



# Experimental Method: A Critical Review

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**Abstract:** In the experimental method researcher studied to establish the causal relationship in the experiment. It is started from with question with respect to the relation between two or more variables. Also, researcher formulates one or more hypothesis which establishes the expected relationship of the experiment. The researchers doing the experiment by planning and carried out to collect the evidence relevant to the hypothesis. The experiment deliberately and systematically changes the natural phenomena and observes the particular things in the experiment. The hypothesis gives expectations to the findings that will result changes that introduce in the actual experiment. The researchers take care to the manipulation and control of variables and observe the result with particular measurement in the experiment.

**Key words:** Experimental, control, Variable, Value

## Introduction:

In the descriptive research method, the data were analyzed by the researcher and found out the relationship between different variables. These relationships between the variables are interpreted in different ways. The researcher interprets their research works in their own way and faces different problems with eliminating some things which are optional. Explanations related to their conclusion because there is less control related to the different variables which were used in it, but on the other hand the experimental method gives much more control over the different variables which were included in the study and also establish a relationship between the variables.

## Nature of Experimental method:

With the logical and systematic way by many ways observed factors and effects. Therefore, researcher should be defined problem and set a possible solutions or hypothesis related to that researcher should be test hypothesis and either accept or reject with respect to the controlled variables and they are relationship which he or she has been observed in the experimental method which is based upon a single variable is define as methods of experimental enquiry.

From these five rules can be set in the experimental research. The first rule is agreement related to the method, second is the difference related to the method, third joint method, and fourth rapid use of method and fifth is about commitment variations of the methods. These five rules work as guidelines to the design of an experimental research and it is used as a guide for planning the experiments. Events which are complex are related to human beings and they are rarely restricted to the relationship between this single variable. This single variable interacting with different variables is the law of single variable considers restricted relationship and highly artificial between the single variables but as an experimentation related to the human being in the laboratory. This type of research variable has failed for different reasons; it is not possible or convenient to study human beings in the laboratory room for some non-laboratory techniques were used to observe the human being in the experimental methods.

### **Major Aspects of an experiment:**

1. In an experiment a question on which researcher wants to answer the question with respect to the relationship between the variables.
2. Hypothesis as to the nature between the relationships of two variables.
3. Introduction of experimental conditions and measurement.
4. Analysis of the data due to the researcher can decide whether or not there is a relationship between the variables.
5. In an education experiment done in field or laboratory. The control of external variable which is so important in the experimental method can usually be handling most adequately in the laboratory. In a laboratory researcher can be control the environment in a way that the independent variable of interest can be isolated. Therefore, researcher be very specific in the operational definition of variables for this reason laboratory experiment can be repeated with high degree of precision.
6. In the field experiment can be conducted in classroom, playgrounds, interest club meeting or other natural setting. The researcher controls the external variable as much as possible while manipulating the independent variable or variables but in the field experiment control is inevitably less complete but field experiment have certain advantages. First experimental variables can be much stronger in the field experiment then in a laboratory for a short period of time whereas a field experiment can encompass daily sessions for an entire school year. Second because the field experiments are conducted in more realistic settings their result are more likely to provide solutions to the actual daily problems of Educators.

### **Characteristics of Experimental Research:**

#### **Control:**

Control in an experimental method is an important essence. In the research work without control it is impossible to evaluate on ambiguously the effect of an independent variable. In an experimental method of science there are two important assumptions regarding the variables

Although matching is a method for providing partial control of inters subject differences, there are several difficulties one may encounter. The first of these is to determine what variable or variables to use for matching. Variable such as IQ, socioeconomic status, age, sex, reading score may be used. The variables on which subjects are matched must be substantially ko related to the dependent variable or else the matching is useless. As a general

rule, researchers suggest that unless the variable correlates 50 or higher with dependent variable, it should not be employed for the matching procedure since it would do little to increase the precision of the study. Ideally research would like to match on two or more variables that correlate well with dependent variable and do not correlate significantly with each other. However, when researcher try to match on more than two variables, it becomes almost impossible to find subjects who are well matched on these several variables. Subjects are lost because no match can be found for them.

Another question that arises is how closely to match the subject on the variables. Matching closely increases the precision of the method but, at the same time it also increases the number of subjects who cannot be matched.

According to the Van Dalen the researcher wants to control the variables due to following three types of reasons as

**1. To achieve isolation:** For the equalization and keeping constant effect on both the control and experimental group researcher should remove the inference variable or unwanted variable which is the effect of acting on the dependent variables. The process in which to prevent the factors accepting independent variables is known as achieving isolations.

**2. To achieve changes in the magnitude:** The most important thing about independent variables is not to isolate only but to consider how much effect its contribution has on the variables for doing such things. The objectives should be different and vary in magnitude with respect to experimental variables.

**3. To achieve qualitative magnitude:** Finally, researchers express the magnitude of the variable in qualitative terms of variables. Researchers do not merely know if one expression with respect to a variable is smaller or larger than another; what he or she wants to know is how smaller or how larger it is. When two variables are related with each other functionally, the researcher not merely to mention it is negative or positive but he or she wants a relationship to a specific degree in terms of numerical value.

In the laboratory setting it is very easy with high degree control to achieve the objectives then the situation outside the laboratory. The researchers deal with a limited number of elements and manipulate the conditions in their own opinion. Researcher sure about the changes taken place within the limited amount of time, measure the effect with great precision

### **Methods for Controlling between the subjects:**

#### **1. Random assignment of subject to group:**

The concept of randomization assignment is based upon the theory of probability and it is a useful technique for the showing equivalency in an experiment. It is the assignment of subject groups for treatments of a universe in which a given assignment is a subset and every member of the universe has an equal opportunity for the selection in the assignment. Randomization process means there are different characteristics such as female or male, low or high intelligence, democratic or Republic and so on. If any member is selected, it is probably counterbalanced with the long run selection process for the other members from the populations with quantity of opposite or quality of characteristics. Consider researchers having available groups of subjects from which some numbers are selected for the experiment. Numbers of subjects which were selected can be divided into groups for comparison and treatment which were different from each other. Two groups assign the subject which is useful for randomization method to

avoid introduction on the judgment which is personal and characteristics themselves related to the subject to find out random groups between these two is conventional method and other is program instruction.

The researcher should be given serial numbers to all employees which were selected and subjects which were available in random procedure for selection of known elements and needed number of subjects of the experiment treatments. Similarly, researchers can be considered teachers, equipment, classrooms and class periods on the basis of randomization by using appropriate statistical tests. The researcher should find out whether the observed difference in the selected geometry subject is sufficiently larger than the sample error which is expected from this point. It is noted that assigning subjects randomly for the two groups can be comparable to starting an experiment with an external source as well as a dependent variable from through the randomization of external variables subject.

## **2. Random assignment with matching subject:**

In this method of random assignment individual subjects should be matched with different external variables as a researcher knows their effect on dependent variables and also it is an applicable random technique. To consider one member with each match the pair on the conditions of experiment. For example, researchers may match subjects with respect to pre-achievements courses in geometry. In that case other variables have been affected by dependent variables and at that time scores on an intelligent test or aptitude test in mathematics, motivation test, social-economic background. The one member from a single pair which is assigned randomly in both the groups while doing search matching. There are several difficulties occurring, the important one is to determine which variable or variables are related significantly to the defendant variable and used with respect to the basis of matching. The variables such as motivation, achievement, age, sex, social- economic status, intelligence. In these course dependent variables which are generally used for the basis of matching, the opinion of experts about those variables on which subject were matched should be correlated to it more with respect to dependent variable. The second problem faced by the researcher is to find a closely matching subject with respect to variables. The matching of subjects increases precision related methods with reducing the cost size of sample and increasing bias in the sampling study.

## **3. Random assignment with respect to Homogeneous selection:**

For the comparison of two groups with the help of external variable homogenous selection method of random assignment it is used. For example, age is a variable for a particular person then by selecting male students. Researchers should be controlling the effect of age on external variables similarly for the social economics status variable which is affected on dependent variables. The researcher should be restricted to the selected range of socioeconomic status. With the help of this method researchers control the effect of socioeconomic status from the homogeneous population subjects were selected. Then a researcher randomly considers two groups with confidence that were comparable with respect to relevant variables to eliminate the problem that homogeneous groups of subjects are helpful for subject-to-subject matching. The main disadvantages of this method are to decrease the extent of the result behind previous situations. When researcher studied behaviors of teaching group of in- service at particular age, he or she should generalize their findings by using their study of behavior of in-service teacher with the help of such generalization it should be repeat the studies with the teacher from other different ages range.

#### **4. Co-variance techniques of analysis:**

The help of analysis of covariance is to control the variance within the group for two different groups and their differences were controlled with the help of analysis of covariance technique with respect to experimental treatment on the two different groups of dependent variables. The initial difference between the two groups measured with the help of pretest as well as relative independent variables should be measured by using analysis of covariance. One or two variables of the defendant should be measured as a covariate variable which is not in control of the researcher during the experiment and it is affected by a dependent variable. This analysis of covariance is not limited to using only one covariate.

#### **5. Subject with control itself:**

By using experimental treatment and to measure their effect on the first group with the help of treatment and the second group for the other treatment. This is an important method for controlling the variables because it is not feasible in some cases. For example, to find out the differences in learning between different types of syllabi related to the low association value with respect to experiment on retention in such a case is learning time between the two subjects and then test of average difference for other subjects and by using statistical test of significance. There are certain factors which affect the result such as fatigue and other inferences cannot be completely and partially and reliable conclusions may be drawn from the study.

#### **Methods related to the situational variables:**

**1. Situational variables holding constant:** Situational variables holding constant are used for the purpose. The researcher tries to provide all subjects alike instead of their exposure with respect to independent variables. For example, in the experiment of reading the researcher should select an equal number of subjects for two groups then by using the same teacher using the same instructions as well as an operator and test. Both the groups start in the same classroom as well as at the same time table with equal environmental conditions like a presence or absence of distracting noise, temperature, furniture and so on.

**2. Randomization method:** Randomization method is a different situation and conditions are not treated alike but research should be tried to balance the randomization. For the study it is not possible to have the same teacher for teaching both the groups. Therefore, researchers divide the groups randomly into and half in the first group and half in the second group the procedure applied. For this purpose, it should be the same as randomization of which situation available like taste apparatus and time.

**3. Manipulating situational variables:** For the situation variable manipulated by systematically and also controlled in a situation for the educational experiments. Researchers can control the condition as if their effect is progressive, controlling the orders and conditions in the experiment through counterbalancing. This method is not only to control the situation potentially but to estimate the size of order of effect obtained from two sequences that are different.

#### **Manipulation:**

Manipulation means researchers doing deliberate operations with respect to certain conditions on the experimental research method. This is in contrast to the descriptive research where researchers only observe different conditions

which are occurring serially but in the experimental research in different stages. The factors which perform occurred and under studied various conditions with respect to other factors which might be complicated. The observations are controlled as well as eliminated manipulation processes meaning it is the purpose of different conditions imposed on the selected subject of the experiment. These different conditions are known as independent variables either treatment variable or experimental variable. Now the independent variable should be considered two or more than two values and their difference with respect to values should be quantitative or qualitative in nature.

For example, methods of teaching, socio economic status, sex, attitudes, types of motivations, personality characteristics, classroom environment were some common examples related to the independent variables. In experimental research the comparison of the performance of male and female students is the independent variable, if researchers comparing two teaching methods with the help of independent variables can be manipulated only to the teacher. The researcher manipulates only one variable or number of variables at the same time. He or she should use the technique of multivariate analysis to save time and energy with respect to simultaneous investigation of the number of variables studied singly and interaction.

### **Observations:**

The researchers were doing study in experimental research, the manipulation related to independent variables as on a dependent variable is observed. For example, if we select some learning related task which is dependent variable, then students learning directly is not measured by the researchers. The researcher should consider it with the help of different sources such as test scales to measure the learning related task in the observations, dependent variable strictly speaking, therefore, the measurement related to the test with score for observation related to their characteristics with the research area is used in experiment.

### **The repetition of a scientific experiment:**

While doing an experiment a researcher tries to control the external variables with the help of different methods such as randomized methods or other methods but there are some discrepancies in variables which always influence the conclusion of the experiment. Therefore, researchers should be taken care of such discrepancy through the help of applications in their study. Replication means it is a process of conducting process within the particular frame of experimental design while conducting actual process. The researcher should compare a single control variable with the single case of experiment which makes multiple comparisons with a selected control group and number of cases with the experimental group but in the same framework of experiment. Researchers always use a subject which is equivalent to the control and experimental group which is at random but the comparison in each pair is an experiment with itself. For example, 30 subjects from each experiment and control groups researcher actually doing parallel 30 experiences in one situation but in some experiment's situations control group and experimental groups consist of equivalent subjects assigned at random with one or another two groups which were combined within the design of a single design.

### **Values included in Experimental research:**

1. Experimental research is useful in to find out accuracy, adequacy, effectiveness in the instructional and educational aim with the help of measurements.
2. With the help of result of an experiment some suggestion's will be given to formulate the theory, process, change in process, applications related to the daily life and so on for the classroom teaching and practices.
3. To find out certain effectiveness of some learning experiences be planned and organized.
4. About teachers' effectiveness and innovations experimental research techniques is suitable for it.

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