Host

Host

Host

Host

Random Effects ANOVA

Importing dataset for random-effects ANOVA: G3 by studytime

Frequencies

[RandomEffectsANOVAData] D:\DATA ANALYSIS\E ANOVA Family\Random Effects ANOVA\SPSS_Output\sav\Random-Effects-ANOVA-data.sav

Statistics

studytime

N	Valid	649
	Missing	0

studytime

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	212	32.7	32.7	32.7
	2.00	305	47.0	47.0	79.7
	3.00	97	14.9	14.9	94.6
	4.00	35	5.4	5.4	100.0
	Total	649	100.0	100.0	

Means

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	Median	Minimum	Maximum
1.00	212	10.8443	3.21862	11.0000	.00	18.00
2.00	305	12.0918	3.24313	12.0000	.00	19.00
3.00	97	13.2268	2.50210	13.0000	8.00	18.00
4.00	35	13.0571	3.03841	13.0000	6.00	19.00
Total	649	11.9060	3.23066	12.0000	.00	19.00

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

Random Effects ANOVA: Classical One-Way ANOVA Components
Mean squares are used to estimate random-effects variance co

Oneway

Descriptives

G3

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum
					Lower Bound	Upper Bound	
1.00	212	10.8443	3.21862	.22106	10.4086	11.2801	.00
2.00	305	12.0918	3.24313	.18570	11.7264	12.4572	.00
3.00	97	13.2268	2.50210	.25405	12.7225	13.7311	8.00
4.00	35	13.0571	3.03841	.51358	12.0134	14.1009	6.00
Total	649	11.9060	3.23066	.12681	11.6570	12.1550	.00

Descriptives

G3

	Maximum
1.00	18.00
2.00	19.00
3.00	18.00
4.00	19.00
Total	19.00

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

Random Effects ANOVA: Classical One-Way ANOVA Components
Mean squares are used to estimate random-effects variance co

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			

Random Effects ANOVA: GLM Random Factor Declaration
studytime is declared as a random factor in GLM

General Linear Model

Between-Subjects Factors

		Value Label	N
studytime	1.00	Studytime 1	212
	2.00	Studytime 2	305
	3.00	Studytime 3	97
	4.00	Studytime 4	35

Descriptive Statistics

Dependent Variable: G3

studytime	Mean	Std. Deviation	N
1.00	10.8443	3.21862	212
2.00	12.0918	3.24313	305
3.00	13.2268	2.50210	97
4.00	13.0571	3.03841	35
Total	11.9060	3.23066	649

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

Random Effects ANOVA: GLM Random Factor Declaration
studytime is declared as a random factor in GLM

Tests of Between-Subjects Effects

Dependent Variable: G3

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	51680.984	1	51680.984	525.767	.000
	Error	319.171	3.247	98.296[a]		
studytime	Hypothesis	465.078	3	155.026	15.876	.000
	Error	6298.189	645	9.765[b]		

Tests of Between-Subjects Effects

Dependent Variable: G3

Source		Partial Eta Squared
Intercept	Hypothesis	.994
	Error	
studytime	Hypothesis	.069
	Error	

a. .609 MS(studytime) + .391 MS(Error)

b. MS(Error)

Expected Mean Squares[a,b]

Source	Variance Component: Var(studytime)	Var(Error)	Quadratic Term
Intercept	85.331	1.000	Intercept
studytime	140.009	1.000	
Error	.000	1.000	

a. For each source, the expected mean square equals the sum of the coefficients in the cells times the variance components, plus a quadratic term involving effects in the Quadratic Term cell.

b. Expected Mean Squares are based on the Type III Sums of Squares.

Random Effects ANOVA: GLM Random Factor Declaration
studytime is declared as a random factor in GLM

Parameter Estimates

Dependent Variable: G3

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	13.057	.528	24.720	.000	12.020	14.094
[studytime=1.00]	-2.213	.570	-3.881	.000	-3.332	-1.093
[studytime=2.00]	-.965	.558	-1.731	.084	-2.060	.130
[studytime=3.00]	.170	.616	.275	.783	-1.040	1.380
[studytime=4.00]	0[a]	.	.	.	.	.

Parameter Estimates

Dependent Variable: G3

Parameter	Partial Eta Squared
Intercept	.487
[studytime=1.00]	.023
[studytime=2.00]	.005
[studytime=3.00]	.000
[studytime=4.00]	.

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

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

Mixed Model Analysis

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters	Subject Variables
Fixed Effects	Intercept	1		1	
Random Effects	Intercept[b]	1	Variance Components	1	studytime
Residual				1	
Total		2		3	

a. Dependent Variable: G3.

b. As of version 11.5, the syntax rules for the RANDOM subcommand have changed. Your command syntax may yield results that differ from those produced by prior versions. If you are using version 11 syntax, please consult the current syntax reference guide for more information.

Information Criteria[a]

-2 Restricted Log Likelihood	3329.931138
Akaike's Information Criterion (AIC)	3333.931138
Hurvich and Tsai's Criterion (AICC)	3333.949743
Bozdogan's Criterion (CAIC)	3344.878920
Schwarz's Bayesian Criterion (BIC)	3342.878920

The information criteria are displayed in smaller-is-better form.

a. Dependent Variable: G3.

Fixed Effects

Random Effects ANOVA: Linear Mixed Model Variance Components
Random intercept for studytime estimates between-level varia

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	3.064	488.616	.000

a. Dependent Variable: G3.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	12.261	.555	3.064	22.105	.000	10.516	14.005

a. Dependent Variable: G3.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% ...
						Lower Bound
Residual		9.764	.544	17.960	.000	8.754
Intercept [subject = studytime]	Variance	1.123	.989	1.136	.256	.200

Estimates of Covariance Parameters[a]

Parameter		95% Confidence .
		Upper Bound
Residual		10.890
Intercept [subject = studytime]	Variance	6.305

a. Dependent Variable: G3.

Explore

Random factor: study time group

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	studytime	N	Percent	N	Percent	N	Percent
G3	1.00	212	100.0%	0	0.0%	212	100.0%
	2.00	305	100.0%	0	0.0%	305	100.0%
	3.00	97	100.0%	0	0.0%	97	100.0%
	4.00	35	100.0%	0	0.0%	35	100.0%

Descriptives

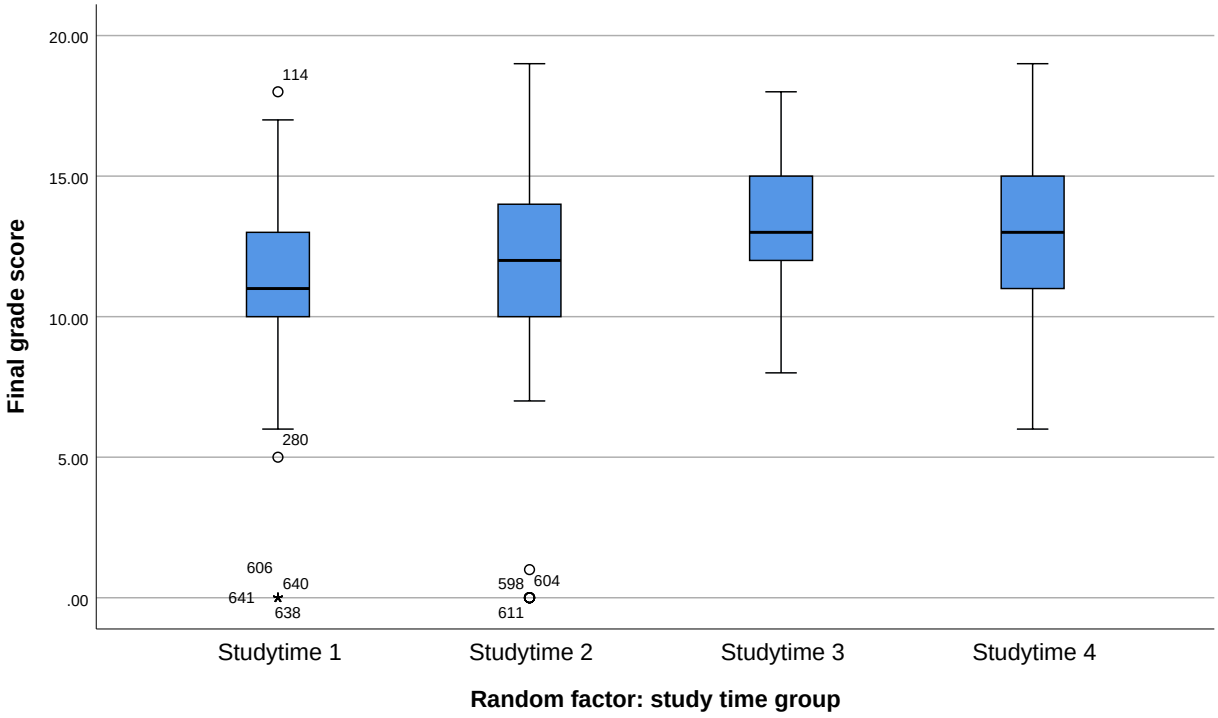
	studytime			Statistic	Std. Error
G3	1.00	Mean		10.8443	.22106
		95% Confidence Interval for Mean	Lower Bound	10.4086	
			Upper Bound	11.2801	
		5% Trimmed Mean		11.0419	
		Median		11.0000	
		Variance		10.360	
		Std. Deviation		3.21862	
		Minimum		.00	
		Maximum		18.00	
		Range		18.00	
		Interquartile Range		3.00	
		Skewness		-1.078	.167
		Kurtosis		3.117	.333
	2.00	Mean		12.0918	.18570
		95% Confidence Interval for Mean	Lower Bound	11.7264	
			Upper Bound	12.4572	
		5% Trimmed Mean		12.2505	
		Median		12.0000	
		Variance		10.518	
		Std. Deviation		3.24313	
		Minimum		.00	

Descriptives

studytime			Statistic	Std. Error
	Maximum		19.00	
	Range		19.00	
	Interquartile Range		4.00	
	Skewness		-1.028	.140
	Kurtosis		3.044	.278
3.00	Mean		13.2268	.25405
	95% Confidence Interval for Mean	Lower Bound	12.7225	
		Upper Bound	13.7311	
	5% Trimmed Mean		13.2732	
	Median		13.0000	
	Variance		6.261	
	Std. Deviation		2.50210	
	Minimum		8.00	
	Maximum		18.00	
	Range		10.00	
	Interquartile Range		3.50	
	Skewness		-.190	.245
	Kurtosis		-.502	.485
4.00	Mean		13.0571	.51358
	95% Confidence Interval for Mean	Lower Bound	12.0134	
		Upper Bound	14.1009	
	5% Trimmed Mean		13.0714	
	Median		13.0000	
	Variance		9.232	
	Std. Deviation		3.03841	
	Minimum		6.00	
	Maximum		19.00	
	Range		13.00	
	Interquartile Range		4.00	
	Skewness		.209	.398
	Kurtosis		-.339	.778

Final grade score

Random Effects ANOVA: Boxplot of G3 by Random Level




```
>Warning # 2003.  Command name: TITLE
>The title given exceeds 60 characters in length.  The first 60 characters wil
l
>be used.
```

General Linear Model

Between-Subjects Factors

		Value Label	N
studytime	1.00	Studytime 1	212
	2.00	Studytime 2	305
	3.00	Studytime 3	97
	4.00	Studytime 4	35

Tests of Between-Subjects Effects

Dependent Variable: G3

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

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

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
RES_1	649	100.0%	0	0.0%	649	100.0%

Descriptives

			Statistic	Std. Error
RES_1	Mean		.0000	.12238
	95% Confidence Interval for Mean	Lower Bound	-.2403	
		Upper Bound	.2403	
	5% Trimmed Mean		.1427	
	Median		-.0918	
	Variance		9.719	
	Std. Deviation		3.11760	
	Minimum		-12.09	
	Maximum		7.16	
	Range		19.25	
	Interquartile Range		3.75	
	Skewness		-.930	.096
	Kurtosis		2.793	.192

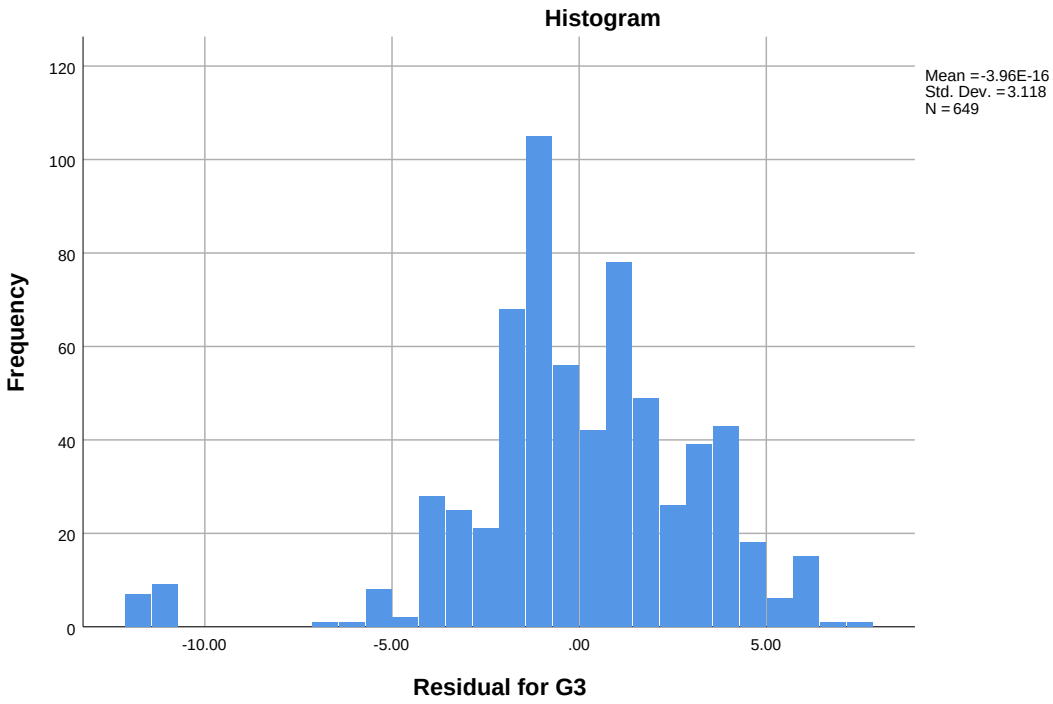
Tests of Normality

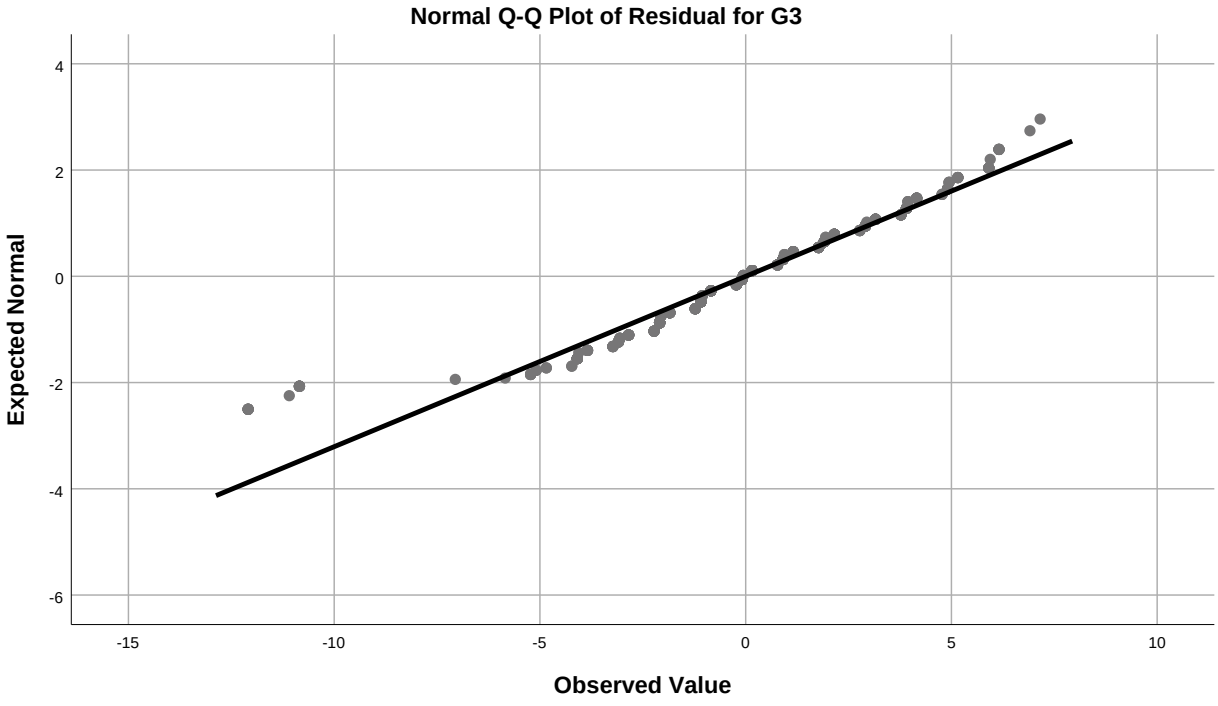
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
RES_1	.094	649	.000	.935	649	.000

a. Lilliefors Significance Correction

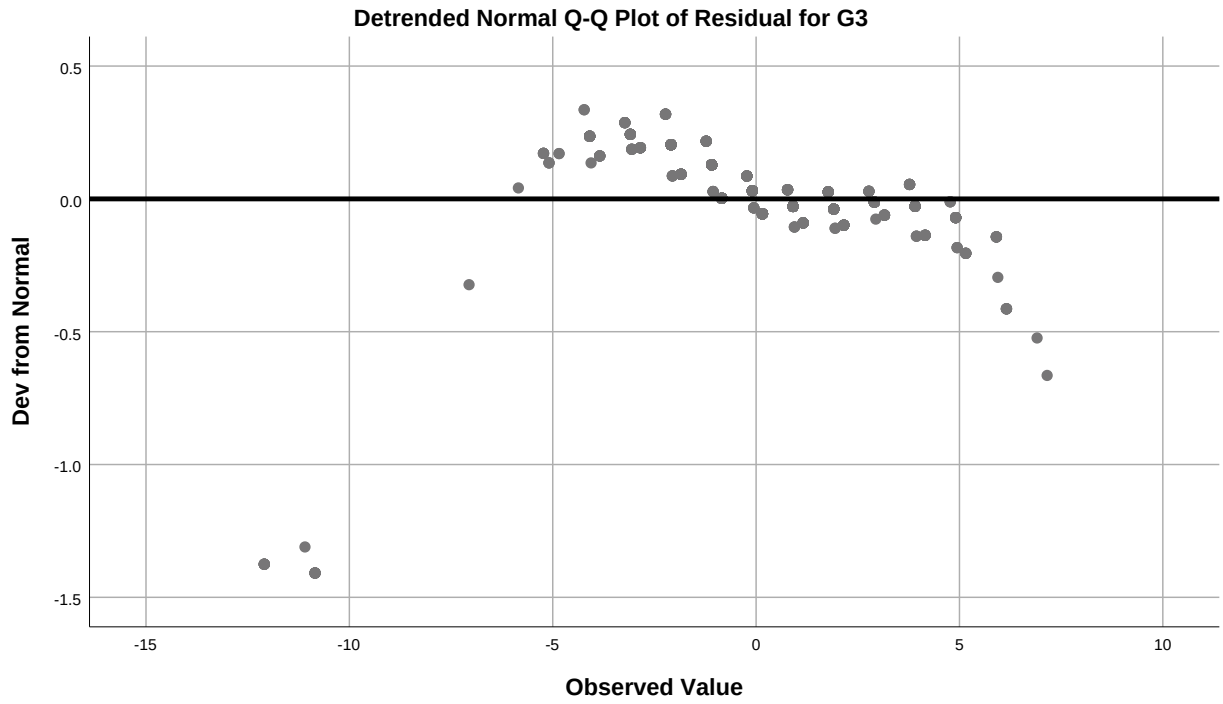
Residual for G3

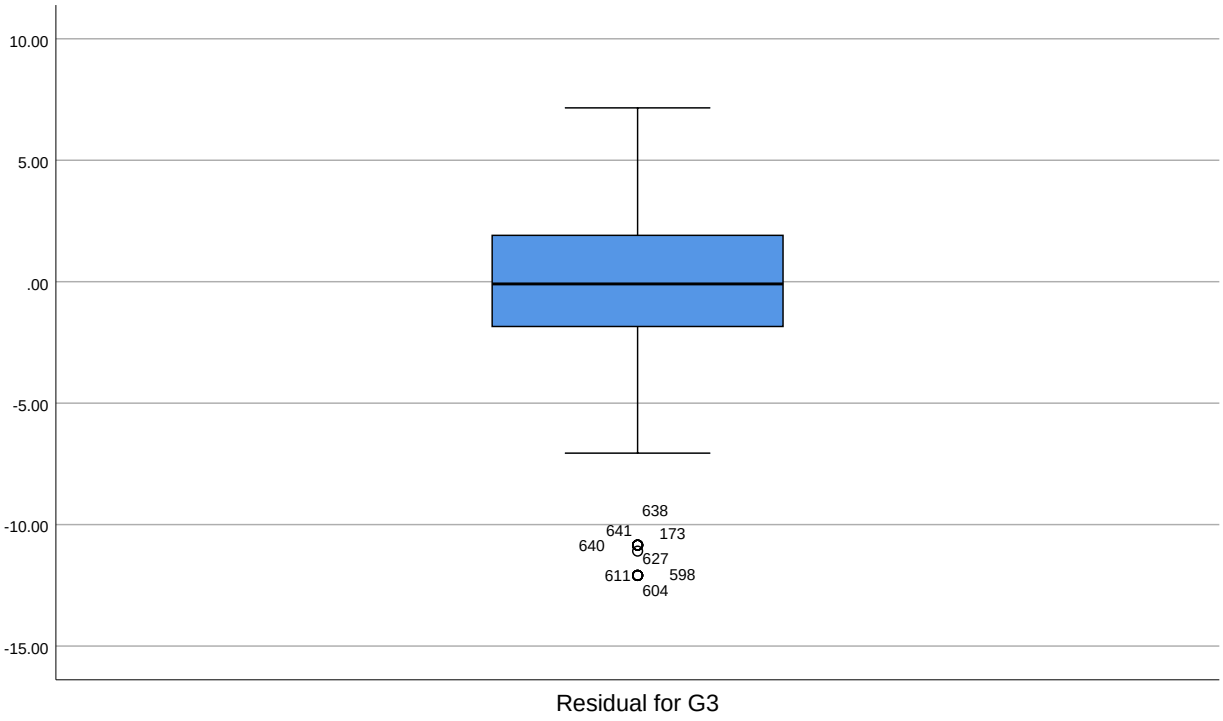
Random Effects ANOVA: Residual Diagnostics





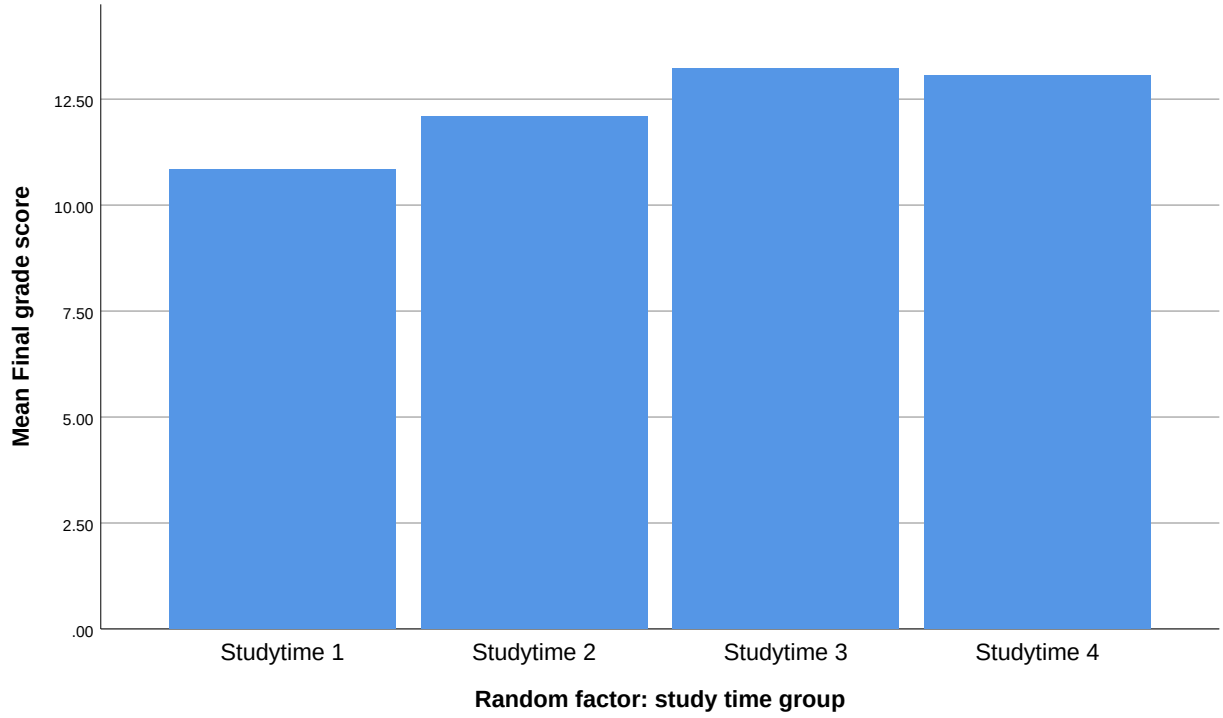
Random Effects ANOVA: Residual Diagnostics



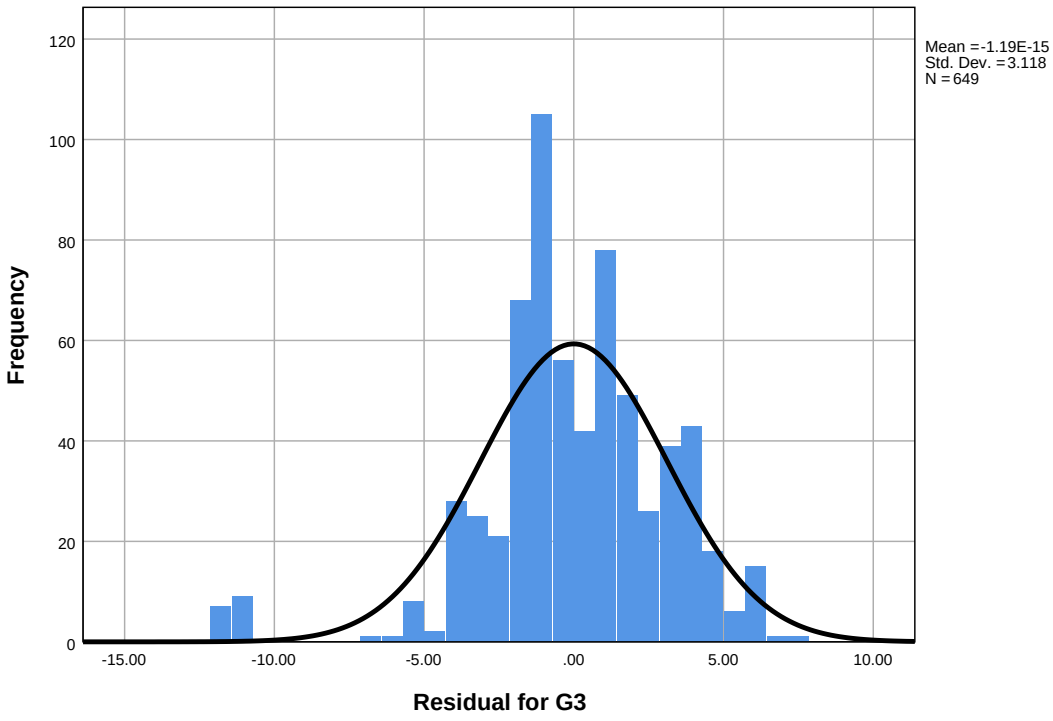


Random Effects ANOVA: Means Bar Chart

Graph



Graph


Mean =-1.19E-15
Std. Dev. =3.118
N =649
Frequency
120
100
80
60
40
20
0
-15.00
-10.00
-5.00
.00
5.00
10.00
Residual for G3