

**For the students of**  
**M. Com. (Applied Economics) Sem IV**  
**Research Methodology (Unit II)**

Note: Study material may be useful for the courses wherever Research Methodology paper is being taught.

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**Experimental or Causal Research Design**

It's a kind of research design which is used to obtain the evidence of cause and effect relationship between two or more than two variables, where one/some variable/s would be the Dependent and another/rest of the variable would be Independent ones. Under this research, the researcher deliberately manipulates the level or nature of dependent variable in order to see its effect on dependent variable.

Before we discuss this design in detail, students must understand the **terminology** used here, as under:

**1. Experiment:**

An experiment is designed when one or more independent A variables are manipulated and their effects are measured on one or more dependent variables, while controlling for the effect of extraneous variables.

**2. Independent Variables:**

Independent variables are variables or alternatives that are manipulated. The levels of these variables are changed by the researcher deliberately and their effects are measured and compared. These variables are also known as treatments.

**3. Dependent Variables:**

Dependent variables are the variables that measure the effect of the independent variables on the test units. These variables may include farm production, sales, income, profit, performance, motivation etc.

**4. Experiment:**

An experiment is designed when one or more independent variables are manipulated and their effects are measured on one or more dependent variables, while controlling for the effect of extraneous variables.

**4. Test Units:**

Test units are individuals, organizations, or other entities on which some experimental exercise (treatment) is administered and whose response to the independent variables or treatments is being examined. Test units may include consumers, personnel, students, agriculture land or any object used for experimentation.

### **5. Experimental and Control Group**

For the purpose of experimentation when a group of test units is selected on random or non-random basis and exposed to a specific treatment, it is called experiment group. At the same time another group consisting the similar type of units (homogeneous group) is selected in the same manner but it is not given any treatment it is called Control Group.

### **5. Extraneous Variables:**

Extraneous variables are all variables other than the independent variables that affect the response of the test units. These variables can confound the dependent variable measures in a way that weakens or invalidates the results of the experiment. In case of experimentation with regard to examining the effect of a new medicine on a patient, the extraneous variable may be the diet or life style of the patient which can also affect the results of the medical treatment. These variables, which are not under consideration in the present research have to be controlled.

We can clearly understand the experimental research design with the help of following **illustrations:**

For example, a special coaching class of one month is provided to the student of a higher class for assessing its effect on their knowledge. Here, conducting special coaching class and then a test for assessing their knowledge is an act of experimentation because it is done deliberately or purposely. Coaching class is the independent variable and knowledge level is the dependent variable. Students have been treated as test units or experimental group.

Another example of farm output can be taken where a new variety of seed of wheat is used for assessing its effect on productivity. In this case applying new variety of seed and measuring the output is an act of experimentation. The dependent variable is the variety of seed and independent variable is crop output of the selected farm unit. The test unit in this case is the sample of a farm or number of farms of the same size on which experimentation has to be conducted.

### **Utility of the Research Design**

This research design is **useful** in cases where researcher wants to:

- (i) find out which variables are the causes and which are the effect
- (ii) ascertain the nature and degree of the relationship between the said variables

(iii) make prediction about the dependent variable with respect to associated independent variable

(iv) assess the effectiveness or motivation (dependent variable) on the respondents (Test Unit/Experimental group) of the manipulation in the independent variable.

## **Types of Experimental Design:**

**I. Pre-experimental designs:** These are the research designs which do not employ randomization procedures to control for extraneous factors. These include the one-shot case study, the one-group pretest-posttest design, and the static-group.

### **1. One-Shot Case Study:**

$X \quad O_1$

In this method a single group of test units is exposed to a treatment  $X$  and a single measurement for knowing the effect of this treatment on the dependent variable is taken as  $O_1$ . The selection of test units is not on random basis.

### **2. One-Group Pretest-Posttest Design**

$O_1 \quad X \quad O_2$

Under this method also only one group is taken without random assignment of test units and level of dependent variable is measured twice before and after the treatment.

$O_1$  and  $O_2$  are the measured value before and after the experiment is done. There is no control group. The treatment effect is computed as  $O_2 - O_1$ .

### **3. Static Group Design**

EG:  $X \quad O_1$

CG:  $O_2$

It is a two-group experimental design, however test units are assigned to these groups without randomisation. The experimental group (EG) is exposed to the treatment, and the control group (CG) is kept aside and no treatment is given. Measurements on both groups are made only after the treatment. The treatment effect would be measured as  $O_1 - O_2$ .

## **II. True experimental designs**

In these designs the researcher can randomly assign test units to experimental groups as well as control group and then gives treatments to only experimental group. These

designs include pretest-posttest control group design, the posttest-only control group design, and the Solomon four-group design.

### 1. Posttest-Only Control Group Design:

EG :  $R \quad X \quad O_1$

CG :  $R \quad O_2$

In this research design, out of the elements in the parent population test units are randomly assigned to both the groups i.e. experimental and the control group. Thereafter treatment is given to only experimental group, while control group remains unattended. Then measurement of dependent variable is done for both the groups.

The treatment effect is obtained by:  $TE = O_1 - O_2$

### 2. Pretest-Posttest Control Group Design

EG:  $R \quad O_1 \quad X \quad O_2$

CG:  $R \quad O_3 \quad O_4$

In this design, out of the elements in the parent population test units are randomly assigned to both the groups. A pretreatment measure is taken on each group written as  $O_1$  and  $O_3$ . Then the treatment treatment is given to only experimental group. Again a post treatment level of the test units is measured as  $O_2$  and  $O_4$ . For measuring the Treatment Effect (TE) we apply the formula:

$$(O_2 - O_1) - (O_4 - O_3).$$