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1. Learning Outcomes

After studying this module, you shall be able to

- Know how to design a research
- Learn different types of research designs
- Identify which type of design applies to which kind of problem under investigation
- Evaluate the merits and limitations of each research design

2. Introduction

As soon as we see a beautiful, well-constructed building, human potential at creating such wonders amazes us. The skyscrapers, the revolving restaurants, the wonders of the world and even the simplest of all these, our own homes have a lot of thinking behind them. Before any building gets constructed, a layout of how it is to be constructed is made, is formulated in the form of a map. On a sheet of paper a skyscraper gets drawn, modified and finalized. This becomes the guiding plan for the constructor and the laborers involved in building that piece of work. Just as we have a plan for construction of buildings, we also have a layout or plans for doing a research. This plan is termed as research design.

3. Research Design

3.1 Meaning of Research Design

A research design is the blueprint of the detailed procedures of testing the hypotheses, collection and analyses of data so as to combine the relevance to the research purpose with economy in the procedure. It is a sequence of steps carried out before beginning the actual research to ensure that the relevant and appropriate data will be collected. This preparation permits objective analysis of the hypotheses formulated in correspondence to the research problems. It enables the researcher in testing the hypotheses by arriving at valid and objective inferences regarding the relationship between independent and dependent variables. It is the conceptual structure within which research is conducted and is an outline of what the researcher will do beginning from writing the hypothesis, its operational implications to the final analysis of data.

3.2 Purpose of Research Design

The function of a research design is to provide maximum amount of information relevant to the problem under investigation in a minimum cost.

- ❖ It answers research questions objectively, validly and economically by suggesting the researcher as to how to collect the data for testing hypotheses, variables that should be made control variables and methods of manipulation appropriate in the context of current investigation, type of statistical analyses to be followed and the possible answer to the research problems. Thus, it enables the researcher to systematically arrive at a valid and objective answer to research questions.

- A research design also acts as a control mechanism and it controls unwanted variances: experimental, error or extraneous variance.
- A good and well planned research design:

    - Enhances reliability of results produced
    - Gives a strong foundation to the investigation
    - Helps researcher organize his/her ideas
    - Helps researcher critically evaluate the flaws and inadequacies in the process
    - Can be given to others for critical evaluation and a comprehensive review of the study

3.3 Questions answered by Research Design

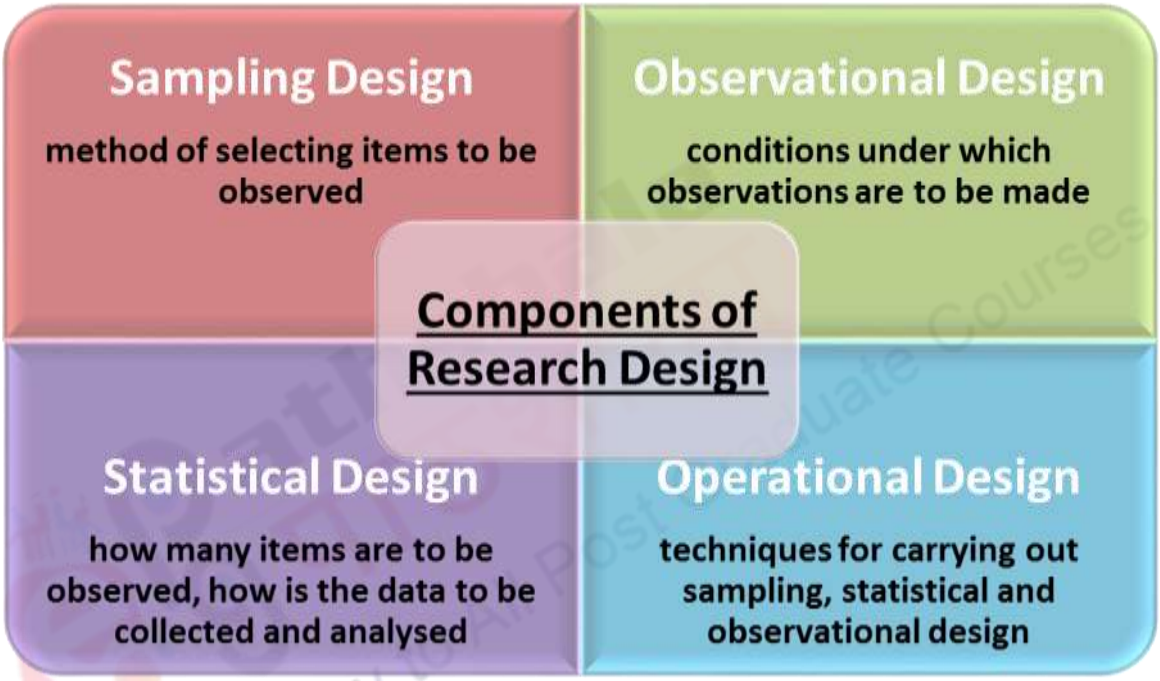
The research design looks at:

- Topic under investigation
- Purpose of the investigation
- Location for conducting the study
- Type of data required
- Place for collecting the required data
- Time period of the study
- Sample design
- Techniques of data collection
- Techniques of data analysis
- Style of report preparation
- Time and cost of the study

3. Dynamics of Research Designs

3.1 Components of Research Design

A good research design should have the following components:



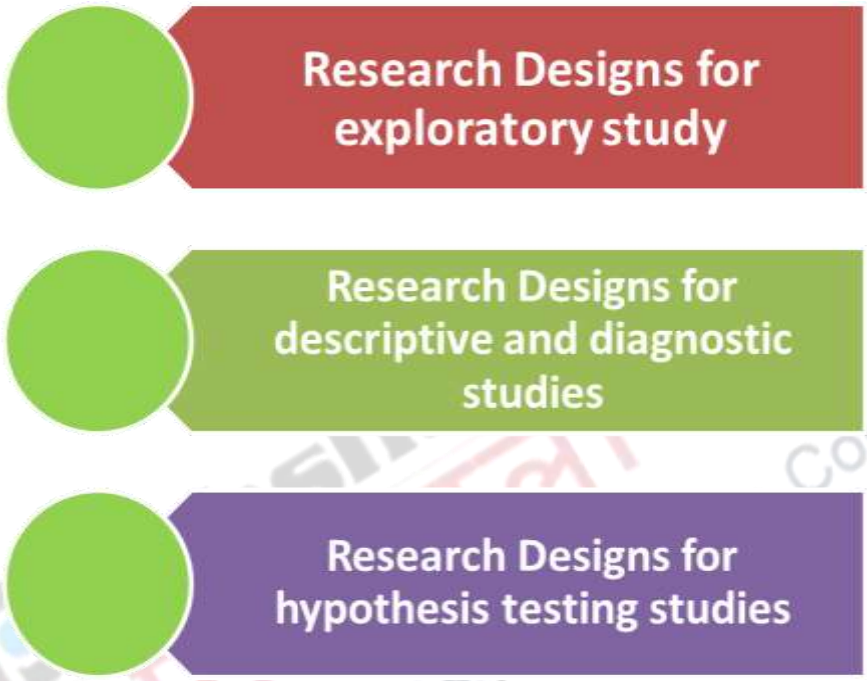
3.2 Features of Research Design

A good research design has the following characteristics:

- Minimizes bias, maximizes reliability of data collected and analyzed
- Gives smallest experimental error
- Provides maximum information
- Gives opportunity for viewing different aspects of the problem

A good research design should consider the process of carrying out the study. For instance, research design must be flexible to consider different perspectives of the phenomenon if the study is exploratory in nature. When association between variables is being established and accurate description of a situation is required, research design must minimize bias and maximize reliability of collected data. Where hypotheses are to be tested, the research design should permit inferences about causality apart from reducing bias and increasing reliability.

4. Types of Research Designs



4.1.1 Research Designs for Exploratory Study

Also called formulative research studies, they intend to formulate a problem for developing a working hypothesis from an operational perspective to carry out a more precise investigation. It emphasizes discovery of ideas, insights and considering different aspects of a problem under study.

The purpose to formulate a research problem could be by surveying concerned literature, reviewing hypotheses stated by previous researchers, evaluating their usefulness for future research and may build upon existing work or formulate a new relevant hypothesis.

Another method to formulate a research problem is through surveying people who have had practical experience with the problem to be studies. By interviewing them, issues and questions not previously thought about by the investigator may be raised and practical possibilities of doing different types of research may be discovered.

For suggesting hypotheses, intensive study of certain instances of a phenomenon of interest may be selected by examining existing records or unstructured interviewing which stimulates insight through a unified interpretation. These instances may be those that provide sharp contrasts or have striking features.

4.1.2 Research Design for Descriptive and Diagnostic Studies

Such studies describe the characteristics of an individual, group or determine the frequency with which something occurs or its association with something else. The former are concerned with specific predictions, narration of facts and individual or group characteristics. The latter are concerned with establishing associations between variables.

In such studies, the objectives must be clearly specified, methods must be carefully selected for collecting data keeping in mind their merits and limitations. Precautions must be taken to minimize bias and unreliability. Structured instruments which are unambiguous and minimize personal opinion are taken as the observers are involved in collecting data. These observers must be trained well and supervised as they collect as well as record information. Appropriate statistical analyses and tests of significance should be used to draw conclusions to maximize reliability.

4.1.3 Research Design for Hypothesis Testing Studies

These are experimental studies involving a test of causal relationship between variables. It reduces bias, increases reliability and allows drawing inferences about the causality.

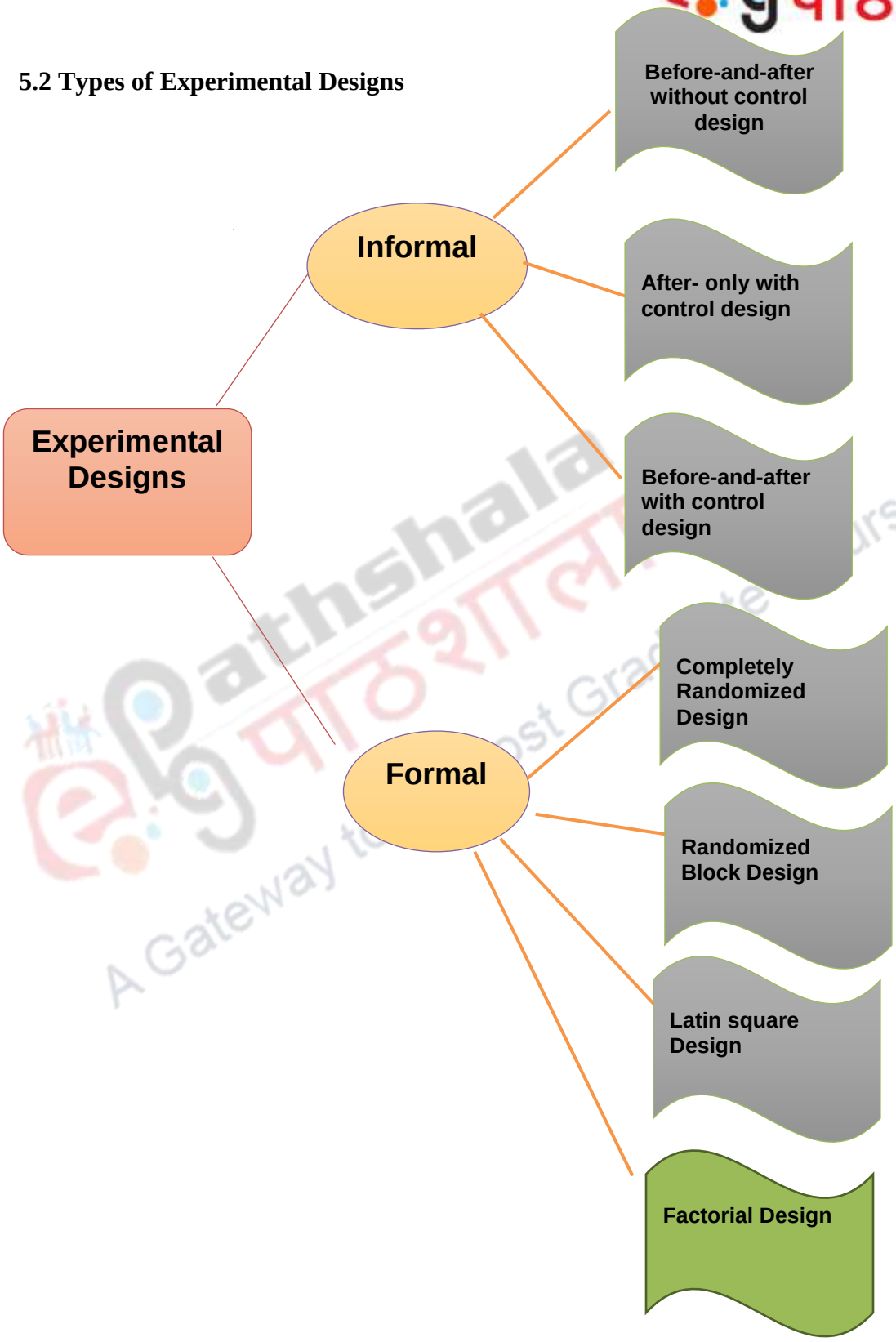
5. Experimental Design

5.1 Principles

There are three principles of experimental design:

- ✓ *Principle of Replication*: to increase the statistical accuracy of the experiments, each treatment is applied in many experimental units than just one. Temporally repeating the experiment also establishes the accuracy of the results. For example, studying the effect of two types of drugs on patients of depression coming to various clinics in Delhi and not just on the patients in one hospital.
- ✓ ***Principle of Randomization*:** it protects against effect of extraneous factors attributing them to chance. For instance, in the case of depression some patients may be suffering from mild and some from severe form of depressions. So, the effect of medicine will vary and hence the results might not be realistic. To better estimate the experimental error we may randomly take participants for the study which may include a wide range of patients.
- ✓ ***Principle of Local Control:*** the extraneous factor or the known source of reliability is made to vary deliberately to as wide range as necessary so that the variability it causes can be measured and eliminated from experimental error. For instance, in the same example, the state of Delhi can be divided into homogenous parts or blocks and the block may then be divided into parts equal to the number of treatments and the treatments thereafter may be randomly assigned to these blocks.

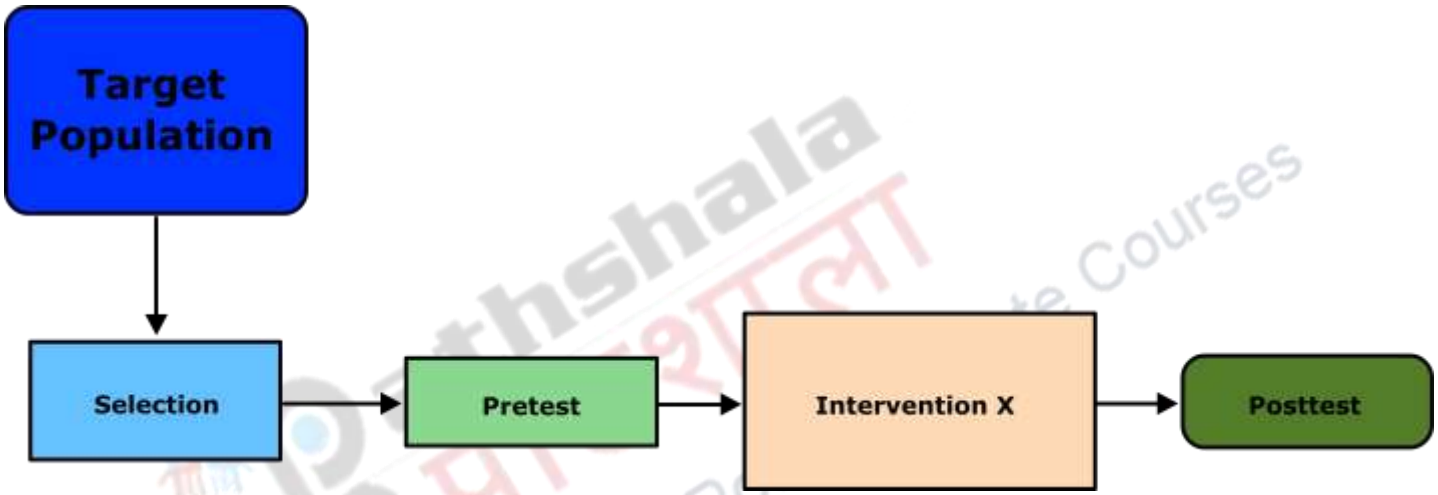
5.2 Types of Experimental Designs



5.2.1 Before-and-After without control design

It involves a single test group or area and dependent variable is measured before introducing the treatment. Thereafter the treatment is introduced and the dependent variable is again measured after introducing the treatment. It can be represented as:

Effect of Treatment = level of phenomenon after treatment - level of phenomenon before treatment



For instance, comparing the performance of a selected group of students before and after they receive remedial education classes.

The difficulty with this kind of a design is that with time extraneous variations may also come in the treatment effect and this differentiation may appear difficult.

5.2.2 After-only with Control Design

It involves selection of two groups or areas i.e. the test area and control area. The treatment is introduced only in the test area. The dependent variable is measured thereafter in both the areas simultaneously. Treatment impact can be represented as:

Treatment effect= Value of dependent variable in test area - Value of dependent variable in control area

For instance, studying the effect of a new medicine on patients suffering from schizophrenia who have not been taking any medication, in the experimental group and the control group becomes

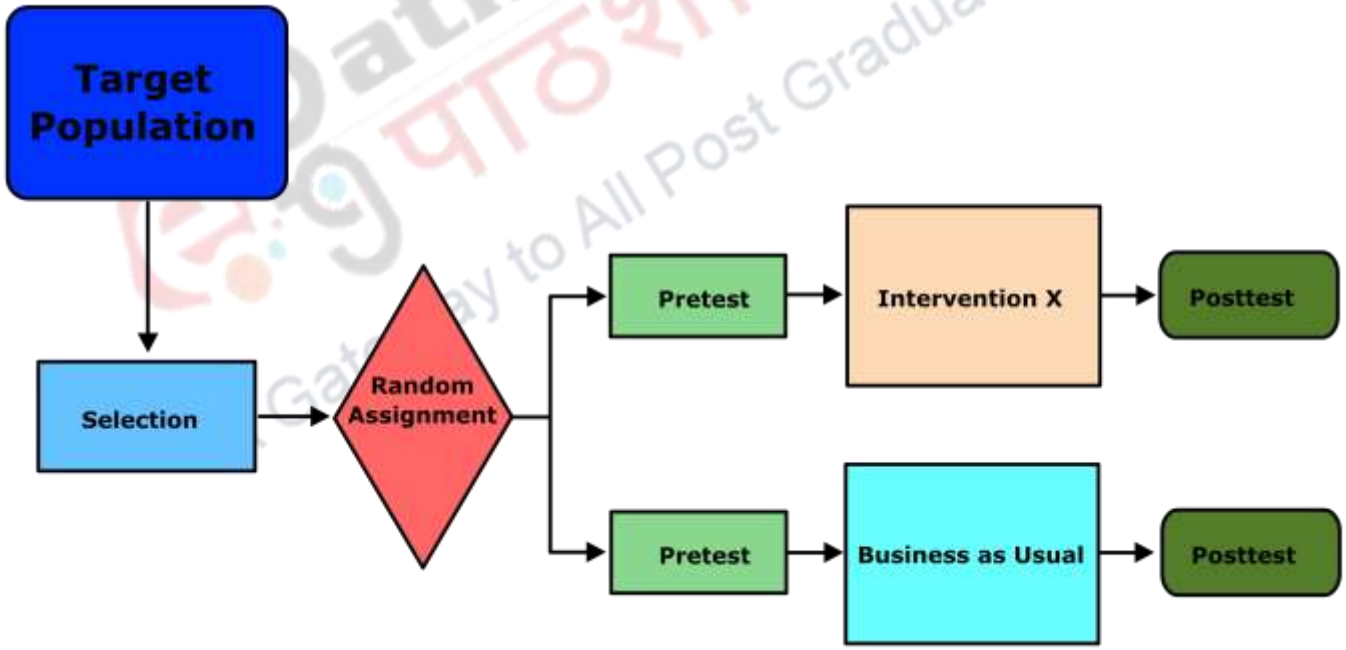
the patients who are living their lives as usual with the illness without any treatment. A comparative assessment is made to study the impact of the new drug introduced.

This design assumes that the control and test group are same with respect to their behavior towards the phenomenon considered. If this assumption is not true, extraneous variation might interfere in the treatment effect. But the advantage is that data can be collected without any problem coming with passage of time.

5.2.3 Before-and- After with control design

It involves selection of two areas and measurement of the dependent variable in both the areas for the same time period before the treatment is introduced. Treatment is then introduced only in the test area and dependent variable is measured in both after specific time period.

Effect of Treatment = Change in dependent variable in test area - Change in dependent variable in control



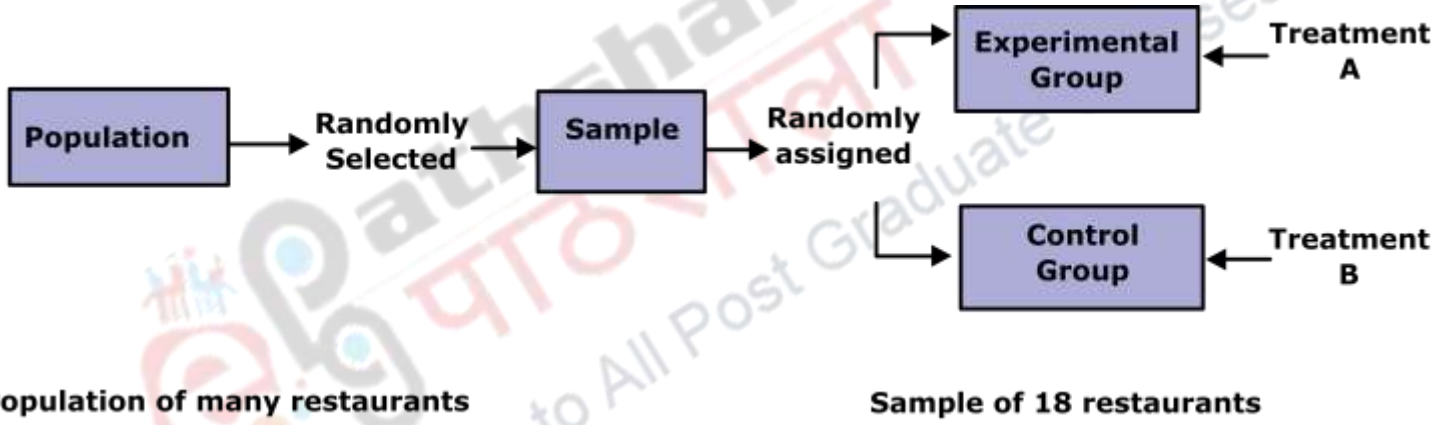
For instance, studying the level of dance performance in a group without the flexibility enhancing exercises in the control group and introducing this program and seeing its effect on the individual's performance.

This design avoids extraneous variation resulting from passage of time and non-comparability of test and control areas.

5.2.4 Completely Randomized Design

This design involves the principles of replication and randomization. Random selection and random assignment are two main features of this type of design.

For instance, A fast food franchise is test marketing 2 new menu items. 18 franchised restaurants are randomly chosen for participation in the study. In accordance with the completely randomized design, 9 of the restaurants are randomly chosen to test market the first new menu item, another 9 for the second menu item. Each new menu item becomes one treatment condition, total number of treatment conditions being 2. The process of randomization gives every group of 9 restaurants in the total of 18 an equal opportunity of being assigned to any of the treatment conditions. One way ANOVA would be used to analyze data of this type of design. Thus it includes all the variations caused by uncontrolled extraneous factors to be included under chance variation.



Many research designs exist but the type of design to be used must be decided by the researcher prior to collecting and analyzing data. The selection of a particular research design depends on the research topic under study. The researcher must consider the type of universe and its nature, objective of the study, sampling frame, standard of accuracy when deciding the research design for usage.

6. Summary

A research design is the blueprint of the detailed procedures of testing the hypotheses, collection and analyses of data so as to combine the relevance to the research purpose with economy in the procedure.

- A research design also acts as a control mechanism and it controls unwanted variances: experimental, error or extraneous variance.
- A good research design has the following characteristics:

- Minimizes bias, maximizes reliability of data collected and analyzed
- Gives smallest experimental error
- Provides maximum information
- Gives opportunity for viewing different aspects of the problem

- The principles of experimental design have been discussed at length in the text.
- The different types of research designs suitable to experimental research have also been taken up and discussed with appropriate examples and applications.