Design of Research Studies-SST 501

Assignment One

**The Question:-**

The following are the factor determining replication in an experiment. Discuss. (20 marks)

• Uniformity of experimental units

• Experimental designs

• Degree of precision required

• Number of treatments

• Time allotment

• Cost and availability of funds or resources

**Uniformity of Experimental Units:-**

An experimental unit is that which receives the treatment. Uniformity of experimental units or having homogeneous experimental units reduces experimental error which in turn increases the precision of the experiment. Experimental error is the variability in the outcome among identically and independently treated experimental units.

Since experimental error arises from natural or inherent differences between experiment units having uniform experimental units minimizes the occurrence of an experimental error .

**Experimental designs:-**

Having a definitive and clear cut experimental design determines the nature of replication that will occur all through the experiment. Different experimental designs require different means of measurement. Hence variability in the measurement process should be avoided at all means since naturally that will lead to the existence of an experimental error. A clear cut means of standardizing the measurement process is through having a definitive experimental design which is done by defining if the observed differences among the treatments included in the experiment are due only to change or whether the size of these differences is of practical importance.

**Degree of precision required:-**

Precision is the closeness to one another of a set of separated measurements of a quantity. Precision is independent of accuracy where accuracy is the closeness of a measured value to a standard or known value.

Before data collection begins, specific questions that the experiment plans to examine must be clearly identified. In addition, the experiment should identify the sources of variability in the experimental conditions. One of the main goals of an experiment is to partition the effects of the sources of variability into distinct components in order to examine specific questions of interest. The objective of the experiments is to improve the degree of precision(reduce scatter) of the results in order to examine the research hypotheses and get an accurate overall picture of the experiment.

**Number of treatments:**

The number of replications to be used is one of the critical questions that should be answered in experimental design. For the experiment to be effective it should allow for the precise comparison to be made. The comparison is best compared when the variance is small or high number of replications since the standard error of treatment mean as calculated by the formula



The bigger the n the small the sigma hence the smaller the standard error .When the standard error is small it means more precision. So replication units will be determined by the precision required and the available resourced.

**Time allotment:-**

The time allocation of an experiment is a crucial aspect of any experiment. It is important to first acknowledge that time may or may not be an important variable to keep track of depending on the nature of the experiment at hand. However this should be clearly defined on the experiment design. Time allocation for a experimental unit should be held constant all through so as not to skew the results of the experiment. Time allocation and management is an important component of experimental design because if not handled correctly it will inevitably lead to an experimental error or even a lack of precision of the replication. Proper prior knowledge of the treatment is paramount since it determines the allocation time. The time should not be sped up or overly done since it will nullify the purpose of the experiment.

**Cost and availability of funds or resources:-**

Taking into consideration the cost and availability of resources to fund the experiment is an important component of the experiment. An experiment will inevitably need some cost of funding in order to be done. These costs can be estimated well in advance so that the researcher can appropriately gauge the viability of the experiment economically. If the cost of the experiment is too high and corresponding funds are not readily available then the experiment will be a big failure due to the fact that there will be some cut backs in order to 'fit' the experiment into the available funds. This may happen by not using enough replications to investigate the treatment on the different experiment units.