# BASUDEV GODABARI DEGREE COLLEGE, KESAIBAHAL

# BLENDED LEARNING STUDY MATERIALS

## UNIT-II

**DEPARTMENT :-ECONOMICS**

**SUBJECT :-Research Methodology**

**SEMESTER :-4th Semester**

# CONTENT

## RESEARCH PROBLEM

It refers to some kind of difficulty the researcher might encounter or experience in the context of either a theoretical or practical situation, which he/she would like to resolve and find a solution to. In general, a research problem refers to some kind of difficulty the researcher might encounter or experience in the context of either a theoretical or practical situation, which he/she would like to resolve and find a solution to.

A research problem is generally said to exist if the following conditions emerge (Kothari 1988):

• There should be an individual or an organization, say X, to whom the problem can be attributed. The individual or the organization is situated in an environment Y, which is governed by certain uncontrolled variables Z

. • There should be at least two courses of action to be pursued, say A1 and A2. These courses of action are defined by one or more values of the controlled variables. For example, the number of items purchased at a specified time is said to be one course of action.

• There should be at least two alternative possible outcomes of the said course of actions, say B1 and B2. Of them, one alternative should be preferable to the other.

• That is, at least one outcome should be what the researcher wants, which becomes an objective.

• The courses of possible action available must offer a chance to the researcher to achieve the objective, but not the equal chance. Therefore, if P(Bj / X, A, Y)represents the probability of the occurrence of an outcome Bj when X selects Aj in Y, then P(B1 / X, A1 ,Y) ≠ P (B1 / X, A2,Y). Putting it in simple words, it means that the choices must not have equal efficiencies for the desired outcome. • Above all these conditions, the individual or organization may be said to have arrived at the research problem only if X does not know what course of action to be taken is the best. In other words, X should have a doubt about the solution. Thus, an individual or a Prof. Mohammad Ubaidullah Bokhari 11 group of persons can be said to have a problem if they have more than one desire outcome. They should have two or more alternative courses of action, which have some but not equal efficiency for probing the desired objectives, such that they have doubts about the best course of action to be taken. Thus, the various components of a research problem may be summarized as: • There should be an individual or a group who have some difficulty or problem.

• There should be some objective(s) to be pursued. A person or an organization who want nothing cannot have a problem.

• There should be alternative ways of pursuing the objective the researcher wants to pursue. This implies that there should be more than one alternative means available to the researcher. This is because if the researcher has no choice of alternative means, he/she would not have a problem.

• There should be some doubt in the mind of the researcher about the choice of alternative means. This implies that research should answer the question relating to the relative efficiency or suitability of the possible alternatives.

• There should be a context to which the difficulty relates. Identify factors to consider in selecting research problems Consideration Factor Description

Interest -Choose a topic which does not greatly interest you, it would become difficult to keep up the motivation to write.

Expertise - To ensure that you met certain level of expertise in the area you are proposing.

-Make use of the facts you learned during the study.

Data availability -Research title needs collection of information (journal, reports, proceedings) and these materials available in the relevant format.

Relevance - Always choose a topic that suits your interest and profession.

- Ensure that your study adds to the existing body of knowledge.

Ethics -Consider some ethical issues as well.

**SOURCES OF RESEARCH PROBLEM:**

• Reading

• Academic Experience

• Daily Experience • Exposure to field situations

• Consultations

• Brainstorming

• Research

• Intuition

**CRITERIA FOR SELECTING A GOOD RESEARCH PROBLEM:**

Once a problem is isolated, the researcher must be able to determine whether or not his problem is worthwhile that is, significant for investigation. Whereas no standard procedure exist for evaluating the suitability of a research problem (Ezejelue &Ogwo, 1990), certain criteria have been found helpful for the selection of a problem. Indeed the researcher's personal knowledge, experience and interest as well as external circumstances generally determine the choice of a problem (Webb, 1961; good, 1969 and Ary et al, 1979, pp.47-49). Details of the aspects of these problem selection criteria may be itemized as follows:

• The problem must be significant in the sense that its solution should make a contribution to the body of organized knowledge in the field represented. This implies that the researcher should not be engaged in the study of trivial problem. Instead, the researcher should demonstrate that the selected topic is likely to add information to existing knowledge or at least to clarify some of the contradictory notions in previous research by making more reliable knowledge available. Furthermore, the problem should have either theoretical or practical implications or both.

• The problem should be a researchable. One. As explained earlier, there are many problems that related to questions that can only be subjected to philosophic rather than scientific investigation. For a researchable problem therefore, it must be concerned with the relationships between two or more variables that can be defined a measured or explained.

• The problem should be one that will lead to new problems and to further research. This criterion implies that in so far as researchers often relate their problems to existing knowledge in the field involved, attention should be given to the selection of a problem whose solution is likely to raise a number of other questions for further research.

The problem must be suitable for the researcher in several respects namely:

The problem should be one which arouses the researcher's genuine interest and intellectual curiosity. This criterion refers to the extent to which the solution of a selected problem is personally important to the researcher in terms of the contribution it can make to his own knowledge in the subject area or to the enhancement of his competence as a social scientist. Thus, while interest sometimes develops with familiarity, the motivation to complete a research project can be sustained only to the extent of the personal meaning that the researcher attaches to the problem.

The problem should be in an area about which one has both knowledge and experience. In other words, for a researcher to recognize a viable and worthwhile problem, he needs to have a clear understanding of the theoretical, conceptual and practical aspects of the area of interest. These may be derived from personal experience and through a review of related literature. Closely related to the factor of knowledge and experience is the need for researchers to have adequate skills and training capable of developing or validating the instruments and of manipulating complex statistical analysis required in the research. The problem should be sufficiently original. This means usually that although repetition or replication of a study is profitable, worthwhile and an acceptable activity in scientific research, one need to possess personality attributes of creativity, flexibility and foresight to be able to select a research problem that does not involve blind and objectionable duplication.

The problem must be one that can be investigated and completed within the stipulated time limit. The time needed to complete a study depends among others things, the variables of the researcher and the problem. Many research problems have been abandoned because of the vastness and complexity of the problem addressed. One should therefore avoid a problem that is too wide in scope or too involved.

**OBJECTIVES OF RESEARCH PROBLEM**

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. "Objectives are the goals you set out to attain in your study". ⌉ They inform a reader what you want to attain through the study. ⌉ It is extremely important to word them clearly and specifically. Objectives should be listed under two headings: a) Main objectives (aims); b) Sub-objectives.

• The main objective is an overall statement of the thrust of your study. It is also a statement of the main associations and relationships that you seek to discover or establish.

• The sub-objectives are the specific aspects of the topic that you want to investigate within the main framework of your study.

They should be numerically listed.

Wording should clearly, completely and specifically Communicate to your readers your intention.

Each objective should contain only one aspect of the Study.

Use action oriented words or verbs when writing objectives.

The objectives should start with words such as

'To determine',

'To find out',

'To ascertain',

'To measure',

'To explore' etc

The wording of objectives determines the type of research (descriptive, correlational and experimental) and the type of research design you need to adopt to achieve them. e.g.

**Descriptive studies:**

To describe the types of incentives provides by Hotel XYZ to employees in Mumbai.

To find out the opinion of the employees about the medical facilities provided by five star hotels in Mumbai.

**Correlational studies:**

To ascertain the impact of training on employee retention.

To compare the effectiveness of different loyalty programmes on repeat clientele.

**Hypothesis –testing studies:**

To ascertain if an increase in working hours will increase the incidence of drug / alcohol abuse.

To demonstrate that the provision of company accommodation to employees in Mumbai hotels will reduce staff turnover.

**SCOPE OF RESEARCH PROBLEM**:

It discovers facts and relationship in order to make educational process more effective.

It deals with the problems of classroom

It deals with the basic problems of Social Studies and teaching learning situations.

It covers areas from formal education and conformal education as well.

Necessity of Defining a Research Problem ?

The problem to be researched needs to be described unambiguously as that will help you to discriminate useful data from the unrelated ones. A proper formulation of research problem will allow the investigator to be on the track in contrast to an ill-defined problem may possibly create difficulties.

Questions like: What data are to be gathered? What attributes of data are appropriate and need to be analyzed? What relations should be investigated. What methods should be employed for the purpose? as well as other questions turn up in the head of the investigator who can well plan his strategy and find solutions to these kinds of questions only when the research problem has been well defined. Therefore, defining the problem accurately is a necessity for any research and is a step of the highest value.

In fact, formulation of a problem is often vital than its solution. It is only on thoroughly describing the problem that we can work out the research design and can efficiently proceed all the consequential steps needed while doing research.

I. The correct question needs to be addressed if research is to help decision makers. A right answer to the wrong question leads either to bad advice or to no advice.

II. Usually in problem we have an inclination to rationalize and defend our actions once we have started upon a specific research plan. The perfect time to examine and think about alternative techniques is in the planning stage. If it is completed unnecessary expense of false start and redoing work may be prevented.

III. An excellent beginning in problem definition is to ask what the decision maker want to know if the requested information can be gathered without error and without expense.

IV. Another excellent rule to follow is "Never settle on a specific strategy" without developing and taking into consideration at least one alternate option".

V. The problem definition stage of research is the determination and structuring of the decision maker's question. It should be the decision maker's question and not the researcher's question.

VI. What decision do you face? Unless you have decision to make, there isn't any research problem.

VII. What are the alternatives? In case there are no options to choose, once again there is absolutely no research problem.

VIII. What are the factors for selecting the best alternative? Unless you have criteria for evaluation, again there's no problem.

IX. The researcher should stay away from the acceptance of the superficial and the obvious.

## THE TECHNIQUES INVOLVED IN DEFINING A RESEARCH PROBLEM

The techniques Involved in defining a Research Problem is a crucial part of a research study and must in no case be accomplished hurriedly. However, in practice this a frequently overlooked which causes a lot of problems later on. Hence, the research problem should be defined in a systematic manner, giving due weightage to all relating points. The technique for the purpose involves the undertaking of the following steps generally one after the other:

1. statement of the problem in a general way;
2. understanding the nature of the problem;
3. surveying the available literature
4. developing the ideas through discussions; and
5. rephrasing the research problem into a working proposition.

A brief description of all these points will be helpful.

1. Statement of the problem in a general way

First of all the problem should be stated in a broad general way, keeping in view either some practical concern or some scientific or intellectual interest. For this purpose, the researcher must immerse himself thoroughly in the subject matter concerning which he wishes to pose a problem. In case of social research, it is considered advisable to do some field observation and as such the researcher may undertake some sort of preliminary survey or what is often called pilot survey. Then the researcher can himself state the problem or he can seek the guidance of the guide or the subject expert in accomplishing this task. Often, the guide puts forth the problem in general terms, and it is then up to the researcher to narrow it down and phrase the problem in operational terms. In case there is some directive from an organizational authority, the problem then can be stated accordingly. The problem stated in a broad general way may contain various ambiguities which must be resolved by cool thinking and rethinking over the problem. At the same time the feasibility of a particular solution has to be considered and the same should be kept in view while stating the problem.

2. Understanding the nature of the problem:

The next step in defining the problem is to understand its origin and nature clearly. The best way of understanding the problem is to discuss it with those who first raised it in order to find out how the problem originally came about and with what objectives in view. If the researcher has stated the problem himself, he should consider once again all those points that induced him to make a general statement concerning the problem. For a better understanding of the nature of the problem involved, he can enter into discussion with those who have a good knowledge of the problem concerned or similar other problems. The researcher should also keep in view the environment within which the problem is to be studied and understood.

3. Surveying the available literature:

All available literature concerning the problem at hand must necessarily be surveyed and examined before a definition of the research problem is given. This means that the researcher must be well-conversant with relevant theories in the field, reports and records as also all other relevant literature. He must devote sufficient time in reviewing of research already undertaken on related problems. This is done to find out what data and other materials, if any, are available for operational purposes. "Knowing what data are available often serves to narrow the problem itself as well as the technique that might be used.". This would also help a researcher to know if there are certain gaps in the theories, or whether the existing theories applicable to the problem under study are inconsistent with each other, or whether the findings of the different studies do not follow a pattern consistent with the theoretical expectations and so on. All this will enable a researcher to take new strides in the field for furtherance of knowledge i.e., he can move up starting from the existing premise. Studies on related problems are useful for indicating the type of difficulties that may be encountered in the present study as also the possible analytical shortcomings. At times such studies may also suggest useful and even new lines of approach to the present problem.

4. Developing the ideas through discussions:

Discussion concerning a problem often produces useful information. Various new ideas can be developed through such an exercise. Hence, a researcher must discuss his problem with his colleagues and others who have enough experience in the same area or in working on similar problems. This is quite often known as an experience survey. People with rich experience are in a position to enlighten the researcher on different aspects of his proposed study and their advice and comments are usually invaluable to the researcher. They help him sharpen his focus of attention on specific aspects within the field. Discussions with such persons should not only be confined to the formulation of the specific problem at hand, but should also be concerned with the general approach to the given problem, techniques that might be used, possible solutions, etc.

5. Rephrasing the research problem:

Finally, the researcher must sit to rephrase the research problem into a working proposition. Once the nature of the problem has been clearly understood, the environment (within which the problem has got to be studied) has been defined, discussions over the problem have taken place and the available literature has been surveyed and examined, rephrasing the problem into analytical or operational terms is not a difficult task. Through rephrasing, the researcher puts the research problem in as specific terms as possible so that it may become operationally viable and may help in the development of working hypotheses.

In addition to what has been stated above, the following points must also be observed while defining a research problem:

I. Technical terms and words or phrases, with special meanings used in the statement of the problem, should be clearly defined.
II. Basic assumptions or postulates (if any) relating to the research problem should be clearly stated.
III. A straight forward statement of the value of the investigation (i.e., the criteria for the selection of the problem) should be provided.
IV. The suitability of the time-period and the sources of data available must also be considered by the researcher in defining the problem.
V. The scope of the investigation or the limits within which the problem is to be studied must be mentioned explicitly in defining a research problem.

## What is Research Design ?

When a research is carried-out, it follows a definite pattern or plan of action throughout the procedure, i.e., since the problem identification to the report preparation and presentation. This definite pattern or plan of action is called "research design". It is a map that guides the researcher in collecting and analyzing the data. In other words, research design acts as a blueprint that is followed throughout the research work.

For example, a building cannot be constructed without the knowledge of its structure. A builder cannot order raw materials or set dates till he knows the structure of this building, such as office building, school, home, etc.

Definition of Research Design

According to William Zikmund :

"Research design is defined as a master plan specifying the methods and procedures for collection and analyzing the needed information."

According to Kerlinger :

"Research design is the plan, structure, and strategy of investigation conceived so as to obtain answers to research questions and to control variance".

According to Green and Tull :

"A research design is the specification of methods and procedures for acquiring the information needed. It is the over-all operational pattern or framework of the project that stipulates what information is to be collected from which sources by what procedures".

According to Selltiz et al. :

"A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure".

A research design is not only a work plan, it also specifies the type of data required to address the research problem. It ensures that the data analysis and the conclusions, lead to answering the initial questions of researcher in a simple way. Therefore, at research design provides the structure of a research in such a way that it provides relevant outcomes economically.

## Features of a Good Research Design

It is considered that a good research design should reduce the biasness while should maximize the reliability of data being collected and analysed. A good research design should provide the opportunity as per the various aspects of research problem. It should minimize the experimental error and should provide maximum information. Hence, it can be concluded the selection of research design relies upon the research problem and the nature of research. Following are the major features of a good research design :

1) Objectivity :

Objectivity refers to the ability of the research instruments to give conclusions that are free from observer's personal biases. A good research design should be able select those instruments only that provide objective conclusions. Usually, it is believed that maintaining objectivity is pretty easy, but it proves to be difficult during execution of research and data analysis.

2) Reliability :

Another essential feature of a good research design is the reliability of responses. The instruments used in research should be able to provide similar responses to a question asked from a respondent. If the response varies, the instrument is considered unreliable. In other words, reliability of research design is measured in terms of consistency in responses.

3) Validity :

An important characteristic of a good research design is its ability to answer the questions in the way it was intended to. It should focus on the objective of the research and make specific arrangements or plan for achieving that objective.

For example, when a research is conducted to measure the effects of advertisements in viewers, it should be able to answer this, and not the sale of a particular product.

4) Generalisability :

A research design is said to be generalisable if the outcome of the research is applicable on a bigger population from which the sample is selected. A research design can be made generalisable by properly defining the population properly, selecting the sample carefully, analyzing the statistical data appropriately, and by preparing it methodologically. Therefore, the more the outcomes are generalisable, more efficient is the research design.

5) Sufficient Information :

Any research is conducted to gain insight of the hidden facts, figures and information. The research design should be able to provide sufficient information to the researcher so that he can analyse the research problem in a broad perspective. The research design should be able to identify the research problem and research objective.

6) Other Features :

Along with the above, there are some other features also that make a research design good. These are adaptability, flexibility. efficiency, etc. A good research design should be able to minimize the errors and maximize the accuracy.

## Importance of Research Design

Purpose of research design / Use of research designs are as follows :

1) Reduces Cost :

Research design is needed to reduce the excessive costs in terms of time, money and effort by planning the research work in advance.

2) Facilitate the Smooth Scaling :

In order to perform the process of scaling smoothly, an efficient research design is of utmost importance. It makes the research process effective enough to give maximum relevant outcome in an easy way.

3) Helps in Relevant Data Collection and Analysis :

Research design helps the researchers in planning the methods of data collection and analysis as per the objective of research. It is also responsible for the reliable research work as it is the foundation for entire research. Lack of proper attention in preparation of research design can harm the entire research work.

4) Assists in Smooth Flow of Research Operations :

Research design is necessary to give better and effective structure to the research. Since all the decisions are made in advance, therefore, research design facilitates the smooth flow of research operations and reduces the possible problems of researchers.

5) Helps in Getting Reviews from Experts :

Research design helps in developing an overview about the whole research process and thus assists in getting responses and reviews from different experts in that field.

6) Provides a Direction to Executives :

Research design directs the researcher as well as the executives involved in the research for giving their relevant assistance.

## Factors Affecting Research Design

Various factors that affect research design are as follows :

1) Research Questions :

Research questions perform an important role in selecting the method to carry-out research. There are various forms of research designs which include their own methods for collecting data.

For example, a survey can be conducted for the respondents to ask them descriptive or interconnected questions while a case study or a field survey can be used to identify the firm's decision-making process.

2) Time and Budget Limits :

Researchers are bound with restricted amount of time and budget to complete the research study. The researcher can select experimental or descriptive research when the time and budget constraints we favorable to him for the detailed study. otherwise exploratory research design can be adopted when the time is limited.

3) Research Objective :

Every research is carried out to obtain the results which help to achieve some objectives. This research objective influences the selection of research design. Researcher should adopt the research design which is suitable for research objective and also provides best solution to the problem along with the valuable result.

4) Research Problem :

Selection of the research design is greatly affected by the type of research problems. For example, the researcher selects experimental research design to find out cause and-effect relationship of the research problem. Similarly, if the research problem includes in depth study, then the researcher generally adopts experimental research design method.

5) Personal Experiences :

Selection of research design also depends upon the personal experience of researchers.

For example, the researcher who has expertise in statistical analysis would be liable to select the quantitative research designs. While, those researchers who are specialists in theoretical facets of research will be forced to select qualitative research design.

6) Target Audience :

The type of target audience plays very important role in selection of research design. Researcher must consider the target audience for which the research is carried-out. Audiences may either be general public, business professionals or government.

For example, if the research is proposed for general public, then the researcher should select qualitative research design. Similarly, quantitative research design would be appropriate for the researcher to introduce the report in front of the business experts.

## Process of Research Design

The stages in the process of research design are interactive in nature and often occur at the same time. Designing of research study follows given process. Steps in research design :

Research Design Process

Step 1: Defining Research Problem :

The definition of research problem is the foremost and important part of a research design process. Defining the research problem includes supplying the information that is required by the management. Without defining the research problem appropriately, it is not possible for the researcher to conclude the accurate, results. While defining research problem, the researchers first analyse the problems or opportunities in management, then they analyse the situation. The purpose of clarifying the research problem is to make sure that the area of concern for research is properly reflected and management decision is correctly described. After situation analysis, they develop a model for research which helps in the next step which is specification of information.

Step 2: Assess the Value of Information :

When a research problem is approached, it is usually based on some information. These data are obtained from past experiences as well as other sources. On the basis of this information, some preliminary judgement are made regarding the research problem. There is always a need for additional information which is available without additional cost and delay but waiting and paying for the valuable information is quite difficult.

For example, a car manufacturing industry may be concerned about decrease in the sale of a particular model. A researcher will look for the solutions by analyzing various aspects.

For this, the researcher has to continuously collect a lot of information and needs to evaluate them by understanding their value and filtering out useless information.

Step 3: Select the Approach for Data Collection :

For any type of research, a researcher needs data. Once, it is identified that which kind of information is required for conducting the research, the researchers proceed towards collecting the data. The data can be collected using secondary or primary sources.

Secondary data is the previous collected information for some other purpose, while the primary data is collected by the researcher especially for the research problem.

Step 4: Select the Measurement Technique :

After collecting data, the measurement technique for the collected data is selected. The major measurement techniques used in research are as follows :

i) Questionnaire :

Questionnaire is a formal structure which contains questions to collect the information from the respondents regarding his attitude, beliefs, behavior, knowledge, etc.

ii) Attitude Scales :

Attitude scales are used to extract the beliefs and feelings of the respondents regarding an object or issue.

iii) Observation :

It is the monitoring of behaviors and psychological changes of the respondents. It is widely used in research.

iv) Projective Techniques and Depth Interview :

Sometimes direct questions are not sufficient to get true responses from the individuals, that is why. different approaches like depth interviews and projective techniques are used. These techniques allow the respondents to give their responses without any fear. Researcher neither disagrees nor gives advice in these techniques.

Step 5: Sample Selection :

Once, the measurement technique has been selected, the next step is selecting the sample to conduct the research. The researchers in this stage select a sample out of the total population instead of considering the population as a whole. Sample can be selected by using two techniques, i.e., random sampling techniques, and non-random sampling techniques.

Step 6: Selecting Model of Analysis :

Researchers select the model of analysis or technique of data analysis, before collecting data. After this, researchers evaluate the techniques using hypothetical values to ensure that the measurement technique would provide the desired outcome regarding the research problem.

Step 7: Evaluate the Ethics of Research :

While conducting research, it becomes very much necessary for the researcher to follow ethical practices. The researches which are conducted ethically draws interests of general public, respondents, clients and other research professionals. Hence, it becomes the duty of the researcher to evaluate the practices in research, to avoid any biasness on behalf of the observer and researcher as well.

Step 8: Estimate Time and Financial Requirements :

This step is one of the most important steps in designing research. Here, researchers use different methods like Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT) to design the plan as well as control process and to determine the resources required.

A flowchart of these activities along with their approximate time is prepared for visual assessment of the research process. With the help of this chart, the researcher can find out the sequence of activities to be taken.

Step 9: Prepare the Research Proposal :

The final step in the process of research design is preparing the research proposal. A research proposal or the research design is prepared the operation and control of research. An effective research proposal is prepared before actual conduction of the research.

## Types of Research Design

Based on the aim of study, there are three types of research design :

Types of Research Design

1) Exploratory Research Design :

Exploratory research design aims to get a better understanding of the problem by explaining the concepts and developing hypotheses regarding the research study. Various techniques used in exploratory research study are literature survey. surveys, focus groups, case studies, etc. Exploratory research does not emphasize upon sampling, but tries to gather information from participants who are considered knowledgeable.

2) Descriptive Research Design :

Unlike exploratory research, the aim of descriptive research is to describe the characteristics of a phenomenon is more rigid than exploratory research. It describes various aspects related to a population. It is the study that is designed to depict the population in much more accurate way. It attempts to describe, explain and interpret the conditions in much detailed approach. It examines a phenomenon that is occurring at a specific place and at specific time.

3) Experimental or Causal Research Design :

Experimental or Causal or Conclusive research design is a type of research design which is predetermined and structured in nature. It is used for causal or conclusive research, which is conducted quantitatively. It is called causal research, because it is helpful in exploring the cause and effect relationship of a research problem. The main objective of casual research is to test the hypotheses which were defined in the exploratory Research Design. Causal research is simply opposite to the descriptive research, as with the help of experimentation, it can interpret whether the relationship is causal or not.

Types of Research Designs

Now that we know the broadly classified types of research, Quantitative and Qualitative Research can be divided into the following 4 major types of Research Designs:

- Descriptive Research Design
- Correlational Research Design
- Experimental Research Design
- Diagnostic Research Design
- Explanatory Research Design

These 5 types of Research Designs are considered the closest and exact to true experiments and are preferred in terms of accuracy, relevance as well as quality.

**Descriptive Research Design**

In Descriptive Research Design, the scholar explains/describes the situation or case in depth in their research materials. This type of research design is purely on a theoretical basis where the individual collects data, analyses, prepares and then presents it in an understandable manner. It is the most generalised form of research design. To explore one or more variables, a descriptive design might employ a wide range of research approaches. Unlike in experimental research, the researcher does not control or change any of the variables in a descriptive research design; instead, he or she just observes and measures them. In other words, while qualitative research may also be utilised for descriptive reasons, a descriptive method of research design is typically regarded as a sort of quantitative research. To guarantee that the results are legitimate and dependable, the study design should be properly constructed. Here are some examples for the descriptive design of research type: • How has the Delhi housing market changed over the past 20 years?

- Do customers of company A prefer product C or product D?
- What are the main genetic, behavioural and morphological differences between Indian wild cows and hybrid cows?

- How prevalent is disease 1 in population Z?

**Experimental Research Design**

Experimental research is a type of research design in which the study is carried out utilising a scientific approach and two sets of variables. The first set serves as a constant against which the variations in the second set are measured. Experimentation is used in quantitative research methodologies, for example. If you lack sufficient evidence to back your conclusions, you must first establish the facts. Experimental research collects data to assist you in making better judgments. Experimentation is used in any research undertaken under scientifically appropriate settings. The effectiveness of experimental investigations is dependent on researchers verifying that a variable change is due only to modification of the constant variable. The study should identify a noticeable cause and effect. The traditional definition of experimental design is "the strategies employed to collect data in experimental investigations." There are three types of experimental designs:

- Pre-experimental research design
- True experimental research design
- Quasi-experimental research design

**Correlational Research Design**

A correlational research design looks into correlations between variables without allowing the researcher to control or manipulate any of them. Correlational studies reveal the magnitude and/or direction of a link between two (or more) variables. Correlational studies or correlational study design might have either a positive, negative or zero. Correlational Studies Direction or Types What Happens? Example Positive correlation Both variables change in the same direction As the prices of petrol increase, the fare of auto increases too. Negative correlation The variables change in opposite directions As tea consumption increases, tiredness decreases Zero correlation There is no relationship between the variables Tea consumption is not correlated with height Correlational research design is great for swiftly collecting data from natural settings. This allows you to apply your results to real-world circumstances in an externally legitimate manner. Correlational studies research is a viable choice in a few scenarios like:

- To investigate non-causal relationships
- To explore causal relationships between variables
- To test new measurement tools

## Diagnostic Research Design

Diagnostic research design is a type of research design that tries to investigate the underlying cause of a certain condition or phenomenon. It can assist you in learning more about the elements that contribute to certain difficulties or challenges that your clients may be experiencing. This design typically consists of three research stages, which are as follows:

- Inception of the issue

- Diagnosis of the issue
- Solution for the issue

## Explanatory Research Design

Explanatory research is a method established to explore phenomena that have not before been researched or adequately explained. Its primary goal is to notify us about where we may get a modest bit of information. With this strategy, the researcher obtains a broad notion and use research as a tool to direct them more quickly to concerns that may be addressed in the future. Its purpose is to discover the why and what of a subject under investigation. In short, it is a type of research design that is responsible for finding the why of the events through the establishment of cause-effect relationships. The most popular methods of explanatory research are:

- Literature research
- In-depth interview
- Focus groups
- Case studies

### Basic Principles of Experimental Designs

Professor Fisher has enumerated three principles of experimental designs:

the Principle of Replication;

the Principle of Randomization; and the

Principle of Local Control

According to the Principle of Replication, the experiment should be repeated more than once. Thus, each treatment is applied in many experimental units instead of one. By doing so the statistical accuracy of the experiments is increased. For example, suppose we are to examine the effect of two varieties of rice. For this purpose we may divide the field into two parts and grow one variety in one part and the other variety in the other part. We can then compare the yield of the two parts and draw conclusion on that basis. But if we are to apply the principle of replication to this experiment, then we first divide the field into several parts, grow one variety in half of these parts and the other variety in the remaining parts. We can then collect the data of yield of the two varieties and draw conclusion by comparing the same. The result so obtained will be more reliable in comparison to the conclusion we draw without applying the principle of replication. The entire experiment can even be repeated several times for better results. Conceptually replication does not present any difficulty, but computationally it does. For example, if an experiment requiring a two-way analysis of variance is replicated, it will then require a three-way analysis of variance since replication itself may be a source of variation in the data. However, it should be remembered that replication is introduced in order to increase the precision of a study; that is to say, to increase the accuracy with which the main effects and interactions can be estimated.

The Principle of Randomization provides protection, when we conduct an experiment, against the effect of extraneous factors by randomization. In other words, this principle indicates that we should design or plan the experiment in such a way that the variations caused by extraneous factors can all be combined under the general heading of "chance." For instance, if we grow one variety of rice, say, in the first half of the parts of a field and the other variety is grown in the other half, then it is just possible that the soil fertility may be different in the first half in comparison to the other half. If this is so, our results would not be realistic. In such a situation, we may assign the variety of rice to be grown in different parts of the field on the basis of some random sampling technique i.e., we may apply randomization principle and protect ourselves against the effects of the extraneous factors (soil fertility differences in the given case). As such, through the application of the principle of randomization, we can have a better estimate of the experimental error.

The Principle of Local Control is another important principle of experimental designs. Under it the extraneous factor, the known source of variability, is made to vary deliberately over as wide a range as necessary and this needs to be done in such a way that the variability it causes can be measured and hence eliminated from the experimental error. This means that we should plan the experiment in a manner that we can perform a two-way analysis of variance, in which the total variability of the data is divided into three components attributed to treatments (varieties of rice in our case), the extraneous factor (soil fertility in our case) and experimental error. In other words, according to the principle of local control, we first divide the field into several homogeneous parts, known as blocks, and then each such block is divided into parts equal to the number of treatments. Then the treatments are randomly assigned to these parts of a block. Dividing the field into several homogenous parts is known as 'blocking'. In general, blocks are the levels at which we hold an extraneous factor fixed, so that we can measure its contribution to the total variability of the data by means of a two-way analysis of variance. In brief, through the principle of local control we can eliminate the variability due to extraneous factor(s) from the experimental error.

**Important Experimental Designs**

Experimental design refers to the framework or structure of an experiment and as such there are several experimental designs. We can classify experimental designs into two broad categories, viz., informal experimental designs and formal experimental designs. Informal experimental designs are those designs that normally use a less sophisticated form of analysis based on differences in magnitudes, whereas formal experimental designs offer relatively more control and use precise statistical procedures for analysis. Important experiment designs are as follows:

Informal experimental designs:

Before-and-after without control design.

After-only with control design.

Before-and-after with control design.

Formal experimental designs:

Completely randomized design (C.R. Design).

Randomized block design (R.B. Design).

Latin square design (L.S. Design).

Factorial designs.

We may briefly deal with each of the above stated informal as well as formal experimental designs.

Before-and-after without control design: In such a design a single test group or area is selected and the dependent variable is measured before the introduction of the treatment. The treatment is then introduced and the dependent variable is measured again after the treatment has been introduced. The effect of the treatment would be equal to the level of the phenomenon after the treatment minus the level of the phenomenon before the treatment. The design can be represented thus:

Before-and-after without control design

The main difficulty of such a design is that with the passage of time considerable extraneous variations may be there in its treatment effect.

After-only with control design: In this design two groups or areas (test area and control area) are selected and the treatment is introduced into the test area only. The dependent variable is then measured in both the areas at the same time. Treatment impact is assessed by subtracting the value of the dependent variable in the control area from its value in the test area. This can be exhibited in the following form:

After-only with control design

The basic assumption in such a design is that the two areas are identical with respect to their behaviour towards the phenomenon considered. If this assumption is not true, there is the possibility of extraneous variation entering into the treatment effect. However, data can be collected in such a design without the introduction of problems with the passage of time. In this respect the design is superior to before-and-after without control design.

Before-and-after with control design: In this design two areas are selected and the dependent variable is measured in both the areas for an identical time-period before the treatment. The treatment is then introduced into the test area only, and the dependent variable is measured in both for an identical time-period after the introduction of the treatment. The treatment effect is determined by subtracting the change in the dependent variable in the control area from the change in the dependent variable in test area. This design can be shown in this way:

before and after with control design

This design is superior to the above two designs for the simple reason that it avoids extraneous variation resulting both from the passage of time and from non-comparability of the test and control areas. But at times, due to lack of historical data, time or a comparable control area, we should prefer to select one of the first two informal designs stated above.

Completely randomized design (C.R. design): Involves only two principles viz., the principle of replication and the principle of randomization of experimental designs. It is the simplest possible design and its procedure of analysis is also easier. The essential characteristic of the design is that subjects are randomly assigned to experimental treatments (or vice-versa). For instance, if we have 10 subjects and if we wish to test 5 under treatment A and 5 under treatment B, the randomization process gives every possible group of 5 subjects selected from a set of 10 an equal opportunity of being assigned to treatment A and treatment B. One-way analysis of variance (or one-way ANOVA) is used to analyse such a design. Even unequal replications can also work in this design. It provides maximum number of degrees of freedom to the error. Such a design is generally used when experimental areas happen to be homogeneous. Technically, when all the variations due to uncontrolled extraneous factors are included under the heading of chance variation, we refer to the design of experiment as C.R. design.

We can present a brief description of the two forms of such a design as given above figure.

Two-group simple randomized design: In a two-group simple randomized design, first of all the population is defined and then from the population a sample is selected randomly. Further, requirement of this design is that items, after being selected randomly from the population, be randomly assigned to the experimental and control groups (Such random assignment of items to two groups is technically described as principle of randomization).

Thus, this design yields two groups as representatives of the population. In a diagram form this design can be shown in this way:

**Two-group simple randomized experimental design (in diagram form)**

**Two group simple randomized experimental design In Research Methodology**

Since in the sample randomized design the elements constituting the sample are randomly drawn from the same population and randomly assigned to the experimental and control groups, it becomes possible to draw conclusions on the basis of samples applicable for the population. The two groups (experimental and control groups) of such a design are given different treatments of the independent variable. This design of experiment is quite common in research studies concerning behavioural sciences. The merit of such a design is that it is simple and randomizes the differences among the sample items. But the limitation of it is that the individual differences among those conducting the treatments are not eliminated, i.e., it does not control the extraneous variable and as such the result of the experiment may not depict a correct picture. This can be illustrated by taking an example. Suppose the researcher wants to compare two groups of students who have been randomly selected and randomly assigned. Two different treatments viz., the usual training and the specialized training are being given to the two groups. The researcher hypothesises greater gains for the group receiving specialised training. To determine this, he tests each group before and after the training, and then compares the amount of gain for the two groups to accept or reject his hypothesis. This is an illustration of the two-groups randomized design, wherein individual differences among students are being randomized. But this does not control the differential effects of the extraneous independent variables (in this case, the individual differences among those conducting the training programme).

**Random replication design (in diagram form)**

**Random replications design in Research Methodology**

Random replications design: The limitation of the two-group randomized design is usually eliminated within the random replications design. In the illustration just cited above, the teacher differences on the dependent variable were ignored, i.e., the extraneous variable was not controlled. But in a random replications design, the effect of such differences are minimised (or reduced) by providing a number of repetitions for each treatment. Each repetition is technically called a 'replication'. Random replication design serves two purposes viz., it provides controls for the differential effects of the extraneous independent variables and secondly, it randomizes any individual differences among those conducting the treatments. Diagrammatically we can illustrate the random replications design thus: above

From the diagram it is clear that there are two populations in the replication design. The sample is taken randomly from the population available for study and is randomly assigned to, say, four experimental and four control groups. Similarly, sample is taken randomly from the population available to conduct experiments (because of the eight groups eight such individuals be selected) and the eight individuals so selected should be randomly assigned to the eight groups. Generally, equal number of items are put in each group so that the size of the group is not likely to affect the result of the study. Variables relating to both population characteristics are assumed to be randomly distributed among the two groups. Thus, this random replication design is, in fact, an extension of the two-group simple randomized design.

Randomized block design (R.B. design) is an improvement over the C.R. design. In the R.B. design the principle of local control can be applied along with the other two principles of experimental designs. In the R.B. design, subjects are first divided into groups, known as blocks, such that within each group the subjects are relatively homogeneous in respect to some selected variable. The variable selected for grouping the subjects is one that is believed to be related to the measures to be obtained in respect of the dependent variable. The number of subjects in a given block would be equal to the number of treatments and one subject in each block would be randomly assigned to each treatment. In general, blocks are the levels at which we hold the extraneous factor fixed, so that its contribution to the total variability of data can be measured. The main feature of the R.B. design is that in this each treatment appears the same number of times in each block. The R.B. design is analysed by the two-way analysis of variance (two-way ANOVA)* technique.

Let us illustrate the R.B. design with the help of an example. Suppose four different forms of a standardised test in statistics were given to each of five students (selected one from each of the five I.Q. blocks) and following are the scores which they obtained.

**Randomized block design**

If each student separately randomized the order in which he or she took the four tests (by using random numbers or some similar device), we refer to the design of this experiment as a R.B. design. The purpose of this randomization is to take care of such possible extraneous factors (say as fatigue) or perhaps the experience gained from repeatedly taking the test.

Latin square design (L.S. design) is an experimental design very frequently used in agricultural research. The conditions under which agricultural investigations are carried out are different from those in other studies for nature plays an important role in agriculture. For instance, an experiment has to be made through which the effects of five different varieties of fertilizers on the yield of a certain crop, say wheat, it to be judged. In such a case the varying fertility of the soil in different blocks in which the experiment has to be performed must be taken into consideration; otherwise the results obtained may not be very dependable because the output happens to be the effect not only of fertilizers, but it may also be the effect of fertility of soil. Similarly, there may be impact of varying seeds on the yield. To overcome such difficulties, the L.S. design is used when there are two major extraneous factors such as the varying soil fertility and varying seeds.

The Latin-square design is one wherein each fertilizer, in our example, appears five times but is used only once in each row and in each column of the design. In other words, the treatments in a L.S. design are so allocated among the plots that no treatment occurs more than once in any one row or any one column. The two blocking factors may be represented through rows and columns (one through rows and the other through columns). The following is a diagrammatic form of such a design in respect of, say, five types of fertilizers, viz., A, B, C, D and E and the two blocking factor viz., the varying soil fertility and the varying seeds:

Latin square design in Research Methodology

The above diagram clearly shows that in a L.S. design the field is divided into as many blocks as there are varieties of fertilizers and then each block is again divided into as many parts as there are varieties of fertilizers in such a way that each of the fertilizer variety is used in each of the block (whether column-wise or row-wise) only once. The analysis of the L.S. design is very similar to the two-way ANOVA technique.

The merit of this experimental design is that it enables differences in fertility gradients in the field to be eliminated in comparison to the effects of different varieties of fertilizers on the yield of the crop. But this design suffers from one limitation, and it is that although each row and each column represents equally all fertilizer varieties, there may be considerable difference in the row and column means both up and across the field. This, in other words, means that in L.S. design we must assume that there is no interaction between treatments and blocking factors. This defect can, however, be removed by taking the means of rows and columns equal to the field mean by adjusting the results. Another limitation of this design is that it requires number of rows, columns and treatments to be equal. This reduces the utility of this design. In case of $(2 \times 2)$ L.S. design, there are no degrees of freedom available for the mean square error and hence the design cannot be used. If treatments are 10 or more, than each row and each column will be larger in size so that rows and columns may not be homogeneous. This may make the application of the principle of local control ineffective. Therefore, L.S. design of orders $(5 \times 5)$ to $(9 \times 9)$ are generally used.

Factorial designs: Factorial designs are used in experiments where the effects of varying more than one factor are to be determined. They are specially important in several economic and social phenomena where usually a large number of factors affect a particular problem. Factorial designs can be of two types: simple factorial designs and complex factorial designs. We take them separately

Simple factorial designs: In case of simple factorial designs, we consider the effects of varying two factors on the dependent variable, but when an experiment is done with more than two factors, we use complex factorial designs. Simple factorial design is also termed as a 'two-factor-factorial design', whereas complex factorial design is known as 'multifactor- factorial design.' Simple factorial design may either be a 2 × 2 simple factorial design, or it may be, say, 3 × 4 or 5 × 3 or the like type of simple factorial design. We illustrate some simple factorial designs as under:

Illustration : (2 × 2 simple factorial design).

A 2 × 2 simple factorial design can graphically be depicted as follows:

**Factorial designs**

In this design the extraneous variable to be controlled by homogeneity is called the control variable and the independent variable, which is manipulated, is called the experimental variable. Then there are two treatments of the experimental variable and two levels of the control variable. As such there are four cells into which the sample is divided. Each of the four combinations would provide one treatment or experimental condition. Subjects are assigned at random to each treatment in the same manner as in a randomized group design. The means for different cells may be obtained along with the means for different rows and columns. Means of different cells represent the mean scores for the dependent variable and the column means in the given design are termed the main effect for treatments without taking into account any differential effect that is due to the level of the control variable. Similarly, the row means in the said design are termed the main effects for levels without regard to treatment. Thus, through this design we can study the main effects of treatments as well as the main effects of levels. An additional merit of this design is that one can examine the interaction between treatments and levels, through which one may say whether the treatment and levels are independent of each other or they are not so. The following examples make clear the interaction effect between treatments and levels. The data obtained in case of two (2 × 2) simple factorial studies may be as given in below.

**simple factorial studies**

All the above figures (the study I data and the study II data) represent the respective means. Graphically, these can be represented as shown in below.

**respective means**

The graph relating to Study I indicates that there is an interaction between the treatment and the level which, in other words, means that the treatment and the level are not independent of each other. The graph relating to Study II shows that there is no interaction effect which means that treatment and level in this study are relatively independent of each other.

The 2 × 2 design need not be restricted in the manner as explained above i.e., having one experimental variable and one control variable, but it may also be of the type having two experimental variables or two control variables. For example, a college teacher compared the effect of the classsize as well as the introduction of the new instruction technique on the learning of research methodology. For this purpose he conducted a study using a 2 × 2 simple factorial design. His design in the graphic form would be as follows:

But if the teacher uses a design for comparing males and females and the senior and junior students in the college as they relate to the knowledge of research methodology, in that case we will have a 2 × 2 simple factorial design wherein both the variables are control variables as no manipulation is involved in respect of both the variables.

Illustration : (4 × 3 simple factorial design).

The 4 × 3 simple factorial design will usually include four treatments of the experimental variable and three levels of the control variable. Graphically it may take the following form:

**simple factorial design**

This model of a simple factorial design includes four treatments viz., A, B, C, and D of the experimental variable and three levels viz., I, II, and III of the control variable and has 12 different cells as shown above. This shows that a 2 × 2 simple factorial design can be generalised to any number of treatments and levels. Accordingly we can name it as such and such (–×–) design. In such a design the means for the columns provide the researcher with an estimate of the main effects for treatments and the means for rows provide an estimate of the main effects for the levels. Such a design also enables the researcher to determine the interaction between treatments and levels.

Complex factorial designs: Experiments with more than two factors at a time involve the use of complex factorial designs. A design which considers three or more independent variables simultaneously is called a complex factorial design. In case of three factors with one experimental variable having two treatments and two control variables, each one of which having two levels, the design used will be termed 2 × 2 × 2 complex factorial design which will contain a total of eight cells as shown below in below.

Complex factorial designs

A pictorial presentation is given of the design shown below

pictorial presentation in Research Methodology

The dotted line cell in the diagram corresponds to Cell 1 of the above stated 2 × 2 × 2 design and is for Treatment A, level I of the control variable 1, and level I of the control variable 2. From this design it is possible to determine the main effects for three variables i.e., one experimental and two control variables. The researcher can also determine the interactions between each possible pair of variables (such interactions are called 'First Order interactions') and interaction between variable taken in triplets (such interactions are called Second Order interactions). In case of a 2 × 2 × 2 design, the further given first order interactions are possible:

Experimental variable with control variable 1 (or EV × CV 1);

Experimental variable with control variable 2 (or EV × CV 2);

Control variable 1 with control variable 2 (or CV1 × CV2);

Three will be one second order interaction as well in the given design (it is between all the three variables i.e., EV × CV1 × CV2).

To determine the main effects for the experimental variable, the researcher must necessarily compare the combined mean of data in cells 1, 2, 3 and 4 for Treatment A with the combined mean of data in cells 5, 6., 7 and 8 for Treatment B. In this way the main effect for experimental variable, independent of control variable 1 and variable 2, is obtained. Similarly, the main effect for control variable 1, independent of experimental variable and control variable 2, is obtained if we compare the combined mean of data in cells 1, 3, 5 and 7 with the combined mean of data in cells 2, 4, 6 and 8 of our 2 × 2 × 2 factorial design. On similar lines, one can determine the main effect for the control variable 2 independent of experimental variable and control variable 1, if the combined mean of data in cells 1, 2, 5 and 6 are compared with the combined mean of data in cells 3, 4, 7 and 8.

To obtain the first order interaction, say, for EV × CV1 in the above stated design, the researcher must necessarily ignore control variable 2 for which purpose he may develop 2 × 2 design from the 2 × 2 × 2 design by combining the data of the relevant cells of the latter design as shown in Fig. below experimental variable in Research Methodology

Similarly, the researcher can determine other first order interactions. The analysis of the first order interaction, in the manner described above, is essentially a sample factorial analysis as only two variables are considered at a time and the remaining one is ignored. But the analysis of the second order interaction would not ignore one of the three independent variables in case of a 2 × 2 × 2 design. The analysis would be termed as a complex factorial analysis.

It may, however, be remembered that the complex factorial design need not necessarily be of 2 × 2 × 2 type design, but can be generalised to any number and combination of experimental and control independent variables. Of course, the greater the number of independent variables included in a complex factorial design, the higher the order of the interaction analysis possible. But the overall task goes on becoming more and more complicated with the inclusion of more and more independent variables in our design.

# Questions.

No. 1 Define Research problem. Discuss the method of selecting Research problem.

No. 2 What is Research problem? Discuss the method of selecting a Research problem.

No. 3 What is Research problem? Discuss the necessities of defining Research problem.

No. 4 What is Research problem? Discuss the techniques involved in Defining a research problem.

No. 5 What do you mean by Research Design? Discuss the need and features of a good research Design.

No. 6 What do you mean by Research Design? Discuss the important Concept relating to Research Design.

No. 7 What do you mean by Research Design? Discuss the different type of Research Design.

No. 8 What do you mean by Experimental Design? Discuss the Basic principles involved in experimental Design.