

## Host

### Notes

Output Created		23-JUN-2026 09:25:07
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVADData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c if not exist "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output" mkdir "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output"'
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.17

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c if not exist "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\png" mkdir "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\png"'
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.12

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c if not exist "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\tables" mkdir "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\tables"'
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.10

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c if not exist "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\pdf" mkdir "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\pdf"'
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.08

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c if not exist "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\spv" mkdir "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\spv"'
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.11

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c if not exist "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\sav" mkdir "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\sav"'
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.11

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c del /q "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\png\*.png" 2>nul'.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.11

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c del /q "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\tables\*.csv" 2>nul'.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.13

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c del /q "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\pdf\*.pdf" 2>nul'.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.11

## Host

## Notes

Output Created		23-JUN-2026 09:25:08
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Three Way ANOVA\SPSS_Output\sav\three_way_anova_spss_ready_data.sav
	Active Dataset	ThreeWayANOVAData
	Filter	<none>
	Weight	<none>
	Split File	<none>
Syntax		HOST COMMAND='cmd /c del /q "D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\spv\*.spv" 2>nul'.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.11

```
File "<string>", line 109
  writer.writerow([factor_a, factor_b, "n", f"mean_{outcome}", f"mean_{covariate}"])
```

^

SyntaxError: invalid syntax

Two Way ANCOVA: G3 by School and Sex Controlling for G1

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Means**

**Notes**

Output Created		23-JUN-2026 09:25:09
Comments		
Input	Data	D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS_Output\sav\two_way_ancova_spss_ready_data.sav
	Active Dataset	TwoWayANCOVADData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	For each dependent variable in a table, user-defined missing values for the dependent and all grouping variables are treated as missing.
	Cases Used	Cases used for each table have no missing values in any independent variable, and not all dependent variables have missing values.
Syntax		MEANS TABLES=G3 G1 BY school_id BY sex_id /CELLS=COUNT MEAN STDDEV MIN MAX.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.02

[TwoWayANCOVADData] D:\DATA ANALYSIS\E ANOVA Family\Two Way ANCOVA\SPSS\_Output\sav\two\_way\_ancova\_spss\_ready\_data.sav

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

### Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
G3 * school_id * sex_id	649	100.0%	0	0.0%	649	100.0%
G1 * school_id * sex_id	649	100.0%	0	0.0%	649	100.0%

### Report

school_id	sex_id		G3	G1
1	1	N	237	237
		Mean	13.0042	12.2869
		Std. Deviation	2.34430	2.34746
		Minimum	7.00	.00
		Maximum	19.00	18.00
	2	N	186	186
		Mean	12.0323	11.6022
		Std. Deviation	2.86055	2.45892
		Minimum	.00	7.00
		Maximum	18.00	18.00
	Total	N	423	423
		Mean	12.5768	11.9858
		Std. Deviation	2.62564	2.41829
		Minimum	.00	.00
		Maximum	19.00	18.00
2	1	N	146	146
		Mean	11.0342	10.5822
		Std. Deviation	3.78821	3.12886
		Minimum	.00	5.00
		Maximum	18.00	19.00
	2	N	80	80
		Mean	9.9500	9.7875
		Std. Deviation	3.84148	2.62748
		Minimum	.00	4.00
		Maximum	19.00	17.00

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model:  $G3 = G1 + \text{school} + \text{sex} + \text{school}*\text{sex}$

**Report**

school_id	sex_id		G3	G1
	Total	N	226	226
		Mean	10.6504	10.3009
		Std. Deviation	3.83399	2.97959
		Minimum	.00	4.00
		Maximum	19.00	19.00
Total	1	N	383	383
		Mean	12.2533	11.6371
		Std. Deviation	3.12415	2.79423
		Minimum	.00	.00
		Maximum	19.00	19.00
	2	N	266	266
		Mean	11.4060	11.0564
		Std. Deviation	3.32069	2.64086
		Minimum	.00	4.00
		Maximum	19.00	18.00
	Total	N	649	649
		Mean	11.9060	11.3991
		Std. Deviation	3.23066	2.74527
		Minimum	.00	.00
		Maximum	19.00	19.00

**Univariate Analysis of Variance**

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Notes**

Output Created		23-JUN-2026 09:25:09
Comments		
Input	Data	D:\DATA ANALYSIS\IE ANOVA Family\Two Way ANCOVA\SPSS_Output\sa\two_way_ancova_spss_ready_data.sav
	Active Dataset	TwoWayANCOVADData
	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 are based on all cases with valid data for all variables in the model.
Syntax		<pre> UNIANOVA G3 BY school_id sex_id WITH G1 /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE /PRINT=DESCRIPTIVE ETASQ HOMOGENEITY PARAMETER /EMMEANS=TABLES (school_id*sex_id) WITH (G1=MEAN) COMPARE (school_id) ADJ(LSD) /EMMEANS=TABLES (school_id*sex_id) WITH (G1=MEAN) COMPARE (sex_id) ADJ(LSD) /CRITERIA=ALPHA(.05) /DESIGN=G1 school_id sex_id school_id*sex_id. </pre>
Resources	Processor Time	00:00:00.08
	Elapsed Time	00:00:00.09

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Between-Subjects Factors**

		Value Label	N
school_id	1	GP	423
	2	MS	226
sex_id	1	F	383
	2	M	266

**Descriptive Statistics**

Dependent Variable: G3

school_id	sex_id	Mean	Std. Deviation	N
1	1	13.0042	2.34430	237
	2	12.0323	2.86055	186
	Total	12.5768	2.62564	423
2	1	11.0342	3.78821	146
	2	9.9500	3.84148	80
	Total	10.6504	3.83399	226
Total	1	12.2533	3.12415	383
	2	11.4060	3.32069	266
	Total	11.9060	3.23066	649

**Levene's Test of Equality of Error Variances<sup>a</sup>**

Dependent Variable: G3

F	df1	df2	Sig.
1.960	3	645	.119

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + G1 + school\_id + sex\_id + school\_id \* sex\_id

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Tests of Between-Subjects Effects**

Dependent Variable: G3

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4648.278 <sup>a</sup>	4	1162.069	353.842	.000	.687
Intercept	34.472	1	34.472	10.496	.001	.016
G1	3942.442	1	3942.442	1200.448	.000	.651
school_id	16.081	1	16.081	4.897	.027	.008
sex_id	14.492	1	14.492	4.413	.036	.007
school_id * sex_id	.002	1	.002	.001	.979	.000
Error	2114.989	644	3.284			
Total	98761.000	649				
Corrected Total	6763.267	648				

a. R Squared = .687 (Adjusted R Squared = .685)

**Parameter Estimates**

Dependent Variable: G3

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	.668	.336	1.990	.047	.009	1.328
G1	.948	.027	34.647	.000	.895	1.002
[school_id=1]	.361	.247	1.461	.144	-.124	.847
[school_id=2]	0 <sup>a</sup>	.	.	.	.	.
[sex_id=1]	.331	.253	1.307	.192	-.166	.827
[sex_id=2]	0 <sup>a</sup>	.	.	.	.	.
[school_id=1] * [sex_id=1]	-.008	.308	-.026	.979	-.614	.597
[school_id=1] * [sex_id=2]	0 <sup>a</sup>	.	.	.	.	.
[school_id=2] * [sex_id=1]	0 <sup>a</sup>	.	.	.	.	.
[school_id=2] * [sex_id=2]	0 <sup>a</sup>	.	.	.	.	.

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Parameter Estimates**

Dependent Variable: G3

Parameter	Partial Eta Squared
Intercept	.006
G1	.651
[school_id=1]	.003
[school_id=2]	.
[sex_id=1]	.003
[sex_id=2]	.
[school_id=1] * [sex_id=1]	.000
[school_id=1] * [sex_id=2]	.
[school_id=2] * [sex_id=1]	.
[school_id=2] * [sex_id=2]	.

a. This parameter is set to zero because it is redundant.

**Estimated Marginal Means**

**1. School factor recoded from school \* Sex factor recoded from sex**

**Estimates**

Dependent Variable: G3

School factor recoded from school	Sex factor recoded from sex	Mean	Std. Error	95% ... Lower Bound
1	1	12.162 <sup>a</sup>	.120	11.926
	2	11.840 <sup>a</sup>	.133	11.579
2	1	11.809 <sup>a</sup>	.152	11.511
	2	11.478 <sup>a</sup>	.207	11.071

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Estimates**

Dependent Variable: G3

School factor recoded from school	Sex factor recoded from sex	95% Confidence . Upper Bound
1	1	12.398
	2	12.101
2	1	12.107
	2	11.885

a. Covariates appearing in the model are evaluated at the following values: G1 = 11.3991.

**Pairwise Comparisons**

Dependent Variable: G3

Sex factor recoded from sex	(I) School factor recoded from school	(J) School factor recoded from school	Mean Difference (I-J)
1	1	2	.353
	2	1	-.353
2	1	2	.361
	2	1	-.361

**Pairwise Comparisons**

Dependent Variable: G3

Sex factor recoded from sex	(I) School factor recoded from school	(J) School factor recoded from school	Std. Error	Sig. <sup>a</sup>
1	1	2	.196	.072
	2	1	.196	.072
2	1	2	.247	.144
	2	1	.247	.144

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Pairwise Comparisons**

Dependent Variable: G3

Sex factor recoded from sex	(I) School factor recoded from school	(J) School factor recoded from school	95% Confidence Interval for <sup>a</sup> ...
			Lower Bound
1	1	2	-.032
	2	1	-.739
2	1	2	-.124
	2	1	-.847

**Pairwise Comparisons**

Dependent Variable: G3

Sex factor recoded from sex	(I) School factor recoded from school	(J) School factor recoded from school	95% Confidence Interval for <sup>a</sup> ...
			Upper Bound
1	1	2	.739
	2	1	.032
2	1	2	.847
	2	1	.124

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

**Univariate Tests**

Dependent Variable: G3

Sex factor recoded from sex		Sum of Squares	df	Mean Square	F	Sig.
1	Contrast	10.644	1	10.644	3.241	.072
	Error	2114.989	644	3.284		
2	Contrast	7.012	1	7.012	2.135	.144
	Error	2114.989	644	3.284		

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Univariate Tests**

Dependent Variable: G3

Sex factor recoded from sex		Partial Eta Squared
1	Contrast	.005
	Error	
2	Contrast	.003
	Error	

Each F tests the simple effects of School factor recoded from school within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

**2. School factor recoded from school \* Sex factor recoded from sex**

**Estimates**

Dependent Variable: G3

School factor recoded from school	Sex factor recoded from sex	Mean	Std. Error	95% ... Lower Bound
1	1	12.162 <sup>a</sup>	.120	11.926
	2	11.840 <sup>a</sup>	.133	11.579
2	1	11.809 <sup>a</sup>	.152	11.511
	2	11.478 <sup>a</sup>	.207	11.071

**Estimates**

Dependent Variable: G3

School factor recoded from school	Sex factor recoded from sex	95% Confidence . Upper Bound
1	1	12.398
	2	12.101
2	1	12.107
	2	11.885

a. Covariates appearing in the model are evaluated at the following values: G1 = 11.3991.

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Pairwise Comparisons**

Dependent Variable: G3

School factor recoded from school	(I) Sex factor recoded from sex	(J) Sex factor recoded from sex	Mean Difference (I-J)
1	1	2	.323
	2	1	-.323
2	1	2	.331
	2	1	-.331

**Pairwise Comparisons**

Dependent Variable: G3

School factor recoded from school	(I) Sex factor recoded from sex	(J) Sex factor recoded from sex	Std. Error	Sig. <sup>a</sup>
1	1	2	.179	.071
	2	1	.179	.071
2	1	2	.253	.192
	2	1	.253	.192

**Pairwise Comparisons**

Dependent Variable: G3

School factor recoded from school	(I) Sex factor recoded from sex	(J) Sex factor recoded from sex	95% Confidence Interval Lower Bound
1	1	2	-.028
	2	1	-.673
2	1	2	-.166
	2	1	-.827

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Pairwise Comparisons**

Dependent Variable: G3

School factor recoded from school	(I) Sex factor recoded from sex	(J) Sex factor recoded from sex	95% Confidence Interval for <sup>a</sup> ..
			Upper Bound
1	1	2	.673
	2	1	.028
2	1	2	.827
	2	1	.166

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

**Univariate Tests**

Dependent Variable: G3

School factor recoded from school		Sum of Squares	df	Mean Square	F	Sig.
1	Contrast	10.725	1	10.725	3.266	.071
	Error	2114.989	644	3.284		
2	Contrast	5.608	1	5.608	1.708	.192
	Error	2114.989	644	3.284		

**Univariate Tests**

Dependent Variable: G3

School factor recoded from school		Partial Eta Squared
1	Contrast	.005
	Error	
2	Contrast	.003
	Error	

Each F tests the simple effects of Sex factor recoded from sex within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

**Graph**

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
 Model: G3 = G1 + school + sex + school\*sex

**Notes**

Output Created		23-JUN-2026 09:25:09
Comments		
Input	Data	D:\DATA ANALYSIS\EANOVA Family\Two Way ANCOVA\SPSS_Output\save\two_way_ancova_spss_ready_data.sav
	Active Dataset	TwoWayANCOVADData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Syntax		GRAPH /LINE(MULTIPLE) =MEAN(G3) BY school_id BY sex_id.
Resources	Processor Time	00:00:00.50
	Elapsed Time	00:00:00.42

Two Way ANCOVA: G3 by School and Sex Controlling for G1  
Model:  $G3 = G1 + \text{school} + \text{sex} + \text{school} * \text{sex}$

