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ANOVA Assumptions

ANOVA Assumptions
Import data

ANOVA Assumptions descriptives

ANOVA Assumptions descriptives
Dependent variable G3 by studytime groups

Means

[ANOVAAssumptionsData] D:\DATA ANALYSIS\E ANOVA Family\ANOVA Assumptions\SPSS_ Output\sav\ANOVA-Assumptions-data.sav

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
G3 * studytime	649	100.0%	0	0.0%	649	100.0%

Report

G3

studytime	N	Mean	Std. Deviation	Variance	Minimum	Maximum
1	212	10.84	3.219	10.360	0	18
2	305	12.09	3.243	10.518	0	19
3	97	13.23	2.502	6.261	8	18
4	35	13.06	3.038	9.232	6	19
Total	649	11.91	3.231	10.437	0	19

ANOVA Assumptions one-way ANOVA and homogeneity test

ANOVA Assumptions one-way ANOVA and homogeneity test
Levene homogeneity of variance test is included

Oneway

Descriptives

G3

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum
					Lower Bound	Upper Bound	
1	212	10.84	3.219	.221	10.41	11.28	0
2	305	12.09	3.243	.186	11.73	12.46	0
3	97	13.23	2.502	.254	12.72	13.73	8
4	35	13.06	3.038	.514	12.01	14.10	6
Total	649	11.91	3.231	.127	11.66	12.16	0

Descriptives

G3

	Maximum
1	18
2	19
3	18
4	19
Total	19

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
G3	Based on Mean	.985	3	645	.400
	Based on Median	1.026	3	645	.380
	Based on Median and with adjusted df	1.026	3	609.885	.380
	Based on trimmed mean	1.081	3	645	.356

ANOVA Assumptions one-way ANOVA and homogeneity test
Levene homogeneity of variance test is included

ANOVA

G3

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	465.078	3	155.026	15.876	.000
Within Groups	6298.189	645	9.765		
Total	6763.267	648			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: G3

Tukey HSD

(I) studytime	(J) studytime	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-1.247*	.279	.000	-1.97	-.53
	3	-2.382*	.383	.000	-3.37	-1.40
	4	-2.213*	.570	.001	-3.68	-.74
2	1	1.247*	.279	.000	.53	1.97
	3	-1.135*	.364	.010	-2.07	-.20
	4	-.965	.558	.308	-2.40	.47
3	1	2.382*	.383	.000	1.40	3.37
	2	1.135*	.364	.010	.20	2.07
	4	.170	.616	.993	-1.42	1.76
4	1	2.213*	.570	.001	.74	3.68
	2	.965	.558	.308	-.47	2.40
	3	-.170	.616	.993	-1.76	1.42

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

Homogeneous Subsets

ANOVA Assumptions one-way ANOVA and homogeneity test
Levene homogeneity of variance test is included

G3

Tukey HSD^{a,b}

studytime	N	Subset for alpha = 0.05	
		1	2
1	212	10.84	
2	305		12.09
4	35		13.06
3	97		13.23
Sig.		1.000	.083

Means for groups in homogeneous subsets are displayed.

- a. Uses Harmonic Mean Sample Size = 85.331.
- b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

ANOVA Assumptions GLM model

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

ANOVA Assumptions GLM model
Save residuals and predicted values for assumption diagnosti

General Linear Model

Warnings

A program error has occurred: A procedure has attempted to add more variables to the file than it provided for in its call to OBINIT. The error was detected in a call to OBPINI. Please note the circumstances under which this error occurred, attempting to replicate it if possible, and then notify Technical Support.
Execution of this command stops.

Between-Subjects Factors

		N
studytime	1	212
	2	305
	3	97
	4	35

Descriptive Statistics

Dependent Variable: G3

studytime	Mean	Std. Deviation	N
1	10.84	3.219	212
2	12.09	3.243	305
3	13.23	2.502	97
4	13.06	3.038	35
Total	11.91	3.231	649

ANOVA Assumptions GLM model
Save residuals and predicted values for assumption diagnosti

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

		Levene Statistic	df1	df2	Sig.
G3	Based on Mean	.985	3	645	.400
	Based on Median	1.026	3	645	.380
	Based on Median and with adjusted df	1.026	3	609.885	.380
	Based on trimmed mean	1.081	3	645	.356

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

a. Dependent variable: G3

b. Design: Intercept + studytime

Tests of Between-Subjects Effects

Dependent Variable: G3

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	465.078 ^a	3	155.026	15.876	.000	.069
Intercept	51680.984	1	51680.984	5292.670	.000	.891
studytime	465.078	3	155.026	15.876	.000	.069
Error	6298.189	645	9.765			
Total	98761.000	649				
Corrected Total	6763.267	648				

a. R Squared = .069 (Adjusted R Squared = .064)

>Warning # 552

>Possibly due to another error, a procedure has defined more new variables than

>it has added to the file. All those which have been defined but not added

>will be discarded and will be unavailable for further processing.

ANOVA Assumptions residual normality

ANOVA Assumptions residual normality
Histogram, boxplot, and normal probability plot of residuals

Explore

Warnings

Text: RES_1 Command: EXAMINE

An undefined variable name, or a scratch or system variable was specified in a variable list which accepts only standard variables. Check spelling and verify the existence of this variable.

Execution of this command stops.

No dependent variables were specified. EXAMINE requires a set of dependent variables for analysis. Check your EXAMINE command.

ANOVA Assumptions group outlier check

ANOVA Assumptions group outlier check
Boxplots of G3 by studytime

Explore

Study time factor

Case Processing Summary

	studytime	Valid		Cases Missing		Total	
		N	Percent	N	Percent	N	Percent
G3	1	212	100.0%	0	0.0%	212	100.0%
	2	305	100.0%	0	0.0%	305	100.0%
	3	97	100.0%	0	0.0%	97	100.0%
	4	35	100.0%	0	0.0%	35	100.0%

Descriptives

studytime		Statistic	Std. Error		
G3	1	Mean	10.84	.221	
		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	.167	
		Kurtosis	3.117	.333	
		2	2	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				

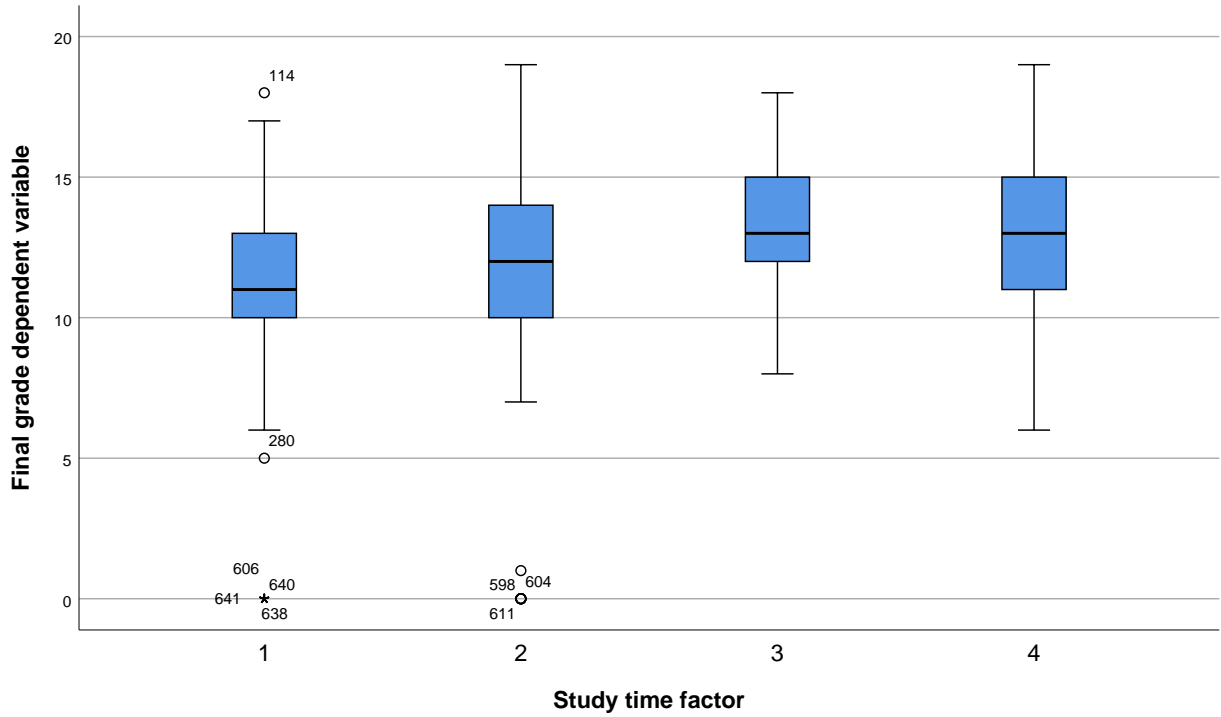
ANOVA Assumptions group outlier check
Boxplots of G3 by studytime

Descriptives

studytime		Statistic	Std. Error	
3	Minimum	0		
	Maximum	19		
	Range	19		
	Interquartile Range	4		
	Skewness	-1.028	.140	
	Kurtosis	3.044	.278	
	Mean	13.23	.254	
	95% Confidence Interval for Mean	Lower Bound	12.72	
		Upper Bound	13.73	
	5% Trimmed Mean	13.27		
	Median	13.00		
	Variance	6.261		
	Std. Deviation	2.502		
	Minimum	8		
Maximum	18			
Range	10			
Interquartile Range	4			
Skewness	-.190	.245		
Kurtosis	-.502	.485		
4	Mean	13.06	.514	
	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	.398	
	Kurtosis	-.339	.778	

ANOVA Assumptions group outlier check
Boxplots of G3 by studytime

Final grade dependent variable



ANOVA Assumptions residuals by fitted values

ANOVA Assumptions residuals by fitted values
Residual spread and constant variance check

Graph

```
>Error # 701 in column 23. Text: PRE_1  
>An undefined variable name, or a scratch or system variable was specified in  
a  
>variable list which accepts only standard variables. Check spelling and  
>verify the existence of this variable.  
>Execution of this command stops.
```

ANOVA Assumptions residual histogram

Graph

```
>Error # 701 in column 22. Text: RES_1  
>An undefined variable name, or a scratch or system variable was specified in  
a  
>variable list which accepts only standard variables. Check spelling and  
>verify the existence of this variable.  
>Execution of this command stops.
```