CHAPTER III

PLAN AND PROCEDURE

Research is a systematic and organized procedure to carry out a sincere study in a particular field. According to John W. Best (1970), “Research is considered to be the more formal systematic and intensive systematic activity directed towards discovery and the development of an organized body of knowledge” (Pp 8-9) The goal of research is development in every field. This goal is to discover cause and effect relationship between the variables.

Plan and procedure of research provides the potential skills necessary to carry out the research process. It includes research design, research method, sampling, research tools. It means it is the skeleton and backbone of the research. Planning of research is a natural process of setting clear objectives and choosing the most effective and efficient means of perceiving them through practical actions. Plan and procedure includes an outline of what the researcher will do from writing the hypothesis and its operational implications to final analysis of data.

Research Design

Research design is outline of the research procedure. “A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure.” (Selltiz, 1962, 50)

Research design consist decisions regarding what, where, when, how much, by what means, concerning an inquiry or a research. As well as it stands for advance planning of the methods to be adopted for gathering the suitable data and the techniques to be used in analysis considering the objectives of the research and availability of time and
money. The proper research design should be prepared before starting research as it helps researcher to synthesize his ideas.

In this phase of the research the researcher tries out his foresight to determine the best alternatives of his future actions in relation with research design, sample design, research tools, procedure, cost of research etc.

The first and foremost goal of the research planning is to maximize the educational contribution to students, teachers, institutions and government. A true researcher carries out the research planning at the optimal level rather than keeping it only on paper.

**Research Design of the study**

The present investigation was a product oriented research and includes development of text-based Computer Multimedia Software Packages for Chemistry related lessons of the General Science text books, prescribed for the classes of VI, VII, and VIII standard of English medium schools. So this product oriented investigation was experimental in nature for that experimental research design was used. There are different design in Experimental method of research among them the researcher used pre-test – post- test equivalent groups design. The two equivalent groups were Experimental and Control groups.

The pre-test was used to equalize two groups and post-test was used to collect data from both the groups.
Pre test for equiving Experimental and Control Group

School (1)                 School (2)               School (3)                 School (4)

Randomly assigned groups

1:1 Matched pairs based on pre-test scores

Experimental groups (2)                Control groups (2)

Treatment
Teaching by use Multimedia Software

No treatment
Teaching by traditional Method

Post test

Fig. 3.1
Flow chart of the research design
As shown in the fig. 3.1 researcher administered pre-tests for the students of four selected schools. After considering scores in pre-test two main groups of Experimental and Control were formed and Experimental groups (comprising students of DYPV and NEMS) were taught by using Multimedia Software and Controlled groups (comprising students of ICHS and REMS) were taught by traditional method that was regular classroom teaching. After this both groups (Experimental and Control) were faced post-test and effectiveness of both methods were analyzed by using appropriate statistical measures.

**Sampling Design**

In most of the studies sampling is useful than population study from the utility as well as scientific point of view. The sampling is the fundamental to all statistical methodology of behavioral and social studies.

“The size of sample may or may not be significantly related to its adequacy. A large sample carelessly selected, may be relatively unbiased and accurate enough to make satisfactory possible.” J. W. Best

“In the strict sense of the term, a representative sample would be a miniature or replica population at least with respect to characteristic under investigation if not in all respect.” Mouely

“Data can be more rapidly collected and processed with a sample than with a complete enumeration of population. This often important when information is urgently needed. It may provide a more accurate account than a report of entire population published much later; the latter in fact have only historical significance.” Sharma S.(2006)
So sampling is more suitable, appropriate useful than population study. But it should be carefully and unbiasedly selected.

**Sampling design of this study**

Mainly purposive sampling design was used for the selection of schools for this present study Among 15 English medium schools four English medium schools were purposively selected. While selecting schools computer facilities are considered mainly and schools with computer facilities were selected. They are as follows

1. Dr. D.Y.Patil Vidyaniketan (DYPV)
2. Radhabai Shinde English Medium School (RSEMS)
3. Irwin Christian Highschool (ICHS)
4. New English Medium school (NEMS)

All these four schools have the computer facilities and gived co education and follow the General Science text books prescribed by the State Government of Maharashtra.

After selecting the schools pre-test was administered on the student of VI, VII and VIII standard of only one division of respective classes of each school. On the basis of pre-test scores two almost identical groups were formed. One is Experimental group (students of DYPV and NEMS) another is Control group (Students of RSEMS and ICHS). The total population of this study was 510 students. This population was drawn from school record. The detailed population of VI, VII and VIII standard students of one division of each class of selected four schools were given in flow chart of sample selection. On the basis of pre-test scores two almost identical groups i.e. Experimental and Control were formed. On the basis of attendance at the time of pre-test and post-test administration the final sample was drawn if one student from a pair had remained
absent at the time of post-test administration then whole pair was dropped out, while selecting final sample. While forming two groups one to one matching pairs were choosed and for this almost same marks and same gender these criteria were keep in consideration and almost two identical groups i.e. Experimental and Control were formed. Each group contains 156 students so total sample of this study was 312. Among them total VI standard sample was 49, VII standard sample was 55 and VIII sample was 52. The same was the sample of other group; the final sample of the study was drawn as follows shown in the flow chart -
Tools and Techniques used for data collection

For any research data is very important for collecting this data various tools are used. Some tools are useful to collect quantitative data some are useful for collecting qualitative data. These tools employ distinctive ways of describing and quantifying the data.

In order to collect data for this research the researcher used the following research tools and techniques:

1. Pre-test prepared by the researcher with the help of subject experts.
2. Post-test prepared by the researcher with the help of subject experts.
3. Computer Multimedia Software Package developed for this study.
4. Annual examination marks taken from the school records.
5. Interview technique
6. Focused group discussions
7. Science textbooks of standard V, VI, VII, and VIII.

Detailed description of data gathering tools

1. **Pre-test**

   Researcher first analyzed the General Science text book of V, VI, and VII and selected Chemistry lessons from that. Then with the help of subject experts pre-test was prepared. The prepared pre-test was based on the Chemistry components given in V, VI, and VII Science text book. These test were administered on VI, VII, and VIII class students. Test of V was on VI class, VI on VII and VII on VIII class. The pre-test consists questions based on knowledge, objective which consists recall and recognition type questions. This test was used to prepare two equivalent groups for the experiment.
Procedure of preparation of pre-test

First phase

In first phase General Science text books of V, VI, and VII standards were analyzed with the help of experts to identify the Chemistry aspects. The content analyses was done under the subject experts supervision.

Second phase

By using Chemistry aspects questions were prepared; while preparing questions objective type questions were constructed. As fill in the blanks, true or false, matching the pairs etc. among them proper questions and question forms were selected and pre-tests were prepared. The first page was also attached to each test which serves guidelines for solving the test.

Third phase (trying out – pilot study)

This prepared test was checked by the ten experts and then was administered on students for pilot study. For checking the difficulties regarding ambiguity of the test, time for solving the test, as well as language difficulty in test. On the basis of students reaction and subject experts suggestions, necessary changes were made in the items. The content validity was established for pre-tests and final draft of pre-test was prepared under the guidelines of subject experts.

Fourth phase (final draft)

Considering suggestions and difficulties confronted in pilot study final draft of the pre-tests were made and final question paper consists twenty objective type questions. Each question
carries one mark. Each correct answer has one mark and wrong zero mark. Pre-test scores were used for equalizing the two groups namely Experimental and Control group. Pre-test of V was given to VI, VI to VII and VII to VIII class students.

Post-test

For post-test text book of general science of VI, VII and VII class was used. This post-test also made to went through four stages as pre-test those were –

First stage

Identification of Chemistry components from General Science text books of VI, VII and VIII class.

Second stage

Construction of questions based on Chemistry aspects of VI, VII and VIII class General Science text book.

Third stage (Pilot Study)

Pilot study of the three post-tests was done on the sample of students of VI, VII and VIII class.

Fourth stage (Final Draft)

Final of the post-tests were made as pre-tests. In this twenty objective type questions were consisted; having the question types as fill in the blanks, true or false, matching the pairs. Time allotted for this post-test was 35 minutes. Each question carries one mark. Each correct answer was given one mark and wrong answer was
given zero mark. Data collected from post-tests were used to find out the effectiveness of computer multimedia.

**Computer Multimedia Software Package developed for this study (CMSP)**

Researcher developed Computer Multimedia Software Package (CMSP). For this, researcher after selecting Chemistry components from the VI, VII and VIII class General Science books, wrote storyboards and get it developed. This CMSP was administered only on Experimental group and find out the effectiveness of CMSP and compare its effectiveness with traditional method of teaching.

**Procedure of development of CMSP**

For preparing CMSP researcher gone through following steps or stages.

I. Preparation stage
II. Developmental stage
III. Confirmation stage

I. **Preparation stage**

In this stage researcher gone through following phase

1. Content analysis

First researcher analyze the Chemistry components from the General Science text book of VI, VII and VIII class; with the help of subject experts. The topics those were directly or indirectly related to Chemistry were selected; those were given in the chapter no IV and page no.
II. Preparation of Story Boards

Blue print or Design of multimedia is storyboard. What should be in multimedia? Answer of this question is storyboard.

According to Adrian Mallon (1995) “A storyboard is an expression of everything that will be contained in the program – what menu screens will look like, what pictures (still or moving) will be seen when and for how long, what audio and text will accompany images.” Storyboard development is a way of organizing the ideas before preparing Multimedia Package. While developing the storyboards, graphics, videos, animations, sound etc. are incorporated along with the text. So text, sound, pictures, graphics animation are the components of a storyboard. There are different ways of developing the storyboards as –

1. Paper story boards
2. Digital storyboards
3. Electric storyboards
4. Screen storyboards
5. Linear storyboards
6. Interactive storyboards

Above each type of storyboard needs essential component of multimedia.
For building the blocks of computer multimedia above five components are very much important

1. **Text** – Text means use of written words and sentences related to content matter. It is said that use of text in Multimedia is limited.

2. **Audio**– Sound effect means audio. Sound effects enriches the effectiveness of multimedia. This involves background music, background sounds and speaking words related to content.

3. **Video/Picture**– Pictures or views or Scenarios related to content are important. Sometimes pictures were used as they are or sometimes they are edited.

4. **Animation** - Effect of movement given to objects is called animation. By this non-living things also can be shown in motion or doing movement some abstract ideas can be explained well

5. **Graphics** - It is proved that children learn and retain more information from pictures than from other forms of information. The graphics include background graphics, photos, three dimensional pictures etc.
All these components are called as building blocks of multimedia. They make the software entertaining. The Computer Software Multimedia packed with colorful animations, sound, video, graphics and text so the children learn without Burdon of learning. It creates interest, amusement in teaching and learning, for creating Multimedia Software Package.

For the present research, researcher proposed storyboards based on the components related to Chemistry subjects. Storyboards were prepared for VI, VII and VIII standard students. Storyboard serve as blue print for multimedia. So researcher prepared storyboards and gave to the computer experts for preparing multimedia. Storyboards were checked by subject experts, and English teachers and by I.T. Teachers. Thus validity of Storyboards were established.

Sample storyboards:

**Standard 6th**

Chapter No.10

Name of Chapter – Methods of separating substances

**Frame 1** Shows a picture of Globe

Que. What do you see in this picture?

(A pause button will be provided for students to think and answer the question) (After the answer following content will be displayed on the monitor.)

In the picture we see the whole globe. We see and use various substances as a sole or as a mixture for various purposes. The air around us is also a mixture of number of gases. We know that there are three stages of substances i.e. solids, liquids and gases, mixed together we get a mixture.
We drink beverages like nimbu-pani which is a mixture of water, sugar, salt and lime. We sometimes need to separate some constituent from its mixture. Various methods are used to separate substances from their mixtures. Let us study the various methods of separating substances.

How will you separate sand and salt from their mixture? Let’s see an experiment.

**Frame 3** Evaporation

Shows a video clip of mixture of water, sand and salt

In the above clip, we see a mixture of two spoons of sand and two spoons of salt and half a cup of water.

Que. From these two substances which substance will dissolve in the water?

Yes, salt will dissolve in the water. Then water can be strained to remove sand so we get the salt water.

Ques. What must be done now to separate the salt from the water?

Yes evaporation technique is useful here so keep the salt solution in a dish and place it in the sun. The water will evaporate leaving behind the salt.

**Frame 4** Threshing

Shows a picture of ripen field of Jowar

In the picture we see the ripen field of Jowar which is harvested. After harvesting there is need to separate grain from the ears. Here, the technique/ method of threshing is used to separate the grain from the ears.
Frame 5 Winnowing
Shows a picture of a man doing winnowing in the field
Dear students, we know the threshed grain contains lots of chaff. Therefore, the grain is winnowed. In this method of winnowing, the lighter chaff gets blown away in a current of air and the heavier grain is collected separately.

Frame 6 Sifting
Shows a picture of wheat, jowar, Rice Semoline or refined flour & a sleve. We get refined flour by putting it through a sleve. So that unwanted things are removed.

Frame 7 Picking
Shows a picture of woman picking out stones from Rice
Dear students we know that we pick out small stones from rice, dal, wheat, jowar etc. before using them.

Standard 7th
Chapter No. 17
Acids, bases and salts
Frame 1 Acids
Shows a picture of tamarind
We use many substances in our everyday life. These substances differ in their taste. Some are sweet, Some are sour and some are salty etc. Substances which are sour to taste are called Acids. Tamarind, Lemmon juice, butter milk, yoghurt are sour to taste because they contain acids.
**Frame 2** Bases

Shows a picture of pot full of soap

There are various substances like baking soda, lime, soap or ash which have a sharp and astringent taste. If mixed in water, their solutions are soapy to the touch so that, the substances when mixed with water give soapy solution are called Bases.

**Frame 3** Indicators

Shows picture of a beaker having some liquid

It is wrong to touch or taste a substance to find out what it is. It can be dangerous to do so. So certain substances are used to find out if a given substance is an acid or a base. These substances are called Indicators.

**Frame 4**

Shows an animated clip of adding indicator to solution

When an indicator is added to an acidic or Basic Solution it changes colour. Litmus, turmeric, Phenaphthalein, methyl alcohol are indicators.

**Frame 5**

Shows an animated clip of litmus in Water

Generally Litmus is used to identify acids and bases. A solution of litmus in water is purple in colour.

**Frame 6**

Shows an animated clip showing effect of litmus to an acid
In above clip we can see that, if litmus is added to an acid it turns red.

**Standard 8**

Chapter No.VI

Chemical reactions and their types

**Frame 1 Introduction**

Shows a picture of nature

We see many things around us. We see buildings, farms, animals, various substances, mountain, river etc. All these things are not static. There are many changes takes place in our surroundings everyday.

**Frame 2 Nature of Changes**

Shows a picture of rustling of Iron particles and curdling of milk

Some of these changes happen quickly while some take place slowly. Iron particles left in open place begin to rust in some days this is example of slow change while in summer milk curdles in a few hour is example of quick change. It is because of chemical reactions taking place in them. So how are the chemical reactions are written? Let’s see

**Frame 3**

Shows structure of writing chemical reactions

The chemical reactions are written in the form of equations. Chemical reaction includes reactants and products. The substances which are taking part in chemical reaction are called reactants and are written on left hand side of equation. The substances which are formed during reaction are called products and are written on right hand side of the equation and arrow is shown between the reactants and products and now we will see types of chemical reactions.
Frame 4 Types of chemical reactions
Shows types of chemical reactions
There are mainly three types of chemical reactions namely combination reactions, Decomposition or dissociation reactions and displacement reactions now we will see each one in detail

Frame 5 Combination reaction
Shows text including definition and example of combination reaction
A chemical reaction in which single compound is formed from two or more reactants is called as combination reaction. eg.

\[
\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2
\]

Calcium oxide + water Calcium hydroxide
Reactants Products

We see that the reaction between the calcium oxide and water produces a single compound i.e. calcium hydroxide. Calcium oxide and water are taking part in reaction. Hence they are reactants and product formed is calcium hydroxide.

Frame 6 Dissociation reaction/ decomposition
Shows diagram of dissociation reaction
Reaction in which a substance is broken down and two or more substances obtained from it are called decomposition reaction.e.g.

When an electric current is passed through acidulated water. Water dissociates in to its constituent substances. i.e. Oxygen and Hydrogen. Thus Oxygen and Hydrogen are products of this reaction.

\[
2 \text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2
\]
Collection of necessary materials

The material necessary for the development of software was collected by the researcher. Material like necessary pictures, newspaper cuttings, textual information, video clips, various educational CD’s and some sounds; were collected. Different sources were handled for this purpose, as internet, newspaper, interview of subject experts, text books, magazines, Encyclopedias, radio, T.V. and readymade educational CD’s. All these materials and storyboards were given to the and they used these material and prepared multimedia package for the present research.

II. Developmental Stage

The storyboards and necessary materials were given to the As this was good one team; the work of development of multimedia was given to them. By using given material they add their technical knowledge and expertise this team prepared present multimedia. Researcher also work with them and guide them from the research point of view.

III. Confirmation Stage

This stage include following steps

1. Validation of Software Package

The Multimedia Software Package developed by Aim Soft Company and researcher was given to the subject experts and IT experts. They were asked to point out in accuracies, inconsistencies and wrong things; and suggest or guide for this. They had freedom of suggesting other alternatives and editing \ omitting some aspects, adding new one, changing combinations etc. according to the feedback of experts; researcher asked for changing in multimedia. These feedbacks were given to Aim Soft Company in written discussion form and were change/modify/revise. After the modification, revised version of Multimedia
Software Package was again given to the subject experts and validation was done.

2. Refined version of Multimedia Software

   After the validation researcher finalize the Computer Multimedia Software and final version of the software was prepared. The final version was administered only on Experimental group and data was collected.

3. For students annual examination marks and their names and Roll Number school records of selected schools were used. Annual Science examination marks were used.

5. Interview technique

   Interview technique is also used to collect data from students regarding to find out difficulties in learning Chemistry and interview of Chemistry teaching teacher were conducted to collect data regarding to find out difficulties in teaching chemistry. Unstructured interview technique was used. Only points were written on the page; regarding to those points questions were asked. Researcher herself conducted the interview. Interview were conducted at the beginning of the academic year and summer vacations. Data related to the views opinions about software package was collected through interview; but that was structured type of interview. The questions (interview Schedule) were prepared. This interview was only faced by Experimental group students. All the students were asked identical questions and in same sequence. They are asked to respond in three ways those were Yes, No and Can’t say. Only last question was unstructured type or open ended; that was asked for improving software package. Only that question was analyzed qualitatively. Other all structured questions were analyzed quantitatively.
6. Focused group discussion

Group discussion was held to collect the data for finding out difficulties of teachers in teaching chemistry. As well as to find out the concepts, aspects related to Chemistry subject. Teachers of Science were asked to find out the Chemistry related components and concept difficult to explain responses of the teachers were collected and grouped chapter wise. This discussion was held at the beginning of the academic year. For this Science text book of VI, VII and VIII class were used. This group discussion was held in B.G.Kharade college of Education Shivaji Peth Kolhapur.

7. Science text book of V, VI, VII and VIII class

Science text book of V, VI, VII and VIII class produced by Maharashtra state bureau of text book production and curriculum Research, Pune were used for selecting Chemistry related components/topics and depending upon those topics pre-test, post-test and multimedia software were prepared. These text books were again used in focused group discussion of science teachers. Thus these text books served as first and foremost tool as the Computer Multimedia Software was text based.

Description of Experiment

The present research dealt with the Chemistry components in General Science texts of standards VI, VII and VIII without altering the integrated approach of teaching science, this experiment was conducted.

In this experiment effectiveness of Computer Multimedia Software was assessed. For that Computer Multimedia Software dealing with Chemistry aspects of VI, VII and VIII standard was prepared and administered on these three classes of Experimental group. The experiment was conducted during school hours with class adjustments.
made by the school authorities; after the administration of pre-test two identical groups were formed. One experimental and another controlled. Experimental group was administered the experiment that was teaching through Computer Multimedia. Software prepared by researcher with the help of Aim Soft Company. This experiment started in the beginning of academic year 2010-11. The Computer Multimedia Software developed by the researcher was administered on the experimental group. The instruments used for the administration were computer, LCD projector, television set, speakers etc. through the consultation with science teachers time mentioned in the annual plan was given to each lesson. After the administration of Computer Multimedia Software Package, post-test was administered and data was collected. In Control group the student were taught by their Science teacher. The students of the controlled group was made to face post-test by the researcher with the help of school teachers, and data was collected.

**Validity of the Experiment**

Validity of any experiment is of two types. Internal validity and external validity. Internal validity means the assurance about the change in independent variable. It deals with the authenticity of cause and effect relationships and deals with the question of whether or not the treatment actually caused the observed outcomes in an experiment. The external validity deals with the application of the result of an experiment to other experimental setting, experimenter and at other times.

**Establishing internal validity**

Internal validity is established by controlling, eliminating, matching random selection of the variables. Through the selection of schools purposive; researcher used the technique of matching. All the
selected four school students were administered the pre-test and on the basis of scores in pre-test almost two identical groups were formed, one experimental and controlled. Maturation was not a serious problem because students in the experiment were of almost equal age group i.e. from 12 to 15 age groups. The experimental mortality was decreased as population of the study was taken from the school record and sample of those students who were present at the time of administration of both pre-tests and post-tests. The threat of pre-testing was controlled by using two different test for post-test and pre-test. To avoid the threat of instrumentation researcher was equipped with the knowledge of handling multimedia.

**Establishing external validity**

There are mainly four threats for external validity

1. Artificial setting
2. Interaction effect of testing
3. Interference of prior treatment
4. Interaction of selection and treatment
5. The extent of treatment verification

The threat of an interaction between the treatment and subjects of the experiment were brought under control by purposively selecting four English medium schools of Kolhapur city, Maharashtra state and randomly selecting experimental and controlled schools from these four schools.

**Variables in the study**

There are two types of variables. Dependent variables and independent variables. Dependent variables of the present study Treatment (administration of multimedia software) given to the Experimental
group. Independent variables of the present study: the academic achievement of school students in post-tests and the marks in science subject at annual examination.

**Controlling the Extraneous variables**

Extraneous variables are those independent variables that are not related to the purpose of the study, but may affect the dependent variable. For example – intelligence, age etc. whatever effect is noticed on dependent variable as a result of extraneous variable is technically described as an experimental error. Many research conclusions are questionable because of the influence of the extraneous variables. In the present study, the extraneous variables of sound and noise were controlled. For this all the four selected schools were away from the heavy city traffic. Special sitting arrangement was made for conducting the tests and administrating the software packages developed for this study.

**Controlling the Intervening variables**

Intervening variables are those which can not be controlled and measured but have the effect on relationship of dependent and independent variables.

These modifying variables intervene between the cause and effect. In classroom situation intervening variables are fatigue, motivation and anxiety.

In the present study the intervening variables were controlled. To control the variable fatigue the pre-tests and post-tests were conducted in the morning sessions. The time selected for the test was between 7:00 am to 9:30 am. To minimize the fatigue factor researcher selected the morning time ( up to 10:00 am)with the permission of schools time of
classes were adjusted so that tests and multimedia package were administered at morning time. The tests and multimedia were conducted and administered on school days and during school hours. No extra time and day was used for tests and experiment.

**Statistical tools used in the present study**

Main purpose of this research was the development of text-based computer multimedia; and investigating the effectiveness of this multimedia. The other important purpose of the study was to enhance the achievement of students in Science in general and Chemistry in particular for all these purposes suitable statistical measures / tools were used; they were as follows
1. Mean
2. Standard deviation
3. ‘t’ test
4. Percentage

The raw data was organized with the help of MS Excel software. The final data of Experimental and Control groups of VI, VII and VIII standard was analyzed with reference to above statistical measures. The analyzed data was tabulated, interpreted and results drawn. The analysis, interpretation of data and results drawn have been presented in the next chapter, Analysis and Interpretation of Data.

**Procedure of Data Collection**

1. Analysis of Science text books of V, VI and VII for identifying Chemistry related topics and constructing pre-test.
2. Administration of pre-test based on General Science related to Chemistry topics and data was collected for equivalence of the groups.
3. Analysis of Science text books of VI, VII and VIII were done to identify Chemistry related topics and constructed post-test.

4. By using interview technique problems in learning Science from the school students.

5. By using interview technique problems in teaching Science from the Science teacher.

6. Administration of post-test based on General Science related to Chemistry topics and data was collected.

7. Annual marks of VI, VII and VIII standard students were collected from the school records.

In this way data was collected and using suitable statistical techniques analysis and interpretation was done and presented in IV chapter.