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CHAPTER – III

METHODOLOGY OF THE STUDY

3.1 Introduction

The third chapter compresses with the pillar of research and research strategy. The value of research design is rule on by the degree of accuracy be present on the level of appropriate evidence search for.

A research design could be constructed either to test a hypothesis or to give a cause effect relationship to a situation. The selection of appropriate research method plays significant role in the research procedure. It refers to the general strategy followed in collecting, analysing and interpreting necessary data for solving the research problem. Achieving good success in every research work depends upon the efficient planning of a research design which comes after the selection of a problem, framing of objectives and formulation of hypothesis. The third step of a scientific research is to make a proper research design. The quality of such research design is rule on by the degree of accuracy which is judged on the level of applicable confirmation search for.

The assumptions made in the previous three categories have implications for the methods you choose to conduct your work of inquiry. Different assumptions incline you toward different methods. Investigators adopting objectivist (or positivist) approach to the social world and who treat it like the world of natural phenomena as being hard, real and external to the individual, will choose from a range of traditional options - surveys, experiments, and the like. Others favouring the more subjectivist (or anti-positivist) approach and who view the social world as being of a much softer, personal and humanly created kind, will select from a comparable range of recent and emerging techniques - accounts, participant observation and personal constructs, for example.

When one subscribes to the view which treats the social world like the natural world - as if it were a hard, external and objective reality - then,
scientific investigation will be directed at analysing the relationship and regularities between selected factors in that word. It will be predominantly quantitative. This perspective expresses itself more forcefully in search of universal laws which explain and govern the reality which is being observed. An approach characterized by procedures and methods designed to discover general laws may be referred to as 'homothetic'. Though, if one favours the alternative view of social reality which stresses the importance of the subjective experience of individuals in the creation of the social world, then the search for understanding focuses upon different issues and approaches them in different ways. The principal concern is with an understanding of the way in which the individual creates, modifies and interprets the world in which he or she finds himself or herself. The approach now takes on a qualitative as well as quantitative aspect. As Burrell and Morgan observe, the emphasis in extreme cases tends to be placed upon the explanation and understanding of what is unique and particular to the individual rather than of what is general and universal. This approach questions whether there exists an external reality worthy of study. In methodological terms it is an approach which emphasizes the relativistic nature of the social world (Burrell and Morgan, 1979). In its emphasis on the particular individual this approach to understanding individual behaviour may be termed as 'idiographic'.

Fig. 3.1 Research Methodology
Burrell and Morgan's analysis of the ontological, epistemological, human and methodological assumptions underlying two ways of conceiving social reality, the foundations have been laid down for a more extended study of the two contrasting perspectives evident in the practices of researchers investigating human behaviour and by adoption, educational problems.

Each of the two perspectives on the study of human behaviour outlined above has profound implications for research in classrooms and schools. The choice of problem, the formulation of questions to be answered, the characterization of pupils and teachers, methodological concerns, the kinds of data sought and their mode of treatment - all will be influenced or determined by the viewpoint held.

3.1.1 Purpose of The Research

1. Progress and Good life
   The purpose of research is progress and good life. Good education recognizes the development of the individual and society. Henceforth, the need of the research in various fields like educational practices is realized. Through educational research new innovation in the field of education are found out and implemented in the practical situation for its operation.

2. System
   Research is regarded as more formal and system of process of carrying out scientific methods of analysis. It involves a more systematic structure of investigation usually resulting in some sort of formal record of procedures and a report of conclusions.

3. Economy
   Decision basing on systematic research in education saves time, money and energy that show the path of progress.
3.1.2 Characteristics of Educational Research

1. A good philosophy of education forms the basis of educational research.
   Research needs the sound philosophy of education which helps the research to move towards a problem systematically. In order to evaluate the principles and activities of research the discipline in this regard is necessary. In case of highly complicated problem, the researcher should never at any place be harassed and inclination in conducting research be continued thereby getting of sure positive responses.

2. It is an inter-disciplinary approach.
   Educational research is related to the study of complex relationship with other disciplines. An educational problem can possess several features of many disciplines like economics, history, philosophy, political science, psychology and sociology.

3. It is not as exact as research in physical sciences.
   Social science and behavioural sciences have not achieved the level of specification possible in case of physical sciences. The methods, commonly used in the sciences, are the combination of arts and science. Difficulties and manipulating and controlling all the variables out limits on the precision of results arrived from social or psychological experiments.

4. It needs imagination and insight as much as scientific attitude of mind.
   Educational research always needs intellectuals having insight and imagination who can look for new things beyond the present. It deals with the problems of motivation and ethics that requires various assumptions and interpretations. Imagination and insight are necessary in educational research.

5. It employs deductive reasoning.
   The scientific bent of mind is always directed towards clear description, explanation, interpretation and sharp conclusion in educational research. Deductive thinking process employs for innovative idea.
6. It is not the field of the specialist only.
   Anybody having some knowledge in research can conduct the educational research relating to the day-to-day classroom problems of the students.

7. Educational research cannot be a mechanical process.
   All educational problems include unknown elements. These unknown elements can be defined by the systematic procedure of educational research. Researcher's willingness to find the innovation makes the problem easy for getting the solution.

8. It requires inexpensive material.
   In educational research, generally the students, tests, study materials are required which are inexpensive in nature.

9. It comes out of a desire to do things better.
   The chief purposes of a researcher are better education, better schools and better results. The practical personnel like teachers, supervisors and administrators should create desire in order to practical applications of theories in real life situations.

10. It is incapable of being dealt through empirical methods.
    In social science most of the matters is qualitative rather than quantitative statement. Qualitative analysis enters into even the highly statistical studies.

11. It is based on the relationship of cause and effect.
    Cause and effect relationships are interdependent to each other. One stimulates the other. It is difficult to say which cause is and which is effect? Usually both are cause and both are effects.

3.1.3 Types of Studies in Educational Research
    Studies in educational research are categorized under two broad heads:
    (a) quantitative studies, and
    (b) qualitative or non-quantitative studies. Qualitative studies are also called 'descriptive' studies by some researches. Various types of research studies under these broad heads are shown.
Table No.3.1
Types of Research Studies

<table>
<thead>
<tr>
<th>Educational Research</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative</td>
<td>Qualitative</td>
</tr>
<tr>
<td>(Based on positivist paradigm)</td>
<td>(Based on Humanistic paradigm)</td>
</tr>
<tr>
<td>1. Experimental</td>
<td>1. Survey</td>
</tr>
<tr>
<td>2. Quasi experimental</td>
<td>2. Case Studies</td>
</tr>
<tr>
<td>3. Correlational</td>
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<tr>
<td></td>
<td>4. Developmental</td>
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<td></td>
<td>5. Ethnographic</td>
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<tr>
<td></td>
<td>6. Historical</td>
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<td></td>
<td>7. Philosophical</td>
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</table>

**Experimental Research**

Experimental research in education is concerned with the investigation of cause-effect relationship in educational events. Variable(s) related to cause must precede those related to the effects. Since in terms of time, the cause variables occur first, they are also known as 'antecedents' while effect variables are called 'consequents'. In experimental studies, the researcher observes 'what happens' if an antecedent is varied under control; the effect is examined on another variable or a set of variables. The variable, which is varied, is also known as the 'Independent Variable' (IV) while the variable(s) on whom the effect is measured are Dependent Variables (DV). Issues like 'which method of teaching is more effective in promoting students' learning in a particular subject?' are settled through well-designed experimental studies.

**Quasi-Experimental Studies**

The literal meaning of 'quasi' is 'seemingly, but not really". Therefore, research studies that do not use a truly experimental design are called quasi-experimental studies. Since educational research is carried out on human beings who are, unlike objects, quite changeable, and controls cannot be
exercised absolutely, therefore much of experimental research in education is quasi-experimental in nature. This type of research investigates the same issues that experimental research does, the difference is only in terms of the manner in which an experiment is designed and conducted.

**Correlational Research**

Correlation means 'going togetherness'; in other words, correlation between two variables tells us about the relationship between them. For example, if we know how achievement in mathematics (x) is related with achievement in science (y), then on the basis of marks, in 'x' we can predict marks in 'y' and vice versa. Variables may be positively related with one another (e.g. High achievement in English is associated with high achievement in science); or the correlation may be negative (for example High achievement in English is associated with low achievement in art); or the correlation may be zero (for example high achievement in English is sometimes associated with low achievement in art, sometimes high achievement in art and sometimes even with average achievement in art). Correlation can vary between '0' and '1' and is expressed in terms of direction as well as magnitude (e.g. + 0.91, - 0.23, + 0.53 etc.) Contrasting experimental research, which aims at discovering cause-effect relationship among variables, correlational studies are concerned with problems like 'What is the relationship between educational achievement and levels of confidence'? Though, the correlation must not be interpreted to mean that one variable is the cause of high or low measure of the other variable. Frequently there are other factors that influence both of the variables under consideration. Correlation is always relative to the situation under which it is obtained, and its size does not represent any absolute natural fact. It is relative to the circumstances under which it is obtained and should be interpreted in the light of those circumstances. Correlational studies enable us to predict one variable from another (or many others). Correlational research helps us explore and understand the phenomena and thus it can prove helpful in theory building.
**Descriptive Research**

Descriptive research investigates 'what exists'. If it is conducted on large samples through surveys, it is called survey study. It may also be based on detailed and comprehensive study of just one unit of population, i.e. just one case, thus resulting in a case study. Descriptive research may examine how various aspects of human development (for example intelligence, attitudes, social development, moral development) or skills (cognitive skills, social interaction skills etc.;) develop in groups of persons of the same characteristics. Such studies are called 'developmental studies'. In the same way, analysis of documents related to a particular aspect / area of education (e.g. religious and moral instruction, value education etc.;) is collectively known as documentary analysis studies. All these are part of descriptive research.

**Ethnographic Research**

Ethnographic research is just the opposite of experimental research. In the latter, research is conducted through carefully controlled experiments but in ethnographic research, the emphasis is on naturalistic (i.e. totally without control) field studies. Ethnographic studies typically describe events that occur in the life of an educational group or a society with respect to social structures and behavior and perceptions of the individual members. Thus ethnographic studies collect primary data (i.e. facts as they occur) and interpret its meaning. Ethnographic studies use both participant as well as non-participant observation for collecting and recording primary data.

**Historical Research**

Historical studies are concerned with the study of 'what was'; they try to determine, evaluate and understand past events primarily for the purpose of gaining a clearer understanding of the present and a better prediction of the future. Historical research thus seeks to provide a perspective on the past so that we may be able to understand the present and the direction the course of events would take in future. Historical research is obviously useful in understanding the trends and the problems associated with educational
developments during a period of time. Historical research can also help us understand well-established educational systems like the one we have in India.

**Philosophical Research**

Philosophical research studies in education can be taken up under historical research. These studies usually deal with philosophical aspects of education (for example, related to knowledge and acquiring knowledge), metaphysical (namely related to reality aspects) or axiological (that is concerned with values) aspects of the education process. Philosophical research is basically interpretive in its approach and it involves careful definition of the terms and processes.

### 3.2 Research Design

Research designs are the utmost important in the research process. A pre-planned and well described method will provide the researcher a scientific and feasible plan for attaching and solving the problem under investigation. Good, Barr and Scates classified research designs into six categories. They are as follows:

- The filed to which philosophy, applied: education, biology and history etc.
- The purpose: description, prediction and determination of causes.
- The place where research designs is shown may be in the field or in the research laboratory.
- The submission: or presentation whether applied research or pure research.
- The data gathering devices employed: test, rating scales and questionnaire.

### 3.2.1 Types of Research Designs

There are various methods to classify research designs. However, the following are the useful distinctions for possible research designs.
1. Descriptive for example survey, observation, case study and naturalistic
2. Correlation for example observational study and case-control study
3. Semi-experimental for example field experiment and quasi-experiment
4. Experimental -Experiment with random assignment
5. Review for example literature review and systematic review
6. Meta-Analysis

3.2.2 Experimental Design

Experimental design is the blueprint of the procedure that enable the researcher to test hypotheses by reaching valid conclusions about the relationship between independent and dependent variables. It provides the researcher an opportunity for the comparison required by the hypotheses. It makes a meaningful interpretation of the result. The experimental designs vary in complexity and adequacy depending on the nature of the problem. It is an outcome, plan or strategy one conceives in attempt to answer a research question. It is a complete structure of the procedure that tells the researcher what he should do at what stage and how. there are three important characteristics for selection of experimental design for conducting experiment. They are (a) appropriateness, (b) adequacy of control and (c) validity.

(a) Appropriateness

It is the very important criteria for the selection of a research design. The design should be appropriate for testing by pattern of the study. If the design is appropriate one, the outcome of the study is a worthy one. The researcher should select a research design, which serves the purpose for which it is required.

(b) Adequacy of control

The design should provide adequate control as a result the effects of the independent variable is well measured. Adequate control on extraneous variable provides valid responses. For selecting an experimental design randomization method is the best method.

(c) Validity

Validity is necessary for the purpose of testing the hypotheses of the study. The validity of the design provides a good relation between the
independent and dependent variable. There are two types of validity such as internal validity and external validity.

I Internal Validity

The most important aspect in the experiment is to determine whether the identified variables have a systematic effect on the dependent variable or not and whether the outcome is affected by the extraneous variables or not? Internal validity measures the extent to which this aim is attained. There are eight extraneous variables that affect the internal validity of an experimental design. They are history, maturation, pre-testing, measuring, instruments, statistical regression, and differential selection of the subjects, experimental mortality, and interaction of selection.

1. History

History refers to the specific element that occurs between the pre-test and post-test other than the exposure. The experimenter should take necessary steps to control the specific events other than experimental treatment, which occurs between the initial and final measurement of the subjects to affect the dependent variable. The specific events are accident, rebuking of the teacher, fear of examination, and calamities significantly affect the dependent variable.

2. Maturation

The time period that elapses during the experimentation creates changes in the subjects. The subjects become very cautious about the time for conduct of the experiment. When the time passes the subjects perform differently on the dependent variable on biological or psychological factors like age, interest or motivation. The dependent variable is affected by this passing of time.

3. Pre-testing

When the subjects are exposed to pre-test, the subjects gather experience about it, which affects certainly the post-test.

4. Measuring instruments

Different measuring instruments, scorers, observers, interviewers, and raters used in the experiment affects the dependent variable.

5. Statistical regression
Statistical regression means the tendency for extreme scores to regress or move towards the common mean on subsequent measures when the groups are selected on the basis of extreme scores causes statistical regression effect.

6. **Differential selection of the subjects**

The groups may differ significantly on some important variables related to the dependent variable even before the application of the experimental treatment. If the subjects in the experimental group are more intelligent than the control group, the experimental group shows better performance than the control group even if the experimental group is not exposed to experimental treatment.

7. **Experimental treatment**

The differential loss of the subjects from the experimental group affects the dependent variable. Suppose if the low achievers of the experimental group are dropped in the post-test, this group will show higher mean than the control group not due to the absence of low scoring subjects.

8. **Interaction of selection and maturation, selection & history**

When two comparison groups have same scores on the pre-test, some other differences due to interaction between the variables like maturation, interest, intelligence, age etc. rather than experimental variable causes one of the groups to get higher post-test scores. Such interaction occurs when the subjects are selected basing on extraneous factors.

II **External Validity**

The researcher determines whether systematic relationships, which are identified, isolate and measured, can be generalized. External validity measures to what extent these objectives have been achieved. It is of two types such as population validity and ecological validity.

1. **Population validity**

If refers to the identification of the population to which the results of an experiment is generalized. Basing on the generalization found from the small experimental group of a particular locality the large population is selected by randomization concerning a large area.

2. **Ecological validity**
It refers to generalizing experimental effects to other environmental conditions. It assesses to what extent the outcome of the study is generalized to the other situation. The presence of observers, experimental equipment and knowledge of participation of the subjects in an experiment makes the subjects aware about receiving the experimental treatment and accordingly they change their normal behaviour. This change is 'Hawthorne effect'.

3.2.3 Type of Experimental Design
The experimental designs are classified as follows.
1. Pre-Experimental Design
2. True Experimental Design
3. Factorial Experimental Design
4. Quasi Experimental Design
5. Time Series Design

1. Pre Experimental Design

Pre-experimental design is one in which there is little or no control on extraneous or situation variables. These are also applied in the research studies. This type is divided into two types.

One group pre-test Post-test design

In this type of design, the dependent variable of a group is measured before the application or withdrawal of independent variable. After the application or withdrawal of independent variable, the dependent variable is measured and the result if any in the change of dependent variable is due to either application or withdrawal of independent variable.

The difference between pre-test and post-test determines the effect of the independent variable. As this design is concerned with one group and one teacher, inter subject differences and extraneous variable is due to the following reasons.
1. There is no control group. Therefore, the change is due to treatment or extraneous variables.
2. History and maturation are two major extraneous variables that are not controlled in this design.
3. It does not provide any procedure for evaluating the effect of the post-test itself.
4. There is a problem of reactivity in the design due to reaction between the subject and pre-test measurement.

**Two Group Static Design / Parallel group design**

In this design the two groups are selected assuming equivalent in all respects. One group is known as control group and another group as experimental group. The experimental group only is exposed to independent variable leaving the control group without independent variable. There is no pre-test. The post-test is measured in both the groups. The change is computed statistically. According it is evaluated whether the performance is due to the treatment of independent variable or not.

The difference between pre-test and post-test determines the effect of the independent variable.

**Limitation**

1. There is neither randomization nor matching procedure for grouping the subjects for experimental and control group.
2. The equivalent groups cannot be formed.
3. It lacks necessary control.
4. Experimental maturity may be there.

**2 True Experimental Designs**

A true experimental design is one in which the investigator has the power to assign the subjects to experimental group and the power to select his subjects at random. True experimental designs are generally used for experimental research in education because they seek to control the main effects of history, maturation, testing, measuring instrument, statistical regression, selection and mortality.

According to Kerlingrer “A true experimental design is one in which the researcher manipulates at least one independent variable. Experimental designs are the strategies of the investigation in which the investigator can have more than one levels of independent variable and can randomly assign subjects to these levels or groups.” Non-experimental designs refer to the use
of natural control groups that already exist unlike the groups made by the experimenter on the basis of the manipulation of the independent variable. Non-experimental designs are or else known as quasi-experimental designs or faculty experimental designs or inadequate experimental designs. True experimental design is divided into four categories as follows.

**Two Groups, Randomized Subjects (Post-Test Only Design)**

The experimenter forms two groups. The subjects available are assigned to two groups by the process of randomization. The samples are obtained either by drawing the subjects individually at random or selecting two samples by toss, one sample in one group and other one to other group. These two groups may be experimental group and control group. The experimental group is exposed to treatment only. No pre-test is conducted for these two groups. The post-test is measured for dependent variable. The difference of post-test between control and experimental group conveys the researcher the effect of independent variable. The means of the two groups are compared through the use of statistical test of significance.

**Merits**
1. Randomization assures statistical equivalent of the groups.
2. It controls history, maturation and pre-test.
3. It is useful in kindergarten or primary stage.
4. More than two groups may be included if necessary.

**Demerits**
1. It restricts the external validity.
2. It is not possible to select the subjects at random from the population of the interest.

**Two Groups Randomized Matched Subjects (Post-Test Only Design)**

The researcher uses the technique of matching. The subjects from the desired population are paired in such a way that their scores on the matching variable become as close together as possible. One subject of each pair is randomly assigned to one group and the other group by tossing of a coin. These two groups are assigned as experimental and control group. No pre-
test is there. The treatment is provided to the experimental group only. The two groups are measured on the dependent variable and the significance of the different between the two means is calculated by statistical procedure.

**Merits**

1. It is useful when small groups are used.
2. Matching system provide similar intelligence level.
3. It controls pre-existing inter-subject differences.

**Demerits**

1. It is not possible to identify the matching.
2. Biasness is there for selecting matching.

**Randomized Group (Pre-Test Post-Test Design)**

The subjects are assigned to the control and experimental group by randomization process. The pre-test is administered in both the groups. The experimental groups are exposed to the treatment. The post-test is administered for both the groups. The difference in means of the dependent variable for each group is compared by statistical test in order to get the significant effect of independent variable.

**Merits**

1. Randomness assures equivalence of the groups.
2. Pre-test provides quality of the groups.
3. It controls most of the extraneous variables.

**Demerits**

1. There is interaction between pre-test and post-test, which change the subjects in various ways.
2. There is interaction in selecting the subjects and experimental treatment.
3. The interaction of experimental variable makes impossible to generalize the findings beyond the specific condition.
4. The administrator creates problem in making generalization due to the reactive effects of the experimental procedure on the subjects of the experimental group.
The Randomized Solomon (Three Groups Design)

This design is given by Solomon and hence the name. There are three groups - two control groups and one experimental group. The subjects are assigned to the groups randomly. The first control group and experimental group are pre-tested only. The experimental groups are given treatment of new method of learning leaving the first control group with no treatment of new treatment. The post-tests are administered in all the three groups. The computation is done by using statistical procedure.

Merits
1. Randomness assures equivalence between the groups.
2. It controls most of the extraneous variables.
3. Second control group provides control on interactive effects of pre-testing and experimental treatment.

Demerits
1. It has no control over any contemporary effect, which occurs between the tests.

Randomized Solomon (Four Groups Design)

This design includes one more control group. This design assigns to the four groups at random. The experimental group and one of the control groups are administered pre-test only. The treatment is given to the experimental group and to one of the control groups who are not administered pre-test. The control group with pre-test and no post-test are not given treatment. All the four groups are post-tested. The results are compared in order to know the effect of the treatment and inter effects of testing. The main effects of maturation and history are controlled.

Merits
1. It controls over any possible contemporary effects, which occur between pre-test and post-test.
2. The subjects get confidence in testing.

Demerits
1. It is difficult to carry out in practical situations.
2. There is no single element of statistical procedure that uses the six available measures simultaneously.

### 3.3 Conceptions of Viewing Reality

A characteristic feature of education has been its uneven progress. Perhaps a major reason for the slow and unsure progress in education has been the inefficient methods used by educators in acquiring knowledge and slowing their problems (Borg, 1963). This rather gloomy but none-the-less accurate assessment of the position maintained generally for many years and which still characterizes some areas of education has now, fortunately, been tempered by the knowledge that in the past few years’ modest advances have been made as a result of the application of the methods of social science to the study of education and its problems. Interestingly, this development has itself resulted in controversy and debate for, in adopting a social scientific orientation, educational research has at the same time absorbed two competing views of social sciences - the established, traditional view and a more recently emerging radical view. The former holds that the social science are essentially the same as the natural sciences and are therefore concerned with discovering natural and universal laws regulating and determining individual and social behaviour; the latter view, however, while sharing the rigor of the natural sciences and the same concern of traditional social science to describe and explain human behaviour, emphasizes how people differ from inanimate natural phenomena and, indeed, from each other (Cohen and Manion, 1994). These contending views - and also their corresponding reflections in educational research - stem in the first instance from different conceptions of social reality and of individual and social behaviour.

The two views of social science mentioned above represent strikingly different ways of looking at social reality and are constructed on correspondingly different ways of interpreting it. Burrell and Morgan (1979) have developed a typology of paradigms in sociology that has proven useful in provoking thought and reflection about some deep assumptions that undergird approaches to research. Their work is presented in the next section
as a guide to help you think about where you stand on some basic questions and to begin to situate yourself along two continua of assumptions; one about research and the other about the social world.

3.3.1 The Objective and Subjective View of Reality

Suppose an organizer of a training programme the researcher is seeking some information from his participants. While the participants are responding, the researcher asks a rhetorical question to know if the participants are telling the truth. Even though the researcher may not fully realize it, the researcher is asking a fundamental question about assumptions the researcher is making, about the construction of knowledge, and about what that knowledge is - what is 'the truth' and how do we know it? Assumptions that relate to these questions are captured by the subjectivity and objectivity continuum. The continuum appears as follows:

i. Subjectivity
ii. Objectivity

Where the researchers position themselves depends on answers to the important questions.

Table No.3.2
A structure for analysing assumptions about the nature of social science.

<table>
<thead>
<tr>
<th>Subjectivist Assumptions</th>
<th>Based</th>
<th>Objectivist Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominalism</td>
<td>Ontology</td>
<td>Realism</td>
</tr>
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<td>Anti-positivism</td>
<td>Epistemology</td>
<td>Positivism</td>
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<tr>
<td>Voluntarism</td>
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<td>Determinism</td>
</tr>
<tr>
<td>Ideographic</td>
<td>Methodology</td>
<td>Nomothetic</td>
</tr>
</tbody>
</table>
3.3.2 The Nature of Reality

Burrell and Morgan (1979) have identified sets of assumptions, and the same have been presented. The first set of assumptions are of an ontological kind - assumptions, which concern the very nature or essence of the social phenomena being investigate. This side of the subject-objective dimension explores beliefs about reality - which is no small task. This question is important because social science, whatever its methodological guise, seeks to learn about social phenomena - reality, as people understand it. To locate on this continuum, ask the following questions. Do I believe that reality is of an objective nature? Is it “out there”, independent of human perception, and consequently something that I can learn about without direct experience? Does it exist independently of my perception? In distinction, do I believe that reality is the product of my individual experience and understanding? Is reality constructed through my subjective experience and inter subjective understanding?

Objectivist assumptions hold that reality exists independent of human cognition and that the work of social science is to discover important facts and processes that constitute the reality. The processes are out there, waiting to be uncovered. Subjectivist assumptions, however, argue that humans construct understanding of reality through their perceptual and interpretive faculties. Social processes are created by human interpretation; they do not constitute reality per se but are concepts that describe it.

The questions presented above on the continuum of subjective and objective dimensions spring directly from what is known in philosophy as the nominalist-realist debate. The former view holds that objects of thought are merely words and that there is no independently accessible thing constituting the meaning of a word. However, the realist position contents that objects have an independent existence and are not dependent for it on the knower.

3.3.3 The Nature of Knowledge
The second set of assumptions is of an epistemological kind. These concern the very bases of knowledge—its nature and forms, how it can be acquired, and communicated to other human beings. Subjectivists hold that the very notion of "truth" is problematic. They argue that, except for certain principles about the physical world, there are few truths that constitute universal knowledge; rather, there are multiple perspectives about the world. An objectivity, by contrast, asserts that there is truth about a particular circumstance that can be determined. Your question then follows. In doing research, will you search for Truth - with a capital T - or Truths - multiple perspectives?

Questions you can ask yourself include the following. How do I learn about something? What do I take as evidence to support a point? Do I accept what I read and hear, or do I examine it critically, based on my own experience? From an objectivist position, one may argue that knowledge is tangible and "hard". With more subjectivist belief, another person may argue that knowledge comes in multiple forms, many quite personal, including dreams, and spiritual and transcendental. Another question invites you to think about where you believe knowledge can appropriately be produced and who can legitimately engage in that creation. Subjectivist views hold that knowledge about the social world arises from many quarters, important understanding are evident in novels, the arts, the media and in formal social science reports and articles. A poem or drawing is as legitimate a portrait of life experience as a research report. An objectivist would see such knowledge as soft, unscientific and idiosyncratic. How one aligns oneself in this particular debate profoundly affects how one will go about uncovering knowledge of social behaviour. The view that knowledge is hard, objective and tangible will demand of researchers an observer's role, together with an allegiance to the methods of natural science to see knowledge as personal, subjective and unique, however, imposes on researches an involvement with their subjects and rejection of the ways of the natural scientist. To subscribe to the former is to be positivist; to the latter anti-positivist.

3.3.4 The Nature of Anthropological Interference
The facet of the subjective - objective dimension focuses on assumptions about our relationship to the world we live in. You might ask yourself the following. Do I assume that people respond mechanically, in an independent manner? Are we conditioned by external circumstances such as social forces? Are we more creative, exercising free will in shaping our environment and everyday lives? Objectivists assume that human actions are predictable and, hence, controllable; subjectivists. However, hold that anthropological interference is crucial for shaping everyday lives. They maintain that unpredictability is the hallmark of human action; the goal is to describe and interpret how people make sense of an act in their worlds. In these two extreme views of the relationship between human beings and their environment, we are identifying a great philosophical debate between the advocates of 'determinism' on the one hand and 'voluntarism' on the other.

3.3.5 Limitations of the Approaches

The elaborate discussion of the assumptions of subjective and objective views of reality has set the stage for a reader / researcher to follow either quantitative or / and quantitative approach based on his belief system. However, before embarking on any study one should know the limitations of these approaches so that meaningful understanding of the researched phenomena can be arrived at. Furthermore, the limitations should be read vis-à-vis the approaches.

One of the major limitations of objectivist (Quantitative) approach is its mechanistic and reductionist view of nature which, by definition, excludes notions of choice, freedom, individually, and moral responsibility. Every individual holds a meaning of his existence which he views as 'concrete' and so his behaviour is unique and irreducible, not amenable to quantitative conceptualization. Another limitation is the quantification of human behaviour and experience which results in the depersonalization of self. The limitation is not directed at quantification per se, but at quantification when it becomes an end in itself. No matter how exact measurement may be, it can never give us an experience of life, for life cannot be weighed and measured on a physical scale.
According to quantitative approach, the subjectivist (quantitative) approach also suffers from some limitation. First the researcher's complete reliance on the actors' definitions of the situations. It is quite probable that some of the actors might be falsely conscious of the societal situations. Second, the unscientific means adopted to construct / gain knowledge. Knowledge gained through human agency is always partial. Third, this approach does not allow any scope for verification of result. Fourth, there is an overriding concern for meaning construction which presupposes a structure of meanings and relationships between situations. Fifth, this process whereby one interprets and defines a situation is itself a product of the circumstances in which one is placed. Accordingly, values and ideas of researcher penetrate into the research process.

Limitation of approaches places some boundaries around and set some conditions. These are the reservation and qualifications inherent in any research. Limitations are derived from the design and methods used in any approach and help to contextualize the study. They stipulate the weaknesses of approaches; thereby encouraging the reader to judge it with these limitations in mind. Nevertheless, while going through the limitations, the reader should remember that no study following any approach(es) is/are perfect; that findings are tentative and conditional, that knowledge is elusive and approximate, and our claims should be humble, given the extraordinary complexity of the social world we want to learn more about.

### 3.4 Aims of Methodology

1. It aims at guiding the researcher in a systematic way.
2. It aims at delimitation.
3. It aims at preparing the tools.
4. It aims at interpreting data by using statistical principles.

According to Good, Barr, and scates (1941 p. 207) research methodology may be classified from various points of view basing on-

1. The field to which it is applied-education, history, philosophy, biology, and psychology etc.
2. Purpose, description, prediction, determination of causes and status.
3. Place of conduct – either in the field or in the laboratory.
4. Application – pure research or applied research.
5. Tools and techniques – various standardized and non-standardized tools, checklist, rating scale and questionnaire.
6. Type of data subjective, objective, quantitative, or qualitative.
7. Symbols employed language and mathematical symbols.
8. Type of thinking-deductive, inductive.
9. Control of factors-controlled, uncontrolled.
10. Method employed-agreement differs, residues and concomitant.

William H. Kilpatrick K. describes three types of methods for research such as scientific, psychological, case study, interview, job analysis, survey curricula making, observation measurement, questionnaire, tabular, statistical, graphic, and library techniques.

Wapler and Taylor describe techniques of analysis, reading and recording, observation, personal interview and group conference, checklist, sampling, comparison, space and frequency counts, testing and experimentation. Knos says that the questionnaire, experiment, measurement, documentary analysis, case study, mathematics and survey. Moreover, a method is selected basing on the nature of study.

But generally there are three types of methods in educational research such as historical, descriptive and experimental.

3.5 Importance of Methodology

1. The researcher gets the right way for conducting research.
2. Methodology delimits the area, sample and gender.
3. It specifies the specific tools and techniques.
4. The data collection and data interpretation becomes easy through methodology.
5. It provides pinpointed idea for conducting research.
6. It keeps the research in alert.
7. It acts as a blue print for the research activity.
8. It keeps good contact with different subjects.
9. It explains entire activity of the research study.
3.6 Descriptive Method

The descriptive method is widely used in educational research. This method tells what exists in current by defining the degree and nature of obtainable conditions. This method refers to a type of investigation. It analysis, interprets and repeats the present status of a social institution, group or area. It is otherwise known as normative survey method. The word normative means ascertaining the normal condition and survey means gathering data regarding present condition. Hence normative survey means suggesting too closely related aspects of this kind of study. Survey studies collect three types information.
1. of what exists
2. of what we want
3. of how to get.

The researcher has decided to follow descriptive survey method for the present study. The descriptive research survey is the most widely held and extensively used enquiry technique in educational field. The descriptive investigations are of immense value in solving problems about children, adult, women, school organization, planning and management, curriculum, teaching methods, examination, reforms and evaluation. The descriptive type of research is useful in the development of data gathering instruments and tools like checklists, schedules, interview, observation, rating scales and questionnaires etc. Descriptive surveys collect and provide three types of information's

What is present with respects to conditions or variables in a selected situation?

Of what the researcher went by identifying standards or norms with which to compare the present conditions or what special consideration is to be anticipated, and

Of how to achieve a goal, by exploring possible ways and means on the basis of experience of others or opinions of experts.

3.6.1 Types of Descriptive Surveys
Descriptive surveys investigate phenomena in their natural setting. There are different types of descriptive survey studies but the researcher has used.

- Sample Survey
- Comparative Survey
- Evaluative Survey
- Cross-Sectional Survey
- Census Survey
- Longitudinal Survey
- Documentary Survey

1 Sample Survey

Sample survey means gathering relevant information about a smaller representation of the population under study. The data gathered through sample survey are indiscriminate to the population of the study. The sample is drawn from Mehsana district of Gujarat only.

2 Comparative Survey

In comparative survey, the purpose is to compare the status of two or more number of variables, institutions, strategies adopted or groups of respondents etc. Comparative survey involves sensitivity with regard to identification of worthwhile things to compare. So worthwhileness of focus of the study is identified through review of literature and experiences of experts.

The researcher is serious about the comparability of situations under investigation. The criterion variables are equally fair to different research situations under investigation. Comparative survey examines the study which deals with problems that cannot be investigated in laboratory locations. Furthermore, such studies produce more appreciated information and even gives evidences in relation to the nature of the occurrences and which are very well matched to many types of field studies which is seeking to start fundamental correlation.

3 Evaluative Survey

Evaluative survey is conducted with the purpose of evaluating a programme, a curriculum, policy etc. Evaluation studies lead towards arriving
at a value judgment about the worthwhileness of a programme or policy or institution. Two purposes can be served in the evaluation of programmes through surveys.

Judging the effectiveness of the programme, and
Taking action for future course of action.

The researcher is interested in studying judgement about the effectiveness of a programme to undertake a decision oriented study.

4 Cross - Sectional Survey

Cross sectional survey can be understood as kind of sample survey when standardized information is gathered from a sample drawn from a cross section of pre-determined population at one point of time.

The sampling techniques like random, stratified and cluster sampling are used in identifying cross sectional representation of population of the study. Hence the basic feature of cross sectional survey is associated with variables respondent covering different status in the study and the information is collected at one point of time. One point of time refers to single slot of data collection stretching over a few days or moths. The researcher is interested in studying relationships between different variable for investigation.

5 Census Survey

A census is an effort to list all the elements in one group. It is used to measure one or more individualities of those elements. The group is frequently a real national population. A census means gathering relevant information about all the units of population through institutions, householders or people. It can provide detailed information of the elements in the population. It enables totals for exceptional population groups or small geographic areas.

A census and a sample survey have many common features, for example the use of questionnaires to collect information, the need to process and edit the data and even the liability to different sources of error. Usually, a census does not suffer from sampling error. Though, other types of errors may remain. Census surveys involve the process of collecting information about each of the member of a given population.

Census surveys is used commonly to employ to understand educational problems, for statistical research, population count or policy
making. The researcher has used questionnaires to collect desired information.

6 Longitudinal Survey

A longitudinal study provides information about the similar individual at dissimilar opinions in time which permit the investigator to pathway adjustment at the separate level. Without a doubt, longitudinal surveys could also be used to investigate the change in the existence of governments and organizations as well as specific individuals.

Longitudinal inquiries apprehensions the gathering and exploration of data in excess of time. Longitudinal information is important if the investigation determination is to measure the societal alteration for the reason that longitudinal study allows a diachronic examination of the incidence of circumstances and proceedings.

This examination can perhaps be provided by wide-ranging statistics about specific manners. Though, the usage of such information postures important hypothetical and practical difficulties.

The determination of longitudinal research studies is to collect and analyses quantitative data, qualitative data, or together both of them in progress, change and development in excess of time. Normally, the importance of the longitudinal research studies branches from the fact that the skills, attitudes, knowledge, behaviors of individual and perceptions subjects generally grow improve, and change in necessary ways during a span or era of time.

These studies require framing of its research questions and hypotheses by using longitudinal data gathering techniques and using its data analysis methods. Longitudinal is an expansive terminology. Longitudinal could be well-termed as a study in research. In research, the information is gathered for every single detail. It may be variable for two or more dissimilar phases. The researcher has collected data from granted and non-granted schools and urban and rural areas of Mehsana district of Gujarat.

7 Documentary Survey
In documentary survey, the outside sources and documents is used to analyses the data already exist in the form of printed text. Documentary research regularly involves some or all of conceptualizing, using and assessing documents. Therefore, review and evaluation of text books, reference books, study materials examination papers, internal assessment of students' performance and assignments and evaluation of answer sheets comes under this research category and is possible. The fundamental issues surrounding types of documents and the capability to use these documents as consistent sources of evidence on the social world must be measured.

In documentary survey, a multiplicity of information resources is familiar to answer the research question. The sources can be any books, workshop material, official records, institutional reports, articles from the newspaper, hand-outs or broachers and even individual experiences etc. Documentary surveys are used to analyses the present proceedings based on the records existing to the researcher. The researcher has used different documentary sources for the recommended investigation.

Research designs are the greatest important in the research process. The investigator has decided to follow survey method for the current study.

3.7 Population of the Study

According to K. S. Siddhu, "Population means an aggregate or the totality of the subject regarding which reference cases are to be made in a sampling study." It means all the people or documents proposed to be covered under the plan of the study. The population is the total numbers of students where the data are collected whereas the sample is the number of students who are selected as a sample for the investigation. (Fig. 3.2 Population and Sample)
In the current study, the investigator has selected 600 students from different parts of Mehsana district of secondary schools from Gujarat as the population of the study. The population is about 1000 students of 8 Gujarati medium schools who follow the syllabus of Gujarat Board from IX standard. The population represents from all the parts of the city i.e. East, West, North and South of Mehsana District of Gujarat. Out of 600 students, 300 students are boys and 300 students are girls.

3.8 Sampling

A sample is selected from a population under study. It is a small group of units of a population. After studying the characteristics of the sample, one can make certain inferences about the characteristics of the population from
which it is drawn. A population is any group of individuals or units that have one or more characteristics in common which are of interest to the researcher, for a particular research. In order to select a sample, the researcher has to follow the sampling methods—probability and non-probability sampling methods.

### 3.8.1 Characteristics of A Good Sample

1. A good sample provides greatest possible accuracy within its restricted size.
2. Selection is deliberate and hence it is free from error.
3. It should be free from sampling error. Sampling error means the difference between population value and sample value.
4. It covers complete coverage of the units meant for the research study.
5. The possibility of sample techniques should be used for reducing similar discrepancies.
6. A good sample is the accurate illustrative of the population corresponding to its properties.
7. It should be free from bias and does not permit prejudices, preconceptions and imaginations to influence its choice.
8. A good sample is an objective one which refers to objectivity in selecting procedure in absence of subjective elements from the situation.
9. It is economical considering energy, time and money point of view.
10. It is comprehensive in trait but may not be a good representative of population.
11. A sample is comprehensive in trait but may not be a good representative of population.
12. It is closely associated with true representativeness.
13. A good sample makes research work more feasible.
14. The subjects of good sample are easily approachable and the tools are easily administered on them and data can be easily collected.
15. A good sample has the practicability for research situation.
16. The size of good sample yields accurate measurement.
17. The possibility of error can be estimated.

### 3.8.2 Steps of Sampling
1. **Stating the objectives of the study.**
   The outlined objective of the research study is clearly and directed stated in such a manner that each and every concept involved gives a clear understanding. As a result, it becomes easy for a researcher to conduct a research. The researchers give eye to all the objectives during his research study.

2. **Defining population for sample**
   The population from which the researcher desires to collect responses is sampled. During sampling the researcher should define the population clearly and out of whole population the selection may be done democratically.

3. **Determining data for collection**
   The data, which the researcher desires to collect for sample, is of great importance. The very necessary and relevant data should be collected from the sample through various tools and techniques developed by the researcher.

4. **Measuring Method**
   The measurement of data is done through various tools and techniques developed earlier.

5. **Selecting Sampling Unit**
   The whole population is divided into various parts known as sampling units that help in research work.

6. **Selecting Sample and organizing field work.**
   Selecting sample means making the size of the sample. The researcher can organize his work by attending the sample in his research area of study. Selecting sample confines the researcher in data collection for his research study.

7. **Analysis of Data**
   The collected data is recorded in tabular form and then analysed

8. **New experience for further study**
   Any kind of new information and mistakes helps the researcher in their further study. As a result, the future researcher becomes alert and avoids the errors occurred.

3.8.3 **Types of Sampling**
With the intention of using such a smaller group to create decisions about the bigger collection, the subgroup have to be resembled the bigger group as thoroughly as conceivable. The sampling methods may be broadly categorized into two kinds.

- Non-Probability Sampling,
- Probability Sampling.

### 3.8.3.1 Non-Probability Sampling

Non-probability selection is not constructed on expectations about the nature of population distribution or expectations. They are so normally overlooked by the researchers by using parametric tests. Here the samples are gathered in a process which does not give equal chances of being selected to all the individuals in the population.

Accessibility sampling or non-probability refers to researchers when the researcher takes whatever individuals find it is easy to right to use as applicants in a research. It can simply be possible when the procedures of the investigators are being tested that are expected to be identical simple in addition to general with the intention of that they could be universal away from such a contracted sample. The non-probability sampling method may be approximately distributed into three types:

- Incidental or Accidental Sampling,
- Purposive Sampling
- Quota Sampling, and
- Snowball Sampling

#### 1 Incidental or Accidental Sampling,

Incidental sampling is also called convenient sampling. The researcher can select units of the population which are incidentally or conveniently available to the researcher. Suppose the researcher wants to study the reactions of students towards the introduction of sex education in secondary schools. The researcher may go on interviewing students in schools that are
easily available to the researcher to arrive the required sample size. Since the sample is not drawn from the population on a representative basis, generalization is not possible.

Incidental sampling is also known as accidental or convenience sampling. When a readily or easily available group is selected as a sample, it is termed as an ‘incidental sample’. A Teacher – educator e.g. may select the students from a school situated in the same campus which serves as practicing school for the concerned college of education, to experimentally find the effectiveness of concept attainment model to teach a mathematical concept say, a quadrilateral.

**Advantages**

The administrative convenience of obtaining sample for the study, the ease of testing, saving in time, completeness of the data collected are some of the merits of this method.

**Limitations**

Since there is no well-defined population and no random sampling method is applied to select the sample, the standard error formulae apply with high degree of approximation.

**2 Purposive Sampling**

Purposive sampling method is based on the researcher’s discretion. The researcher can use judgement or rationality to choose the sample. However, the researcher’s judgement is based on his/her experience or understanding of the population. The purpose here is very specific to the objectives of the research. Suppose, the researcher wants to select 100 M.Ed. teacher trainees of SNDT University to study as to how they learn from the self-learning material provided to them. In this case, the researcher may visit a programme centre and take M.Ed. teacher trainees enrolled under that programme centre for the sample. The problem in this type of sampling is that it fails to represent the wider population. Henceforth, the researcher need to take care to report the findings of the study carefully.
Another non-probability sampling method is ‘Purposive Sampling’. In this method samples are specifically selected for the reason that it is an available evidence and they resemble approximately larger collection with respect to one or more individualities or features. The criteria for categorization in such samples are generally recognized as characteristic areas such as a district, a city or state even country etc.

Have you noticed that till this phase the criteria are to some extent comparable to stratification criteria? After deciding upon the category required for the research, the researcher has to select the sample.

**Advantages**

This method of sampling is useful where small sample is required. It is focused on solving problems of particular groups.

**Limitations**

This method is applicable only for the selection of samples including typical/special case ‘such as best teacher award winners’ from the population of teachers or ‘meritorious past students of the school’ from the population of the past students.

2 **Quota Sampling**

Quota sampling method is somewhat more or less similar to the stratified random sampling method. But the difference between the two is that the randomization process is not required in quota sampling, as is in the case of stratified random sampling method. In quota sampling the researcher tries to represent the strata (characteristics) in proportion to their presence in the population. For example, if the population of 1,000 comprises 60 per cent boys and 40 per cent girls, then in the sample there should be 60 per cent boys and 40 per cent girls. If the sample selected is 100, then there would be 60 boys and 40 girls in the sample.

Since the selection of the sample is done according to a fixed quota for different characteristics of the population, the sample is known as quota sampling. Sometimes, if there are too many characteristics of population, it is difficult to fix up quota for each characteristic. Henceforth, it is advisable to choose a few characteristics and accordingly decide about the sampling.
This is another method of non-probability sampling. It involves the selection of the sample units within each stratum, on the basis of the judgement of the researcher. What distinguishes it from probability sampling is that, once the strength of the samples (e.g. how many women teacher from among the college teachers) is decided which forms the ‘quota’, the choice of the actual units to fit into this framework is left to the researcher.

3 Snowball Sampling

Sometimes, the researcher may find it difficult to access the sample because of the very nature of the members of population. In this case, the researcher first selects a few members of the population whom the researcher access, then uses them to identify and select another group of members who identify the third group of members. The process goes on till the researcher arrive at the required size of sample. Consequently, this sampling method is called snowball sampling. This sampling method, for example, can be used when the researcher wants to study behaviour of those students who are addicted to computer games. In the same way, when it is difficult to trace the members of population due to lack of proper communication networks, the researcher may use snowball sampling method.

3.8.3.2 Probability Sampling

In Probability sampling, the samples are gathered in a process. It gives equal chances of being selected to all the individuals in the population. This type of sampling discusses about the sampling wherever the accidental of any given individual has been carefully chosen is well-known. These characters are check out to each other self-sufficiently. It is also well-defined as random sampling.

In this type of sampling, the units of the population are not selected at the discretion of the researcher, but by means of certain procedures which ensure that every unit of population has one fixed probability of being included in the sample. It is also called random sampling method.

Any scholar or investigator could just practise an unsystematic numeral initiator to select partakers is called simple random sampling or systematic sampling. Investigators might even breakdown their decided population into
sections and formerly relate these methods inside every sections to make sure that they are receiving sufficient partakers from every sections to be capable to appeal assumptions. The probability sampling method may be approximately distributed into six categories:

- Simple Random Sampling,
- Systematic Sampling,
- Stratified Random Sampling,
- Multiple or Double Sampling,
- Multi Stage Sampling, and
- Cluster Sampling.

1 Simple Random Sampling,

In the sampling method, each unit of the population is given an equal chance of being selected. The researcher may use lottery methods to draw sample or take the help of Random Numbers Table for selecting a sample. Simple random sampling is neither possible nor feasible if lists of units are not available or incomplete.

Theoretically, this is a technique of choosing n units from N units in such a way that everyone in the population of N units has an equal chance of being a selection of it. This could be done through the following steps:

- Defining population by specifying its various limits.
- Preparing the sampling frame.

Lottery Method

After naming or numbering every unit in the population, they are well mixed. The required numbers of units are then drawn from all these well-mixed chits. The individual/objects with these identifications names/numbers are then picked up for inclusion in the sample.

Random Table Method

In view of the above mentioned objections it is advised to use the random number tables instead of lottery method. The use of random numbers or manual lot drawing will be too cumbersome to recommend in case of large
population. In such situation, computer generated random selection should be resorted to, in order to save time and labour.

2 Systematic Sampling

In systematic sampling method, the units of population in the sample are selected from a list made in alphabetic or some other order. In order to select the sample, the researcher select a unit at random and this becomes number k. thereafter, every kth subsequent number is selected. In order to find the number k, the researcher can use the following statistic in which the total of the wider population being represented is divided by the sample size required

\[ f = \frac{N}{sn} \]

Where \( f \) = the frequent interval
\( N \) = the total number of the wider population
\( sn \) = the required number in the sample.

For example, the researcher wants to study the attitudes of 400 secondary school teachers towards the introduction of computer education in the school and decide to have a sample of 40 teachers. the researcher can get the k number by dividing 400/40, which comes to 10. Then you can choose any number from the list of 400 teachers and go on selecting every 10th number of the sample. This method is convenient, simple and less time consuming than simple random sampling.

A variation of the random process of sampling is the systematic sampling. Generally, an element of randomness is acquainted with into this type of sampling. The random numbers are used to pick up the unit to begin with. This technique is useful when sampling setting is accessible in the form of a list. In this type a design, the selection procedure beginsby picking some random idea in the list and then every nth element is carefully chosen until the preferred number is available. As the elements are chosen from regular intervals, this method is well-known as sampling by regular intervals, sampling by fixed intervals or sampling.

**Advantages**

It is more practical in that it involves less labour.
Because it is simpler to perform, it may reduce errors.
The procedure is speedy in comparison with simple random sampling.

**Limitations**

Selection of every element other than the first selected randomly is linked with the first element. This makes the process different from the simple random method where selection of every element is independent of another one.

When the list of element has a **periodic arrangement**, there is a risk that the sample interval may coincide with the periodic interval in the list.

**The answer is**

Because every school is repeated in the list with an interval of ‘5’ and elements are selected with an interval of ‘5’.

Another limitation of systematic sampling method is the **trend** of the listed population.

**3 Stratified Sampling**

A simple random sample may have an undue proportion of one type of units in it. As a result, different types of units do not get proper representation in the sample. In order to get over such problem, you can opt for stratified random sampling in this sampling method, you need to divide the population into different strata on the basis of some characteristics, and from each of the smaller homogenous strata or groups you may draw randomly a pre-determined number of units. Let us understand how stratified random sampling is carried out.

One question may arise in your mind is that?

How to increase the precision of the sample?

By increasing the size of the sample, its precision can be increased.

But this is not the only way. Let us see which the other one is. It is the ‘stratified sampling’. The term ‘stratified’ is very much self-explanatory. It involves dividing the population into such sub-populations (starts) that each one of them is homogeneous within itself.
The steps to be followed in this method are as under –

Deciding upon one of more characteristics on the basis of which strata will be formed e.g. location of schools – rural, urban, suburban, urban-slums, metropolitan etc.

Dividing the population under consideration into strata on the basis of stratification characteristics/criteria.

**Important points to be noted**

The criteria for dividing the population into strata should be correlated with the variable being studied.

The criteria should be practical. It should not yield a unwieldy number of strata.

A good measure of the stratification criteria should be available; e.g. if reliable and valid tool of determining socio-economic status is not available, stratification on this basis would lead to confounding of the results.

**Advantages**

Stratified random sampling is very useful when a list of the element in the population is not available.

4 **Multi-stage and Multi-Phase Sampling**

When the research involves large units of population and it is difficult to access the population spread across a large geographical area, you may opt for multi-stage sampling. In this method, sampling is done at different stages, which you define as per the objectives of the study. Each stage of sampling has some definite purpose. For example, you are interested to study the reactions of distance learners enrolled in different academic programmes of Teacher Training in Gujarat state towards distance learning system. At the first stage, suppose the researcher may select 10 study centers located in different parts of state on random basis so as to represent different parts of the state. In the second stage, the researcher can select five academic programmes out of the programmes activated at the study centers. In the third stage, the researcher may select randomly 20 students out of all the students enrolled in these programmes. In this way, the final sample of students can
come to 10 study centres x 5 programmes x 20 students = 1,000 students. Therefore, 1,000 students will be constituting the sample for the study.

The investigation is based on the sampling of the study. The researcher after defining a population and listing all its units selects a sample of unit from the sampling frame. The process of such selection is called sampling.

Sample is an insignificant fraction of a population carefully chosen for any of the study. By way of noticing the physical characteristics of the section, anyone will be able to sort definite implications nearly the features of the population drawn. The word sampling discusses about the strategic that facilitate us to choose a subcategory from a bigger cluster and at that time use the smaller group as a foundation for creating conclusion about the bigger group.

In the multi-stage sampling selection of different types of sampling units such as some Districts in a stage, some Taluka places in those Districts and then some schools, is involved at different sampling stages. Whereas in the multi-phase sampling, the researcher is concerned with the same type of sampling unit at each phase but some members are asked for more information than others, e.g. information regarding study habits of distance learners can be collected from 100 distance learners through a questionnaire and 20 out of them can be interviewed for more information.

**Advantages**

- In both the methods burden on respondents is reduced.
- Relative cost also gets reduced.
- Two-phase sampling is useful in studying rare cases.

### 5 Cluster Sampling

When the population is too large and geographically scattered and it is difficult to prepare list of units of population, and sampling poses administrative problems, you may opt for cluster sampling. Clusters or groups representing the wider population are selected for sampling purpose. Suppose you want to survey the study habits of secondary school children of a district in your state. It is difficult for you to travel to each school in the
district. Instead, you can choose some schools, which form the clusters and survey study habits of children in those schools.

These schools are supposed to represent characteristics of all secondary schools in the district. While selecting the cluster schools and the children in the cluster schools, you need to use simple random method for ensuring randomization.

When listing of population or at least the total strength of the population is possible and available or in other words when the population is finite we saw that the sampling methods applicable were – random, systematic or stratified random sampling.

But what to do when the population is infinite?
In such a case, the method applicable is called as ‘Cluster Sampling’.

Cluster sampling is used when the population under study is relatively infinite, where the list of the elements is not available, the elements/units are geographically scattered or when sampling of individual elements is not required or is not convenient.

A Cluster is an intact group as available in the field. It is not formed by the researcher for the purpose of data collection. For example, a school complex (a group of schools) is a cluster. Some such cluster is selected to make a sample. Here a sampling element/unit is a group/cluster.

**Advantages**

This method of sampling is economic, especially when the cost of measuring a unit is relatively small.

**Limitations**

When the sampling unit is being an individual element/unit or number in the population, this method is not applicable.

It is the most applicable method of sampling when the population is heterogeneous

**3.8.4 Sample of the Present Study**
The research is based on the sampling of the study. In the present study, the sample is selected by randomly sampling method from the target population. A sample of 600 students (300 boys and 300 girls) of Gujarati medium secondary schools of Mehsana District of Gujarat those who follow the syllabus of Gujarat Board have selected for the study. The sample is taken from granted & non-granted and urban & rural areas of Mehsana District. The entire sample follows the syllabus of Gujarat Board.

Each schools comprised 75 which have been selected randomly for the sample. Data's have been collected from 8 Gujarati medium secondary schools Mehsana District of Gujarat. The investigator has also collected the data from self-made questionnaires. The tests are closed ended questions. There are 70 questions and each question carry 1 marks each.

Table No.3.3
Samples Collected from 8 Schools

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>School’s Names</th>
<th>Areas</th>
<th>Types of Schools</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SarvodayaVidyalayaAmbasan</td>
<td>Rural</td>
<td>Granted</td>
<td>33</td>
<td>32</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>Shree Ram SarvaVidyalaya</td>
<td>Rural</td>
<td>Granted</td>
<td>32</td>
<td>33</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>Shree SomnathJivaram Patel Vidhavalya</td>
<td>Rural</td>
<td>Non Granted</td>
<td>33</td>
<td>32</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>Shree SaraswatiVidhyaMandir</td>
<td>Rural</td>
<td>Non Granted</td>
<td>32</td>
<td>33</td>
<td>75</td>
</tr>
<tr>
<td>5</td>
<td>Shri M.C. Patel GayatriVidhyalay</td>
<td>Urban</td>
<td>Granted</td>
<td>33</td>
<td>32</td>
<td>75</td>
</tr>
<tr>
<td>6</td>
<td>P.M.G. ThakarAdarsh School</td>
<td></td>
<td>Granted</td>
<td>32</td>
<td>33</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>Exotica Secondary School</td>
<td></td>
<td>Non Granted</td>
<td>33</td>
<td>32</td>
<td>75</td>
</tr>
</tbody>
</table>
3.9 Tools and Techniques of the Data Collection

Data collection is an essential characteristic of all types of research study. Inappropriate or improper data collection could influence the outcomes of a study and in the end it will lead to null and void results.

3.9.1 Data Gathering Tools

After selection of sample the researcher will require data gathering tools and techniques for collection of evidences. Each tool or technique is appropriate for the collection of certain type of evidence or information. The researcher has to select tools from the available tools, which will provide data the researcher requires for achieving the research objectives or testing the hypothesis(est.) of the study. In some situations, the researcher may find that the existing research tools do not meet his/her purpose and so the researcher is required to modify them or construct his/her own.

As a researcher, you should familiarize yourself with the nature, merits and limitations of the existing tools and should also develop skills in the construction of the research tools.

Methods of information gathering for impression assessment fluctuate alongside a scale. At the single end of this collection are quantitative techniques but at the former end of the collection are Qualitative techniques for information collection. There are two types of data collection methods which are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Shree Dahyabhai Patel</th>
<th>VidhyaSankul</th>
<th>Urban</th>
<th>Non Granted</th>
<th>32</th>
<th>33</th>
<th>75</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>300</td>
<td>300</td>
<td>600</td>
</tr>
</tbody>
</table>
(1) **Quantitative Data Collection Methods**

The Quantitative methods of data collections are interviews, meetings, observations, review of internal documents and questionnaires. These data are obtained by using various tools and tests based on scale of measurement namely nominal, ordinal, interval or ratio. These type of information are closed ended and only just make available seriousness and particulars. It is easy to compare, summarize and generalize in the case of qualitative data.

This investigation is apprehensive with analysis assumptions resulting from principle. It enables to the researcher to estimate the size of an occurrence of interest. Participants may be randomly assigned to different procedures depending on the research question. These data are gathered by a variety of methods and techniques which are as follows:

1. Interviews
2. Meetings
3. Observations
4. Review of internal documents
5. Questionnaires

The quantitative data can be parametric or non-parametric in nature. Parametric statistics are measured on intermission or proportion scale measurements. Ratio scale permits all the four operations namely addition, subtraction, multiplication and division. Non-parametric data are used in the case of counted or ranked data. This data comprises numerical figures. Various descriptive statistical measures are used in analysis of parametric or non-parametric data.

(2) **Qualitative Data Collection Methods**

Qualitative information gathering approaches play a significant measure in influence evaluation. These methods provide useful information to comprehend the procedures behind observed outcomes. It is useful in assessing modifications in publics’ insights of their good fortune or happiness.

Moreover, qualitative techniques are vocal or other representational resources. The in depth description of witnessed performances, general public, circumstances and happenings are certain examples of these
information. These data are gathered by a variety of methods and techniques which are mentioned below:

1. Observations
2. Interviews
3. Questionnaires
4. Opinionnaires
5. Inventories

Qualitative data collection methods are categorized by the following qualities:

1. These methods are open-ended.
2. They have less structured protocols.
3. Researchers may change the data collection policy by refining, dropping or adding techniques.
4. They depend further genuinely on collaborative dialogues.
5. Defendants might be questioned a number of intervals.
6. Qualitative data are descriptive narrations, observation notes, responses to questions.
7. Descriptive narrations, observation notes and responses to questions are qualitative data.

3.9.2 Types of Research Tools

There are multiplicities of tools used in collecting data in research which include the following:

1. Tests
2. Questionnaires (Close-ended and open-ended)
3. Opinionnaire or attitude scale
4. Quantitative interviews
5. Qualitative interviews
6. Focus groups
7. Observations
8. Quantitative observations
9. Inventories

The researcher has collected qualitative data through self-made questionnaires for the present study.
3.9.3 Questionnaires

Questionnaire is the widely used tool of research to collect data. It is used to collect information regarding any events, phenomenon, practices, or attitudes of an individual or a group of individuals. As the name suggests questionnaire contains a series of questions pertaining to the particular problem being investigated. A questionnaire is either administered personally to a group of individuals or sent by mail to the respondents located at different places. The purpose of the questionnaire must explain to the respondents and directions need to be given about how to respond to the questions.

3.9.3.1 Construction of A Questionnaire

A questionnaire needs to be constructed very carefully. This requires both competence and ability on our part. The following points need to be taken into consideration while constructing a questionnaire.

• Reflection of the purposes of research: A good questionnaire must reflect the objectives of the research problem through specific questions contained in it. Each question must communicate to the respondents its objective so that analysis and interpretation of responses are made properly. Moreover, the covering letter of the questionnaire should indicate the purposes of the research study.

• Make the questions more precise: The following principles given by Best (1977, pp. 160-162) may be considered to make questions precise.
  i) Properly define terms that otherwise could easily be misinterpreted. For example, "What work did you do in the year 2005?" This question is subject to various interpretations. Hence needs precision in its statement.
  ii) Be careful in using adjectives and adverbs that have no agreed upon meaning. Words like 'rarely', 'occasionally', 'scarce', 'hardly' may be interpreted differently; hence should be carefully used.
  iii) Beware of double negative.
  iv) Avoid the double-barrelled questions. Break it into questions. For example, the question 'Do you agree that distance education is cost-effective and promote democratization of education?' can be split into two separate questions.
v) Be careful of inadequate alternatives. For example, the question Are you employed? Yes/No, does not specify the nature of employment to the respondents.

vi) Underline a word if you wish to indicate special emphasis.

vii) When asking for rating or comparisons a point of reference is necessary. For example, 'The temperature of place' A is (hot, warm or cool) needs to have a point of reference like in comparison to place B.

viii) Phrase questions so that they are appropriate for all respondents. For example, "How many academic counselling sessions for a course do you attend in a month?" may not be appropriate for all distance learners as there is provision of intensive counselling sessions in many cases.

ix) Design questions that will give a complete response. The question "Do you watch television?" does not real the TV viewing habit of respondents.

x) Provide for the systematic qualification of responses. For example, number of alternatives to a question may be ranked and given some numerical weight age in a systematic manner. For example, in the case of a 3-point scale A may be 3 point, B may be 3 point, and C may be 1 point. based on the type of questions asked.

• A question must correspond to the background information of the respondents.

• A question needs to be framed in such a way that they are socially accepted by the respondents. They do not feel offended by it.

• Leading questions are to be avoided. For example, "Do you agree that teachers should be consulted in formulation of University's policies?" would always invite positive response from the respondents. Therefore, the questions should be framed without providing any suggestions.

• The questions should be restricted to a single idea or to a single reference. They should be so arranged that they permit the idea of the respondents to flow logically. This is a procedure of asking the most general questions first and following it with successively more specific and restricted questions. This procedure helps the respondent to organize his own thinking and motivate him to respond logically.

• A questionnaire should contain either closed type of questions, or open type of questions or both.
• A questionnaire should not be too long lest respondents should feel bored to respond.
• Once the questionnaire is drafted, it should be given to a few experts for their comments. After receiving the comments, the draft should be revised in their light. Questionnaire, as we discussed, is a popular tool of research. But there are some limitations. This cannot be administered to illiterates and younger children. There is problem of poor response in the case of mailed questionnaires. Sometimes, the respondents may not express what they really intend to communicate.

3.9.4 Validity

Validity is associated with specific purpose for which the test is developed. According to Gronlund (1981), it refers to the extent to which the results of an evaluation procedure serve the particular uses for which they are intended. For example, a test of attitude towards science ought to evaluate the children’s’ attitude towards science. The validity of test may be low or high which depends upon the result of the test the validity of a test depends upon the nature of a test. Hence generally estimate the following different types of validity:

i) Content Validity
ii) Criterion-Related Validity
iii) Construct Validity

1. Content Validity

Content validity of test refers to the proper representation of contents (learning tasks) in the test. This validity is generally looked for in the case of an achievement test. Content validity of test is ensured by subjecting the test to the judgement of several subject experts. In an achievement test, preparing a table of specification or blueprint is the best way of ensuring its content validity. Based on the blueprint, the items can be developed to ensure content validity.

2. Criterion-Related Validity
When the test developer intends to predict the future performance of the test takers or evaluate their current performance in attestation against some criterion, it is presumed that he/she is concerned with criterion-related validity. Criterion-related validity, thus, can be predictive validity which establishes the relationship between the present results of a test and the future performance of the test takers. Concurrent validity is concerned with correlating the result of a new test with the results of a currently available standardized test, which measures the same traits as intended in the new test. For example, a test developer develops a test of creativity and correlates the results of his/her test with the results of Torrance Test of Creativity and finds out the correlation coefficient to establish the validity of his/her test. A significant positive correlation between the two tests is an indicator of concurrent validity of the test.

3. Construct Validity

When the objective is to measure certain psychological constructs, the test maker must ensure construct validity of the test. According to Koul (1984), 'a construct is a trait or ability, temperament, or attitude which is hypothesized to explain certain aspects of behaviour for example achievement motivation, intelligence, creative thinking, or test anxiety. Construct validity is established through a long continued experimentation based on imagination, reasoning and observation. Even the results of test can be compared with like and unlike tests. For example, the results of an attitude test can be compared with the results of another attitude tests (like test) as well as with the results of an intelligence test (unlike test).

3.9.4.1 Validity Coefficient

The validity of test is always reported in terms of validity coefficient. Lovell and Lawson (1973) recommend that a test ought to have a validity coefficient of at least +0.70. but many tests with lower coefficient can be used in the absence of better ones if they measure something for which no other test has been constructed.

3.9.5 Reliability
The second important characteristic of a test is reliability. In common parlance, it refers to consistency. The same meaning is also applicable to the reliability of a test. When a test is administered to the same individuals with the same conditions and there is consistency of test results at both the times, it can be conceded that the test has reliability. Cohen et al. (2000) defines reliability as a synonym for consistency and reliability over time, over instruments and over group of students. Consequently, reliability refers to consistency of measurement from one testing situation to another. For example, a teacher of class IX has developed an achievement test in English, which is administered to students. After six months, she/he administers the same test against to them. If the test results in two situations match with each other, the test seems to have reliability. Reliability of attest is estimated through four methods. These are test re-test method; alternate or parallel forms method; split-half method; and rational-equivalence method. Let us discuss each of this method.

3.9.6 Type of Questionnaires

Any researcher requires many information collecting techniques or procedures which might be different in their complication, strategy, direction and explanation. Each instrument is applicable for the collection of assured type of proof or material. The investigator has taken a self-made questionnaire as a tool for collection of data.

(1) Closed-ended questions

A closed-ended question is one type of the interrogation layout which bounds defendants/repliers with multiple list of response selections from which the responders be required to select the correct response to the interrogation. Usually, close-ended questions are in the form of multiple choices with one correct answer and rest others are wrong answers. But it also can be in scale set-up where responder must choose to frequency of the condition in along assessment scale range alike to Likert questionnaires like, dislike, agree or disagree.

A closed-ended question can be responded with a simply answering either no or yes or with a particular part of evidence. It provides the individual
to answer the interrogation opportunity to provide the evidence which give the impression to them to be suitable. Sometimes, open-ended questions are formulated as a declaration which necessitates an answer.

Benefits of Closed Ended Questionnaires

- Closed-ended questionnaires are more effortlessly analysed.
- It is comfortable and faster for responders to give responses
- The replies of dissimilar responders are convenient to match
- Responses are comfortable to programme and analyses can be done statistically. They are conducive to reviewing statistical calculations (degree of difficulty and reliability).
- The answer selections can make clear question’s significance for responders
- Responders can give supplementary predictable answers about thoughtful themes
- There exist less extraneous or disordered responses to questions
- Least expressive/ lesser knowledgeable defendants are not difficult
- Reproduction is easier
- Closed-ended questions can be more specific
- These questions can be the superior suitable for analysis by computer.
- In larger-scale investigations, these questions yield a smaller amount time from the interrogator as well as the contestant. The investigator, consequently, spends a smaller amount of money on this survey method
- The answer ratio is greater with this type of surveys who use this type of objective/ restricted questions than with compare to brief/short or long/ unrestricted questions.
- It does not create problem whether students are good or bad at framing their answers.

Weaknesses of Closed Ended Questionnaires

- Restricted questions can recommend thoughts that the responder may not partake
• Responders who do not have any idea or belief or without understanding can answer well
• Contestant may be upset for the reason that their sought for the response is not of their option
• These questions often confuse if numerous answer option are presented
• Misunderstanding of a question could be overlooked or eliminates
• Differences in the middle of responders’ responses may perhaps be undistinguishable
• Typing or printing errors or selecting by mistake by marking the incorrect answer is likely
• These may compel the responders to contribute simple-minded answers to complicated problems
• These questions may compel the persons to mark by choosing which they would not like to mark in the actual world
• Not all learning objectives or objectives can be measured with the help of these type of questions
• These type of questions make significant demands of student’s reading skills which can be a problem for other students
• Small number of alternative answers will give more chance to the students to guess the correct answer
• Composing good questions is problematic and time consuming task.

(2) Open-ended questions.

The types of question are intended to raise the responders’ spirits a complete and significant response by expending their own topic awareness and state of mind. Open-ended question is the contradictory of those closed-ended questions. It does not inspire a brief or single-worded response. These kinds of questions also have an inclination to be additional impartial and least prominent,

Benefits of Open-Ended Questionnaires
• Enables improved levels of collaboration and consideration.
• Be responsible for the chance to the respondents to direct themselves more honestly and openly.
• Inspires the respondents to deliver the information containing their worries, mental state and ideas.
• Supports in constructing an optimistic learning environment and sharing experiences.
• They give chances to answer an unrestricted amount of conceivable responses.
• Responders may give long responses. Responders be able to succeed and make clear answers
• Unexpected conclusions be able to be exposed
• These questions may allow suitable responses to complicated issues
• These may allow creativeness, expressiveness and fruitfulness in detail
• These may disclose a defendant’s sensibleness, their thoughtful progression in addition to framing of references.

Weaknesses of Open-ended Questionnaires
• Dissimilar defendants may give diverse varieties of long responses in open-ended questionnaires
• Answers might be beside the point or enclosed with hopeless detail
• Judgements and numerical examination turn out to be further challenging
• Coding answers is problematic, communicative in addition to extremely knowledgeable responders partake the benefit
• Interrogations might be very universal for responders who is unable to discover track
• More quantity of defendant’s period, effort as well as thought is needed
• Responders know how to give responses to anxious questions
• Responses need more space in the questionnaires

Closed-ended questions are the ones in which the respondents are to choose from the restricted or fixed responses. They cannot exercise their own
options. There are different forms of closed questions like replying yes/no, objective questions or circle around the alternative in a scale.

Here in this research, the researcher has taken yes/no and objective questions in closed ended questions for the students. Closed–ended questions i.e. only yes/no and open-ended questions for teachers. Open-ended questions call for a free response from respondents. The questions are not structured. The respondents are given freedom to express their opinions and feelings. Closed-ended i.e. only yes/no questions for parents.

In the present study, the researcher has set 35 yes/no questions and 35 objective questions which carries 4 options but only 1 correct option. These all questions are closed-ended questions. Closed-ended questions are the ones in which the respondents are to choose from the restricted responses. They cannot exercise their own options. The purpose of the questionnaire has been explained to the respondents and directions were given to respond to the questions. The instruction was as follows. Please read the following instructions before you start answering the questions:

- The questions are divided into two sections.
- All questions are compulsory
- Answer all the questions clearly and carefully
- Write your details in the answer sheet before answering the tests.
- Please tick ( □ ) the applicable answer
- Each question carries one mark.
- The question is divided into two sections;
  (i) Yes/No questions
  (ii) Objective questions with 4 options

All the answers are to be written in the answer sheets. Hence, do not write anything in the booklet. Write yes or no whichever is appropriate. Mark tick ( □ ) for the correct answer only in the appropriate space from a, b, c or d on answer sheet.

Here the researcher has considered the following criteria to prepare the test.
- This study is restricted only to secondary schools and their students.
- This study is limited only to the Mehsana district of Gujarat.
• This study is limited only to IX standard students.
• This study is limited only to Gujarati medium schools who follow the syllabus of Gujarat Board.
• The aims and objectives of global warming with reference to environmental education applied to the secondary schools of state board.
• Examination pattern set by the board.
• The level of the students studying in the secondary schools of Gujarat State Board.
• Awareness of global warming and its causes and results.

3.9.7 Preparation of a Tool

In general, the term “tool” refers to something that are essential to carry out his/her occupation in order to earn his living hood. In research, research tool is important to carry out the investing the help tools in research work. For preparing the tool for the present study, the researcher has studied different related literature, past dissertations and journals of global warming and environmental education. The researchers have also collected the experts’ reviews and requested them to give their suggestions on self-made questionnaires.

In the present study, the investigator has set 70 closed-ended questions for students. The investigator has set the question paper into two sections, namely yes/no and objective questions in for the students. The below mentioned are the questionnaires on which the experts’ guidance and suggestions are collected:

3.9.8 Questionnaires of the Study

Dear Students

I am doing Ph.D. in Education from JJT University, Rajasthan. My topic is “Awareness of Global Warming among the Secondary School Students in Mehsana District of Gujarat”. Your cooperation is very essential in this research. It is my humble request that you should answer all the answers carefully. Information given by you is only for research purpose and it is kept secret.
Thank you
Researcher
Jalpa R. Patel

Important instructions for Students

Please read the following instructions before you start answering the questions:

The questions are divided into two sections.
All questions are compulsory
Answer all the questions clearly and carefully
Write your details in the answer sheet before answering the tests.
Please tick ( ) the applicable answer

Personal Details of the Students
Name:
Standard:
Caste:
Area: ( ) Urban ( ) Rural
Name of the School:
Type of School: ( ) Granted ( ) Non-granted
Gender: ( ) Male ( ) Female
Address of the School:

Section-1
Answer the following questions in Yes or No
(1) Is greenhouse effect responsible for the cause of global warming?
   Yes / no
(2) Does increase in the temperature of the earth due to ozone air?
   Yes / no
(3) Does the rapid growth of the industries also cause global warming?
   Yes / no
(4) Are due to global warming many environmental problems generated?
   Yes / no

(5) Is population explosion also be considered the factor for the increase in earth’s temperature?
   Yes / no

(6) Can incident like catching fire be possible in the forest due to global warming?
   Yes / no

(7) Do you think, dreadful disease like AIDS could be due to global warming?
   Yes / no

(8) Is the increase of hot air in the atmosphere due to global degradation?
   Yes / no

(9) Does ozone’s negative impact not affect the plantation and irrigation processing agriculture?
   Yes / no

(10) Is drought on the earth because of global warming?
    Yes / no

(11) Is global Warming responsible for floods?
    Yes / no

(12) Is global Warming responsible for extinction of animals from the earth?
    Yes / no

(13) Leaves of plants do not get affect because of acid rain?
    Yes / no

(14) Developing countries are responsible for global Warming?
    Yes / no

(15) Global Warming responsible for tornadoes and cyclones occurring on earths?
    Yes / no

(16) Insects like mosquitoes and flies increasing because of global warming?
    Yes / no

(17) Pollution is responsible for global Warming?
    Yes / no
(18) The problem of global warming can be solved by testing more nuclear weapons?
   Yes / no

(19) Use of organic mature in place artificial fertilizers can stop global warming?
   Yes / no

(20) Because of global warming most part of land will submerge under water?
   Yes / no

(21) To decrease global warming we should increase use of C.N.G?
   Yes / no

(22) We should use more plastic to save ozone layer?
   Yes / no

(23) Is global warming responsible for behind the current disasters like tsunami and earthquake?
   Yes / no

(24) Incidents of volcanic eruption have increased due to global warming?
   Yes / no

(25) Excessive use of plastic is responsible for global warming?
   Yes / no

(26) We should reduce or decrease the excessive use of money for comforts to stop global warming?
   Yes / no

(27) Global warming increases if we dig out minerals and other resources from the earth crust?
   Yes / no

(28) Pollution due to industrialization increase global warming?
   Yes / no

(29) Global warming is responsible for melting of Himalaya glaciers?
   Yes / no

(30) Sea level increasing due to global warming?
   Yes / no

(31) Greenhouse gases are responsible for global warming?
   Yes / no
(32) Ozone layer also knows as ozone umbrella?
Yes / no

(33) Refrigerators and air conditioner are also responsible for the harming the ozone Layer?
Yes / no

(34) Fertile sea coast regions will not decrease due to increasing sea level?
Yes / no

(35) Change in atmosphere is becoming dangerous because of global Warming?
Yes / no

Section - 2
Choose the correct option and tick (✓) in front of right question.

Global Warming arises because getting effected in which of following layers?
(A) Layer of Oxygen
(B) Layer of Nitrogen
(C) Layer of Ozone
(D) None of the above

(2) To what affect can be seen because of Global Warming which has a raised to change in layer of air (Atmosphere)?
(A) Decrease in Temperatures
(B) Increase in Temperatures
(C) Changes in Temperatures
(D) None of the above

(3) Which artificial gas is responsible behind Global Warming?
(A) C.N.G gas
(B) Nitrogen gas
(C) Greenhouse gas
(D) None of the above

(4) Which human activities are associated with the Global Warming?
(A) Modernization
(B) Urbanization
(C) Industrialization
(D) All of the above
(5) What effects are noticed due to Global Warming?
(A) Good farming
(B) Decrease in farming
(C) Farming vanishes
(D) None of the above

(6) Use of which of following in fertile land is responsible for Global Warming?
(A) Use of natural fertilizer
(B) Use of artificial fertilizer
(C) Use of tools
(D) None of the above

(7) Use of which of following should be stopped to prevent Global Warming?
(A) Artificial fertilizer
(B) Use of vehicles in farming
(C) Use of medicines
(D) All of the above

(8) What effects are seen in the frozen regions due to Global Warming?
(A) Ice melts
(B) Increase in ice
(C) Cyclone of ice
(D) None of the above

(9) What effects is noticed on the atmosphere due to Global Warming?
(A) Climate remains same
(B) Change in climates
(C) Increase in climate
(D) None of the above

(10) What effects are seen on human health because of Global Warming?
(A) Decrease in the diseases
(B) Increase in the diseases
(C) Eradication of diseases
(D) None of the above

(11) What effects is seen on sea level due to Global Warming?
(A) Same sea level
(B) Decrease in sea level
(C) Increase in sea level
(D) None of the above

(12) What effect is seen on aquatic life due to Global Warming?
(A) Biodiversity vanishes
(B) Biodiversity increases
(C) Biodiversity decreases
(D) None of the above

(13) Use of which human activity (artificial things) are responsible for Global Warming?
(A) More use of vehicles
(B) More use of artificial things
(C) More use of plastic
(D) None of the above

(14) IPCC is associated with which of following?
(A) Ruling out poverty
(B) Employment
(C) Forest department
(D) Global Warming

(15) Which problem has arisen due to environmental pollution?
(A) Poverty
(B) Global Warming
(C) Crime rate
(D) Cyclone

(16) What effects are seen on desert region due to Global Warming?
(A) Stop desertification
(B) Desertification
(C) To eradicate desert
(D) None of the above

(17) What changes are seen in weather conditions due to Global Warming?
(A) Increase in storm
(B) Increase in rain
(C) Decrease in rain
(D) All of the above

(18) Which of the following is responsible for the increasing temperature of the earth?
   (A) Population
   (B) Industrial increase
   (C) Urbanization
   (D) All of the above

(19) What changes are observed in the poverty due to Global Warming?
   (A) Decrease in poverty
   (B) Increase in poverty
   (C) Eradication of poverty
   (D) None of the above

(20) What changes are noticed in the proportion of the UV radiations of the sun due to depletion in ozone layer?
   (A) Increases
   (B) Decreases
   (C) Remains same
   (D) None of the above

(21) What human activities are responsible for the Global Warming?
   (A) Increase in use of petrol-diesel
   (B) Increase in pollution
   (C) Increase of plastics
   (D) All of the above

(22) What changes are needed to be implemented in environment field to control Global Warming?
   (A) A Forestation-Growing more trees
   (B) Decrease pollution
   (C) Reducing use of plastics
   (D) All of the above

(23) Green planet effect is known by which name?
   (A) Greenhouse mission
   (B) Greenhouse effect
(C) Greenhouse evolution
(D) Greenhouse temperature

(24) Which factors are affects due to Global Warming?
(A) Melting of ice
(B) Increase in rain
(C) Decrease of moisture in soil
(D) All of the above

(25) To reduce Global warming which of the following activity should be used?
(A) Controlling population
(B) Condemn use of polythene bag
(C) Growing of more trees
(D) All of the above

(26) Proportion of which gas needs to the increase to reduce Global Warming?
(A) Nitrous oxide
(B) Carbon dioxide
(C) Oxygen
(D) Methane

(27) What situation will arise due to Global Warming?
(A) Drought
(B) Decrease in crop production
(C) Increase in starvation
(D) All of the above

(28) What should be done to decrease green planet gas?
(A) Use of motors and motors cycle
(B) Use of bus and cycle
(C) Use of truck and tractor
(D) None of the above

(29) Which diseases/problems are caused by ozone?
(A) Cold and Flu
(B) T.B and AIDS
(C) Asthma and Eye infection
(D) All of the above
(30) What effects will be noticed on the crops of cooler region due to Global Warming?
(A) Increase in time  
(B) Decrease in time  
(C) In regular time  
(D) None of the above  

(31) Which of the following should be practiced to reduce Global Warming?
(A) Grow of more trees  
(B) Take care of trees  
(C) Avoid deforestation  
(D) All of the above  

(32) Which factor is the most responsible for decreasing in the ozone layer?
(A) Urbanization  
(B) Industrialization  
(C) More use of CFC  
(D) Global Warming  

(33) What effects are seen on the temperature of sea water due to Global Warming?
(A) Stable temperature  
(B) Reduction in temperature  
(C) Increase in temperature  
(D) None of the above  

(34) What effects on the proportion of carbon dioxide is noticed due to deforestation?
(A) Low level of CO2  
(B) High level of CO2  
(C) Normal level of CO2  
(D) None of the above  

(35) How the modern technology be used to control the problem of Global Warming?
(A) Use of solar energy in cars  
(B) Use of C.N.G in cars
(C) Battery runs vehicles
(D) All of the above

3.9.9 Experts' Information & Suggestions

The below mentioned are the experts’ educational details, review and suggestions for the above mentioned questionnaires.

Table 3.4

<table>
<thead>
<tr>
<th>Sr. NO.</th>
<th>Name of Experts</th>
<th>Qualification &amp; Experience</th>
<th>Given Information &amp; Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr. Jyotsana Ravat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professor of Arts &amp; Comers College Vidyanagar, M.A., M.Ed., M.Phil., Ph.D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex. – 18 years</td>
<td>Questionnaires are properly framed to cover the awareness of Global Warming.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Dr. Nilesh Gajjar</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professor of Swami Vivekananda M.Ed. College, Mehsana, M.Com. M.Ed., M.Phil., Ph.D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex. – 07 years</td>
<td>Make only one Section instead of two Sections.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Dr. Bhavana Modi</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professor of B. D. Shah College of Education Modasa, M.A., M.Phil.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ph.D., GSLET.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex. – 08 years</td>
<td>Questions can be prepared according to the Situation.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dr. Suresh Paramar</td>
<td>M.Sc., M.Ed.,</td>
<td>Questionnaires</td>
</tr>
</tbody>
</table>
3.10 Procedure of the Data Collection

Depending upon the nature of the required data, the researcher has to decide which data tool will be suitable under the research study.

3.10.1 Types of Data

Data is genuine evidence, particularly evidence are prearranged for examination or useful to make intention or conclusions. Hence, data means observations or evidences collected by the researcher. Data can be both qualitative and quantitative in nature.

Gathering of data creates the principal stage in a numerical examination. Greatest precaution is essential to work out in gathering data for the reason that gathering of data arrangement lay the grounds of statistical technique. Suppose the data are defective then the assumption made could under no circumstances be consistent.
In general, data are of two types which are as follows:

1. **Primary Data**

   The information that is initially gathered/put together by an organisation for the first time for some statistical analysis is called primary data. Primary data are the data which is collected for the first time and therefore are in unpolished form. Primary data are always collected from the source. It is collected either by the investigator himself/herself or through his agents.
There exist numerous techniques of gathering primary data but it is mainly helpful in surveys and descriptive research. Each method has its relative merits and demerits. The primary data or information can be collected by the following resources:

1. Observing Behaviours of Participants/ Observation Method
2. Questionnaire Method
3. Interview Method
4. Schedules Method
5. Information from Correspondents/Other Methods

2. Secondary Data

Secondary data is the records which is unruffled by somebody apart from the user. Secondary data investigation protects time to be spent on gathering of data predominantly in the circumstance of greater excellence of databanks that could be impracticable for every specific investigator to bring together on their individual.

Moreover, experts of economic and social transformation /modification secondary data are important because secondary data is difficult quantitative data. Secondary data are responsible for bigger and to lead or do a new-fangled review which could sufficiently apprehend preceding adjustment as well as improvements. These data are previously being put together by certain organisation and in use in excess from there in addition is used by any other organisation for their statistical exertion are called secondary data.

Collective foundations of secondary data for natural science consist of surveys, organisational minutes/accounts and information unruffled by qualitative approaches or else methods or qualitative study. Therefore, in short, suppose the primary data is gathered or kept together for a statistical analysis are used in other statistical analysis at that point that information are called secondary data.

Data is actual information, particularly information which are systematized for analysis or used to reason or make decisions. Therefore, data means observations or evidences collected by the researcher. Data can be both qualitative and quantitative in nature.
The researcher has used the primary data in addition to secondary data. Primary is used through self-made questionnaires. From secondary data, almost all the sources are used for the planned study.

In the current study, the investigator has prepared a questionnaire to measure the awareness of global warming among the secondary school students of Mehsana district of Gujarat who follows the syllabus of Gujarat State Education Board (GSEB).

The first step of administration, the researcher has divided the city into the four zones as mentioned earlier and collected the detail of the school from Ahmedabad city of Gujarat State. After fixing the sample, the researcher has contacted the principals of the school and obtained their permission for collecting the data. After getting the permission, the students were convinced to give their responses. Before answering the questions, the researcher gave clear and precise information about the test and clarified their doubts. Then researcher gave a short explanation of the aim and scope of the study to the students and appealed for their willing co-operation and participation.

The researcher has collected the data to explore the present status of awareness of global warming among students of IX standard. The students are from Gujarati medium so questionnaires were also in Gujarati. The sample of 600 students in which 300 students were boys and 300 students were girls. It included closed-ended questions and it carries 70 marks 1 each for each questions. Then the marks were compared through comparative survey method and lastly it was evaluated through evaluation survey. The judgement was given on 't' value at 0.05 level of significance.

In the present study, the investigator has prepared a questionnaire to measure the standard of awareness of global warming among the secondary schools’ students in Mehsana District of Gujarat who follows the syllabus of Gujarat Board.

3.11 Procedure of the Data Analysis

Analysis of the data means reviewing the systematized factual with the aim of discovering the data are planned from as various point of view as possible to discover the new facts. According to Kalpan, “Analysis attempts to
characterize the meaning in a given body to discourse in a systematic and quantitative fashion.” Analysis involves an attentive, observant, open-mind and flexible. It is worthwhile to prepare a plan of analysis before the actual collection of data. The data are of two types

- Qualitative.
- Quantitative.

In the existing study, the investigator has used qualitative data for data analysis for descriptive survey method. Qualitative data are collected by a multiplicity of methods but the investigator has adopted questionnaire method. The questionnaire consists of seventy questions. The students have to select the right option from the given four options and yes/no questions. After collecting the information, the researcher has analysed the data. For analysing the information, the researcher has prepared an analysis sheet having different categories as per the questionnaire prepared. The collected information was put in the respective columns.

Analysis of the data means reviewing the well thought-out material with the purpose of discovering the data are considered from as numerous approaches as possible to search the new facts.

In the present study, the investigator has used qualitative data for data analysis for survey method. Qualitative data are gathered by a variety of methods but the investigator has adopted questionnaire method.

To analyse the data statistically, the techniques which are used in this research namely, mean (M), Standard Deviation (S.D.), Standard Error Difference (SED) and t-Value. The calculation has been judged on the basis of ‘t’ value at 200 degrees of freedom and at 0.05 level of significance. Soon after the data of the research has been gathered, the analysis of the data has been made. The researcher then proceeds forward to the other stages of interpreting the consequences.

### 3.12 Conclusion

In this chapter, the researcher has explained the base of the present research and research design employed for the research. In this way, this
chapter compacts with all the important aspects of the study and it provides a flawless representation of the study. The reason for choosing the topic becomes clear in the origin of the study. The research design contains the population of the study, sample of the study, research method, tools and techniques used for data collection, procedure of the data collection and procedure of data analysis. These steps will help the researcher to apply the proper methods in dealing with the research problem. It also gives the researcher a proper understanding in analysis and interpretation of data which is the heart of the whole study as it deals with the outcome of the study. The findings of the research will give insight to the solutions of the problem.

In this chapter, the investigator has explained the base of the present research and research design employed for the research. In this way, this chapter the transactions have been made with all the important aspects of the study and it gives a perfect representation of the study.