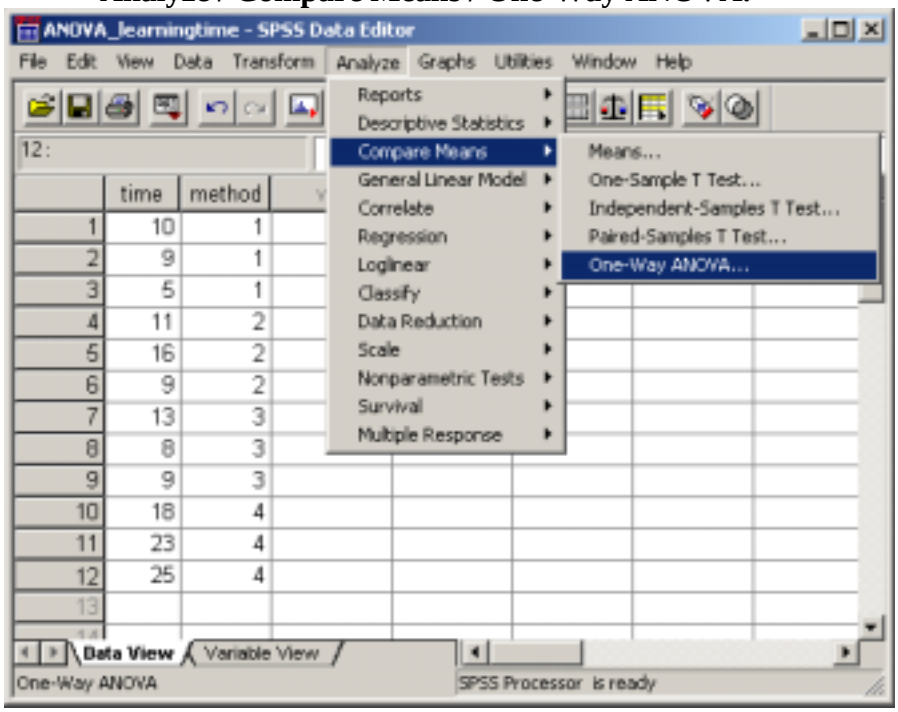
SPSS for One-Way ANOVA

Example: Evaluation of training programs.
Goal: To see if there is significant difference in learning time using different training methods.

To perform one-way ANOVA, for the data listed in the data table which contain 4 independent random samples:

1. Enter the dependent variable values and the independent variable (factor variable) values in the Date Editor. In the SPSS Data Editor sheet, it contains a data sheet for a one-way layout design with four treatment groups. The data in the following picture were scores from four treatment groups. **Method** is the factor variable and learning **time** is the dependent variable.

2. Click through the following menu selection:
   Analyze / Compare Means / One-Way ANOVA.

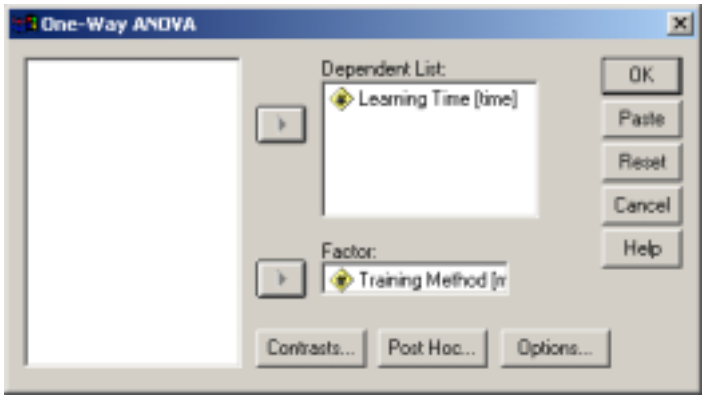


Data table: 3 observations in each sample.

Method 1	Method 2	Method 3	Method 4
10	11	13	18
9	16	8	23
5	9	9	25

Method is a treatment, group or independent variable. Learning time is the dependent variable.

3. Select the dependent or response variable and put into the **Dependent List** box, and put the method or treatment variable into **Factor** box.



4. Click **Options** button, check **Descriptive** and **Homogeneity-of-Variance box**, and click **Continue** and click **OK**.

SPSS Output:

Descriptives

Learning Time

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
M1	3	8.00	2.65	1.53	1.43	14.57	5	10
M2	3	12.00	3.61	2.08	3.04	20.96	9	16
M3	3	10.00	2.65	1.53	3.43	16.57	8	13
M4	3	22.00	3.61	2.08	13.04	30.96	18	25
Total	12	13.00	6.24	1.80	9.04	16.96	5	25

Test of Homogeneity of Variances

Learning Time

Levene Statistic	df1	df2	Sig.
.267	3	8	.848

p-value indicating equal variances

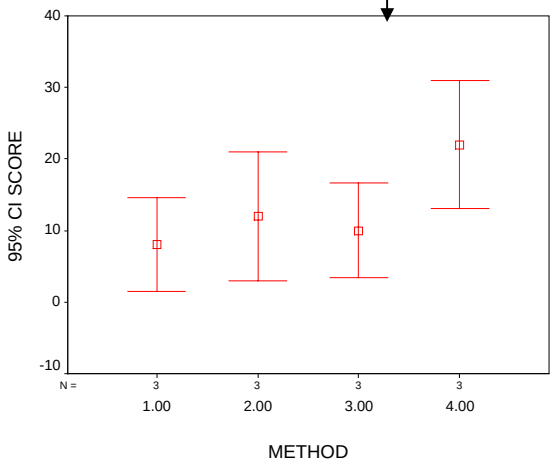
ANOVA

Learning Time

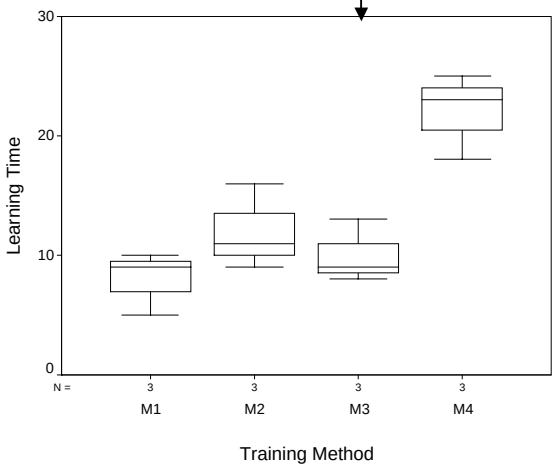
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	348.000	3	116.000	11.600	.003
Within Groups	80.000	8	10.000		
Total	428.000	11			

p-value indicating significant difference between treatment groups.

Error bar chart using SPSS graph



Side-by-side boxplot using SPSS Explore



Both error bar chart and side-by-side box plot above seem to suggest that the treatment group "four" may be significantly different from treatments 1, 2 and 3.

5. To perform multiple comparisons, in the ANOVA dialog box, click the **Post Hoc…** button and check Tukey or any other method and click **Continue** and **OK**.

SPSS produces two tables. The multiple comparisons table containing confidence intervals can help us to understand the difference between each pairs of means. If interval doesn't cover zero, it implies that the difference between the pair of means are statistically significant.

Multiple Comparisons

Dependent Variable: Learning Time

Tukey HSD

(I) Training Method	(J) Training Method	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
M1	M2	-4.00	2.58	.455	-12.27	4.27
	M3	-2.00	2.58	.864	-10.27	6.27
	M4	-14.00*	2.58	.003	-22.27	-5.73
M2	M1	4.00	2.58	.455	-4.27	12.27
	M3	2.00	2.58	.864	-6.27	10.27
	M4	-10.00*	2.58	.020	-18.27	-1.73
M3	M1	2.00	2.58	.864	-6.27	10.27
	M2	-2.00	2.58	.864	-10.27	6.27
	M4	-12.00*	2.58	.007	-20.27	-3.73
M4	M1	14.00*	2.58	.003	5.73	22.27
	M2	10.00*	2.58	.020	1.73	18.27
	M3	12.00*	2.58	.007	3.73	20.27

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

The homogenous subsets table can help us to divide the four groups into homogenous subgroups. Within each subgroup the difference in means is statistically insignificant. The difference between average learning time of Methods 1, 2 and 3 are statistically insignificant and their means are significantly different from the mean from Method 4.

Learning Time

Tukey HSD[a]

Training Method	N	Subset for alpha = .05	
		1	2
M1	3	8.00	
M3	3	10.00	
M2	3	12.00	
M4	3		22.00
Sig.		.455	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3.000.