

TWO WAY ANOVA - To check Interaction effect of 2 or more Independent categorical variables to one dependent continuous variable.

What does "One-Way" or "Two-Way" ANOVA Mean?

→ A Two way ANOVA is an extension of One Way ANOVA.

→ One way or two way refers to numbers of Independent Variables (IV) in ANOVA.

→ One-way has one independent variables (with 2 or more Groups / levels)

Eg - IV (Teaching Variable) → Levels (1. Lecture Method, 2. Lecture-cum-Demonstration  
3. Video based learning)

→ Two-way has two independent variables (with 2 or more Group/levels).

Eg - IV's (Teaching Method & Intelligence) → Levels (1. Lecture Method 2. Lecture -Demonstration  
3. Video based learning)  
(1. High, 2. Average, 3. Low)

→ With a One-way, we have one independent variable affecting a dependent variable.

It means by which means student achieve highest marks in exam.

Independent variable → way of teaching, Dependent Variable → Marks scored in exam.

Lecture Method	Lecture cum demonstration	Video base learning	(Main effect)
89	80	100	
61	92	91	
73	91	63	
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→ Two-way anova, there are two independent variables.

(Interaction effect)	Lecture Method   Lecture cum demonstration   Video based learning		
	High	95, 51, 78, 36	89, 59, 23
Average	76, 25, 47, 88, 19	59, 49, 75, 69	52, 71, 63
Low	35, 79, 19	41, 77, 45, 27	61, 75

H<sub>0</sub>: There is no significant independent effect of IV<sub>A</sub> on DV. Teaching effect → Exam score.  
(Main effect) (Independent var) (Dependent var)

H<sub>0</sub>: There is no significant independent effect of IV<sub>B</sub> on DV. Intelligence → Exam score.  
(Main effect) (Independent var) (Dependent var)

H<sub>0</sub>: There is no significant interaction effect of IV<sub>A</sub> & IV<sub>B</sub> on DV. Teaching method  
(Interaction effect) → Exam score.

Summary table for Two-way ANOVA.

Source of Variation	df	SS	MSS	F-calculated	From F <sub>1</sub> , F <sub>2</sub> and F <sub>3</sub> we can conclude which null hypothesis to accept.
IV A .	Column-1 (C-1)	SS <sub>BA</sub>	MSS <sub>BA</sub>	F <sub>1</sub>	
IV B .	Rows-1 (R-1)	SS <sub>BB</sub>	MSS <sub>BB</sub>	F <sub>2</sub>	
Interaction A × B .	(C-1)(R-1)	SS <sub>Int</sub>	MSS <sub>Int</sub>	F <sub>3</sub>	
Cells	No of cell-1	SS <sub>Cell</sub>			
Within	N-No of cell	SS <sub>W</sub>	MSS <sub>W</sub>		
Total	N-1	SST			

Assumptions - i) Dependent Variable should be continuous (Teaching, Intelligence)  
(Marks) ii) Independent variable should be categorical.  
iii) Sample Independence - Each sample has been drawn independent of other samples.  
iv) Variance equality - Variance of each group should be same. v) Normally distributed population.