CHAPTER-III

METHOD AND PROCEDURE OF THE STUDY

The methods and procedure of conducting a research study are, by and large, determined by the design of the study and realization of its objectives, stipulated purposes and testing the variables involved. This would imply sub-heads like:

3.1 Method of research
3.2 Research Design
3.3 Population and sample
3.4 Procedure followed
3.5 Statistical analysis
3.6 Precautions observed
3.7 Constraints and difficulties

3.1 Method of research

In the words of Hillway (1964, p.138) ----- “to describe in detail the specific method being used, incidentally, constitutes a very good way of determining whether the method chosen has been worked out properly and is likely to prove effective. If the scholar cannot describe his method, the chances are that it is too vague and general to yield him satisfactory results”.

Broudy (1963) stated that “Method refers to the formal structure of the sequence of acts commonly denoted by instruction. The term method includes both strategy and tactics of teaching and involves the choice of what is to be taught and the order in which it is to be taught”. 
George J. Mouly has classified research methods into three different categories: survey research, historical research and experimental research.

Methods of conducting a research study vary in their nature and intent. It is the nature of the problem that determines the choice of the method to be used.

The present study is an attempt to study the effect of Educomp Smartclass on the students’ academic achievements and retention in mathematics. It is obvious that the effect of Educomp Smartclass cannot be studied through survey or historical method. It needs an experimental setting. Keeping this thing in mind, the investigator used pre-test, post-test experimental method to conduct this study.

The term experiment should be confined to those actions or series of actions here it is possible to do all of the following:

- Randomly assigning the subjects of the experiment to the experimental group (to which something will be done) and the control group (to which the thing done to experimental group will not be done).
- Manipulating (do something to) the experimental group.
- Technically a true experiment must be distinguished by characteristics of ‘random assignment’, ‘manipulation’ and ‘control’.

By definition, experimental research is always quantitative.

### 3.2 Research Design

A design is used to draw an outline of the research, to make it clear show how all the major parts of the research project the sample or groups, measures, treatments or
programmes and method of assignments work together to try to address the main research question.

Winer (1971) compared the design of an experiment to an architect’s plan for the structure of a building. The designer of experiments performs a role similar to that of an architect. The person who wants to construct a building gives his basic requirements to the architect, who then exercising his ingenuity prepares a plan or a blueprint outlining the final shape of the structure. Similarly, the designer of the experiment has to do the planning of the experiment so that the experiment on completion fulfils the objectives of research.

Research design is a mapping strategy which is based on sampling technique. It essentially includes objectives, sampling research strategy, tools and techniques for collecting the evidences, analysis of the data and reporting the findings. A researcher designs the work before getting the project underway.

An experimental design is a blueprint of the procedure that enables the researcher to test the hypothesis by reaching valid conclusions about relationship between independent and dependent variables. It refers to conceptual framework within which the experiment is conducted. In the present study the investigator has employed Two Group, Randomized Matched Subjects, Post-test-only Design. In this design instead of using random assignment of subjects to experimental and control groups, a technique of matching is used. The variable selected for matching i.e. intelligence and socio-economic-status, has a significant correlation with the dependent variable i.e. post-test achievement scores. The subject from desired population was paired so that their scores on matching variable became as close as possible. One subject of each pair was randomly
assigned to one group and the other to the second group. A coin was tossed to designate the groups as experimental and control group.

In the present study, students of Educomp Smartclassroom group are taught using Educomp Smartclass which is a digital initiative pioneered and invented by Educomp and is equipped with interactive Digiboard systems is a technology enabled classroom where the classroom teaching is enhanced through the use of technology. The teacher's computer in a smartclass room is connected to a dedicated server engine which allows teacher to use the large repository of curriculum based digital content in order to create a multi sensory learning experience for the students. The teacher gains complete attention and interest of every child in the classroom. Every child gets a visual input on how it happens and the concepts are well understood and internalized. Towards the end of the class, teacher displays a set of questions on a large screen; every child in class gets ready to answer the questions with their personal answering device – SAS. Students click the answers, instantly; teacher is able to get a score sheet for every child in class.

In the present study, pre-test post-test control group quasi experimental, design was employed with a purposive sample in the form of intact sections of class VIII of Navyug Public School, Sonipat (Haryana).

The study included a control group (40 students) and an experimental group (40 students). The experimental group was taught through Educomp Smartclass and the control group through traditional method.

The selected sections were equated on intelligence and socio-economic status. A figurative representation of the design is given in Table 3.1.
Table 3.1 Design of the Study

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-Test</th>
<th>Independent variable</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>$Y_1$</td>
<td>Educomp Smartclass teaching</td>
<td>$Y_2$</td>
</tr>
<tr>
<td>Control</td>
<td>$Y_1$</td>
<td>Traditional teaching</td>
<td>$Y_2$</td>
</tr>
</tbody>
</table>

The study involved four operational stages as identification stage, treatment stage, post-testing stage and retention testing stage. The first stage involved pre-testing of all the students of both groups on intelligence, socio-economic status, and achievement in mathematics. The second stage involved the experimental treatment, which consisted of two units of VIII grade mathematics taught through Educomp Smartclass used teaching and through traditional teaching to control group. The third stage dealt with post testing of the control and experimental group using the achievement test in mathematics. The fourth and the last stage were testing the retention in mathematics of the students. A schematic view of the phases of experiment is presented in Table 3.2.

Table 3.2 Phases of the study

<table>
<thead>
<tr>
<th>Stage</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>II. Treatment</td>
<td>Teaching mathematics through conventional method</td>
<td>Teaching mathematics through Educomp Smartclass method</td>
</tr>
<tr>
<td>IV. Retention testing</td>
<td>1. Measurement of retention in Mathematics (30 Days after the post test)</td>
<td>1. Measurement of retention in Mathematics (30 Days after the post test)</td>
</tr>
</tbody>
</table>
Variables under Study

In an experimental research, the relationship between two types of variables, namely independent and dependent variables is studied. Independent variables are the causes, while dependent ones are the effects. Another category of variables, which is equally important, is of the intervening variables. The three kinds of variables, identified for the study are:

Independent Variables

These variables are manipulated in order to see their effect on the learning outcome of students. In this study ‘Treatments’ acted as an independent variable. The treatments involved the two approaches of teaching viz., Educomp Smartclass used teaching and traditional teaching. The experimental group was taught through Educomp Smartclass used teaching and the control group was taught through the traditional teaching. Thus, Educomp Smartclass used teaching and traditional teachings were the two independent variables for the study.

Dependent Variables

Achievement in mathematics and retention in mathematics were taken as dependent variables. Achievement in mathematics was measured twice during the course of the study. First, before beginning the experimental treatment, i.e. at the pre-test stage and then, after completing the experimental treatment, i.e. at the post-test stage, where as retention was measured only after completing the experimental treatment, i.e. at the post-test stage.
Intervening Variables

There are certain variables known as intervening variables which have their effect on the learning outcomes, and influence both independent and dependent variables. Intervening variables such as nature of school, grade level, subject to be taught, intelligence of pupils, socio-economic status of pupils, previous knowledge of pupils etc. were successfully controlled experimentally.

Control Employed

It is necessary to control all those variables that may significantly affect the dependent variables. Hence, such intervening variables were controlled by employing suitable controls.

1. Nature of school

The sample was selected from a single English medium public school i.e. Navyug Public School, Sonipat (Haryana) affiliated to CBSE.

2. Grade Level

Only VIII class students were selected for the study and grade level was thus kept constant during the study.

3. Teacher Behaviour

The investigator herself taught the content to both the experimental and the control group i.e., inter-teacher variation was eliminated. She herself outlined the entry level behaviour, prepared achievement test, lesson plans etc. Hence there was equal familiarity with all the treatments.
4. Subject

The two groups were taught same two units of mathematics of class VIII NCERT prescribed text book i.e. Algebraic Expressions & Identities and Understanding Quadrilaterals.

5. Socio-Economic Status

The experimental group and the control group were given S.E.S. Test. t-test was applied to find out the difference between S.E.S. test scores of the two groups. The results are given in the Table 3.3

Table 3.3‘t’-Value of S.E.S. test scores of Experimental group and Control Group

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S. D.</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>40</td>
<td>63.175</td>
<td>11.513</td>
<td>0.222</td>
</tr>
<tr>
<td>Experimental Group</td>
<td>40</td>
<td>63.725</td>
<td>10.614</td>
<td></td>
</tr>
</tbody>
</table>

Not significant at 0.01 level

Table3.3. shows that the t-value between the groups is (0.222) which is not significant at 0.01 levels. It means that no significant differences existed between the S.E.S. of the two groups, indicating that they belonged almost to the same kind of a socio-economic milieu.

6. Intelligence of Pupils:

To eliminate the initial variability of the pupils statistically in the two groups, they were measured on general mental ability, through Group Test of Intelligence (GGTI) by Dr. G. C. Ahuja. Group Test of Intelligence (GGTI) is an index of intelligence which might have affected the independent variables, t-value was computed to analyse the difference between intelligence test scores of the two groups. The results are given in Table 3.4.
Table 3.4 ‘t’-VALUE OF INTELLIGENCE TEST SCORES OF EXPERIMENTAL GROUP AND CONTROL GROUP

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S. D.</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>40</td>
<td>71.10</td>
<td>8.532</td>
<td>0.161</td>
</tr>
<tr>
<td>Experimental Group</td>
<td>40</td>
<td>70.78</td>
<td>9.504</td>
<td></td>
</tr>
</tbody>
</table>

Not significant at 0.01 level

Table 3.4 shows that the t-value between the Educomp Smartclass group and Control group is (0.161) which is not significant at 0.01 levels. It means that no significant difference existed between the intelligence of the two groups. Initially, general mental ability was thought to be controlled statistically through covariance but since the two groups selected did not differ on general mental ability at the pre-test stage, there was no need to control covariate. The independent variables, dependent variables, control variables and the kind of control employed in the study are summarized in Table 3.5.

Table 3.5 Control Employed to Variables

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>Control Variables</th>
<th>Control Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of Teaching</td>
<td>1. Achievement In Mathematics</td>
<td>1. Nature of school</td>
<td>1. Administrative (Single School)</td>
</tr>
<tr>
<td></td>
<td>2. Retention in Mathematics</td>
<td>2. Grade Level</td>
<td>2. Administrative (Only VIII class chosen as sample and taught)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Teacher</td>
<td>3. Both the groups were taught by the same teacher (investigator hereby)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Subject to be Taught</td>
<td>4. Administrative (Same units of Mathematics taught in both groups)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Duration of</td>
<td>5. The two groups taught for 30 days, 40 minutes each period daily.</td>
</tr>
</tbody>
</table>
Specific events and factors like anxiety, home environment, adjustment, and social maturity could have only a marginal effect upon the experiment, so these factors were not taken into consideration.

3.3 Population and Sample

The term ‘Population’ is used in research to describe any group of individuals, events or observations in which the researcher is interested. In the present study, the term population refers to class VIII students studying in English Medium Public Schools of Sonipat district of Haryana.

“A sample is a finite part of a statistical population whose properties are studied to gain information about the whole” (Webster, 1985).

When dealing with people, it can be defined as the set of respondents (people) selected from a larger population for the purpose of a survey. In majority of the studies, it is just not feasible to collect data from each and every subject. In addition, to work on a sample saves time, labour and money.

Sampling makes it possible to draw valid generalisations by studying a relatively small proportion of the population selected for observation and analysis. In the present
investigation, Sonipat district of Haryana was the field of study. The sample of the study comprised 40 pupils each studying in two sections of the VIII class of Navyug Public School, Sonipat situated in Haryana. One section formed the control group and the other section formed the experimental group, as shown in Table 3.6.

**Table 3.6 Sample of the Study**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Group</th>
<th>Total No. of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Experimental Group</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>Control Group</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>80</td>
</tr>
</tbody>
</table>

No doubt, the sample is small for the result of the study to be generalised; an experimental study is normally more suitable on a small sample, as is evident from earlier investigations conducted through experimental design, which used small samples only. Krulger (1999) and Angrist and Lavy (2004) provided evidence in favour of positive and significant effect of small classes in experimental studies.

Arias and Walker (2004) conducted an experimental research to test the relationship between class size and student performance. They controlled variation in instruction, lecture material, and topic coverage by using the same instructors. The results were statistically significant which concluded that small class size had a positive impact on student performance.
3.4 Procedure Followed

Procedure of the experiment comprised of two main stages, that is, selection of the sample and conducting the experiment.

Stage 1: Selection of the sample

The sample of the study comprised of 80 students of class VIII (40 as control group and 40 as experimental group) studying in Navyug Public School, Sonipat (Haryana).

Selection of Experimental Group:

For the experimental group, a total of 40 learners studying in VIII standard, section A was chosen from Navyug Public School, Sonipat (Haryana).

Selection of Control Group: The control group consisted of 40 learners studying in VIII standard; section B of the same school. The group was exposed to traditional method of instruction. No novel treatment was given to the control group of students.

Stage 2: Conducting the experiment

The experiment consisted of four phases:

Phase I: Administration of the Pre-test

Before the start of the experiment, the sample subjects were contacted and rapport was established with them. They were oriented about the tests to be used. Three pre-tests i.e., S.E.S., Intelligence, Achievement Test were administered to the students of two groups by the researcher herself. The class teacher co-operated the researcher for administering the tests properly. The instructions pertaining to the tests were explained verbally in clear terms to the students before administering the test. The administration of the tests was carried out as per norms and instructions contained in respective test manuals.
After this, the students of both the groups were provided orientation and instructions about the treatment to be allotted to them to get over the anxiety and curiosity of the students. The students of the experimental group were given a trial of their respective materials, which helped them in getting over the curiosity and anxiety around via the electronic system being applied in the classroom setting. The students of the control group were also made familiar about the objectives, etc, of the tests to elicit their cooperation in the conduct of the study.

**Phase II: Conducting the Instructional Programme**

The second phase of the experiment was the real execution of the experiment. In this phase, the experimental group students were taught by Educomp Smartclass teaching and the control group students were taught by traditional method of teaching. The instructional treatment was given about 30 working days to the experimental group, where as the control group was taught by the traditional method for the same period of time. Same content was taught to both the groups.

**Phase III: Administration of Post-test**

Immediately after the instructional treatment was over, the researcher tested the subjects of experimental group and control group on the dependent variables (Mathematics Achievement Test).

**Date Schedule of the Instructional Phase for both the groups:**

**Phase 1: Pre-test Stage**

10 April 2014-Administration of Achievement Test in Mathematics

**Phase2: Instructional Programme**
The instructional programme started from 11 April 2014 and continued for next 30 working days. The instructions were completed on 19 May 2014. The achievement test was taken on 20 May 2014 after the completion of two units as per the syllabus prescribed by CBSE.

**Table 3.7 Date Schedule of the Instructional Phase for both the groups**

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>Date Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Algebraic Expressions</td>
<td>11-16 April 2014</td>
</tr>
<tr>
<td>1.2 Addition of Algebraic Expressions</td>
<td>17-21 April 2014</td>
</tr>
<tr>
<td>1.3 Multiplication of Algebraic Expressions</td>
<td>22-25 April 2014</td>
</tr>
<tr>
<td>1.4 Standard Identities</td>
<td>26-30 April 2014</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 2</th>
<th>Date Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Polygons</td>
<td>01-06 May 2016</td>
</tr>
<tr>
<td>2.2 Kinds of Quadrilaterals</td>
<td>07-13 May 2016</td>
</tr>
<tr>
<td>2.3 Some Special Parallelograms</td>
<td>14-19 May 2016</td>
</tr>
</tbody>
</table>

**Phase IV: Administration of Retention-test**

The retention test was administered on 01 July 2014 after the summer vacations.

**3.5 Statistical Analysis**

To achieve the objectives of the study, the data collected was statistically analysed using the following techniques:

1. Descriptive statistics such as mean and S.D worked out on the score of achievement in Mathematics.
2. ‘t’ value was computed in order to adjudge pupil’s intelligence and socio-economic status.
3. ‘t’ test was employed for testing the significance of difference between the means of pupils’ achievement in mathematics on pre - test, post - test and gain scores.

4. t’ test was employed for testing the significance of difference between the means of pupils’ retention in answering the test questions in mathematics on pre - test, post - test and gain scores. The value of ‘t’ was computed with the help of the following formula:

\[ t = \frac{M_1 - M_2}{\sqrt{\frac{\sigma_1}{N_1} + \frac{\sigma_2}{N_2}}} \]

Where

- \( M_1 \) = Mean of first group
- \( M_2 \) = Mean of second group
- \( \sigma_1 \) = Variance of first group
- \( \sigma_2 \) = Variance of first group
- \( N_1 \) = Number of cases in first group
- \( N_2 \) = Number of cases in second group

Mean scores in respect of achievement in mathematics and retention in mathematics were pictorially presented in the form of histograms. Histograms were drawn in respect of pre-test, post-test and gain scores of experimental group and control group.

**3.6 Precautions Observed**

Following precautions were observed during the course of experiment (Pre-test – treatment-Post-test) for ensuring effectiveness and high precision in experimental condition which may have contributed to the results.
No undue stress or control of any kind was imposed on the subjects at any time during the study and the experiment was conducted in a relaxed natural setting.

Both the experimental and control groups were taught by the investigator herself to avoid any variation.

The effectiveness of the experimental treatment was insured by establishing rapport with students and teachers, maintaining natural setting, harmonious atmosphere, providing sufficient time for various activities in the experimentation and the like.

It was insured that the topics on contents of treatment had not been previously taught to the students in both the experimental and the control groups.

Care was taken to keep importance of content matter during the course of treatment and it was not underplayed while fitting into the instructional treatment.

Teaching periods of 40 minutes duration were utilized fully for treatment and time was not wasted during experimentation.

3.7 Constraints and Difficulties Faced During the Experiment

Whenever a research project is in the process, necessarily some difficulties would come during the experiment. But because of the cooperative and supportive nature of the school authorities the problems sorted by the researcher herself were:

- Power failure
- Infrastructural lapses
- Time-table related difficulties
Efforts were needed to convince the teachers and the principal about the experiment and to seek their co-operation in the conduct of the experiment within the framework of the school schedule. The researcher contacted the school authorities and convinced them about the programme and its usefulness to ensure that the treatment be fully provided to every student and that the sample groups regularly attended the school during that period. The experiment was accordingly adjusted as per the timetable in vogue for pursuing a regular course of studies, making some minor changes in the regular time-table in consultation with the time-table in charge. The students’ motivation and the helpful attitude of the school authorities encouraged the researcher to carry out the experiment with full enthusiasm and very smoothly to study the effectiveness of Educomp Smartclass on students’ achievement and retention in Mathematics.