

# MPPU 1034: Application of Statistic in Educational Research

## Kruskal Wallis Test

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## The Kruskal Wallis Test

- The Kruskal Wallis test can be viewed as an alternative to One-Way ANOVA.
- The test is used to compare more than two treatments for data in ordinal scales, or data in interval and ratio scales that do not satisfy the standard assumptions of parametric tests.
- In order to use the test, the data should be able to be ranked.

## Example of Kruskal Wallis Test

A researcher conducted a research to examine students' level of self-concept of ability when taking Statistics Test. The research is conducted towards students from four classes, that is Class A, Class B, Class C, and Class D using a 5-point Likert scale question and is shown in the Table 1 in the next slide.

I cannot answer Statistics Test confidently	1	2	3	4	5	I can answer Statistics Test confidently

Perform a complete Kruskal Wallis test at 0.05 level of significance to say about students' level of self-concept of ability when taking Statistics Test of the four classes.

## Example of Kruskal Wallis Test

Table 1. Students' level of self-concept of ability when taking statistics test in 4 classes

Class A	Class B	Class C	Class D
2	1	5	2
5	4	2	4
3	4	3	5
3	3	5	3
5	2	2	1
4	2	4	4
	5	2	5
	4	5	
	5		

# 4 Steps of Kruskal Wallis Test

## Step 1: State Hypotheses

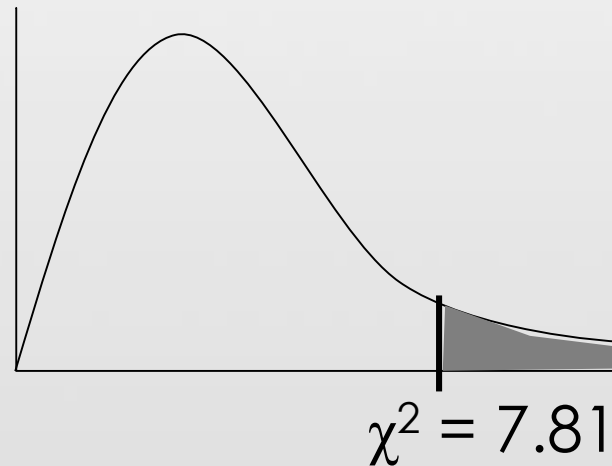
Null Hypothesis,  $H_0$ : There are no differences between students' level of self-concept of ability when taking statistics test among the four classes.

Alternative Hypothesis,  $H_1$ : There are differences between students' level of self-concept of ability when taking statistics test among the four classes.

# 4 Steps of Kruskal Wallis Test

## Step 2: Locate Critical Region

When  $\alpha = 0.05$  and  $df = k - 1 = 4 - 1 = 3$ ; where  $k$  is number of groups  
 from Chi Square table  $\rightarrow \chi^2 = 7.81$



## 4 Steps of Kruskal Wallis Test

### Step 3: Compute Kruskal Wallis H Value

1. The raw data should be arranged ascendingly as shown in the first column of the table in next slide.
2. Put number from 1, 2, 3, and so on until the last raw data as shown in the middle column of the table.
3. The ranked data formula is

$$\frac{\text{Sum all number of the middle column of the same raw data}}{\text{The frequency of the same raw data}}$$

e.g: ranked data for raw data of 1 =  $(1 + 2)/2 = 1.5$

# 4 Steps of Kruskal Wallis Test

## Step 3: Compute Kruskal Wallis H Value

Raw Data		Ranked Data
1	1	1.5
1	2	1.5
2	3	6
2	4	6
2	5	6
2	6	6
2	7	6
2	8	6
2	9	6
3	10	12
3	11	12
3	12	12
3	13	12
3	14	12
4	15	18

Raw Data		Ranked Data
4	16	18
4	17	18
4	18	18
4	19	18
4	20	18
4	21	18
5	22	26
5	23	26
5	24	26
5	25	26
5	26	26
5	27	26
5	28	26
5	29	26
5	30	26



## 4 Steps of Kruskal Wallis Test

### Step 3: Compute Kruskal Wallis H Value

	Class A	Class B	Class C	Class D	
Ranked Data	6	1.5	26	6	<b>N = 30</b>
	26	18	6	18	
	12	18	12	26	
	12	12	26	12	
	26	6	6	1.5	
	18	6	18	18	
		26	6	26	
		18	26		
		26			
		<b>100</b>	<b>131.5</b>	<b>126</b>	<b>107.5</b>
	<b>6</b>	<b>9</b>	<b>8</b>	<b>7</b>	<b>n</b>

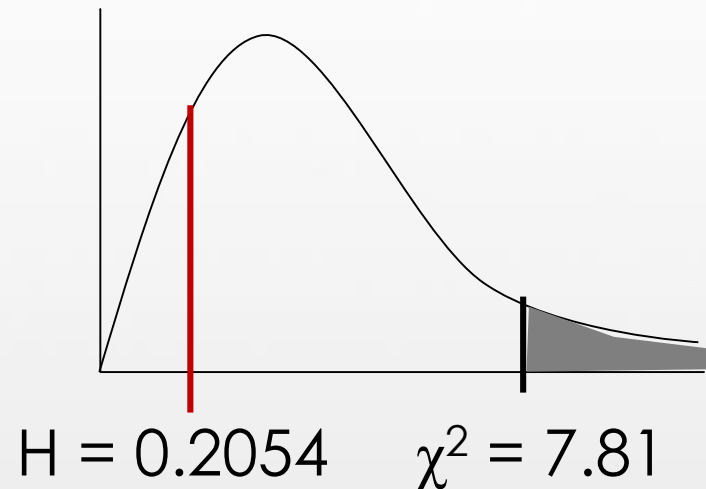
## 4 Steps of Kruskal Wallis Test

### Step 3: Compute Kruskal Wallis H Value

$$\begin{aligned}
 H &= \frac{12}{N(N+1)} \left( \sum \frac{T_i^2}{n_i} \right) - 3(N+1) \\
 &= \frac{12}{30(31)} \left( \frac{100^2}{6} + \frac{131.5^2}{9} + \frac{126^2}{8} + \frac{107.5^2}{7} \right) - 3(31) \\
 &= \underline{0.2054}
 \end{aligned}$$

## 4 Steps of Kruskal Wallis Test

### Step 4: Make Decision



Since  $H$  lies outside the critical region, we do not have enough evidence to reject the null hypothesis.

Therefore, there are no differences between students' level of self-concept of ability when taking statistics test among the four classes,  $\chi^2(3) = 0.2054$ ,  $p > 0.05$ .

# Kruskal Wallis Test using SPSS

Table 2. Descriptive statistics

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>50<sup>th</sup> (Median)</b>
SCAbility	30	1	5	4.0
Class	30	1	4	2.5

# Kruskal Wallis Test using SPSS

Table 3. Ranks

	<b>Class</b>	<b>N</b>	<b>Mean Rank</b>
<b>SCAbility</b>	1	6	16.67
	2	9	14.61
	3	8	15.75
	4	7	15.36
	Total	30	

# Kruskal Wallis Test using SPSS

Table 4. Test statistics

	<b>SCAbility</b>
Chi-Square	.218
df	3
Asymp. Sig	.975

## Kruskal Wallis Test using SPSS

Since the significance value,  $p = 0.975$ , greater than alpha value of 0.05, we failed to reject the null hypothesis. Therefore, there are no differences between students' level of self-concept of ability when taking statistics test among the four classes,  $\chi^2(3) = 0.2054$ ,  $p = 0.975$ .

# Thank You