CHAPTER – III

RESEARCH METHODOLOGY

Introduction

The present study is indented to find out the Effectiveness of teaching Vedic Mathematics on students’ Achievement of class VII. In the present chapter, the design and procedure followed to carry out the study has been presented in detail.

The details of the design and procedure are discussed as:-

3.1.1 Statement of the problem
3.1.2 Definitions of the Key terms
3.1.3 Objectives of the study
3.1.4 Hypothesis of the study
3.1.5 Delimitation of the study
3.1.6 Variables of the study
3.2 Sample
3.3 Method of Research
3.4 Experimental design
3.5 Procedure of the study
3.6 Research Tools

3.7 Data Collection

3.8 Analysis of Data

Conclusion

3.1.1 Statement of the problem

“A Study of Effectiveness of teaching Vedic Mathematics on Students’ Achievement”.

3.1.2 OPERATIONAL DEFINITIONS OF KEY TERMS:

**Effectiveness**: The capability of producing a desired result.

**Teaching**: The act of imparting knowledge.

**Vedic Mathematics**: Solving mathematical problems easily with the help of some sutras.

**Achievement**: The act of achieving or performing; successful performance.

3.1.3 Objectives of the study:

- To study the effectiveness of teaching through Vedic Mathematics and Conventional methods in relation to achievement of students.
• To compare the means scores on the achievement of Mathematics of the two groups of students to be taught through Vedic Mathematics and conventional method of teaching before the experiment treatment.

• To compare the means scores on the achievement of Mathematics of the two groups of students to be taught through Vedic Mathematics and conventional method of teaching after the experiment treatment.

• To find out whether Vedic mathematics is useful for all levels of students. (High achievers & Low achievers).

• To create awareness about the importance of Vedic Mathematics among students.

### 3.1.4 Hypothesis:

Ho1: There is no significant difference in the mean scores of experimental group & control group on pre-test.

Ho2: There is no significant difference in the mean scores of high achievers of the experimental group & the control group on pre-test.
Ho3: There is no significant difference in the mean scores of low achievers of the experimental group & the control group on pre-test.

Ho4: There is no significant difference in the mean scores of the experimental group & the control group on post-test.

Ho5: There is no significant difference in the mean scores of high achievers of the experimental group & the control group on post-test.

Ho6: There is no significant difference in the mean scores of low achievers of the experimental group & the control group on post-test.

Ho7: There is no significant difference in the mean scores of high achievers and low achievers in the experimental group on post-test.

Ho8: There is no significant difference in the mean scores of high achievers and low achievers in the control group on post-test.

Ho9: There is no significant difference in the mean scores of girls in the experimental group & the control group on pre-test.

Ho10: There is no significant difference in the mean scores of boys in the experimental group & the control group on pre-test.
Ho11: There is no significant difference in the mean scores of girls in the experimental group & the control group on post-test

Ho12: There is no significant difference in the mean scores of boys in the experimental group & the control group on post-test

Ho13: There is no significant difference in the mean scores of boys and girls in the experimental group on pre-test.

Ho14: There is no significant difference in the mean scores of boys and girls in the control group on pre-test

Ho15: There is no significant difference in the mean scores of boys and girls in the experimental group on post-test

Ho16: There is no significant difference in the mean scores of boys and girls in the control group on post-test.

3.1.5 DELIMITATIONS

1. The study will be confined to Mathematics Subject only.

2. The study will be delimited to Thane District only.

3. The study will be delimited to Secondary Section class only.

4. The study will be delimited to English Medium Students only.

5. The study will be delimited to 130 students only.

6. In Vedic mathematics there are 16 sutras. It is very descriptive and consumes a lot of time and also students may get confused if
all the 16 sutras are taught to them at one time. So, to make them understand very easily and keeping the time in mind, the researcher selected only few sutras.

3.1.6 Variables selected for the study:

In the present study the researcher used the following variables:

Independent variables: Teaching Vedic mathematics

Dependent Variable : Students’ Achievement

Variables controlled : Teacher, Time, Average Age, and Classroom conditions.

Variables uncontrolled: I.Q. of the students, their previous achievement, socio-economic status, anxieties, self-concept, interests and attitude.

Variables – Variables are characteristics experimenter manipulates controls or observes in an experimental study i.e element or characteristic being studied.

In layman’s understanding, a variable means a quality ‘which varies’. A research problem involves study of variations in either one variable over time, or social, economic, cultural or geographic groups, or the relationships between the variations in several variables. For example, the study may be just about how the height
varies among persons in population. This is the case of variable ‘height’. Alternatively, one may wish to study the variations in height and their relationship to variations in family incomes, etc. Here, the variable height is related to the second variable ‘family income’. In these two cases, the variables are quantitative i.e., their values can be expressed in numbers. Variables whose values can be expressed in terms of numbers are called quantitative variables. The variables are not directly expressed in terms of numbers. Such variables are called qualitative variables. However, qualitative variables can be converted into quantitative variables by assigning suitable numerical codes to their values. For example, all states can be numbered 1 to 35 in alphabetical order, gender can be expressed as codes 1 and 2, managerial styles can be classified and given numerical representations (e.g. 1 for authoritative, 3 for democratic, etc.). it is also possible to convert quantitative variables.

There are two types of variables. a) Independent variable b) Dependant variable. (Best and Kahn 1996 p.137).
3.2 Sample of the study

In this research, the random sampling technique was used for the selection of the sample. 130 students of Lourdes high school, Kalyan (W) and Shankara Vidyala, Dombivili(E) were divided into two groups, as Experimental group and Control group. The number of students in each group was 65.

Since the sample size is small there might arise the problem of generalizing to a large population, but it must be noted that large sample is not feasible in this study because it is an in depth study, taking place for a long duration (12 weeks including the intermittent holidays). Not only that, it is beyond the control of the researcher. Smaller samples were taken for number of experimental studies.

A sample represents the population and it is “any part of a population of individuals on whom information is obtained” (Frankel & Wallen 2006, p.107).
A random sample is a sub-set of units that are selected randomly from a population. In a random sampling all the possible samples of the same size have the same probability of being included in the sample. For example, if the process of selecting 1000 households from 2,00,000 households using chits or random number tables mentioned above to estimate household income in a city.

The advantages of Random sampling are as follows:

- It is a simple process of sample selection through chance mechanism. Thus, it avoids all personal and other biases in selection.

- It gives equal chance to every possible sample of the same size.

- The design is applicable in all situations.

Judgement or purposive sampling: The researcher selects a sample to serve a specific purpose, even if this makes a sample less than fully representative.
Judgement samples are most useful in studying those cases, which we believe, are in the best position to provide us with information. For example, we may be interested only in those who hold extreme position, have had certain types of experiences within the last few years, and so forth. The subjects may be those, which are judged by some expert to be the best ones for study. In these cases we seek a particular type of subject and may not even be interested in securing a cross-section of a population.

**Advantages of Purposive Sampling:**

1. Purposive sampling is less costly.

2. It is more readily accessible to the investigator.

**Quota sampling**

In Quota sampling we are interested in selecting subjects to conform to certain predesigned control measures. For example, we may know that the student body at Madras University is 55 per
cent male and 45 per cent female. We may require interviewers in this ratio.

In most quota samples we specify more than one control dimension, depending upon our opinions or evidence as to their importance. For example, we may believe that response to a question should vary, depending upon the sex of the respondent. If so, we seek proportional responses from both men and women. We may also feel that undergraduates differ from graduate students, so this would be a dimension. We may also choose dimensions such as the student’s academic discipline, ethnic group, religious affiliation and social group affiliation.

This reasoning by analogy is obviously dangerous and gives no assurance that the sample is truly representative.

In spite of these weakness already mentioned, quota sampling is widely used by the opinion pollsters and researchers. Its advocates feel that, while there is some danger of systematic bias, the risks
are worth taking. They are interested in averages and these tend to be rather stable even if there is some bias involved.

3.3 METHOD OF RESEARCH

The various types of research are explained below. But, the researcher had selected Experimental research for her study.

**Historical Research** - describes what was.

**Quantitative descriptive research:** Quantitative descriptive research uses quantitative methods to describe what is.

**Qualitative descriptive research:** Qualitative descriptive research uses systematic procedures to discover non quantifiable relationships between exiting variables.

**Experimental research:** Experimental research describes what will happen when certain variables are carefully controlled or manipulated. As defined here, deliberate manipulation is always a part of the experimental method.

"If this is done under carefully controlled conditions, what will happen?" After experiments define a problem, they propose a
tentative answer or guessed answer or hypothesis. After testing the hypothesis the experimenter confirm or disconfirm. It is important to note that the confirmation or rejection of the hypothesis is stated in terms of probability rather than certainty.

In testing hypothesis or evaluating tentative answers to questions, experimenters make decisions based on probability rather than on certainty.

Teachers can make their most effective contribution to educational research by identifying important problems that they encounter in their classrooms and by working cooperatively with research specialists in the conduct and interpretation of classroom experiments.

3.4 Experimental design

The present study was experimental in nature. For this purpose, ‘The Pre-test- Post-test Equivalent-Groups Design’ was used. The design of the study was as follows:-
<table>
<thead>
<tr>
<th>Stage</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre-test</td>
<td>Measurement of achievement in Mathematics</td>
<td>Measurement of achievement in Mathematics</td>
</tr>
<tr>
<td>2. Treatment</td>
<td>Teaching problems of Mathematics through Traditional Method</td>
<td>Teaching problems of Mathematics through Vedic Mathematics.</td>
</tr>
<tr>
<td>3. post-Test</td>
<td>Measurement of achievement in Mathematics</td>
<td>Measurement of achievement in Mathematics</td>
</tr>
</tbody>
</table>

Experimental research is the blueprint of the research. Choice of an exact design is depend upon the intention of the experiment, the type of variables to be manipulated and the situations or restrictive
factors under which it is to be conducted. The intend plan deals with such practical problems as how subjects are to be manipulated and restricted, and the type of statistical analysis to be used in interpreting data relationships. The design of an experiment has the purpose of giving the collection of details in such a manner that inferences of a casual relationship between the dependent and independent variables can be drawn while framing an experimental design some important aspects should be kept in mind such as the method of selecting experimental and control groups, measurement of dependent and independent variables, time of measurement, pattern of controlled groups used and number of possible casual variables.

The purpose of an experimental design is to obtain maximum information with the minimum of cost and labour. For this purpose, two groups are chosen in such a manner that they do not differ from each other in significant respects except by chance. The experimental group is exposed to the independent variable while
the controlled group is not. The two groups are then compared in terms of the assumed effect.

**Types of experimental design**

The adequacy of experimental designs is judged by the degree to which they eliminate or minimize threats to experimental validity. Three categories are presented here:

i) Pre-experimental design

ii) True experimental design

iii) Quasi- experimental design

Each category is further subdividing into a number of designs.

**Pre-experimental design:** Pre experimental designs involve only one group. A Pre experimental design always control the extraneous variables that Jeopardize validity. The least adequate of designs is characterised by:

i) the lack of a control group, or ii) a failure to provide for the equivalence of a control group.
The One group pre-test-post-test Design: This design provides some improvement over the first one.

True experimental designs

The pre-test – post-test Equivalent-Groups design

\[ R \quad O_1 \quad X \quad O_2 \quad X \quad gain = O_2 - O_1 \quad O_1 \quad O_2 = \]

pre-test

\[ R \quad O_3 \quad C \quad O_4 \quad C \quad gain = O_4 - O_3 \quad O_2 \quad O_4 = \]

post-test

The above design has been used in the present study. This design is similar to the previously described design.

The Time-Series Design:

At periodic intervals, observations (measurements) are applied to individuals or a group. The purpose of the series of measurements before and after the intervention or treatment is to demonstrate little or no change except immediately after the intervention.
The Equivalent Time-Samples Design:

Instead of having equivalent samples of persons, it may be necessary to use one group as the experimental and control group. In this design, the experimental condition (X1) is present between some observations and not (X0) between others.

The Equivalent Materials, Pre test, Post test Design:

Another experimental design, using the same group or class for both experimental and control groups, involves two or more cycles. The class may be used as a control group in the first cycle and as an experimental group in the second.

Factorial Designs:

When more than one independent variable is included in a study, whether a true experimental or a quasi-experiment, a factorial design is necessary.

3.5 Procedure of the study

The procedure of the study consisted of following steps:
1. The Researcher contacted Fr. Philip Gonsalves, the Principal of the Lourdes High School, Kalyan (W) and Mrs.Sorupa, the Head Mistress of Shankara Vidyalaya, Dombivili(E), the Institutions selected for conducting the experiment.

2. The Lourdes high School Supervisor, Mrs. Elizabeth and Shankara Vidyalaya’s Supervisor, Mrs.Sudha Ramakrishnan were contacted for necessary arrangements of classrooms for the Experiment.

3. The pre-test was administered on students in order to acquire their pre-test scores. Their pre-test scores were arranged in descending order and the students of the sample were allotted into two groups. The groups were randomly assigned to one control and one experimental group.

4. The pre-test results were preserved for the purpose of data analysis.

5. The experimental group was taught by the researcher herself by the method of Vedic Mathematics.
6. The control group was taught by the researcher herself in traditional way.

7. The duration of the experiment was spread over six weeks.

8. On the final day of the experiment, the post-test was administered.

3.5.1 Sample Equating Test

All students were selected from 7th class of the two schools. Total sample was 130, which was divided into two groups (i.e. experimental and control) of 65 students each. Experimental group had 65 students. In this group of 65 students, forty students were high achievers, twenty five were low achievers. And also the two groups i.e. experimental group and control group students were divided into boys group and girls group. 37 boys and 28 girls were selected in the experimental group and 41 boys and 24 girls were selected in the control group for the study.
3.6 Research Tools

Pre-test and post-test was administered to conduct the research.

3.6.1 Validity of the Test

Validity of the tests was evaluated by a committee, which consisted of Mathematics teachers and Teacher Educators.

Validity:

It is clear that the definition of validity has two parts:

a) that the measuring instruments are actually measuring the concept in question, and not some other concept; and b) that the concept is being measured accurately.

Assessing Validity: A casual reading of the research literature, reveals the existence of many alleged validation procedures. One type is face validation and the another is criterion validation by Selltiz et al. Two forms of pragmatic validation distinguished by Selltiz are concurrent validation and predictive
validation. Kerlinger also uses their terms “predictive” and “concurrent” validity. The third major form of validation is construct validation.

**Face Validity:** Face Validation is probably the easiest validation procedure to explain but the most difficult to carry out in the course of actual field research.

**Criterion Validity:** Criterion validity, variously called pragmatic validity, concurrent validity, or predictive validity, involves multiple measurement of the same concept. The term “concurrent validity” has been used to describe a measure that is valid for measuring a particular phenomenon at the present time. An example of the former would be prejudice scale that is capable of distinguishing between prejudiced and on prejudiced respondents. Face
validity cannot be proved but must be assumed; that is, the measure must at least appear to be valid.

**Construct Validity:** Imagine that we construct two indices of social class, which we may label index 2. Assume that we have a theory that contains a proposition stating an inverse relationship between social class and prejudice as social class increased, prejudice decreases. Assume further that this proposition has been tested by measuring social class by index 1, and has been substantiated. Construct validity consists of replacing index 1 by index 2 in the theory and retesting the entire theory. If we get the same results for the whole theory (especially for the proposition containing index 2) as when we used index 1 to measure social class, then we say that the new measure (index 2) has construct validity.
**Internal and External Validity:** In addition to face validity, criterion validity, and construct validity, two other somewhat different uses of them have appeared in research literature—internal and external validity, Webb et al. define these terms as follows:

*Internal validity asks whether a difference exists at all in any given comparison. To what other population, occasions, stimulus objects, and measures may they obtained results be applied.*

The terms were developed within an experimental context and apply to sources of error within the experimental (internal validity) and to problems of generalizing from the experiment to a larger population. For example, if one does not encounter contradictions in the data within a given experiment,
then the study is said to have internal validity. Contradictory findings signal the absence of internal validity. Even if internal validity is present, the findings are not said to have external validity unless they are held to be valid for additional (external) situations besides the original study that generated the findings.

3.7 Data Collection

Two different treatment patterns were applied during the research. The researcher provided both the groups the same direct instruction strategy with same lesson plans and activities, except for the control group was provided with traditional routine situation in the class room while experimental group was provided with Vedic mathematic method of teaching as treatment. The experimental continued for six weeks. Soon after the treatment was over, post test was administered on the same day and same time.
3.8 Analysis of data

For the purpose of interpretation, Raw scores obtained from pretest and post test were presented in tabular form. For the manipulation of data, the means, standard deviation and t-test were used.

The following formulae were applied:

1. Mean (X)

   (Best and Kahn, 2004, P.279)

   The mean of the distribution is commonly understood as the arithmetic average. It is computed by dividing the sum of all the scores by the number of scores.

   In formula form

   $X = \frac{\Sigma X}{N}$

   Where $X = \text{means},$

   $\Sigma = \text{sum of}$

   $X = \text{scores in a distribution}$
N = Number of scores.

2. Standard Deviation

Standard deviation was computed by the formula:

\[ S.D = \sqrt{\frac{\sum(x - \bar{x})^2}{(n-1)}} \]

Where: SD = Standard Deviation

\[ \sum = \text{Sum of} \]

\[ X = \text{Score} \]

n = Number of cases

3. t-Test (Independent samples)

\[ t_{test} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \]
where $\bar{x}_1 = \text{mean of sample 1}$

$\bar{x}_2 = \text{mean of sample 2}$

$n_1 = \text{number of subjects in sample 1}$

$n_2 = \text{number of subjects in sample 2}$

$s^2_1 = \text{variance of sample 1} = \frac{\Sigma(x_1 - \bar{x}_1)^2}{n_1}$

$s^2_2 = \text{variance of sample 2} = \frac{\Sigma(x_2 - \bar{x}_2)^2}{n_2}$

Data was analyzed with the help of computer. On the basis of analysis findings, conclusions and recommendations were made.

**CONCLUSION**

In this chapter the researcher explained how she had conducted the present research work. The researcher had given the detailed work plan and research methodology of the research. He also had given about sample, sampling method, and data collection method, objective of the study, hypothesis of the study, research method and limitation of study.