

Host

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Main Effects vs Interaction Effects

Main Effects vs Interaction Effects
Import dataset.csv from the test folder

Main Effects vs Interaction Effects - Data Context

Main Effects vs Interaction Effects - Data Context
 Cell counts for the two-factor design

Crosstabs

[MainEffectsInteractionEffectsData] D:\DATA ANALYSIS\F Post Hoc Tests\Main Effects vs Interaction Effects\SPSS_Output\sav\Main-Effects-vs-Interaction-Effects-data.sav

Case Processing Summary

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
	Student sex / Factor A * Weekly study time / Factor B	649	100.0%	0	0.0%	649	100.0%

Student sex / Factor A * Weekly study time / Factor B Crosstabulation

		Weekly study time / Factor B			
		<2 hours	2 to 5 hours	5 to 10 hours	
Student sex / Factor A	Female	Count	89	198	75
		% within Student sex / Factor A	23.2%	51.7%	19.6%
		% within Weekly study time / Factor B	42.0%	64.9%	77.3%
		% of Total	13.7%	30.5%	11.6%
	Male	Count	123	107	22
		% within Student sex / Factor A	46.2%	40.2%	8.3%
		% within Weekly study time / Factor B	58.0%	35.1%	22.7%
		% of Total	19.0%	16.5%	3.4%
	Total	Count	212	305	97
% within Student sex / Factor A		32.7%	47.0%	14.9%	
% within Weekly study time / Factor B		100.0%	100.0%	100.0%	
% of Total		32.7%	47.0%	14.9%	

Main Effects vs Interaction Effects - Data Context
 Cell counts for the two-factor design

Student sex / Factor A * Weekly study time / Factor B Crosstabulation

			Weekly study ...	
			>10 hours	Total
Student sex / Factor A	Female	Count	21	383
		% within Student sex / Factor A	5.5%	100.0%
		% within Weekly study time / Factor B	60.0%	59.0%
		% of Total	3.2%	59.0%
	Male	Count	14	266
		% within Student sex / Factor A	5.3%	100.0%
		% within Weekly study time / Factor B	40.0%	41.0%
		% of Total	2.2%	41.0%
Total	Count	35	649	
	% within Student sex / Factor A	5.4%	100.0%	
	% within Weekly study time / Factor B	100.0%	100.0%	
	% of Total	5.4%	100.0%	

Cell Descriptives

Cell Descriptives
Dependent variable G3 summarized for sex x studytime cells

Means

Case Processing Summary

	Included		Cases Excluded		Total	
	N	Percent	N	Percent	N	Percent
	Final grade / dependent variable * Student sex / Factor A * Weekly study time / Factor B	649	100.0%	0	0.0%	649	100.0%

Report

Final grade / dependent variable

Student sex / Factor A	Weekly study time / Factor B	N	Mean	Std. Deviation
Female	<2 hours	89	11.19	2.969
	2 to 5 hours	198	12.20	3.224
	5 to 10 hours	75	13.12	2.610
	>10 hours	21	14.19	2.874
	Total	383	12.25	3.124
Male	<2 hours	123	10.59	3.377
	2 to 5 hours	107	11.90	3.285
	5 to 10 hours	22	13.59	2.108
	>10 hours	14	11.36	2.499
	Total	266	11.41	3.321
Total	<2 hours	212	10.84	3.219
	2 to 5 hours	305	12.09	3.243
	5 to 10 hours	97	13.23	2.502
	>10 hours	35	13.06	3.038
	Total	649	11.91	3.231

Cell Descriptives
Dependent variable G3 summarized for sex x studytime cells

Report

Final grade / dependent variable

Student sex / Factor A	Weekly study time / Factor B	Std. Error of Mean	Minimum	Maximum
Female	<2 hours	.315	0	17
	2 to 5 hours	.229	0	18
	5 to 10 hours	.301	8	18
	>10 hours	.627	10	19
	Total	.160	0	19
Male	<2 hours	.305	0	18
	2 to 5 hours	.318	0	19
	5 to 10 hours	.449	9	17
	>10 hours	.668	6	17
	Total	.204	0	19
Total	<2 hours	.221	0	18
	2 to 5 hours	.186	0	19
	5 to 10 hours	.254	8	18
	>10 hours	.514	6	19
	Total	.127	0	19

Distribution Context by Factor A

Distribution Context by Factor A
 Boxplot and descriptives for G3 by sex

Explore

Student sex / Factor A

Case Processing Summary

Final grade / dependent variable	Student sex / Factor A	Cases			
		Valid		Missing	
		N	Percent	N	Percent
	Female	383	100.0%	0	0.0%
	Male	266	100.0%	0	0.0%

Case Processing Summary

Final grade / dependent variable	Student sex / Factor A	Cases	
		Total	
		N	Percent
	Female	383	100.0%
	Male	266	100.0%

Descriptives

Final grade / dependent variable	Student sex / Factor A	Statistic			Std. Error
		Mean	Lower Bound	Upper Bound	
Final grade / dependent variable	Female	Mean	12.25	.160	
		95% Confidence Interval for Mean	Lower Bound	11.94	
			Upper Bound	12.57	
		5% Trimmed Mean	12.37		
		Median	12.00		
		Variance	9.760		
		Std. Deviation	3.124		
		Minimum	0		
		Maximum	19		
		Range	19		
		Interquartile Range	4		
		Skewness	-.857	.125	
	Kurtosis	2.683	.249		
	Male	Mean	11.41	.204	

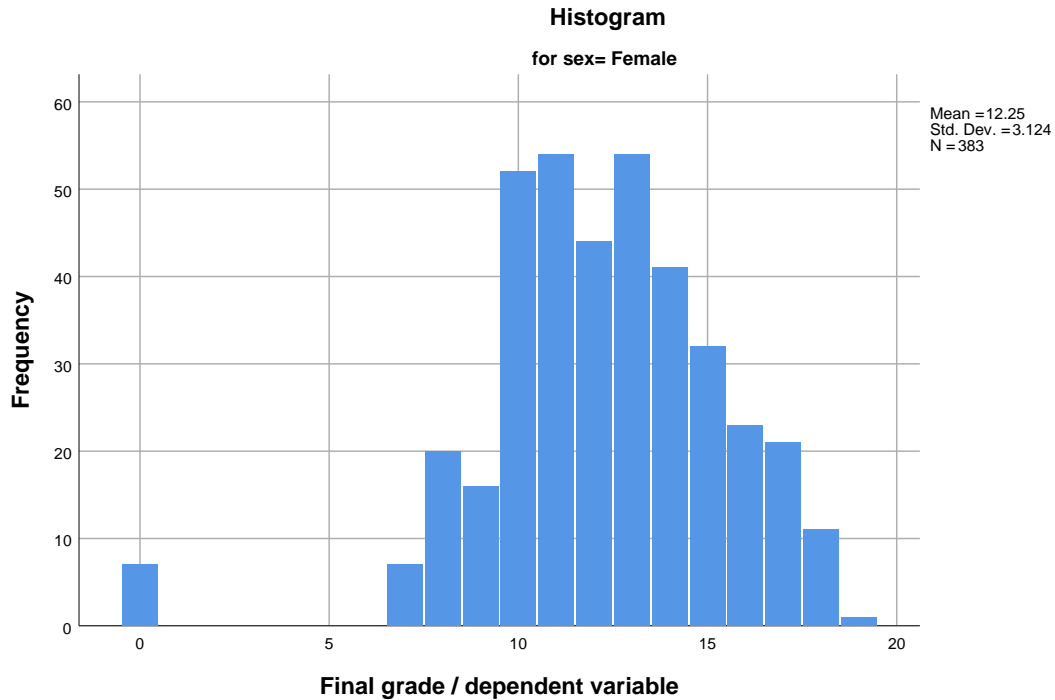
Distribution Context by Factor A
 Boxplot and descriptives for G3 by sex

Descriptives

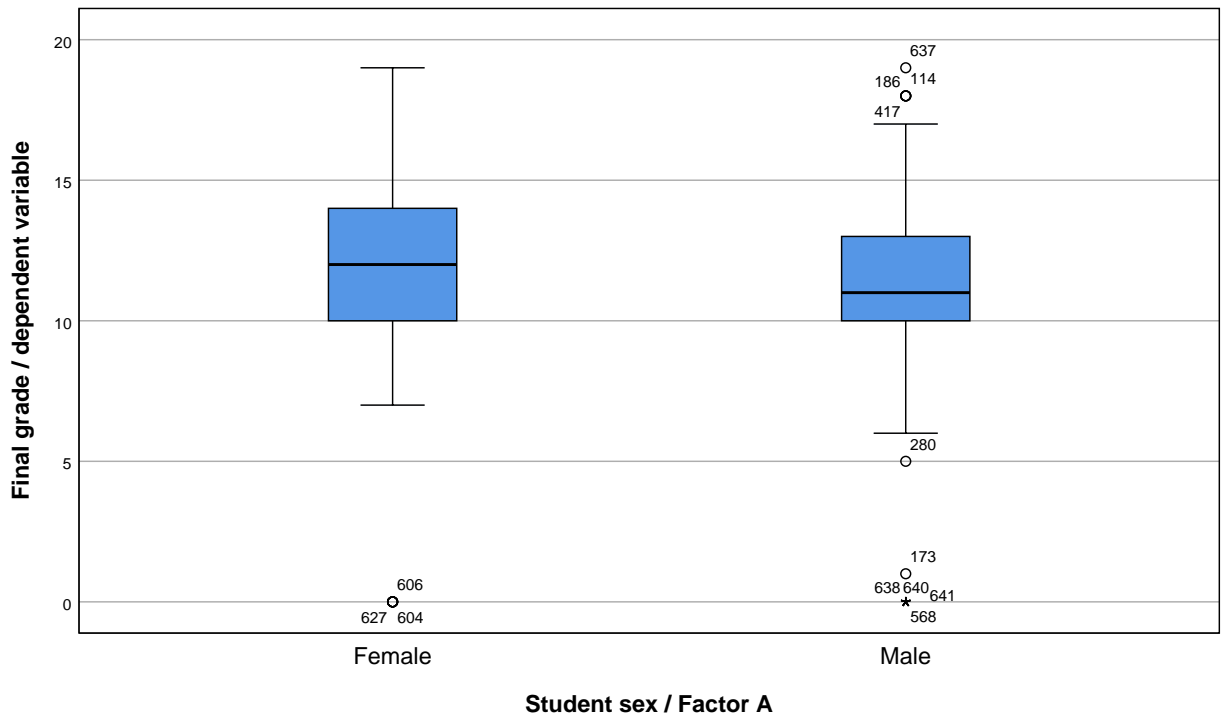
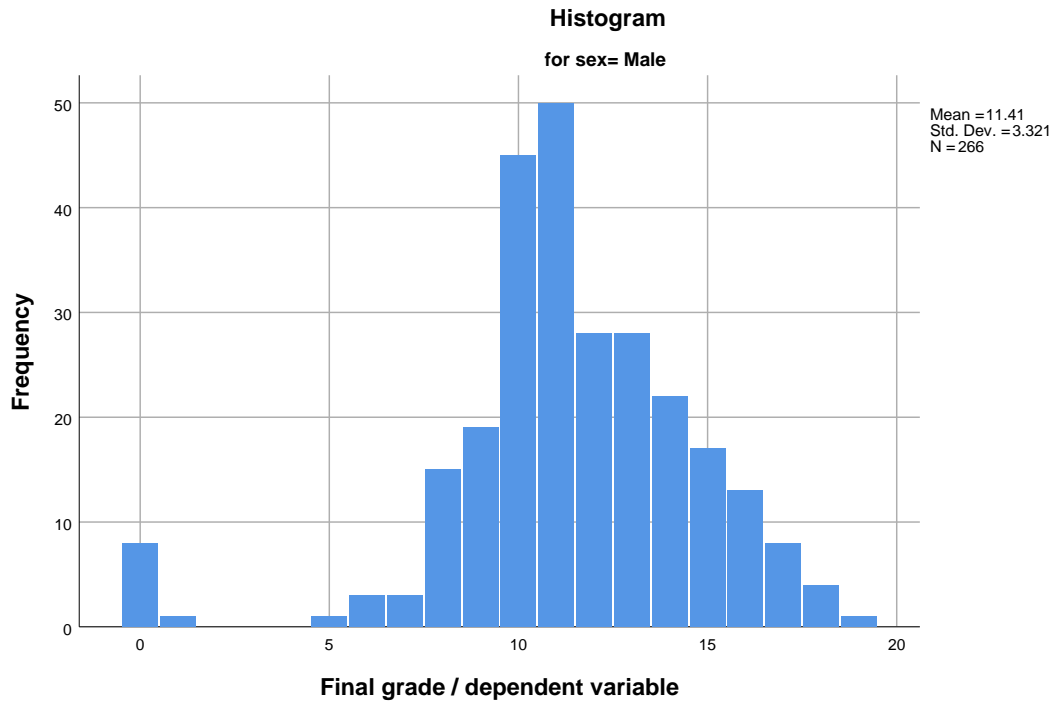
Student sex / Factor A		Statistic	Std. Error
95% Confidence Interval for Mean	Lower Bound	11.01	
	Upper Bound	11.81	
5% Trimmed Mean		11.60	
Median		11.00	
Variance		11.027	
Std. Deviation		3.321	
Minimum		0	
Maximum		19	
Range		19	
Interquartile Range		3	
Skewness		-.980	.149
Kurtosis		2.803	.298

Final grade / dependent variable

Histograms



Distribution Context by Factor A
 Boxplot and descriptives for G3 by sex



Distribution Context by Factor B

Distribution Context by Factor B
 Boxplot and descriptives for G3 by studytime

Explore

Weekly study time / Factor B

Case Processing Summary

	Weekly study time / Factor B	Cases			
		Valid		Missing	
		N	Percent	N	Percent
Final grade / dependent variable	<2 hours	212	100.0%	0	0.0%
	2 to 5 hours	305	100.0%	0	0.0%
	5 to 10 hours	97	100.0%	0	0.0%
	>10 hours	35	100.0%	0	0.0%

Case Processing Summary

	Weekly study time / Factor B	Cases	
		Total	
		N	Percent
Final grade / dependent variable	<2 hours	212	100.0%
	2 to 5 hours	305	100.0%
	5 to 10 hours	97	100.0%
	>10 hours	35	100.0%

Distribution Context by Factor B
Boxplot and descriptives for G3 by studytime

Descriptives

Weekly study time / Factor B		Statistic			
Final grade / dependent variable	<2 hours	Mean	10.84		
		95% Confidence Interval for Mean	Lower Bound	10.41	
			Upper Bound	11.28	
		5% Trimmed Mean	11.04		
		Median	11.00		
		Variance	10.360		
		Std. Deviation	3.219		
		Minimum	0		
		Maximum	18		
		Range	18		
		Interquartile Range	3		
		Skewness	-1.078		
		Kurtosis	3.117		
		2 to 5 hours	2 to 5 hours	Mean	12.09
				95% Confidence Interval for Mean	Lower Bound	11.73
Upper Bound	12.46				
5% Trimmed Mean	12.25				
Median	12.00				
Variance	10.518				
Std. Deviation	3.243				
Minimum	0				
Maximum	19				
Range	19				
Interquartile Range	4				
Skewness	-1.028				
Kurtosis	3.044				
5 to 10 hours	5 to 10 hours			Mean	13.23
				95% Confidence Interval for Mean	Lower Bound	12.72
		Upper Bound	13.73		
		5% Trimmed Mean	13.27		
		Median	13.00		
		Variance	6.261		

Distribution Context by Factor B
Boxplot and descriptives for G3 by studytime

Descriptives

Weekly study time / Factor B		Std. Error			
Final grade / dependent variable	<2 hours	Mean	.221		
		95% Confidence Interval for Mean	Lower Bound		
			Upper Bound		
		5% Trimmed Mean			
		Median			
		Variance			
		Std. Deviation			
		Minimum			
		Maximum			
		Range			
		Interquartile Range			
		Skewness	.167		
		Kurtosis	.333		
		2 to 5 hours	2 to 5 hours	Mean	.186
				95% Confidence Interval for Mean	Lower Bound
Upper Bound					
5% Trimmed Mean					
Median					
Variance					
Std. Deviation					
Minimum					
Maximum					
Range					
Interquartile Range					
Skewness	.140				
Kurtosis	.278				
5 to 10 hours	5 to 10 hours			Mean	.254
				95% Confidence Interval for Mean	Lower Bound
		Upper Bound			
		5% Trimmed Mean			
		Median			
		Variance			

Distribution Context by Factor B
Boxplot and descriptives for G3 by studytime

Descriptives

Weekly study time / Factor B		Statistic
	Std. Deviation	2.502
	Minimum	8
	Maximum	18
	Range	10
	Interquartile Range	4
	Skewness	-.190
	Kurtosis	-.502
>10 hours	Mean	13.06
	95% Confidence Interval for Mean	Lower Bound 12.01 Upper Bound 14.10
	5% Trimmed Mean	13.07
	Median	13.00
	Variance	9.232
	Std. Deviation	3.038
	Minimum	6
	Maximum	19
	Range	13
	Interquartile Range	4
	Skewness	.209
	Kurtosis	-.339

Distribution Context by Factor B
 Boxplot and descriptives for G3 by studytime

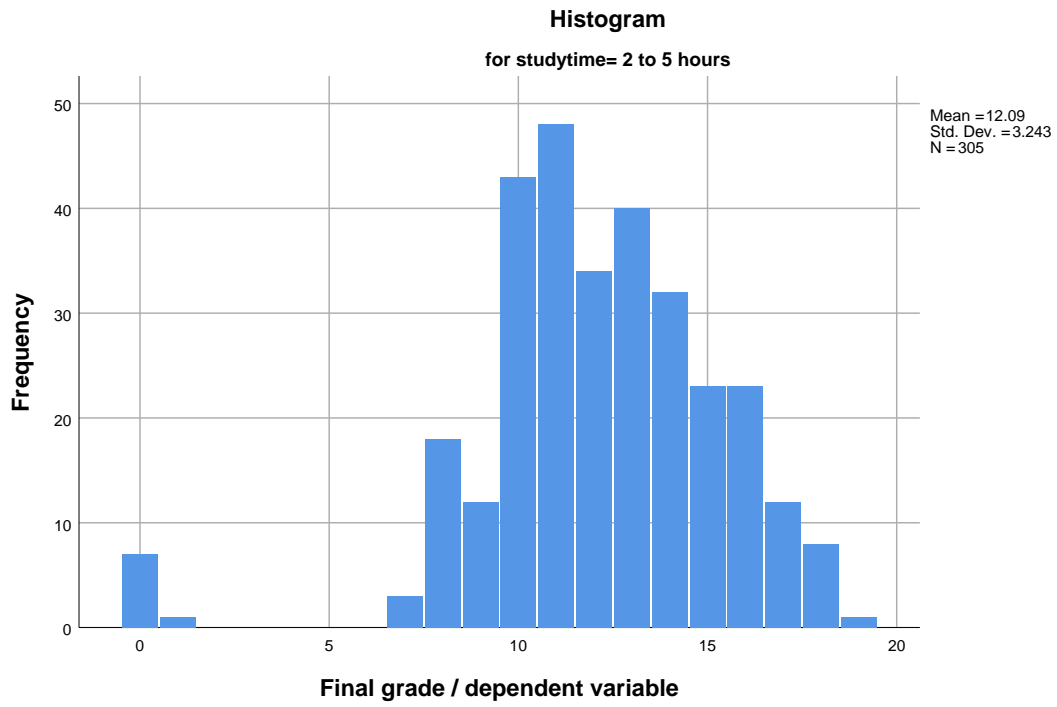
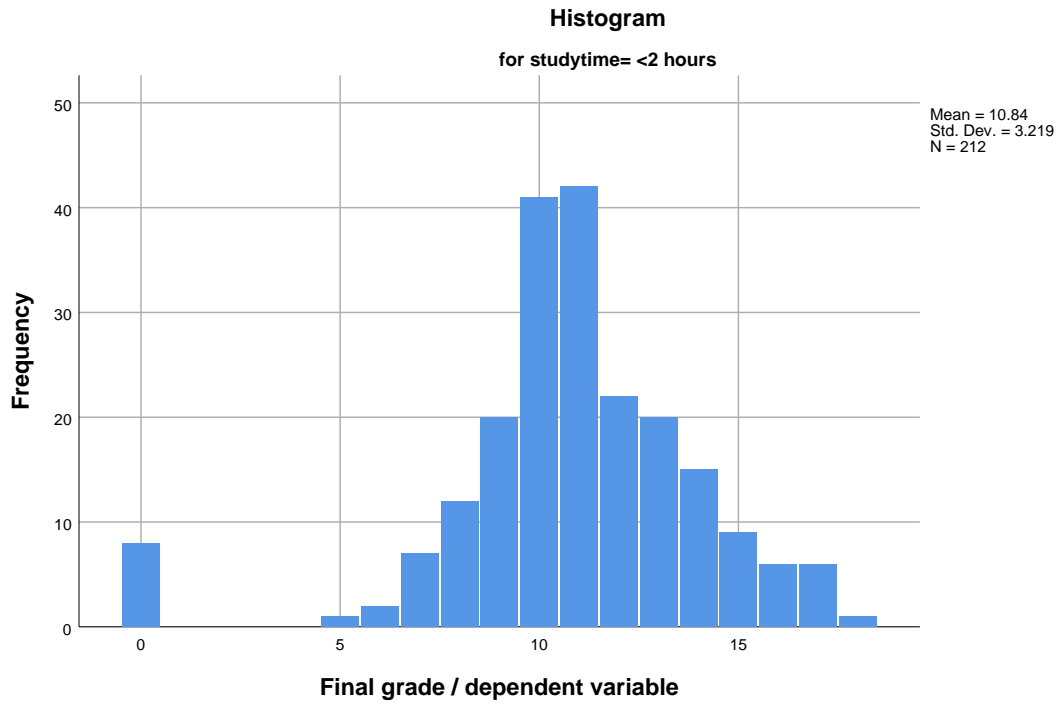
Descriptives

Weekly study time / Factor B		Std. Error
	Std. Deviation	
	Minimum	
	Maximum	
	Range	
	Interquartile Range	
	Skewness	.245
	Kurtosis	.485
>10 hours	Mean	.514
	95% Confidence Interval for Mean	Lower Bound Upper Bound
	5% Trimmed Mean	
	Median	
	Variance	
	Std. Deviation	
	Minimum	
	Maximum	
	Range	
	Interquartile Range	
	Skewness	.398
	Kurtosis	.778

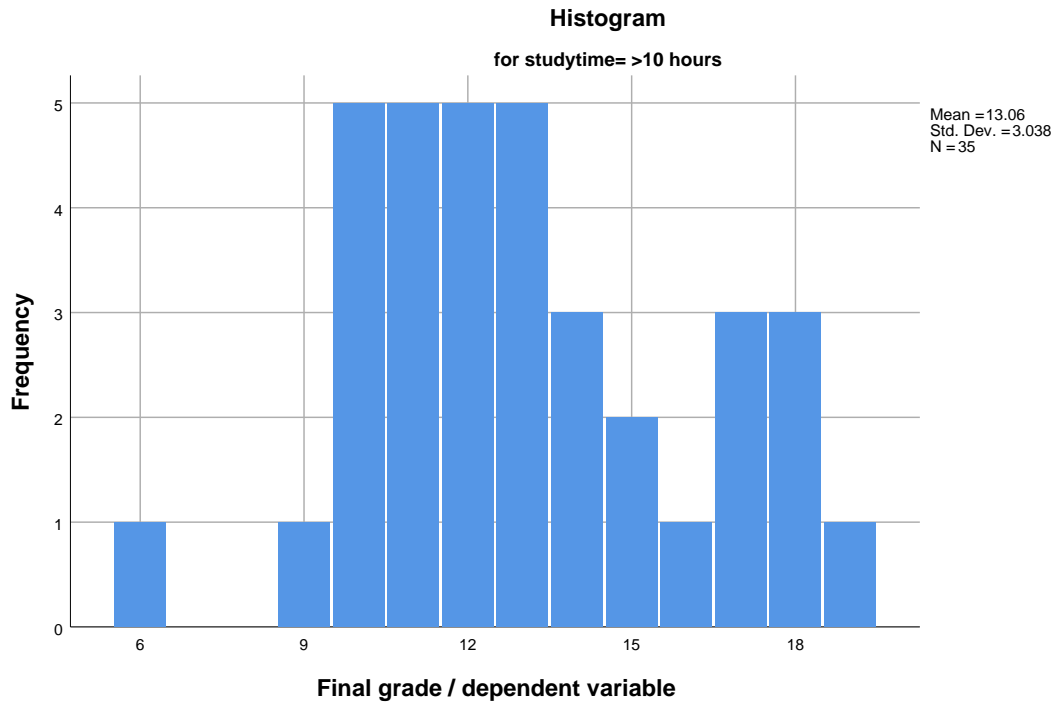
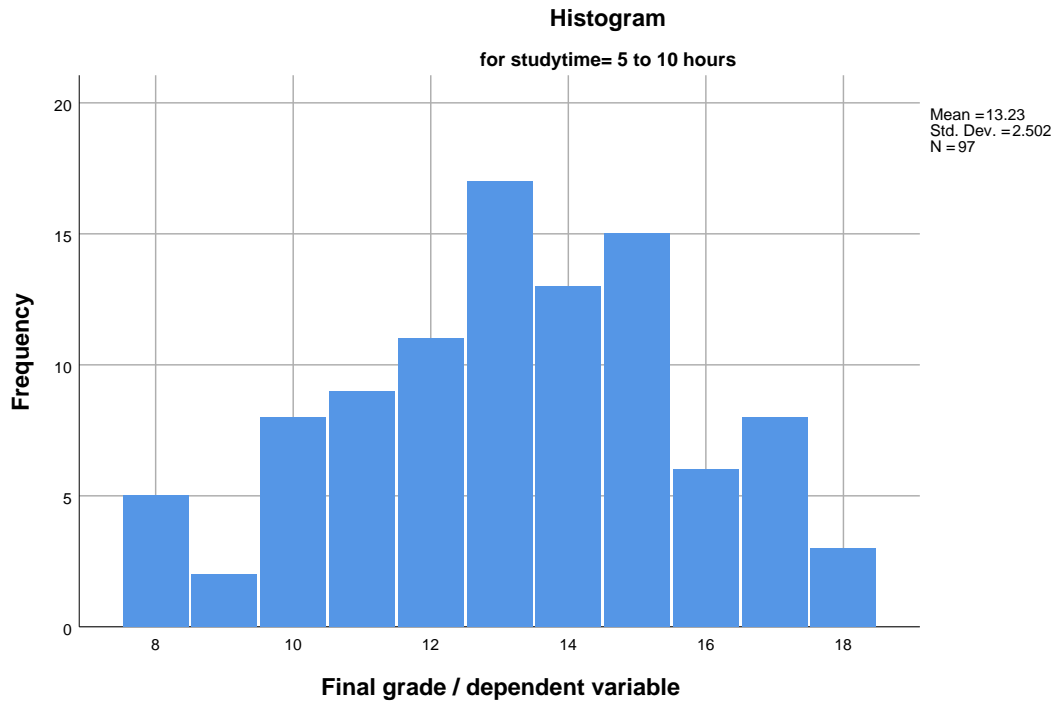
Final grade / dependent variable

Histograms

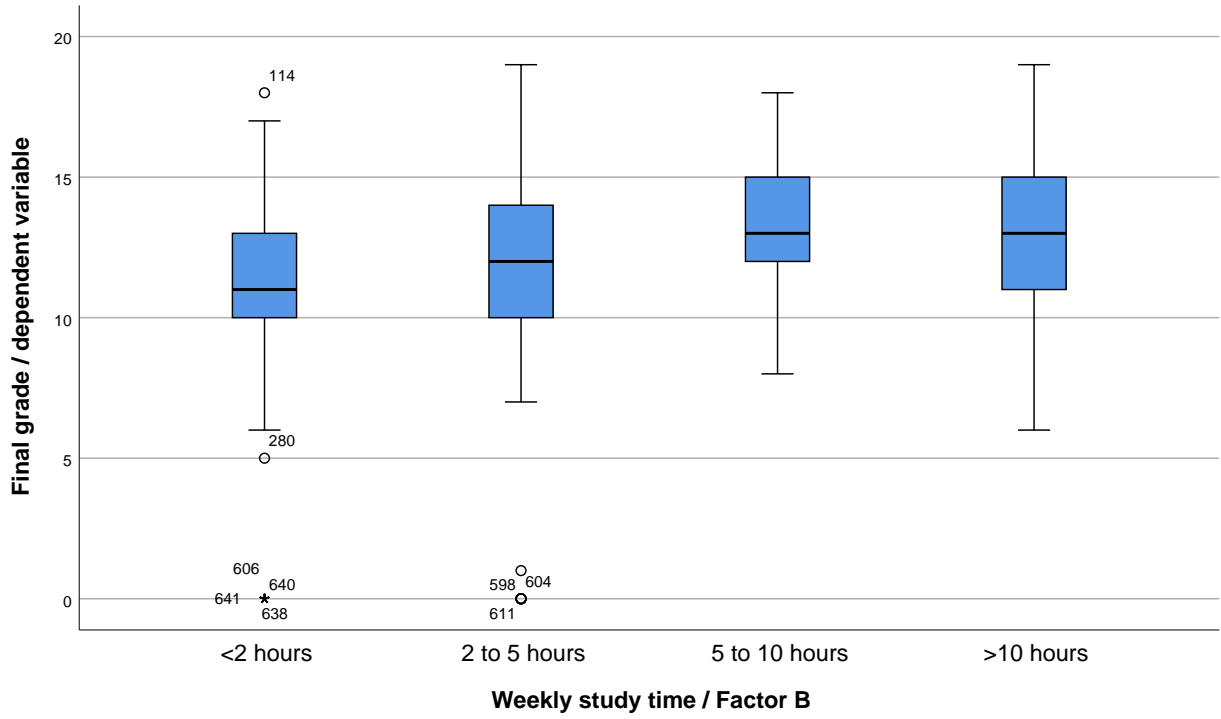
Distribution Context by Factor B
Boxplot and descriptives for G3 by studytime



Distribution Context by Factor B
Boxplot and descriptives for G3 by studytime



Distribution Context by Factor B
Boxplot and descriptives for G3 by studytime



Two-Way ANOVA: Main Effects vs Interaction Effects

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
Student sex / Factor A	F	Female	383
	M	Male	266
Weekly study time / Factor B	1	<2 hours	212
	2	2 to 5 hours	305
	3	5 to 10 hours	97
	4	>10 hours	35

Descriptive Statistics

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	Weekly study time / Factor B	Mean	Std. Deviation	N
Female	<2 hours	11.19	2.969	89
	2 to 5 hours	12.20	3.224	198
	5 to 10 hours	13.12	2.610	75
	>10 hours	14.19	2.874	21
	Total	12.25	3.124	383
Male	<2 hours	10.59	3.377	123
	2 to 5 hours	11.90	3.285	107
	5 to 10 hours	13.59	2.108	22
	>10 hours	11.36	2.499	14
	Total	11.41	3.321	266
Total	<2 hours	10.84	3.219	212
	2 to 5 hours	12.09	3.243	305
	5 to 10 hours	13.23	2.502	97
	>10 hours	13.06	3.038	35
	Total	11.91	3.231	649

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Levene's Test of Equality of Error Variances^{a,b}

		Levene Statistic	df1	df2	Sig.
Final grade / dependent variable	Based on Mean	.719	7	641	.656
	Based on Median	.733	7	641	.644
	Based on Median and with adjusted df	.733	7	593.511	.644
	Based on trimmed mean	.720	7	641	.656

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

a. Dependent variable: Final grade / dependent variable

b. Design: Intercept + sex + studytime + sex * studytime

Tests of Between-Subjects Effects

Dependent Variable: Final grade / dependent variable

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	560.961 ^a	7	80.137	8.282	.000	.083
Intercept	45515.165	1	45515.165	4703.932	.000	.880
sex	50.217	1	50.217	5.190	.023	.008
studytime	382.980	3	127.660	13.193	.000	.058
sex * studytime	64.815	3	21.605	2.233	.083	.010
Error	6202.306	641	9.676			
Total	98761.000	649				
Corrected Total	6763.267	648				

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Tests of Between-Subjects Effects

Dependent Variable: Final grade / dependent variable

Source	Noncent. Parameter	Observed Power ^b
Corrected Model	57.975	1.000
Intercept	4703.932	1.000
sex	5.190	.624
studytime	39.580	1.000
sex * studytime	6.699	.566
Error		
Total		
Corrected Total		

a. R Squared = .083 (Adjusted R Squared = .073)

b. Computed using alpha = .05

Parameter Estimates

Dependent Variable: Final grade / dependent variable

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	11.357	.831	13.661	.000	9.725	12.990
[sex=F]	2.833	1.073	2.640	.008	.726	4.941
[sex=M]	0 ^a	.	.	.	.	.
[studytime=1]	-.764	.877	-.870	.384	-2.487	.959
[studytime=2]	.540	.884	.611	.541	-1.196	2.276
[studytime=3]	2.234	1.063	2.100	.036	.145	4.322
[studytime=4]	0 ^a	.	.	.	.	.
[sex=F] * [studytime=1]	-2.236	1.157	-1.932	.054	-4.508	.037
[sex=F] * [studytime=2]	-2.534	1.136	-2.230	.026	-4.765	-.302
[sex=F] * [studytime=3]	-3.304	1.312	-2.519	.012	-5.880	-.728
[sex=F] * [studytime=4]	0 ^a	.	.	.	.	.
[sex=M] * [studytime=1]	0 ^a	.	.	.	.	.
[sex=M] * [studytime=2]	0 ^a	.	.	.	.	.

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Parameter Estimates

Dependent Variable: Final grade / dependent variable

Parameter	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Intercept	.225	13.661	1.000
[sex=F]	.011	2.640	.750
[sex=M]	.	.	.
[studytime=1]	.001	.870	.140
[studytime=2]	.001	.611	.094
[studytime=3]	.007	2.100	.555
[studytime=4]	.	.	.
[sex=F] * [studytime=1]	.006	1.932	.488
[sex=F] * [studytime=2]	.000	2.200	.605
[sex=F] * [studytime=3]	.010	2.519	.711
[sex=F] * [studytime=4]	.	.	.
[sex=M] * [studytime=1]	.	.	.
[sex=M] * [studytime=2]	.	.	.

Parameter Estimates

Dependent Variable: Final grade / dependent variable

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
[sex=M] * [studytime=3]	0 ^a	.	.	.	.	.
[sex=M] * [studytime=4]	0 ^a	.	.	.	.	.

Parameter Estimates

Dependent Variable: Final grade / dependent variable

Parameter	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
[sex=M] * [studytime=3]	.	.	.
[sex=M] * [studytime=4]	.	.	.

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

b. Computed using alpha = .05

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Estimated Marginal Means

1. Student sex / Factor A

Estimates

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Female	12.675	.216	12.250	13.099
Male	11.860	.285	11.300	12.419

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

(I) Student sex / Factor A	(J) Student sex / Factor A	Mean Difference (I-J)	Std. Error	Sig. ^b
Female	Male	.815 [*]	.358	.023
Male	Female	-.815 [*]	.358	.023

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

(I) Student sex / Factor A	(J) Student sex / Factor A	95% Confidence Interval for Difference ^b	
		Lower Bound	Upper Bound
Female	Male	.112	1.517
Male	Female	-1.517	-.112

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Univariate Tests

Dependent Variable: Final grade / dependent variable

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	50.217	1	50.217	5.190	.023	.008
Error	6202.306	641	9.676			

Univariate Tests

Dependent Variable: Final grade / dependent variable

	Noncent. Parameter	Observed Power ^a
Contrast	5.190	.624
Error		

The F tests the effect of Student sex / Factor A. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

2. Weekly study time / Factor B

Estimates

Dependent Variable: Final grade / dependent variable

Weekly study time / Factor B	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
<2 hours	10.892	.216	10.467	11.317
2 to 5 hours	12.047	.187	11.681	12.414
5 to 10 hours	13.355	.377	12.615	14.096
>10 hours	12.774	.537	11.720	13.828

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Mean Difference (I-J)	Std. Error	Sig. ^b
<2 hours	2 to 5 hours	-1.155*	.286	.000
	5 to 10 hours	-2.463*	.435	.000
	>10 hours	-1.882*	.579	.007
2 to 5 hours	<2 hours	1.155*	.286	.000
	5 to 10 hours	-1.308*	.421	.012
	>10 hours	-.727	.568	1.000
5 to 10 hours	<2 hours	2.463*	.435	.000
	2 to 5 hours	1.308*	.421	.012
	>10 hours	.582	.656	1.000
>10 hours	<2 hours	1.882*	.579	.007
	2 to 5 hours	.727	.568	1.000
	5 to 10 hours	-.582	.656	1.000

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% Confidence Interval for Difference ^b	
		Lower Bound	Upper Bound
<2 hours	2 to 5 hours	-1.911	-.399
	5 to 10 hours	-3.614	-1.313
	>10 hours	-3.413	-.350
2 to 5 hours	<2 hours	.399	1.911
	5 to 10 hours	-2.422	-.195
	>10 hours	-2.230	.777
5 to 10 hours	<2 hours	1.313	3.614
	2 to 5 hours	.195	2.422
	>10 hours	-1.154	2.317
>10 hours	<2 hours	.350	3.413
	2 to 5 hours	-.777	2.230
	5 to 10 hours	-2.317	1.154

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Univariate Tests

Dependent Variable: Final grade / dependent variable

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	382.980	3	127.660	13.193	.000	.058
Error	6202.306	641	9.676			

Univariate Tests

Dependent Variable: Final grade / dependent variable

	Noncent. Parameter	Observed Power ^a
Contrast	39.580	1.000
Error		

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

The F tests the effect of Weekly study time / Factor B. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

3. Student sex / Factor A * Weekly study time / Factor B

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	Weekly study time / Factor B	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Female	<2 hours	11.191	.330	10.544	11.838
	2 to 5 hours	12.197	.221	11.763	12.631
	5 to 10 hours	13.120	.359	12.415	13.825
	>10 hours	14.190	.679	12.858	15.523
Male	<2 hours	10.593	.280	10.043	11.144
	2 to 5 hours	11.897	.301	11.307	12.488
	5 to 10 hours	13.591	.663	12.289	14.893
	>10 hours	11.357	.831	9.725	12.990

4. Student sex / Factor A * Weekly study time / Factor B

Estimates

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	Weekly study time / Factor B	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Female	<2 hours	11.191	.330	10.544	11.838
	2 to 5 hours	12.197	.221	11.763	12.631
	5 to 10 hours	13.120	.359	12.415	13.825
	>10 hours	14.190	.679	12.858	15.523
Male	<2 hours	10.593	.280	10.043	11.144
	2 to 5 hours	11.897	.301	11.307	12.488
	5 to 10 hours	13.591	.663	12.289	14.893
	>10 hours	11.357	.831	9.725	12.990

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Weekly study time / Factor B	(I) Student sex / Factor A	(J) Student sex / Factor A	Mean Difference (I-J)
<2 hours	Female	Male	.598
	Male	Female	-.598
2 to 5 hours	Female	Male	.300
	Male	Female	-.300
5 to 10 hours	Female	Male	-.471
	Male	Female	.471
>10 hours	Female	Male	2.833*
	Male	Female	-2.833*

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Weekly study time / Factor B	(I) Student sex / Factor A	(J) Student sex / Factor A	Std. Error	Sig. ^b
<2 hours	Female	Male	.433	.168
	Male	Female	.433	.168
2 to 5 hours	Female	Male	.373	.422
	Male	Female	.373	.422
5 to 10 hours	Female	Male	.754	.533
	Male	Female	.754	.533
>10 hours	Female	Male	1.073	.008
	Male	Female	1.073	.008

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Weekly study time / Factor B	(I) Student sex / Factor A	(J) Student sex / Factor A	95% Confidence Interval for ^b ...
			Lower Bound
<2 hours	Female	Male	-.253
	Male	Female	-1.448
2 to 5 hours	Female	Male	-.433
	Male	Female	-1.033
5 to 10 hours	Female	Male	-1.952
	Male	Female	-1.010
>10 hours	Female	Male	.726
	Male	Female	-4.941

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Weekly study time / Factor B	(I) Student sex / Factor A	(J) Student sex / Factor A	95% Confidence Interval for ^b ...
			Upper Bound
<2 hours	Female	Male	1.448
	Male	Female	.253
2 to 5 hours	Female	Male	1.033
	Male	Female	.433
5 to 10 hours	Female	Male	1.010
	Male	Female	1.952
>10 hours	Female	Male	4.941
	Male	Female	-.726

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Univariate Tests

Dependent Variable: Final grade / dependent variable

Weekly study time / Factor B		Sum of Squares	df	Mean Square	F	Sig.
<2 hours	Contrast	18.436	1	18.436	1.905	.168
	Error	6202.306	641	9.676		
2 to 5 hours	Contrast	6.242	1	6.242	.645	.422
	Error	6202.306	641	9.676		
5 to 10 hours	Contrast	3.772	1	3.772	.390	.533
	Error	6202.306	641	9.676		
>10 hours	Contrast	67.433	1	67.433	6.969	.008
	Error	6202.306	641	9.676		

Univariate Tests

Dependent Variable: Final grade / dependent variable

Weekly study time / Factor B		Partial Eta Squared	Noncent. Parameter	Observed Power ^a
<2 hours	Contrast	.003	1.905	.281
	Error			
2 to 5 hours	Contrast	.001	.645	.126
	Error			
5 to 10 hours	Contrast	.001	.390	.096
	Error			
>10 hours	Contrast	.011	6.969	.750
	Error			

Each F tests the simple effects of Student sex / Factor A within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

5. Student sex / Factor A * Weekly study time / Factor B

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Estimates

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	Weekly study time / Factor B	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Female	<2 hours	11.191	.330	10.544	11.838
	2 to 5 hours	12.197	.221	11.763	12.631
	5 to 10 hours	13.120	.359	12.415	13.825
	>10 hours	14.190	.679	12.858	15.523
Male	<2 hours	10.593	.280	10.043	11.144
	2 to 5 hours	11.897	.301	11.307	12.488
	5 to 10 hours	13.591	.663	12.289	14.893
	>10 hours	11.357	.831	9.725	12.990

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Mean Difference (I-J)
Female	<2 hours	2 to 5 hours	-1.006
		5 to 10 hours	-1.929*
		>10 hours	-2.999*
	2 to 5 hours	<2 hours	1.006
		5 to 10 hours	-.923
		>10 hours	-1.994*
	5 to 10 hours	<2 hours	1.929*
		2 to 5 hours	.923
		>10 hours	-1.070
	>10 hours	<2 hours	2.999*
		2 to 5 hours	1.994*
		5 to 10 hours	1.070
Male	<2 hours	2 to 5 hours	-1.304*
		5 to 10 hours	-2.997*
		>10 hours	-.764

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Std. Error	Sig. ^b
Female	<2 hours	2 to 5 hours	.397	.069
		5 to 10 hours	.488	.001
		>10 hours	.755	.000
	2 to 5 hours	<2 hours	.397	.069
		5 to 10 hours	.422	.174
		>10 hours	.714	.032
	5 to 10 hours	<2 hours	.488	.001
		2 to 5 hours	.422	.174
		>10 hours	.768	.983
	>10 hours	<2 hours	.755	.000
		2 to 5 hours	.714	.032
		5 to 10 hours	.768	.983
Male	<2 hours	2 to 5 hours	.411	.010
		5 to 10 hours	.720	.000
		>10 hours	.877	1.000

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% Confidence b...
			Lower Bound
Female	<2 hours	2 to 5 hours	-2.057
		5 to 10 hours	-3.219
		>10 hours	-4.997
	2 to 5 hours	<2 hours	-.045
		5 to 10 hours	-2.039
		>10 hours	-3.883
	5 to 10 hours	<2 hours	.639
		2 to 5 hours	-.193
		>10 hours	-3.103
	>10 hours	<2 hours	1.002
		2 to 5 hours	.104
		5 to 10 hours	-.962
Male	<2 hours	2 to 5 hours	-2.392
		5 to 10 hours	-4.903
		>10 hours	-3.086

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% Confidence Interval for ^b ...
			Upper Bound
Female	<2 hours	2 to 5 hours	.045
		5 to 10 hours	-.639
		>10 hours	-1.002
	2 to 5 hours	<2 hours	2.057
		5 to 10 hours	.193
		>10 hours	-.104
	5 to 10 hours	<2 hours	3.219
		2 to 5 hours	2.039
		>10 hours	.962
	>10 hours	<2 hours	4.997
		2 to 5 hours	3.883
		5 to 10 hours	3.103
Male	<2 hours	2 to 5 hours	-.215
		5 to 10 hours	-1.092
		>10 hours	1.558

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Mean Difference (I-J)
	2 to 5 hours	<2 hours	1.304*
		5 to 10 hours	-1.694
		>10 hours	.540
	5 to 10 hours	<2 hours	2.997*
		2 to 5 hours	1.694
		>10 hours	2.234
	>10 hours	<2 hours	.764
		2 to 5 hours	-.540
		5 to 10 hours	-2.234

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Std. Error	Sig. ^b
	2 to 5 hours	<2 hours	.411	.010
		5 to 10 hours	.728	.122
		>10 hours	.884	1.000
	5 to 10 hours	<2 hours	.720	.000
		2 to 5 hours	.728	.122
		>10 hours	1.063	.216
	>10 hours	<2 hours	.877	1.000
		2 to 5 hours	.884	1.000
		5 to 10 hours	1.063	.216

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% Confidence Int...
			Lower Bound
	2 to 5 hours	<2 hours	.215
		5 to 10 hours	-3.621
		>10 hours	-1.800
	5 to 10 hours	<2 hours	1.092
		2 to 5 hours	-.233
		>10 hours	-.581
	>10 hours	<2 hours	-1.558
		2 to 5 hours	-2.880
		5 to 10 hours	-5.048

Pairwise Comparisons

Dependent Variable: Final grade / dependent variable

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% Confidence Interval for ...
			Upper Bound
	2 to 5 hours	<2 hours	2.392
		5 to 10 hours	.233
		>10 hours	2.880
	5 to 10 hours	<2 hours	4.903
		2 to 5 hours	3.621
		>10 hours	5.048
	>10 hours	<2 hours	3.086
		2 to 5 hours	1.800
		5 to 10 hours	.581

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Two-Way ANOVA: Main Effects vs Interaction Effects
 Model: G3 = sex + studytime + sex*studytime

Univariate Tests

Dependent Variable: Final grade / dependent variable

Student sex / Factor A		Sum of Squares	df	Mean Square	F	Sig.
Female	Contrast	236.204	3	78.735	8.137	.000
	Error	6202.306	641	9.676		
Male	Contrast	212.074	3	70.691	7.306	.000
	Error	6202.306	641	9.676		

Univariate Tests

Dependent Variable: Final grade / dependent variable

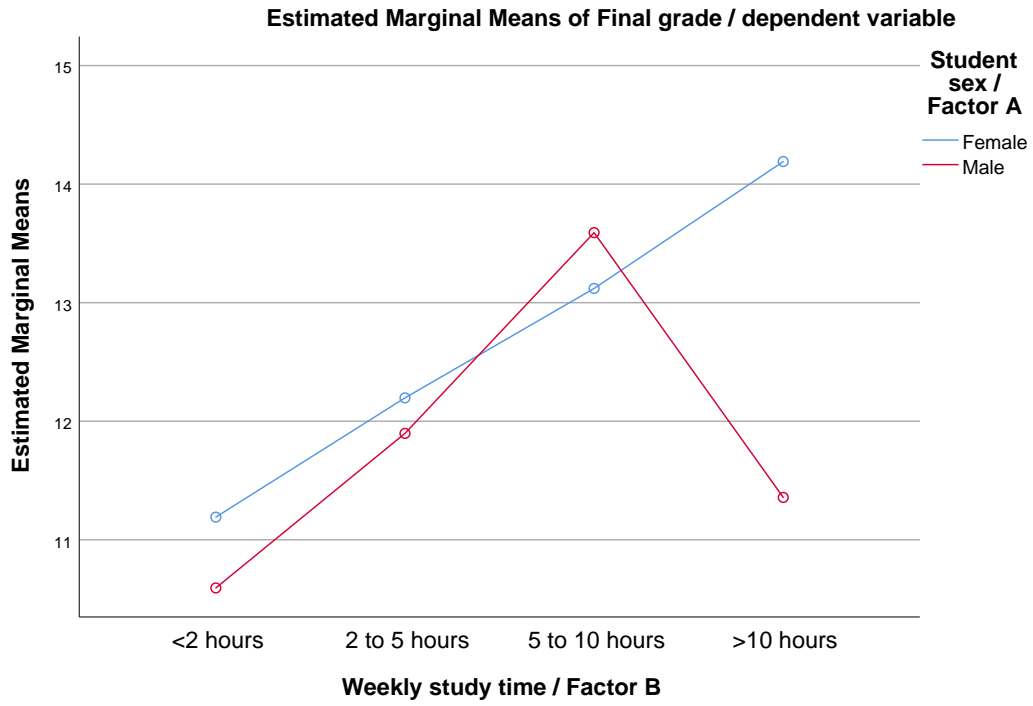
Student sex / Factor A		Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Female	Contrast	.037	24.411	.992
	Error			
Male	Contrast	.033	21.918	.984
	Error			

Each F tests the simple effects of Weekly study time / Factor B within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

Profile Plots

Two-Way ANOVA: Main Effects vs Interaction Effects
Model: $G3 = \text{sex} + \text{studytime} + \text{sex} * \text{studytime}$



Simple Effects: Studytime Tested Within Each Sex

```
>Warning # 2004. Command name: SUBTITLE  
>The subtitle given exceeds 60 characters in length. The first 60 characters  
>will be used.
```

Simple Effects: Studytime Tested Within Each Sex
Use when the interaction is significant or methodologically

Oneway

Descriptives

Final grade / dependent variable

Student sex / Factor A		N	Mean	Std. Deviation	Std. Error	95% Confidence ...
						Lower Bound
Female	<2 hours	89	11.19	2.969	.315	10.57
	2 to 5 hours	198	12.20	3.224	.229	11.75
	5 to 10 hours	75	13.12	2.610	.301	12.52
	>10 hours	21	14.19	2.874	.627	12.88
	Total	383	12.25	3.124	.160	11.94
Male	<2 hours	123	10.59	3.377	.305	9.99
	2 to 5 hours	107	11.90	3.285	.318	11.27
	5 to 10 hours	22	13.59	2.108	.449	12.66
	>10 hours	14	11.36	2.499	.668	9.91
	Total	266	11.41	3.321	.204	11.01

Descriptives

Final grade / dependent variable

Student sex / Factor A		95% Confidence Interval for Mean		
		Upper Bound	Minimum	Maximum
Female	<2 hours	11.82	0	17
	2 to 5 hours	12.65	0	18
	5 to 10 hours	13.72	8	18
	>10 hours	15.50	10	19
	Total	12.57	0	19
Male	<2 hours	11.20	0	18
	2 to 5 hours	12.53	0	19
	5 to 10 hours	14.53	9	17
	>10 hours	12.80	6	17
	Total	11.81	0	19

Simple Effects: Studytime Tested Within Each Sex
 Use when the interaction is significant or methodologically

Test of Homogeneity of Variances

Student sex / Factor A			Levene Statistic	df1	df2
Female	Final grade / dependent variable	Based on Mean	.580	3	379
		Based on Median	.618	3	379
		Based on Median and with adjusted df	.618	3	359.269
		Based on trimmed mean	.577	3	379
Male	Final grade / dependent variable	Based on Mean	1.012	3	262
		Based on Median	.992	3	262
		Based on Median and with adjusted df	.992	3	247.621
		Based on trimmed mean	1.011	3	262

Test of Homogeneity of Variances

Student sex / Factor A			Sig.
Female	Final grade / dependent variable	Based on Mean	.628
		Based on Median	.604
		Based on Median and with adjusted df	.604
		Based on trimmed mean	.631
Male	Final grade / dependent variable	Based on Mean	.388
		Based on Median	.397
		Based on Median and with adjusted df	.397
		Based on trimmed mean	.388

Simple Effects: Studytime Tested Within Each Sex
Use when the interaction is significant or methodologically

ANOVA

Final grade / dependent variable

Student sex / Factor A		Sum of Squares	df	Mean Square	F	Sig.
Female	Between Groups	236.204	3	78.735	8.545	.000
	Within Groups	3492.229	379	9.214		
	Total	3728.433	382			
Male	Between Groups	212.074	3	70.691	6.834	.000
	Within Groups	2710.076	262	10.344		
	Total	2922.150	265			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Final grade / dependent variable

Bonferroni

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Mean Difference (I-J)
Female	<2 hours	2 to 5 hours	-1.006
		5 to 10 hours	-1.929*
		>10 hours	-2.999*
	2 to 5 hours	<2 hours	1.006
		5 to 10 hours	-.923
		>10 hours	-1.994*
	5 to 10 hours	<2 hours	1.929*
		2 to 5 hours	.923
		>10 hours	-1.070
	>10 hours	<2 hours	2.999*
		2 to 5 hours	1.994*
		5 to 10 hours	1.070
Male	<2 hours	2 to 5 hours	-1.304*
		5 to 10 hours	-2.997*
		>10 hours	-.764

Simple Effects: Studytime Tested Within Each Sex
 Use when the interaction is significant or methodologically

Multiple Comparisons

Dependent Variable: Final grade / dependent variable

Bonferroni

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Std. Error	Sig.
Female	<2 hours	2 to 5 hours	.387	.059
		5 to 10 hours	.476	.000
		>10 hours	.736	.000
	2 to 5 hours	<2 hours	.387	.059
		5 to 10 hours	.412	.153
		>10 hours	.697	.027
	5 to 10 hours	<2 hours	.476	.000
		2 to 5 hours	.412	.153
		>10 hours	.749	.924
	>10 hours	<2 hours	.736	.000
		2 to 5 hours	.697	.027
		5 to 10 hours	.749	.924
Male	<2 hours	2 to 5 hours	.425	.014
		5 to 10 hours	.744	.000
		>10 hours	.907	1.000

Simple Effects: Studytime Tested Within Each Sex
 Use when the interaction is significant or methodologically

Multiple Comparisons

Dependent Variable: Final grade / dependent variable

Bonferroni

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% ...
			Lower Bound
Female	<2 hours	2 to 5 hours	-2.03
		5 to 10 hours	-3.19
		>10 hours	-4.95
	2 to 5 hours	<2 hours	-.02
		5 to 10 hours	-2.01
		>10 hours	-3.84
	5 to 10 hours	<2 hours	.67
		2 to 5 hours	-.17
		>10 hours	-3.06
	>10 hours	<2 hours	1.05
		2 to 5 hours	.15
		5 to 10 hours	-.92
Male	<2 hours	2 to 5 hours	-2.43
		5 to 10 hours	-4.98
		>10 hours	-3.18

Simple Effects: Studytime Tested Within Each Sex
 Use when the interaction is significant or methodologically

Multiple Comparisons

Dependent Variable: Final grade / dependent variable

Bonferroni

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% Confidence .
			Upper Bound
Female	<2 hours	2 to 5 hours	.02
		5 to 10 hours	-.67
		>10 hours	-1.05
	2 to 5 hours	<2 hours	2.03
		5 to 10 hours	.17
		>10 hours	-.15
	5 to 10 hours	<2 hours	3.19
		2 to 5 hours	2.01
		>10 hours	.92
	>10 hours	<2 hours	4.95
		2 to 5 hours	3.84
		5 to 10 hours	3.06
Male	<2 hours	2 to 5 hours	-.17
		5 to 10 hours	-1.02
		>10 hours	1.65

Simple Effects: Studytime Tested Within Each Sex
Use when the interaction is significant or methodologically

Multiple Comparisons

Dependent Variable: Final grade / dependent variable

Bonferroni

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Mean Difference (I-J)
	2 to 5 hours	<2 hours	1.304*
		5 to 10 hours	-1.694
		>10 hours	.540
	5 to 10 hours	<2 hours	2.997*
		2 to 5 hours	1.694
		>10 hours	2.234
	>10 hours	<2 hours	.764
		2 to 5 hours	-.540
		5 to 10 hours	-2.234

Multiple Comparisons

Dependent Variable: Final grade / dependent variable

Bonferroni

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	Std. Error	Sig.
	2 to 5 hours	<2 hours	.425	.014
		5 to 10 hours	.753	.152
		>10 hours	.914	1.000
	5 to 10 hours	<2 hours	.744	.000
		2 to 5 hours	.753	.152
		>10 hours	1.100	.259
	>10 hours	<2 hours	.907	1.000
		2 to 5 hours	.914	1.000
		5 to 10 hours	1.100	.259

Simple Effects: Studytime Tested Within Each Sex
Use when the interaction is significant or methodologically

Multiple Comparisons

Dependent Variable: Final grade / dependent variable

Bonferroni

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% ...
			Lower Bound
	2 to 5 hours	<2 hours	.17
		5 to 10 hours	-3.70
		>10 hours	-1.89
	5 to 10 hours	<2 hours	1.02
		2 to 5 hours	-.31
		>10 hours	-.69
	>10 hours	<2 hours	-1.65
		2 to 5 hours	-2.97
		5 to 10 hours	-5.16

Multiple Comparisons

Dependent Variable: Final grade / dependent variable

Bonferroni

Student sex / Factor A	(I) Weekly study time / Factor B	(J) Weekly study time / Factor B	95% Confidence .
			Upper Bound
	2 to 5 hours	<2 hours	2.43
		5 to 10 hours	.31
		>10 hours	2.97
	5 to 10 hours	<2 hours	4.98
		2 to 5 hours	3.70
		>10 hours	5.16
	>10 hours	<2 hours	3.18
		2 to 5 hours	1.89
		5 to 10 hours	.69

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

Simple Effects: Sex Tested Within Each Studytime Level

>Warning # 2004. Command name: SUBTITLE

>The subtitle given exceeds 60 characters in length. The first 60 characters
>will be used.

Simple Effects: Sex Tested Within Each Studytime Level
Use when the interaction is significant or methodologically

Oneway

Warnings

Text: sex Command: ONEWAY

A string variable was used in a variable list where only numeric variables are allowed.

Execution of this command stops.
