# What is the definition of explanatory and response variables and what are some examples?

Authored by

**stats writer**

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Explanatory and response variables are important concepts in statistical analysis that help to understand and explain the relationship between two or more variables. The explanatory variable, also known as the independent variable, is the variable that is manipulated or controlled in order to analyze its effect on the response variable. On the other hand, the response variable, also known as the dependent variable, is the variable that is measured or observed in response to changes in the explanatory variable.

For example, in a study examining the effect of exercise on weight loss, the amount of exercise would be the explanatory variable and the weight loss would be the response variable. By manipulating the amount of exercise, we can observe its effect on weight loss, which is the response variable.

In another example, in a study investigating the impact of education on income, the level of education attained would be the explanatory variable, while the income earned would be the response variable. By varying the level of education, we can analyze its impact on the income earned, which is the response variable.

Overall, explanatory and response variables are critical in understanding the relationship between different variables and are often used in research studies and data analysis.



## Explanatory & Response Variables: Definition & Examples

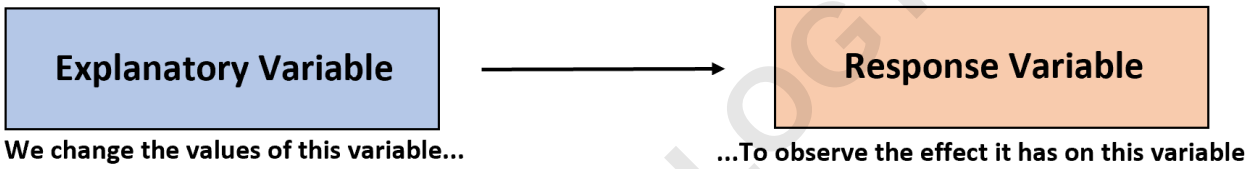
## Two of the most important types of variables to understand in statistics are explanatory variables and response variables.

## Explanatory Variable: Sometimes referred to as an *independent variable* or a *predictor variable*, this variable explains the variation in the response variable.

## Response Variable: Sometimes referred to as a *dependent variable* or an *outcome variable*, the value of

this variable responds to changes in the explanatory variable.

In an experimental study, we're typically interested in how the values of a response variable change as a result of the values of an explanatory variable being changed.




The following examples show different scenarios involving explanatory and response variables.

### Example 1: Plant Growth

A botanist wants to compare the effect that two different fertilizers have on plant growth. She randomly selects 20 plants from a field and applies fertilizer A to them for one week. She also randomly selects another 20 plants from the same field and applies fertilizer B to them for one week. After one week she measures the average plant growth for each group.

**In this example, we have:**

**Explanatory Variable: Type of fertilizer. This is the variable we change so that we can observe the effect it has on plant growth.**

**Response Variable: Plant growth. This is the variable that changes as a result of the fertilizer being applied to it.**

***Fun Fact: We would use a two sample t-test to perform this experiment.***

**Example 2: Max Vertical Jump**

**A basketball coach wants to compare the effect that three different training programs have on player's max vertical jump. He randomly assigns 10 players to use training program A for one week, another 10 players to use training program B for one week, and another 10 players to use training program C for one week. At the end of the week he measures the max vertical jump of each player to see if there are significant differences between the groups.**

**In this example, we have:**

**Explanatory Variable: Type of training program used. This is the variable we change so that we can observe the effect it has on max vertical jump.**

**Response Variable: Max vertical jump. This is the variable that changes as a result of the training program used by the player.**

### Example 3: Real Estate Prices

**A real estate agent wants to understand the relationship between square footage of a house and selling price. She collects data about square footage and selling price for 100 houses in her city and analyzes the relationship between the two variables.**

**In this example, we have:**

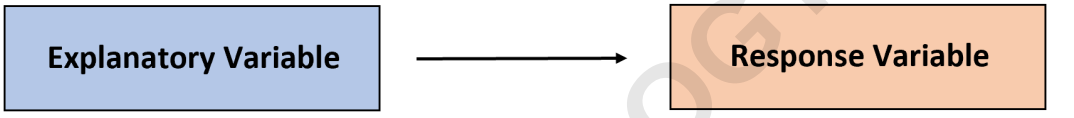
**Explanatory Variable: Square footage. This is the variable that we observe change in so that we can observe the effect it has on selling price.**

**Response Variable: Selling price. This is the variable that changes as a result of the square footage of the house being changed.**

***Fun Fact: We would use simple linear regression to perform this experiment.***

## Summary

**In each of the examples above, we changed the values of some explanatory variable and observed the resulting change in values of some response variable.**




We change the values of this variable... ...To observe the effect it has on this variable

Example 1: We change the type of fertilizer used... ...To observe the effect it has on plant growth

Example 2: We change the training program used... ...To observe the effect it has on max vertical jump

Example 3: We change the square footage... ...To observe the effect it has on house selling price