

## 4. Experimental Research Designs: A Review

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### **Abstract:**

Research designs are the frame works of a research which provides insight about how to conduct research using a certain methodology. Research designs helps in the decision regarding what, where, when, how much, by what means concerning an inquiry or a research study. Experimental research is a study that strictly adheres to a scientific research design. This article focuses on the importance of research designs in experimental research and its various types etc.

**Keywords:** Research Design, Experimental Research, Scientific Research Design and Inquiry

### **4.1 Introduction:**

Research in common parlance refers to a search for knowledge. Research can be defined as a scientific and systematic search for pertinent information on a specific topic. According to Merriam- Webster Dictionary, research is a careful or diligent search and it is the investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws. Research methodology is a means to reach the findings of a research.

It is the specific procedures or techniques used to identify select, process and analyze information about a topic. The methodology section of any research answers two main questions: "How was the data collected or generated? How was it analyzed?" Thus the purpose of the research methodology is to satisfy the research plan.

### **4.2 Research Design:**

Research design is the general plan to answer a research question. As a systematic approach to conducting a scientific inquiry, it brings together several components, strategies and methods to collect data and analyze it (Saunders, et al, 2009). It is a framework that includes the methods and procedures to collect, analyze and interpret data. Research design also defines all other constituent parts of a study, such as variables, hypotheses, experiments, methodology and statistical analysis (Creswell et al, 2018).

An excellent research design has the one and only purpose to make the data address the research problem as clearly, as accurately and as unbiased as possible, whereas the Research Methodology is the path through which researcher need to conduct their research. Research is an art of scientific investigation (Patel & Patel, 2019). Research design is the frame work of research methods and techniques chosen by a researcher. The design allows researchers to hone in on research methods that are suitable for the subject matter and set up their studies for success.

#### **4.2.1 Significance of Research Design:**

Research Design carries an important influence on the reliability of the results attained. It therefore provides a solid base for the whole research. It is needed and significant due to the fact that it allows for the smooth working of the research operations.

This makes the research effective by providing maximum information with minimum of effort, money and time. Research design can be compared to a blueprint that is meant for data collection and analysis of the research study. This has a great significance and impact on the reliability of the results achieved and as such constitutes the firm base for the research work.

#### **4.2.2 Key Characteristics of a Research Design:**

There are four key characteristics of a research design. They are:

- **Neutrality:** The results projected in the research design should be free from bias and neutral.
- **Reliability:** The research design should indicate how to form research questions to ensure the consistency of the results.
- **Validity:** Even though there are multiple measuring tools, the tools shall help the researcher in gauging results according to the objectives of the research.
- **Generalization:** The outcome of the research should be applicable to the population with similar accuracy.

#### **4.2.3 Types of Research Design:**

There are 5 types of research designs:

- Descriptive research design
- Experimental research design
- Correlational research design
- Diagnostic research design
- Explanatory research design

#### **4.3 Experimental Research Design:**

Experimental Research Design is concerned with constructing research that is high in internal (causal) validity. This validity in turn concerns the accuracy of statements regarding cause and effect relationships. The experimental research designs have 3 components:

- **Manipulation:** The ability to influence or direct the independent variable.
- **Control:** The ability to direct or influence important extraneous variables and study measurements.
- **Randomization:** Unbiased or random subject assignment to each group.

#### 4.3.1 Types of Experimental Research Design:

There are 3 primary types of experimental designs:

- Pre - experimental
- True - experimental
- Quasi - experimental

##### A. Pre - Experimental Designs:

Out of the three experimental research designs, this is the effective one. It is characterized by the lack of a control group or a failure to provide for the equivalence of a control group. Three types of research designs come under this category. They are:

- **The One-Shot Case Study:** In this the result of the treatment are compared with a general expectation of what would have happened if the treatment had not been applied (Best & Kalm, 2006). This design provides the weakest basis for generalization.
- **The One-Group, Pretest: Posttest Design:** This design provides some improvement over the One-Short Case Study Design for the effects of the treatment are judged by the difference between the pretest and the post test scores. However, no comparison with a control group is provided.
- **The Static-Group Comparison Design:** This design compares the status of a group that has received an experimental treatment with one that has not. There is no provision for establishing the equivalence of the experimental and control groups which is a limitation of this design.

##### B. True - Experimental Designs:

In a true experiment, the equivalence of the experimental and control groups is provided by random assignment of subjects to experimental and control treatments. It is the strongest type of design. In this type of design too, there are three designs such as:

- **The Posttest - Only, Equivalent Group Design:** This design is one of the most effective in minimizing the threats to experimental validity. In this experimental and control groups are equated by random assignment. After completing the experimental period the difference between the mean test scores of the experimental and control groups is subjected to a test of statistical significance.
- **The Pretest - Posttest Equivalent Groups Design:** This method is almost equivalent to the Post – test only Equivalent Groups Design but the pretests are administered before the application of the experimental and control treatments and posttest at the end of the treatment period. Pretest scores can be used in analysis of covariance to statistically control for any difference between the groups at the beginning of the study.

This is a strong design, but there may be a possibility of the influence of the interaction effect of testing with the experiment variable (Best & Kahn, 2006).

- **The Solomon Four - Groups Design:** This design is a combination of the two group's designs, the posttest only and the pretest - posttest. This design permits the evaluation of the testing of the effects of testing, history and maturation. Analysis of variance is used to compare the four posttest scores.

### **C. Quasi - Experimental Designs:**

This is similar to the Pretest - Posttest Equivalent group design, but differs because random assignment to experimental and control treatments has not been applied. Hence the equivalence of the groups is not assured. Of the many quasi - experimental designs, the often used design is:

### **D. The Pretest – Posttest Nonequivalent Groups Design:**

This design is often used to classroom experiments, when experimental and the control groups are natural intact classes which may be similar. Analysis of covariance is used with the pretest as the covariate.

### **4.3.2 Advantages & Disadvantages of an Experimental Research Design:**

This is the most powerful design to establish causal relationship between independent and dependent variable. It creates conditions in a short period of time that may take years to occur naturally. These are conducted in laboratory, experimental unit or in specialized research setting.

Whereas, the experimental research designs have many disadvantages too such as; it cannot be replicated in studies conducted in humans due to ethical problems. Many of the human variables neither have valid measurable criteria nor instruments to measure. Studies conducted in community are difficult to control the extraneous variable. It is also very difficult to get cooperation for treatment / intervention (Kavitha, 2014).

### **4.4 Conclusion:**

Experimental research design is the blue print of the procedures that enables the researcher to test hypotheses by reaching valid conclusions about relationships between independent and dependent variable. This is needed because it facilitates the smooth sailing of the various research operations. Hence the research designs provide a framework to the research and combine various components of research in a reasonably logical manner so that the research problem is efficiently handled.

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