Comparison of Research Methods: A Literature Review

Anmol,
PhD JRF Scholar,
Post Graduate Department of Psychology,
Ravenshaw University, Cuttack, India.

Abstract : The present paper aims to review the various forms of research methods and map the similarities and dissimilarities among such research methods. The characteristics of several popular research methods have been discussed. The findings from the existing literature will be then used to formulate the relationship between various research method. The first part of the paper deals with the features of various forms of research methods. The second part of the paper uses the finding obtained in part 1 to formulate relationships among the various research methods. The relationship is discussed in the context of similarities and dissimilarities. The list of major of research methods that will be investigated for mapping the similarities or dissimilarities involves experimental research and correlation research method, basic research and evaluation research method, pure, applied and action research methods, descriptive research and statistical research method.

IndexTerms **- Hypothesis testing, Evaluation studies, Causal and Casual relationships, Experimental designs.**

I. INTRODUCTION

Research methods are the strategies, processes or techniques utilized in the collection of data or evidence for analysis in order to uncover new information or create better understanding of a topic [1]. There are different types of research methods which use different tools for data collection. Research involves inductive and deductive methods. Inductive research methods are used to analyze the observed phenomenon whereas, deductive methods are used to verify the observed phenomenon. Inductive approaches are associated with qualitative research and deductive methods are more commonly associated with quantitative research [2]. There is a difference between research methods and research methodology. Research method involves conducting experiments, testing numerous components, ending up surveys, and many others. Research Methodology is an accurate theoretical and systematic analysis of the strategies employed to the fixed topic talked about all through this system [3].

The rationale of the study

Although a significant amount of literature is available related to the various research methods, however, an integration of these findings is necessary for mapping the similarities and dissimilarities between the different forms of research methods. This paper aims to explore the various research methods and then use the findings to investigate the similarities and dissimilarities among such research methods.

REVIEW OF LITERATURE

The various forms of research methods are as follows-

I. Pure research

Pure research is conducted for the sake of knowledge and one's curiosity [4]. It is not likely to have any practical application in immediate present or future. It helps in exploring new principles and adding knowledge to existing literature [5].

II. Applied research

Applied research is used to solve specific questions or problems. Applied research seeks immediate and practical research [4]. In other words, the main objective of applied research is to find solutions and apply them to existing problems.

III. Exploratory research

Exploratory research is used to explore a problem about which little or no prior knowledge is available [4]. It is much less focused on an objective, instead is more explorative. The main uses of exploratory research involves-

- To check the feasibility of a project
- To explore those domains about which little to no information is available.

IV. Descriptive research

Descriptive research refers to collection and interpretation of facts or data [4]. Descriptive research is more focused than exploratory research. It is to be noted that in descriptive research, only casual analysis of quantitative data takes place without any form of hypothesis testing [6]. A casual analysis is not similar to causal analysis. The casual analysis focuses on finding the correlation between variables, whereas causal analysis aims to find the cause and effect relationship between variables. In hypothesis testing, the researcher proposes a set of assumptions or expected results for a given event or a phenomenon [7]. The researcher then conducts experiments to check the validity of the hypothesis statement.

V. Statistical research

The statistical method focuses on extensive analysis of data using statistical tools. The component of hypothesis testing is also present under this method. Inclusion of hypothesis testing improves the validity as well as reliability of a research method [8]. The

statistical method is also called an analytical study. Statistical research involves in-depth analysis to find the relationship among the given variables [5]. Therefore the primary uses of statistical research involve-

- In-depth analysis
- Casual as well as causal relationships
- Hypothesis-testing

Both casual, as well as a causal relationship, can be investigated using the statistical method. It is to be noted that a causal relationship also implies the presence of a casual relationship, but the vice versa may not always be true.

VI. Diagnostic study

- The diagnostic study aims to answer the following questions
- What is happening ?
- Why a particular phenomenon is happening ?
- What are the solutions for addressing the particular event or problem ?

The diagnostic study is commonly used by medical professionals to diagnose the precise reason for a particular set of symptoms [9]. The component of hypothesis testing is also present under the Diagnostic study method [4]. Therefore the Diagnostic study approaches are concerned with diagnosing a problem, finding the causes, and finding the solutions. One limitation of Diagnostic study is that this study is not possible in areas where no prior knowledge is available [4]. For example, if a patient is suffering from an illness whose symptoms have been well documented in the medical literature, Diagnostic study method can be used to precisely diagnose the illness of the patient. However, if the form of illness is a new one like a new outbreak of virus or a contagious disease, the accurate diagnosis might not be possible because of lack of prior knowledge about the new disease or illness.

VII. Evaluation studies

Evaluation studies aim to measure the effectiveness of a given program or a course of action [10]. The primary use of the evaluation study is to provide a suggestion for the improvement of a program [4]. Evaluation studies are divided into three categories [4]. The first category is called concurrent evaluation method. Concurrent evaluation studies focus on ongoing programs [6]. The second category is related to periodic evaluation study which aims to evaluate a program at definite time periods [6]. The final category is called the terminal evaluation study and is employed after the completion of a project [6].

Action research is a particular case of evaluation studies which is covered under the concurrent evaluation method [4]. Action research in simple words means conducting research on a given plan of action [11]. The word action used here can denote an ongoing program, project, or an event. Therefore action research aims for researching on current programs or projects to provide solutions and feedback. The main uses of action research involve-

- Initial analysis of a project
- Calculating the cost-benefit ratio of a program
- Checking the efficiency of an ongoing project or program

There are five designs of action research [4] which are as follows -

- Classical design - In classical design, the program managers may be unaware of the relevant and existing research works conducted by a researcher. Also, a particular researcher may not deliberately direct his work toward evaluating the effectiveness of an ongoing program. In other words, research and action are independent of each other [4].
- Research built into action - Here, the research work is dependent on the project. The requirements of the action managers guide the researcher, and the objectives of the research are modified as per the scope of the ongoing project of the program [4].
- Action for research - Here, the program managers are dependent on the research works of a researcher. The findings from a research guide the course of the actions undertaken by the project managers [4].
- The interdependence of action and research- Under this arrangement, some level of interdependence exist between the program managers and the researcher. Although an independent authority undertakes the research, the researcher is dependent on the requirements or specification of the project. The action managers, on the other hand, use the findings from the research report to modify the schedules and activities of the ongoing project of the program [4].
- Research cum Action- Under this arrangement, both action and research go simultaneously. This form of arrangement requires continuous interaction between the researcher and the program managers [4].

VIII. Historical research

Historical research aims to study the past phenomenon in order to understand the present events [10]. For example, the study of past civilizations is conducted to gain insight into the formation of modern society in the present world. The sources of data in historical research are difficult to find because a researcher conducting historical research has to rely solely on the existing literature relevant to his or her topic [4]. Events in the history that were not documented might, therefore, stay as an ambiguous state of events.

IX. Experimental research

Experimental research is concerned with the causal relationship as well as a casual relationship [12]. Experimental research is considered to be the most robust research method for investigating causation effects [13]. However, there are specific criteria for research to be defined as an experimental research. Three condition that defines experimental research involves [14] -

- Manipulation of the independent variable.
- Random sampling to obtain the samples.
- Use of control groups.

Based on the above three conditions, various versions of experimental design are possible [4]. The four main types of experimental design involve -

A. Pre experimental design
B. Quasi-experimental design
C. True experimental design
D. Single-subject designs

A. Pre experimental design

Pre experimental design meet all the conditions of experimental research except the fact that no control groups are used in the pre-experimental design [4]. A control group is the same as an experimental group in all aspects. The main difference between a control group and an experimental group lies in the exposure of treatment methods [15]. While a treatment method is exposed to the experimental group, the control group is not exposed to the same treatment method. Different exposures to experimental group and control group are required to ascertain the final findings or the differences between the two groups as a cause of effect of the treatment method that was exposed to the experimental group but was not exposed to the control group.

B. Quasi-experimental design

A quasi-experimental design is characterized by the absence of the random sampling method [4]. Therefore such designs are also called as pseudo experimental design or compromise experimental design [16].

C. True experimental design

True experimental design meets all the three conditions that defines on experimental research [4]. Manipulation of the independent variable is possible. Random sampling is used for obtaining the sample, and control groups are also used in the study. Therefore true experimental design is more robust, reliable, and less error-prone as compared to other types of experimental designs [12].

D. Single-subject designs

Under single-subject design, a single subject is observed continuously before and after exposure to a relevant variable [4]. The pre-observation period is also called as the baseline period. The subject is then exposed to a particular treatment method or a variable. After the exposure, post observations are then conducted to assess the changes incurred in the subject due to the treatment method [17].

X. Correlational Research Design

Such designs are characterized by their casual objectives [18]. There is no manipulation of the independent variable, and the findings that are obtained are casual [14]. As indicated earlier, a casual relationship may not always denote the existence of a causal relationship. Correlational Research Design uses various methods to collect data without the manipulation of the independent variable.

1. Differences between experimental research design and correlational research design

The main difference between experimental research design and correlational research design lies in the fact that manipulation of the independent variable and use of control groups applies to experimental research designs, but the same is not true for the correlational research designs [14]. Further the results obtained in experimental research design fall under the category of causal relationships, whereas the results obtained under the correlational research design are casual in nature [13].

2. Differences between basic research and evaluation method

The basic research is taken as per the will of the researcher [4]. The basic research can be undertaken for knowledge or curiosity without any particular or practical applications of the findings. The time management under basic research is contingent upon the researcher. The evaluation studies are generally conducted in accordance with the aims of the program managers or the will of the clients [6]. Evaluation studies are undertaken for evaluating the effectiveness of an ongoing program and suggesting suitable courses of action [4]. The researcher has no control over the ongoing project, and time management of researcher is contingent upon the schedules of the project.

3. Differences between descriptive research and statistical research

Both descriptive research and statistical research involves collection of data and making interpretations from them [19]. However, the statistical method involves extensive and in-depth analysis of data using statistical tools [5]. Further hypothesis testing is absent in descriptive research while it is present in statistical research. Finally, findings from the descriptive research are casual in nature, whereas findings from the statistical research can be both casual as well as causal in nature.

4. Differences between pure research, applied research, and action research

Pure research is dedicated to the development of theory only and aims to add knowledge to existing literature without focusing on any practical applications [4]. Applied research is focused on using the findings from pure research and applying it to solve the existing problems in a given domain [14]. Action research is focused on investigating and solving a problem in the immediate present [11].

CONCLUSION

This paper reviewed and discussed the characteristics of various research methods. The findings from the existing review of the literature suggest that significant differences exist between various forms of research method. Some of the significant differences are related to the presence or absence of hypothesis testing, manipulation of the independent variable, sampling methods, practical application of the research findings, and casual and causal relationship [10]. Experimental Research and correlational Research differ in terms of strength of the relationship between the variables and the ability to manipulate the independent variable [14]. The presence of practical application or immediate application of the findings of a research study acts as a differentiating factor between pure research, applied research and action research [4]. The significant difference between descriptive research and statistical research method is the presence of hypothesis testing as well as a casual and causal relationship under the statistical research methods [5]. Future studies should be conducted to overcome the existing limitations of the various research methods to improve the efficiency of the research studies and reduce the percentage of error arising due to the various limitations of the existing research methods.

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