Chapter – III
Research Design and Methodology
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RESEARCH DESIGN AND
METHODOLOGY OF STUDY

The task of defining the research problem means the preparation of the design of the investigation undertaken, which is popularly known as ‘Research Design’. A Research design is an arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure.

It was very much essential on the part of the researcher to determine appropriate method of research in solving the problems and in verifying the hypothesis formulated.

The researcher was very much careful about the wasteful expenditure of money, time as well as energy, and designing was the process of making decisions before the actual situation aroused.

The researcher anticipated before conducting the research inquiry, that he cannot hold all the decisions in his mind.

Therefore to overcome this difficulty, the researcher recorded his decisions by making use of certain relevant concepts, such a symbolic construction, termed as ‘Research
Design’. Research design made it possible for an overall evaluation of the total plan.

A Research-Design was thus an arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. In fact the present research design is the conceptual structure within which the research is conducted. It constituted a sort of blue-print for the collection, measurement and, analysis of data.

As such the design included an outline of what the researcher was doing from writing the hypothesis and its operational implications to the final analysis of data.

The research purpose could be achieved with the minimum expenditure of money, time and, energy. The design decisions were based on good grounds and also on an accepted methodology. The researcher selected the appropriate method of making design decision. It must be noted, however, that no enquiry is fully or completely methodological just as no enquiry is completely unmethodological.

In fact, research varies between these two extremes; but along with this fact, it was also essential for the researcher to note certain important features of a research design.
**IMPORTANT FEATURES OF THIS RESEARCH DESIGN:**

This research design is characterized by the, objective like flexible, appropriate, efficient, economical, etc. These important features are stated below:

1. This research design minimized bias and maximized the reliability of the data collected and also analyse it.

2. This design yielded maximum information and provided an opportunity for considering different aspects of a problem.

3. This design specified the sources and types of information relevant to the research problem.

4. This design brought about its own strategy in specifying which approach will be used for gathering as well as analyzing the data.

5. This design included in its planning the proper time as well as appropriate cost and budget.
NEED FOR METHODOLOGICAL RESEARCH-DESIGN:

Just as for better, economical and attractive construction of a building, an architect needs well thought out design or plan in advance, so too about this study the researcher needed a research design or a plan in advance for data collection and analysis of the research project.

Simply, it can be stated that the research design was needed because it facilitated the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximum information with the minimum of time, effort and, money.

However researcher considered the need for methodologically designed research which is as stated below:

1. In research enquiries, the researcher has clear cut idea regarding the accurate results of his study. The researcher also had an idea as to how much inaccuracy can be tolerated. Therefore, he has designed the entire research just to get assurance of useful results.

2. Research designing was also needed for advance planning of the methods to be adopted for collecting the relevant data and, technique to be used in its analysis. This, however, was also done, keeping in view the
objectives of the research as well as the availability of the
time and money.

3. In this project, the time consumed in trying to ascertain
what data means after they have been collected was
much greater than the time taken to design a research
which yields whose meaning is known.

Finally, it is stated that this research design helped the
researcher to organize the ideas in such a way wherein it
will be possible for the researcher to look for flaws and
inadequacies, According to E.A. Schuman “Research
design is not a highly specific plan to be followed without
deviations, but rather a series of guide posts to keep one
headed in the right direction.

METHODOLOGY OF RESEARCH

TYPES OF EDUCATIONAL RESEARCH:

There are different methodologies for research and
these methods can be used according to the nature of the
study.

There is, really speaking, no absolute method by which
research can be classified into mutually exclusive groups.
But, in practice, it is found that different researches do fall
into different types in terms of goals, search for data,
interpretation, analysis and, area of application. Attempting
to classify the Educational Research into various types, poses a difficult problem. However, to systematize a method of presentation, some pattern or the other is definitely desirable.

In fact, all researches involve an element of observation, description and, analysis of what happens under certain circumstances. Generally, a rather three point analysis is used to bring about and particularly, all studies fall under one or a combination of the following types:-

1. Historical research

2. Descriptive research or Survey Research.

3. Experimental research.

Researcher had gone deep to study all the above methodologies of research, in brief to say -

**Historical Research:**

Describes ‘WHAT WAS ?’, The process involves investigating, recording, analyzing and, interpreting the events of the past for the purpose of discovering and generalizations that are helpful in understanding the past, understanding the present, and to a limited extent, in anticipating the future.
Descriptive Research or Survey Research:-

Describes ‘WHAT IS’?, It involves the descriptive, recording, analyzing and, interpretation of conditions that exist. It also involves some type of comparison or contrast and attempts to discover relationships between existing non-manipulated variables.

Experimental Research:-

Describes ‘WHAT WILL BE’?, When certain variables are carefully controlled or manipulated. The focus is on variable relationships.

The researcher finally selected the Normative Survey Method for his studies.

The Normative Survey Method:

The term ‘Normative’ implies the determination of normal or typical conditions or practices. The term Normative-Survey is generally used for the type of research that one intends to consider here – i.e., the research, which proposes to ascertain what is the normal or typical condition or practice at the present time. While historical studies discover; describe and, interpret what existed in the past.
Normative Survey Method is concerned with conditions or relationships that exist, practices that prevail, beliefs, points of view or attitudes that are held, processes that are going on, effects that are being felt or trends that are developing.

The Normative-Survey type of research is not peculiar to education or to other social sciences, but it is a significant mode of attack in any field of knowledge, where geographic distribution is involved, or where the objects of any class vary among themselves.

Normative-Survey Research is thus directed towards ascertaining the prevailing conditions. It seeks to answer the question, "What are the real facts with regard to the existing conditions?"

The Normative-Survey Method is also called as Descriptive Research. Normative or descriptive studies are designed to determine the facts of current situations and thereby to clarify status. John Best has preferred to use terms “Descriptive Research”; whereas in chapter V, Good prefers the term “Descriptive Survey Studies”. The compound adjective ‘Normative-Survey’ is applied in order to suggest the two closely related aspects of the study – ‘survey’ and ‘normative’, The word ‘survey’ indicates the gathering of the data regarding the current conditions and
the word ‘normative’ is used because surveys are frequently made for the purpose of ascertaining which is the normal or typical condition or practice.

**Importance of Normative Survey Method:**

The researcher has selected Normative Survey Method because-

1. Normative Survey Method served as a stepping stone to more precise investigations.

2. At its most elementary stage, the survey was concerned with determining the immediate status of a given phenomenon.

3. Although the major purpose of Normative or Descriptive research in education is to tell “what is”, many surveys do not go beyond a mere description of the existing situation.

4. Normative type of survey was often carried out as a preliminary step, which is followed by research employing more vigorous, controlled and, objective methods.

5. It secured historical perspective through a series of cross-sectional pictures of similar conditions at different times.
6. Normative or Descriptive Study served as a direct source of valuable knowledge concerning human behaviour.

7. It contributed to the advancement of knowledge in many ways. For example, by studying children of standard VIII, the researcher obtained some picture of the trend of development of Scientific Creativity.

8. Its purpose was to prepare a background for a constructive programme of educational research as also the removal of evil thinking.

9. It suggested the course of future development and gave pertinent data to the planning for the future.

Normative Survey helped the researcher in planning various educational programmes.

**SAMPLING**

One of the most important problems relating to the practical formulation of research is concerned with the estimation of characteristics of Universe or Population and the method of selecting for study a portion of the Universe is known as Sampling.
Population in this research was very large. There are near about ten thousand students studying in standard VIII in different media schools of Aurangabad City.

Sampling was the selection of some part of an aggregate on the basis of which a judgement or inference about the aggregate was made. There are about 150 secondary schools of different media in the Aurangabad City.

**Need for Sampling:**

It was difficult for the researcher to include all the students, therefore, a small population of the total was taken as sample.

The reasons for taking sample by the researcher was as follows:

a. It saved time.

b. It was less expensive.

c. It was manageable.

**Sampling Size:**

One way to increase the precision of a result in this study was to increase the size of the sample, therefore, for greater precision the larger but manageable size of the sample was taken.
Instead of taking very large and unmanageable size of sample, the researcher emphasized on the degree of precision as an important factor rather than size.

The prime concern in the selection of the sample was to assure its representativeness. The sample used in this study was selected to make representation to the population.

The researcher after defining the population has also determined the size of the sample. Out of this population, about 600 students of standard VIII were taken as sample from English, Urdu and, Marathi Medium schools. This sample size has been taken to increase the precision of results in this study.

**Sampling method:**

There will be wastage of time, money and, energy if the research data are not generalizable to some degree beyond the sample used in research. Thus sampling is the most significant thing in research to select appropriate method of sampling.

Variety of samples are employed in drawing samples and are grouped under following heads –

1. Random Sampling.
2. Purposive Sampling.

4. Area Sampling.

5. Quota Sample.


7. Multiphase Sampling.

8. Convenience Sampling.


11. Accidental Sampling.

After studying different methods of sampling the researcher has selected the Stratified Sampling method for this research.

**Stratified Sampling:**

The researcher has selected stratified method of sampling because the stratified sampling is a combination of both random sampling and purposive sampling. According to this method the researcher has subdivided the entire population into many categories or strata according to certain conditions.

Out of different media schools the researcher has selected only English, Urdu and, Marathi medium
secondary schools. To get more appropriate comparative results the above medium schools located in Posh localities and also Slum localities were selected.

Variables:

Variable refers to attributes, properties or characteristics which can change from one individual to the next. It is concern of the researcher to discover relationship between variables and to discover ways to effect those that are changeable within individuals. The researcher has selected Fluency, Flexibility and, Originality factors of the Scientific Creativity as variables to study the differences between the students learning in various medium students.

TOOL

SELECTION OF TEST ON CREATIVITY:

The selection of an appropriate test for this study was a difficult task, because according to several experts the factors related to intellectual abilities and creative abilities are common. Therefore it was better for the researcher to understand some of the views of psychologist on testing aspects.
The researcher had gone through the number of tests on creativity before the final selection of the test.

Frank Barron has made the following observation at one place:

The suspicion that in most of the standardized intelligence tests the very important domain of intellectual ability, creativity, was being neglected has existed for sometime. In 1898 G. V. Dearborn published in the 'American Journal of Psychology' an article titled, "A Study of Imagination", in which he reported the responses of Harvard students and faculty to a series of ink blots, one of his observations was that some of his more "intellectual" subjects were least imaginative. The same sort of observation was made sporadically by a variety of experiments in the "American Journal of Psychology" (1922) several years after the development of psychometrically sophisticated Stanford-Binet Intelligence Test, was perspicuous enough to write: Tests..... to ascertain either native intelligence or acquired knowledge ... (have) no elements in them to extract from the mind of the individual his powers of creative productivity and his tendencies towards originality.³

³ Frank Barron, op.cit. 43, Chap.4.
These observations point out that I.Q. tests do not seek to measure creativity. However, it is equally wrong to suppose that those who are very low in I.Q. measure, e.g. morons and idiots, may plausibly be expected to be creative geniuses.

At the Institute of Personality Assessment and Research of the University of California (IPAR) at ‘Berkeley’ an intensive study of architects made by MacKinnon and Hall in 1968 actually revealed: It is not that intelligence is unrelated to creativity, but rather than individuals of varying degrees or in profession intrinsically creative in character are of quite high measured intelligence, but their degree of creativity does not cover significantly with their intelligence test scores.

Another way of putting this is to say that for certain intrinsically creative activities a specifiable minimum IQ is probably necessary in order to engage in the activity at all, but that beyond the minimum, which often is surprisingly low, creativity has little correlation with scores on IQ tests.4

Note 1: MacKinnon has called the studies of creativity conducted by Torrance(1959) and Getzels and Jackson(1962) with the help of the so-called creativity tests

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4 Ibid., P. 42.
as "a highly questionable procedure" on the ground of lack of validity. (D.W. MacKinnon in Davis and Scott, p. 196.)

Note 2: Robert L. Thorndike has criticized the validity of the creativity tests devised by Getzels and Jackson, by Torrance, and by Guilford and his associates (R.L. Thorndike on "The Measurement of Creativity" in the Teachers College Record, Vol.64, No.5, Feb., 1963, p.422-24)

Stephen P. Kein (1967) has pointed out that the available tests of creativity are no more highly related to each other than they are to Intelligence Tests. It is, however agreed that creative ability belongs as much to human mind as does intelligence. But whereas intelligence has a growth pattern of its own and a measure like the IQ is possible, it is yet to be explored whether creativity has also any such growth-pattern and whether any creativity quotient can be found out. So far the studies have not been able to establish whether individual creators have any cycles of creative work during their lifetime, having some definite peak periods of creative work with intervening period of (creative) stagnation, Lehman, who conducted considerable research in this field, however, claims to establish that in every field of human endeavour the best productions occur most frequently between thirty and forty years of age. His findings are however, not so very
conclusive as the findings in respect of growth and decay of intelligence are.⁵

The use of creativity test as a criterion of creativity seems justified only to the extent that the abilities measured by the test are important and valuable in a culture and judged creatively by that culture. Creativity seems to be inseparable from its social and cultural environment. A culture-free creativity test, even if it could be constructed, would probably have little meaning.⁶

Creativity Tests according to Encyclopaedia of Psychologicaals-Experiments to measure creativity accurately have conducted since 1930 (C. Spearman) significant studies however have only been made in recent years (C.W. Taylor, J.P.Guilford). In particular it was Guilford’s concept of the divergent thinking which is required in these tests is essentially the production of as large a number of answers as possible (e.g. as many suitable titles as possible have to be found for some story).

⁵ For complete account see Chp. IX, "Age of Productivity" in What is Creative Thinking by Catherine Patrick (Bombay, Jaico Publishing House, 1956,) pp. 109-29.

⁶ Norma Trowbridge, op.cit., p.154 Note: More about Criterion Problem in Chapter II.
Evidently therefore there appear to be equally strong claims in support of the views that creativity depends upon divergent thinking as well as convergent thinking.

It is now no longer disputable that intelligence tests do not measure that important ability of the mind which is known as creativity. Even the Winchester Adult Intelligence Scale, which is widely used in individual intelligence testing and which is considered to be the most valid, factorial Intelligence Test, fails to measure those aspects of the mind which constitute creative potential.⁷

Guilford (1957) visualized that out of 120 S-I factors may contribute significantly to Scientific Creativity. From such a line of thinking it could be inferred that “Scientific Creativity” may be some how to some extent different from general creativity as conceptualized by Torrance, Barren and others.

Scientific Creativity may be considered from the following points of view:

i. Scientific Creativity deals with the unusual and original excellence in the field of science or scientific productivity.

⁷ E. Paul Torrance, Creativity, Pamphlet No. 28 of the What Research Says to the Teacher Series, op. cit., pp. 9, 10
ii. Scientific Creativity can also be thought as scientific method or scientific process primarily involved in production of unusual and original scientific contribution.

iii. The unusual scientific thinking abilities characterized by systematic approach for all contents whether from science or humanities or otherwise could be considered as the basic attributes of Scientific Creativity.

For developing such a measure which could tap exactly the Scientific Creativity defined here, it is essential that content of the test items of Scientific Creativity should be of very general nature. Though the content need not be restricted to the fields of science; however it would be effective in measuring such a dimension of Scientific Creativity if they touch the fundamental or general elementary contents of science.

**Final Selection of Test:**

There are several tests available on Scientific Creativity. After going through these tests the researcher had lastly selected a "Verbal Test of Scientific Creativity (VTSC)" constructed by Dr. V.P. Sharma and Dr. J.P. Shukla to study the Scientific Creativity of the students of
standard VIII studying in various media schools situated in posh and slum areas of Aurangabad City.

ABOUT THE TEST OF Dr. SHARMA & SHUKLA ON SCIENTIFIC CREATIVITY:

The test has been designed by incorporating six important factors as presented below from the 28 S-I factors inherent in Scientific Creativity ( Guilford 1959).

It is a test of Creativity; and not a test of creativity in science. It, therefore, lacks in the content aspect of science. Only contents in general form of Science as well as from Scientific thinking in terms of process orientedness have been included in this test of Scientific Creativity.

Only three factors i.e., Fluency, Flexibility and, Originality of Scientific Creativity have been taken in the evaluation of the Scientific Creativity.

DESCRIPTION OF THE TEST:

The test of Scientific Creativity consists of 12 items which have been classified into four sub-tests namely (1) Consequences Test (2) Unusual Uses Test (3) New Relationship Test (4) Just Think Why Test.
1. THE CONSEQUENCE TEST:

It is designed on the test patterns of Guilford (1952)
and Torrance (1962). In this test the familiar things are
presented in the form of hypothetical happening. This
applies to cause consequence relationship. The subject
has to think the effects of consequence whether usual or
unusual, logical or illogical.

The Consequence Test consists of three hypothetical
situations arising from fundamentals of science.

1. What would happen if there is no earth in the world?

2. What would happen if there are no bones in human
body?

3. What would happen if there is no air on the earth?

The situations are the hypothetical one hence, the
experience is minimized. An example is given in the test
booklet to make the students familiar with the test. The time
allotted for the test is 15 minutes.

2. UNUSUAL USES TEST:

The test of unusual uses has been designed on the
lines of Guilford's (1952) 'Brick Uses Test' and Torrance's
(1962) 'Tin Can Uses Test'. The present test of Scientific
Creativity includes the names of the common objects;
namely (i) Nails, (ii) Water and, (iii) Leaves of plants and trees which can be used for numerous purposes. All these items are very common objects from the fields of physical and biological sciences. They do not require any knowledge and skill in science; however, vertical scientific thinking is an essential requirement for attaining high on this test. The students are required to write as many novels, interesting and unusual uses of these objects as they may think. One practice item is given in the booklet to acquaint the pupil with the nature of activity that he has to do, time allowed here is also 15 minutes.

3. NEW RELATIONSHIP TEST:

The New Relationship Test has been designed on the pattern of Mednick’s(1962) Remote Association Test. In this activity, the articles of daily use with which the child is familiar are taken so that he may think more naturally. All the articles of this test scientifically belong to the same group. This New Relationship Test consists of three pairs of words, namely (i) Sugar & Salt, (ii) Oil & Water and, (iii) Cat & Dog, which are similar to some extent in some of their physical, chemical or biological properties. Student has to think over as many new and novel similarities between these pairs of familiar objects from physical and biological sciences. This permits the subject an opportunity for free play of their imagination in the production of novel,
original and unusual responses. One practice item is given in the test booklet, time allowed is fifteen minutes.

4. **JUST THINK WHY TEST:**

The Just Think Why Test of Scientific Creativity consists of common events based on cause-effect relationship. The subjects are asked to think on various causes of the events.

The test contains three events namely:

1. What are the occasions for increase in heart-beating?
2. What are the reasons for non-germination of the seed?
3. On which occasion the man is not able to express his thoughts?

The students have ample opportunity to imagine and to produce novel and original ideas. The time allowed is 15 minutes.

The total time required to administer the whole test of Scientific Creativity is one hour in addition to 20 minutes time for general instructions and practice items. The test can be administered on a group.
ADMINISTRATION OF THE TEST:

As per the manual of the test it was administered on the students of VIII standard of English medium, Urdu medium and, Marathi medium schools located in posh and slum localities of Aurangabad city. The researcher personally visited each and every school as listed in the following pages and administered the test to the students.

This test of Scientific Creativity included four subtests, namely:

1. The Consequences Test.
2. The Unusual Uses Test.
3. The New Relationship Test and,
4. Just Think Why Test.

The researcher acquainted himself well with the test by going through test manual, which contained general, instructions as well as instructions for each activity. Time allotted to each activity was 15 minutes which was strictly adhered to. The test was conveniently administered to group of 25 to 30 students at a time.

The total time required to administer the whole test was one hour in addition to 20 minutes time for general instructions and practice items. The subjects were asked to
give their responses on separate printed sheet of test paper supplied to them for each activity. The students were properly motivated to response every test item.

The following are the names of the schools where the test was administered -

**English Medium Schools of Aurangabad:**

1. Saint Xavier's High School.
2. Saint John's High School.

**Marathi Medium Schools of Aurangabad:**

1. S.B. High School.
2. Gujarati High School.
4. Rashtriya Vidyalaya.

**Urdu Medium Schools of Aurangabad:**


**SCORING TECHNIQUE:**

While scoring, it was kept in mind that each item was to be scored for fluency, flexibility and, originality.

1. **Fluency** had been scored in terms of total number of responses related to the object.

2. **Flexibility** had been scored in terms of total number of categories. Each category had been assigned one score.

3. **Originality** had been scored in terms of weights assigned in accordance with their degree of unusualness.

The unusual responses had been defined as that response which occurs beyond 5% had been considered as common response, and hence had not been scored for originality. The scoring procedure for originality was presented in the following table.

If there were cases in which some responses were such which were not included in the scoring guide, the test user worked the originality weight for these new responses
according to the scoring scheme as indicated in the manual.

**TABLE**

Scoring for Originality

<table>
<thead>
<tr>
<th>Percentage of Responses</th>
<th>Weight assigned i.e., Marks given</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1% to 1.0%</td>
<td>5</td>
</tr>
<tr>
<td>1.1% to 2.0%</td>
<td>4</td>
</tr>
<tr>
<td>2.1% to 3.0%</td>
<td>3</td>
</tr>
<tr>
<td>3.1% to 4.0%</td>
<td>2</td>
</tr>
<tr>
<td>4.1% to 5.0%</td>
<td>1</td>
</tr>
<tr>
<td>Beyond 5%</td>
<td>0</td>
</tr>
</tbody>
</table>