

Experimental Design

- An ***experiment*** is a process or study that results in the collection of data. The results of experiments are not known in advance. Usually, statistical experiments are conducted in situations in which researchers can manipulate the conditions of the experiment and can control the factors that are irrelevant to the research objectives.
- ***Experimental design*** is the process of planning a study to meet specified objectives. Planning an experiment properly is very important in order to ensure that the right type of data and a sufficient sample size and power are available to answer the research questions of interest as clearly and efficiently as possible.
- ***Blocks*** are groups of experimental units that are formed to be as homogeneous as possible with respect to the block characteristics. The term block comes from the agricultural heritage of experimental design where a large block of land was selected for the various treatments, that had uniform soil, drainage, sunlight, and other important physical characteristics. Homogeneous clusters improve the comparison of treatments by randomly allocating levels of the treatments within each block.

Types of Effects

Effect An effect is a change in the response due to a change in a factor level. There are different types of effects. One objective of an experiment is to determine if there are significant differences in the responses across levels of a treatment (a fixed effect) or any interaction between the treatment levels. If this is always the case, the analysis is usually easily manageable, given that the anomalies in the data are minimal (outliers, missing data, homogeneous variances, unbalanced sample sizes, and so on).

Random Effect A random effect exists when the levels that are chosen represent a random selection from a much larger population of equally usable levels. This is often thought of as a sample of interchangeable individuals or conditions. The chosen levels represent arbitrary realizations from a much larger set of other equally acceptable levels.