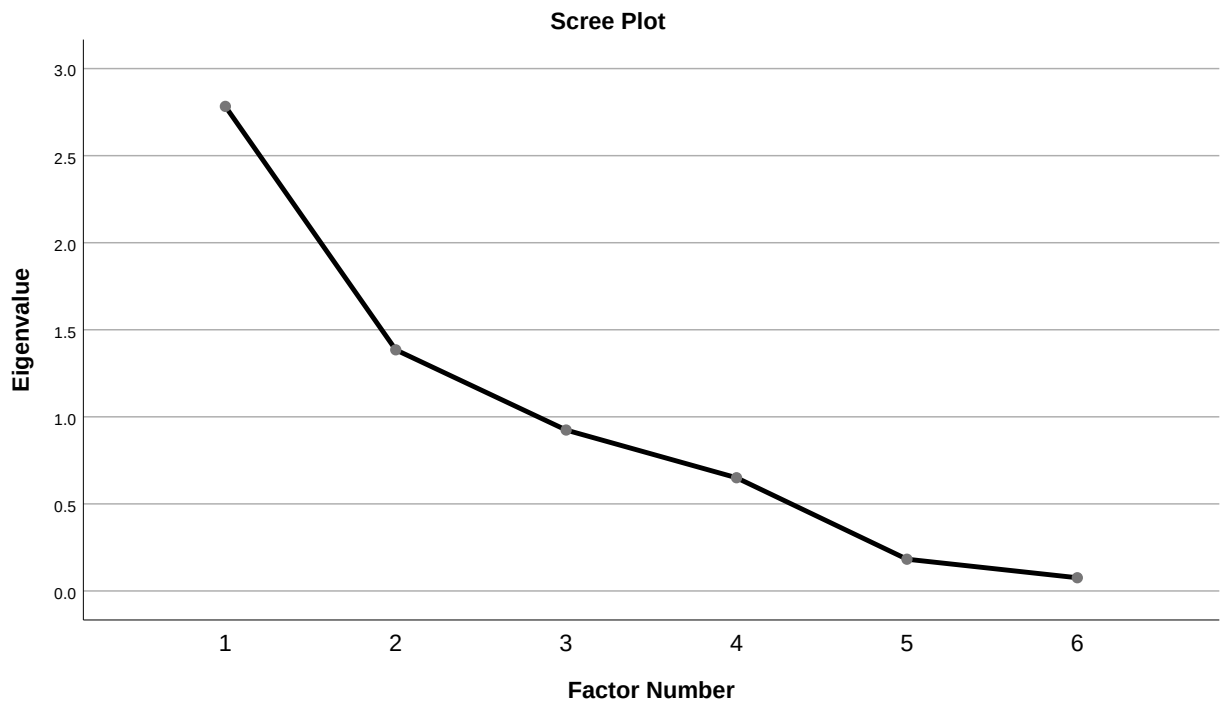
Extraction Method: Principal Axis Factoring.

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.

Construct Validity Evidence
Convergent discriminant and criterion evidence



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.

```
607 0 RELIABILITY /VARIABLES=G1 G2 G3 /SCALE('Academic measurement block')
ALL /MODEL=ALPHA /STATISTICS=DESCRIPTIVE SCALE CORR.
607 0 M> RELIABILITY /VARIABLES=G1 G2 G3 /SCALE('Academic measurement block
') ALL /MODEL=ALPHA /STATISTICS=DESCRIPTIVE SCALE CORR
```


Construct Validity Evidence
Convergent discriminant and criterion evidence

Reliability

Notes

Output Created		18-JUL-2026 10:54:43
Comments		
Input	Data	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Construct Validity\dataset.csv
	Active Dataset	ConstructValidityData
	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\Construct Validity\construct_validity_ 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	00:00:00.05
	Elapsed Time	00:00:00.04

Scale: Academic measurement block

Construct Validity Evidence
Convergent discriminant and criterion evidence

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

```
608 0 RELIABILITY /VARIABLES=famrel freetime goout /SCALE('Social measureme
nt block') ALL /MODEL=ALPHA /STATISTICS=DESCRIPTIVE SC
ALE CORR.
```

Construct Validity Evidence
Convergent discriminant and criterion evidence

```
608  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 10:54:43
Comments		
Input	Data	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Construct Validity\dataset.csv
	Active Dataset	ConstructValidityData
	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\Construct Validity\construct_validity_ 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	00:00:00.03
	Elapsed Time	00:00:00.04

Construct Validity Evidence
Convergent discriminant and criterion evidence

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

Construct Validity Evidence
Convergent discriminant and criterion evidence

```

609  0  COMPUTE earlier_grade=MEAN(G1,G2).
609  0  M> COMPUTE earlier_grade=MEAN(G1,G2).
610  0  CORRELATIONS /VARIABLES=earlier_grade G3 famrel freetime goout /PRINT
=TWOTAIL NOSIG.
610  0  M> CORRELATIONS /VARIABLES=earlier_grade G3 famrel freetime goout /PR
INT=TWOTAIL NOSIG.

```

Correlations

Notes

Output Created		18-JUL-2026 10:54:43
Comments		
Input	Data	D:\DATA ANALYSIS\L Validity Factor Analysis and Scale Testing\Construct Validity\dataset.csv
	Active Dataset	ConstructValidityData
	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=earlier_grad e G3 famrel freetime goout /PRINT=TWOTAIL NOSIG.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.05

Construct Validity Evidence
Convergent discriminant and criterion evidence

Correlations

		earlier_grade	G3	famrel	freetime	goout
earlier_grade	Pearson Correlation	1	.905**	.072	-.104**	-.080*
	Sig. (2-tailed)		.000	.066	.008	.043
	N	649	649	649	649	649
G3	Pearson Correlation	.905**	1	.063	-.123**	-.088*
	Sig. (2-tailed)	.000		.107	.002	.026
	N	649	649	649	649	649
famrel	Pearson Correlation	.072	.063	1	.129**	.090*
	Sig. (2-tailed)	.066	.107		.001	.022
	N	649	649	649	649	649
freetime	Pearson Correlation	-.104**	-.123**	.129**	1	.346**
	Sig. (2-tailed)	.008	.002	.001		.000
	N	649	649	649	649	649
goout	Pearson Correlation	-.080*	-.088*	.090*	.346**	1
	Sig. (2-tailed)	.043	.026	.022	.000	
	N	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).

```

611 0 * END METHOD-SPECIFIC SPSS WORKFLOW.
611 0 M> * END METHOD-SPECIFIC SPSS WORKFLOW.
612 0
612 0 M>
613 0 SAVE OUTFILE='D:\DATA ANALYSIS\L Validity Factor Analysis and Scale T
esting\Construct Validity\SPSS_Output\sav\construct-va
lidity_spss_ready_data.sav' /COMPRESSED.
613 0 M> SAVE OUTFILE='D:\DATA ANALYSIS\L Validity Factor Analysis and Scal
e Testing\Construct Validity\SPSS_Output\sav\construct
-validity_spss_ready_data.sav' /COMPRESSED.
614 0
614 0 M>
615 0 ECHO '=====
====='.

```

Construct Validity Evidence
Convergent discriminant and criterion evidence

```
615  0 M> ECHO '=====
====='.
=====
616  0 ECHO 'CONSTRUCT VALIDITY EVIDENCE'.
616  0 M> ECHO 'CONSTRUCT VALIDITY EVIDENCE'.
CONSTRUCT VALIDITY EVIDENCE
617  0 ECHO 'Design: Integrated CFA evidence from convergence, discriminatio
n, and criterion association.'.
617  0 M> ECHO 'Design: Integrated CFA evidence from convergence, discrimina
tion, and criterion association.'.
Design: Integrated CFA evidence from convergence, discrimination, and criterio
n association.
618  0 ECHO 'Null hypothesis: The construct scores show no convergent, discr
iminant, or criterion-related evidence.'.
618  0 M> ECHO 'Null hypothesis: The construct scores show no convergent, di
scriminant, or criterion-related evidence.'.
Null hypothesis: The construct scores show no convergent, discriminant, or cri
terion-related evidence.
619  0 ECHO 'Formula: Evidence combines AVE, CR, HTMT, factor correlation, a
nd external criterion r.'.
619  0 M> ECHO 'Formula: Evidence combines AVE, CR, HTMT, factor correlation
, and external criterion r.'.
Formula: Evidence combines AVE, CR, HTMT, factor correlation, and external cri
terion r.
620  0 ECHO 'Variables: G1, G2, G3, famrel, freetime, goout, criterion G3'.
620  0 M> ECHO 'Variables: G1, G2, G3, famrel, freetime, goout, criterion G3
'.
Variables: G1, G2, G3, famrel, freetime, goout, criterion G3
621  0 ECHO 'Rows analyzed: 649'.
621  0 M> ECHO 'Rows analyzed: 649'.
Rows analyzed: 649
622  0 ECHO 'criterion_p_value = 2.9749991570957307e-240'.
622  0 M> ECHO 'criterion_p_value = 2.9749991570957307e-240'.
criterion_p_value = 2.9749991570957307e-240
623  0 ECHO 'criterion_r = 0.9034976113559182'.
623  0 M> ECHO 'criterion_r = 0.9034976113559182'.
criterion_r = 0.9034976113559182
624  0 ECHO 'factor_correlation = -0.14469453186032052'.
624  0 M> ECHO 'factor_correlation = -0.14469453186032052'.
```

Construct Validity Evidence
Convergent discriminant and criterion evidence

```
factor_correlation = -0.14469453186032052
625  0  ECHO 'htmt = 0.21043104090296003'.
625  0 M> ECHO 'htmt = 0.21043104090296003'.
htmt = 0.21043104090296003
626  0  ECHO 'minimum_ave = 0.26809760378634656'.
626  0 M> ECHO 'minimum_ave = 0.26809760378634656'.
minimum_ave = 0.26809760378634656
627  0  ECHO 'minimum_cr = 0.46472892919002623'.
627  0 M> ECHO 'minimum_cr = 0.46472892919002623'.
minimum_cr = 0.46472892919002623
628  0  ECHO 'Cross-check status: pass'.
628  0 M> ECHO 'Cross-check status: pass'.
Cross-check status: pass
629  0  ECHO '=====
====='.
629  0 M> ECHO '=====
====='.
=====
630  0
630  0 M>
631  0  OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\L Validity Factor Analysis and
Scale Testing\Construct Validity\SPSS_Output\spv\const
ruct-validity_spss_output.spv'.
631  0 M> OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\L Validity Factor Analysis a
nd Scale Testing\Construct Validity\SPSS_Output\spv\co
nstruct-validity_spss_output.spv'.
632  0  OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRI
NTSETTING
632  0 M> OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=
PRINTSETTING
```