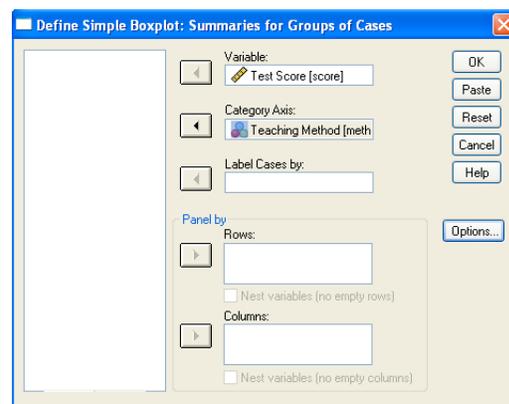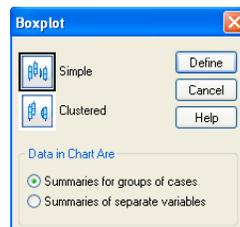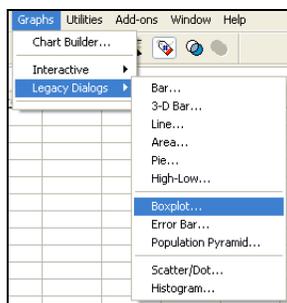# *Kruskal-Wallis Tests in SPSS*   STAT 314

Three teaching methods were tested on a group of 19 students with homogeneous backgrounds in statistics and comparable aptitudes. Each student was randomly assigned to a method and at the end of a 6-week program was given a standardized exam. Because of classroom space and group size, the students were not equally allocated to each method. The results are shown in the table below. Test for a difference in distributions (medians) of the test scores for the different teaching methods using the Kruskal-Wallis test.

Method 1	94	87	90	74	86	97	
Method 2	82	85	79	84	61	72	80
Method 3	89	68	72	76	69	65	

1. Enter the time values into one variable and the corresponding teaching method number (1 for Method 1, 2 for Method 2, 3 for Method 3) into another variable *(see figure, below)*. Be sure to code your variables appropriately.

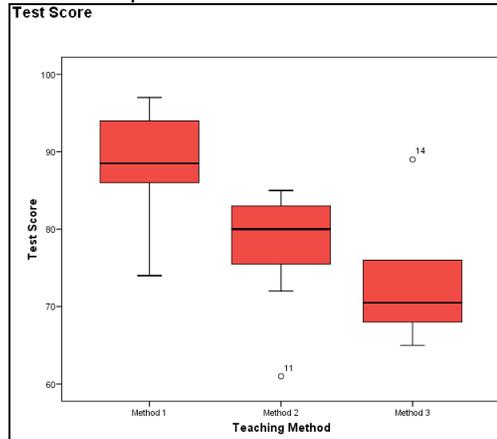|	method	score
1	Method 1	94
2	Method 1	87
3	Method 1	90
4	Method 1	74
5	Method 1	86
6	Method 1	97
7	Method 2	82
8	Method 2	85
9	Method 2	79
10	Method 2	84
11	Method 2	61
12	Method 2	72
13	Method 2	80
14	Method 3	89
15	Method 3	68
16	Method 3	72
17	Method 3	76
18	Method 3	69
19	Method 3	65

2. Now it is time to check the assumption of same shape for the treatment distributions. Select Graphs → Legacy Dialogs → Boxplot… (be sure the type is "Simple" and the data in the chart are "Summaries for groups of cases") with "Test Score" as the variable measured and "Teaching Method" as the category axis variable *(see figures, below)*. Click "OK". You may double-click the resulting boxplot to access the chart editor and adjust any display settings as desired (background color, bar width, bar color, etc.). As long as the boxes have approximately the same shape, you may continue with the Kruskal-Wallis procedure.

3. Select Analyze → Nonparametric Tests → K Independent Samples… *(see upper-left figure, below)*. Select "Test Score" as the test variable, select "Teaching Method" as the grouping factor, and select "Kruskal-Wallis H" as the test type *(see upper-right figure, below)*. Click "Define Range…" and enter the minimum value (1) as well as the maximum value (3) *(see lower-left figure, below)*. Click "Continue" to close the range definitions and then click "OK" *(see lower-right figure, below)*.

4. Your output should look like this.

NPar Tests

Kruskal-Wallis Test

Ranks

	Teaching Method	N	Mean Rank
Test Score	Method 1	6	15.0000
	Method 2	7	8.7857
	Method 3	6	6.4167
	Total	19	

Test Statistics[a,b]

	Test Score
Chi-Square	7.5023
df	2
Asymp. Sig.	.0235

a. Kruskal Wallis Test

b. Grouping Variable: Teaching Method

5. You should use the output information in the following manner to answer the question.

Step 0: **Check Assumptions**

The samples were taken randomly and independently of each other.

The populations have approximately the same shapes since the boxplots are all about the same shape.

All sample sizes are at least 6 if $k = 3$ (smallest in table is 6).

Ranks	Teaching Method	N	Mean Rank
Test Score	Method 1	6	15.0000
	Method 2	7	8.7857
	Method 3	6	6.4167
	Total	19	

Step 1: **Hypotheses**

$H_0: M_1 = M_2 = M_3$ (*The median test scores are equal.*)

$H_a:$ *Not all of the medians are equal.*

Step 2: **Significance Level**

$\alpha = 0.05$

Step 3: **Rejection Region**

Reject the null hypothesis if p-value ≤ 0.05.

Step 4: **Test Statistic**

Test Statistics[a,b]	Test Score
Chi-Square	7.5023
df	2
Asymp. Sig.	.0235

a. Kruskal Wallis Test

b. Grouping Variable: Teaching Method

Note that the test statistic (KW = Chi-Square = 7.5023) is corrected for the existence of ties in the ranks of the data.

Step 5: **Decision**

Since p-value = 0.0235 $\leq$ 0.05 = α, we reject the null hypothesis.

Step 6: **State conclusion in words**

At the $\alpha = 0.05$ level of significance, there exists enough evidence to conclude that there is a difference in the median test scores (and, hence, the mean test scores) among the three teaching methods based.