CHAPTER III

METHODOLOGY OF RESEARCH

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3.1. Introduction :

A researcher must have a thorough understanding of all the known research methods with particular reference to their strengths, applicability and appropriateness. It will help him to carefully plan the steps he will have to take in the research process and describe the method clearly before he actually starts working on the solution of the problem. To describe in detail the specific method being used, incidently constitutes a very good way of determining whether the method chosen has been worked out properly and is likely to prove effective. If the investigator cannot describe his method, the chances are that it is too vague and general to yield him satisfactory results.

A pre-planned and well described method will provide the researcher a scientific and feasible plan for attacking and solving the problem under investigation. The method selected should be in harmony with scientific

principles and adequate enough to lead to dependable generalization.

The purpose of this study was to study effect of use of multimedia on learners' achievement in Science. The investigator chose the Experimental method as the best method of study as it provides much control and therefore establishes a systematic and logical association between manipulated factors and observed effects.

3.2. Experimental Method :

J. C. Bell in 1918 and W. A. Mc. Call in 1923 revealed a sublime faith in the value of experimentation as a means of solving the educational problems.

> " Now comes the experimentalist and with clear, unfaltering eye and steady relentless tone, he demands of each subject the justification of its existance. "[1]

> " Everywhere there are evidences of an increasing tendency to evaluate the educational procedures experimentally. " [2]

After citing several leaders recently critical of educational experimentation and while noting that pessimism in the 1930's followed the optimism of 1920's. Carter V Goods states.

> " We must always remember, however that experimentation is the only valid procedure for settling disputes concerning educational practice, for verifying educational improvement and for establishing a tradition in which improvements can be introduced without the danger of a faddish discard of old wisdom in favour of inferior novelties. " [3]

An experiment calls for the satisfaction of four basic interrelated conditions i.e.

a) Control.

B) Manipulation.

c) Observation.

d) Replication.

Experimental research is the description and analysis of what will be or what will occur, under carefully controlled conditions. The experimenter controls the educative factors to which a child or group

of children is subjected during the period of inquiry and observes the resulting achievement. This procedure is distinctly different from the historical and survey methods. Despite its scientific rigour, experimentation is the only one aspect of the scientific method for the scientific method involves a great number of activities of which experimentation is simply an important form. The purpose of experimentation is to derive, verified functional relationship among phenomena under the controlled conditions or more simply, to identify the condition underlying the **occurence** of a given phenomena. From the operational point of view, the variation in the independent variable in order to study changes in the dependent variable under controlled conditions. The experiment is generally regarded as the most sophisticated research method for testing the hypothesis.

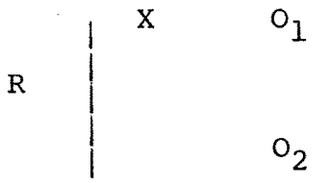
Experimenters deliberately and systematically manipulate certain **stimuli** or behaviour of the subject. They are also aware of the factors that could influence the outcome and remove or control them in such a way that they can establish a logical association between manipulated factors and observed effect.

In the present study the researcher had to study the effect of the multimedia package on the learners cognitive structure. Hence this method best suited the purpose.

3. Experimental Design :

An experimental design is to a researcher what a blueprint is to an architect. The researcher has selected the design that will do the job it is supposed to do and is able to arrange objectively the experimental conditions to meet the requirements of the study. The design provides adequate control and helps the researcher to get dependable answers to the questions raised by the hypothesis.

The investigator selected the post-test only control group design recommended by Stanley and Campbell. No pre-test was used to prevent the problem of pre-test sensitization.



R - Experimental and Control group.

X - Experimental treatment given to experimental group.

O_1 - Performance of the Experimental group in terms of gain.

O_2 - Performance of the Control group in terms of gain.

3.1. Reason for selecting the design.

This design is one of the simplest and powerful experimental design. The available subjects were assigned to two groups through randomization which controlled all the possible relevant extraneous valuables. Pre-test was not used which took care of pre-test sensitization and any initial differences between the groups were attributed to the chance factor.

This design minimized the threat to experimental validity.

3.2. Validity of Experimental design :

The researcher has tried her best to create a balance between the external and internal validity.

Since 1957, Donald Campbell, Julian Stanley, Glen Bracht and Gene Glass have reported comprehensive analysis of factors or threats jeopardizing the validity of experiments.

The threats are or usually less concerns in true experiments where subjects are assigned at random to treatments and measurements are under the control of the experimenter. The threats are of much greater concern in " quasi " experiments, where random assignment is not feasible and the experimenter has less or no control of the variables. [4]

The investigator has taken utmost care to control the sources of invalidity.

3.3. Threats to internal validity :

a) History :

The researcher tried to control the specific events, other than the experimental treatment. No events took place between the two tests and the experiment was continuous.

b) Maturation :

Maturation refers to the time period that elapses during the experimentation and may produce some change in the subjects. Fatigue, age, interest and motivation might affect the dependent variable.

This factor was taken care of by the researcher by timing the duration of the experiment to twenty five days. The students were engaged thirty five minutes everyday, which was included in their school time. Both the experimental and control group had the same maturational and developmental experiences which controlled maturation.

c) Instability :

The sampling was done by a simple randomized technique which resulted in the equivalent groups. This minimized the errors in measurement and sampling to a great extent.

d) Effects of testing :

The scores of the post-test may be affected by the pre-test apart from effects of the

treatment. To minimize the effects of the pre-test, the investigator opted for the post-test only design.

e) Instrumentation :

The investigator kept the conditions and tools of testing of both the groups, identical to prevent the differences arising due to experimentation.

f) Statistical Regression :

Two equivalent groups were made by giving them an objective test based on their previous knowledge. The investigator selected a random sample and hence the problem of statistical regression did not arise.

g) Selection :

The biases due to the differential selection of subjects was avoided by the investigator by giving them an objective test of twenty marks based on their previous knowledge.

h) Experimental Mortality :

This threat refers to the loss of subjects during an experiment. The investigator issued a prior warning to all his subjects, that the experiment was a part of their learning and had to be taken seriously. The experiment was compulsory for all.

3.4. Threats to external validity :

External validity pertains to the extent to which the findings of an experiment can be generalized. To what extent can the conclusions be applied to other populations or conditions ? Threats to the external validity may limit the generalization to a restricted population and to a specific population. The following are the threats to the external validity which were put under control by the investigator.

a) Inadequate description of the independent variable.

The independent variable was explicitly stated by the investigator. It was the use of multimedia package in the present study.

b) Inadequate representativeness :

The subjects who participated in the present study were representative of the target population, to which the generalization would apply.

c) Departure from school conditions :

The subjects participating in an experiment may be motivated by the knowledge that they were participating in an experiment. To avoid this the investigator told the subjects that this experiment was a part of their syllabus and would not be retaught.

d) Inadequate measurement of the dependent variable :

The dependent variable in the study was Pupil achievement and the investigator selected appropriate measuring instrument for the study.

Thus the investigator selected such a sample which was **unbiased** Duration of the experiment was less and it did not lead to fatigue and loss of interest. The use of the control group put a check on the interaction affect. The selected sample was representative and the interaction effect of selection and treatment was eliminated.

4. Control factors and Variables :

The investigator brought the following factors under control.

i) Chronological age.

ii) Sex

iii) Environment.

iv) Study habits.

i) Chronoligical age :

The students selected for the experiment were studying in VIII standard. The researcher checked the school general register and it was found that the age of the selected groups was not below thirteen years and not more than fourteen y ears. So there was a uniformity in the subject age.

ii) Sex :

The researcher had selected a boys school and hence there was no problem controlling the sex factor.

iii) Environment :

All the subjects were in the same school and

from the same class. So there were no physical differences. All the subjects were exposed to the same physical conditions and environment.

iv) Study habits :

The study habits of the learners were also brought under control. The subjects were learners from the same class and were taught by the same teachers.

In this way the investigator controlled the above factors.

Variables :

The two types of variables included in this study **were** -

a) Independent variables :

The variable which is manipulated by the experimenter is called as the independent variable. Here in this study, ' Multimedia package ' was the independent variable used for the teaching of science.

b) Dependent variable :

The dependent variable was the condition or characteristic which appears, disappears or changes as the experimenter introduces, removes or changes the independent variable.

In this study the learners achievement in terms of cognitive structure was the dependent variable.

3.5. Cognitive structure of the student :

The researcher directed his study to investigate the changes taking place in the cognitive domain of the student after administering the treatment. Thus the investigator studied the first four major abilities that lie within the cognitive domain. These abilities were -

a) Knowledge.

b) Comprehension.

c) Application.

d) Analysis.

a) Knowledge :

This is concerned with the pupils ability to recall terms, facts, rules, principles etc. It

is almost synonymous with the term information objectives that emphasize memorization of facts, principles, procedures and pattern in different subjects fall under this category of the Toxonomy.

b) Comprehension :

It refers to the pupil's ability to understand a given content to the extent that he can put it into his own words. summarize or explain it. He will be able to translate, give examples, illustrate and summarize.

c) Application :

This is concerned with pupil's ability to use rules, methods, procedures, principles and other types of new generalization to new situations. The unfamiliarity and the problematic nature of a given situation evokes this level of thinking which is higher that mere comprehension. The pupil is able to solve, predict, develop, explain or apply.

d) Analysis :

Here the pupil can break the material into its constituent parts detection of the relationships of the parts and the way they are organised.

3.6. Preparation for the Experiment :

The investigator did some prior preparations for the conduct of the experiment. The investigator decided to conduct the experiment in Sweet Memories High School, Panchgani. The reason for opting for the above school was that the investigator was working in the same school and hence it was convenient and comfortable for her. The school was a residential school and one of the schools in the galaxy of twenty two schools in Panchgani. The following steps were included in the preparation.

3.6.1. Consent of the authority :

The investigator being the Headmistress of the school made the task easier. This brought the various administrative factors under the investigator's control. She was also well acquainted with her subjects. The problems of provision of resources, planning of the experiment, its execution was looked after and taken care of easily by the investigator.

3.6.2. Material required for the Multimedia package :

The investigator selected media which were easily available, easy to use and appropriate. The explanation for the preparation of the multimedia package was given in detail by the investigator.

3.6.3. Selection of tools for testing :

In the beginning the investigator prepared tests based on the previous knowledge. These tests were objective in nature. This test was used in deciding the two groups for the experiment.

The other achievement tests after every sub-unit and the two comprehensive tests after every unit contained different types of questions.

3. 6.4. Duration of the Experiment :

The investigator decided to conduct the experiment at the beginning of the second term. The researcher limited the duration of the experiment to thirty days and for thirty five minutes everyday. This brought threats like maturation and history under control.

3.6.5. Scheduling the time-table.

The experiment was conducted in the school hours only. It was conducted thirty five minutes everyday. The students were told that the experiment was a part of their syllabus and the unit would not be re-taught. The daily time-table of class VIII was changed a little, to ensure the smooth conduct of the experiment. The schedule of the experiment is given in succeeding pages.

3.7. Sampling :

Sampling is the process by which a relatively small number of individuals or measures of individuals, objects, events are selected and analysed in order to find out something about the entire population from which it was selected. This procedure was to be clearly understood by the investigator if correct and trustworthy results were to be obtained.

The population was already defined by the investigator and there was no ambiguity. The study was representative. The investigator used a simple randomized sample which she selected in the following manner.

The school had one division of fifty students. No pre-test was used and the subjects were listed on the basis of their performance in the previous test. Two equivalent groups were selected as follows -

i) The subjects were listed in the descending order of their previous performance and were then drawn individually at random and assigned alternatively to the groups.

ii) Two different random samples were selected first and then groups were assigned randomly to the experimental or the control condition by the flip of the coin. The means and standard deviations of both the groups were determined. The means and standards of both the groups were almost equal. Thus the researcher obtained two equal groups. The names of the subjects their previous scores on the basis of which the pupils were assigned their groups, their scores obtained in the achievement tests are all given in the appendix.

The random assignment of subjects to different groups promotes the control of those factors which can bias the findings of the experiment. Thus the fifty

students of one division were divided into two groups of twenty five each. One group was assigned as the experimental group and the other group as the control group randomly.

3.8. Analysis of the syllabus :

The investigator analysed the syllabus of class VIII in the science subject before the conduct of the experiment.

Preparation of the syllabus is a complicated and difficult process. The syllabus has to be prepared according to the needs and developments of taking place in the society and the country.

The syllabus for Primary Education - 1988 was prepared in the State of Maharashtra following the National Policy on Education 1986. The syllabus is being implemented from 1989-90. It includes the subject 'General Science' separately from III standard onwards.

The text-book was designed and prepared by the Text-book Bureau of Maharashtra according to the

prescribed syllabus. It was designed with the perspective that the students should acquire the skills of observations, classification and drawing inferences and should thus understand the correlation between the scientific ideas, concepts and human life. A few questions where the students are expected to think independently have been included in the units.

The book was scrutinised by many teachers, educationists and experts from all parts of the state to make it as flawless and useful as possible.

A ' teachers handbook ' has been introduced by the bureau for guiding the teacher in effective teaching and learning of this book.

The syllabus of standard VIII is a continuation of syllabus of standard V and VII.

All the three pure sciences viz. Physics, Chemistry and Biology are all included in one book. There is a correlation between scientific ideas, concepts and human life in the syllabus. Various topics which are the need of the day have been included in the book.

The main thrust of the new syllabus is on equipping the student with a scientific attitude, acknowledging the student with the uses of science and connecting it with day to day life. It also throws light on the adaptation and evaluation of life and focuses on the need for conservation of natural resources and the impending energy crisis. The New Educational policy stresses the importance of science, technology and agriculture. Many activities and thought provoking questions have been included in the book. These activities stress group activity. As recommended by the education commission, a minimum essential care of knowledge, for promotion of intellectual capabilities has been provided.

In their comprehensiveness, the syllabus provides a wide range of information. Emphasis has been laid on making the knowledge as relevant to life as possible by weaving the content around day to day experiences, wherever possible; application of knowledge has been emphasized to help the students solve their simple and day to day problems.

9. Objectives of the Syllabus :

A teacher must have a thorough knowledge of the objectives of the subject he teaches.

The teaching of General Science to class VIII should produce the following learning outcome in them.

i) The pupils acquire the knowledge of the fundamentals of science, whereby he recognises certain terms, facts, principles, objects and recall them.

ii) The pupils develop understanding of science as a result of which he uses certain symbols, units, gives illustrations, verifies rules, recognises proper sequence, distinguishes, judges the adequacy or superfluity of data.

iii) Applies the knowledge of science to novel situations. After acquiring this ability the student explains scientific phenomena, makes predictions, draws inferences and makes generalizations, suggests procedures for experiments, establishes cause and effect relationship, modifies old procedures and suggests improvisation of apparatus and experiments.

iv) The pupil develops laboratory skills. This ability helps him to arrange the apparatus, check various instruments and rectifies errors, measures material accurately performs experiments neatly, makes accurate observation of parts, specimens, processes etc. adapts himself to new instruments and noval experiments, draws diagrams, graphs, calculates and finalises results, interprets data and draws conclusion, explains orally the procedures, records, experimentals procedures and conclusions, tabulates correctly, dismantles and cleans the apparatus.

v) The pupils develop an interest in science after which he reads scientific literature, collects specimens, models of scientific interest, participates in science fairs, science exhibitions, selects science projects and works upon them.

vi) The pupil develops a scientific attitude and is clear and precise in his statements and activities, makes interpretations, free from bias. Does not believe in superstitions and is prepared to review his arguments and opinions.

vii) The pupil develops a sense of appreciation.

After developing this sense he realizes the importance of science in human progress. He derives a pleasure in understanding the advances of science and technology. Takes delight in understanding the contribution of science in day to day life things like advertising, synthetic products, homeappliances etc.

viii) Appreciates the contribution made by scientists to human progress and expresses joy, excitement and thrill.

ix) Pupil develop a desirable personality trait and shows inquisitiveness and is clear and precise in his arguments, shows tolerance, perseverance and insists on accuracy and neatness.

10. Nature of the Text-book.

The investigator studied the text-book of science of standard VIII to fix the units and the sub-units. The text-books consists the three pure sciences - Physics, Chemistry and Biology, all in one. In the IX and X standard these are distributed into two papers - paper I and paper II.

The first five pages of the text-book are alloted to the introduction. It includes the members of the committee, who have helped in the preparation of the book, year of print, a praface by the Director of the text-book Bureau, which includes the objectives the text-book is required to achieve.

There are a total of Sixteen Units in the book. The first ten units are from Chemistry and Physics and the remaining six units belong to Biology. The number of sub-units in every unit vary depending on the length of the unit. At the end of each sub-unit are given thought provoking questions which a pupil can answer only after a thorough understanding of the sub-unit. At the end of the unit are given the important points and summary of the unit under the heading ' Review of the lesson '. After the review comes the ' Exercise ' for evaluation purposes.

All the important definitions, principles, rules, laws are given in coloured and large point. Explanatory figures, diagrams, tables are given wherever required. Additional information which arouses the interest of the pupils are included

Most important is the inclusion of activities which the student can do on his own at home. This helps

in developing the **practical** skills and also gives a scientific attitude and interest in the child.

The units included in the text are interesting blend really well with day to day experiences. The illustrations given are those with which the pupils can identify with. Topics like ' Conservation of natural resources ' and the energy crisis makes the students realise their importance and provokes them to think about the dangerous consequences the future generations may have to face as a result of their depletion.

11. Reasons for Selection of certain units :

The investigator divided to have the experiment in the second term of the academic year 1999-2000. The investigator selected two units from Biology. The reasons for the selection of these units were -

- They were suitable for the preparation of the media packages.
- It would be a continuation of the learners syllabus for the whole year.
- The experiment would not disturb the daily routine of the class.
- It would prevent repetition.

- It was helpful to the learners from the examination point of view.

The two units selected were -

Unit I Beneficial and Nuiscance micro-organisms.

Unit II Conservation and Preservation of Natural resources.

12. Determination of Media according to the Content.

After the selection of the units, the next step was the suitability and selection of media according to the content. The investigator had a wide choice of media and she used different packages for different topics. The details of the media used in the Unit I are given below.

UNIT I BENEFICIAL AND NUISCANCE MICRO-ORGANISMS.

The subjects had already studied the types of micro-organisms viz. Fungi, Bacteria, Viruses, protozoa and Algae and their disease causing nature in man, plants and animals. This unit deals with the benefits as well as the disadvantages of micro-organisms and throw lights on the havoc they create in our lives.

This entire unit was split up into four sub-units.

a) Microbial Fermentation.

b) Microbial Fixation of Nitrogen.

c) Nuiscance Micro-organisms.

d) Protection and Preservation of food and other articles.

The investigator prepared media packages based on every sub-unit.

MEDIA PACKAGES ACCORDING TO CONTENT

UNIT - I Beneficial and Nuiscance Micro-organism.

Sub-unit : 1 Microbial Fermentation

TABLE 1

Sub-unit : 1 Microbial Fermentation

Period	Content	Media
Introduction (1st period)	i) Comparison between living and non-living thing. ii) Types of foodmaterials and their breakdown into simple by-products during digestion. iii) This breakdown into simpler food material is called fermentation and enzymes make it happen. iv) Application of micro -bial fermentation preparation of food-stuffs medicines and chemicals.	Pictures of foodstuffs containing carbohydrates, proteins, vitamins, fats and minerals. - Transparencies showing the breakdown of complex food material into simpler food material.

Period		Content	Media
Preparation of foodstuffs. (2nd period)	i)	Curd, **bread** , idlis, dosas, cakes are all prepared due to microbial fermentation	<u>activity :</u> - Observation of lacto-bacillus from Curd.
	ii)	Preparation of Curd.	
	iii)	Preparation of bread	- Observation of yeast.
	iv)	Preparation of idlis, dosa.	- Transparencies.
	v)	Difference in the fermentation of Curd, bread, idlis, and dosas.	
Preparation of chemicals and medicines. (3rd period)	i)	Medicines used for curing diseases are prepared from micro-organisms. These medicines are called antibiotics.	

Period.	Content.	Media
	ii) Definition of anti-biotics, preparation of penicillin, Anti-biotic plant situated at Pune, broad spectrum antibiotics.	Transparencies.
	iii) Table of various antibiotics and the micro-organism which produce it and micro-organism destroyed by it.	Flashcards
	iv) Chemicals like ethylalcohol are also produced by fermentation.	
	v) Citric acid, glutonic acid, acetic acid, gluconic acid and also other chemicals produced by action of micro-organism.	Flash Card and Group discussions.

Package

1. Pictures.
2. Transparencies.
3. Flash Card.
4. Group Discussion.

TABLE 2

Sub-unit 2 - Microbial fixing of Nitrogen

Period		Content	Media
Introduction (4th period)	i)	Compnents of air.	
	ii)	Use of micro-oranisms in fixing atmospheric nitrogen	Flashcards.
Fixation of Nitrogen and production of humus. (4th and 5th periods)	iii)	Activity Observation of nitrogen fixing bacteria in the members of the family rhizobiaceae like peanuts.	Activity and Group discussion.
	iv)	Activity : Observation of the azatobacter which lives in soil.	Activity and Group discussion.
	v)	Difference between the Rhizobium and azatobacter nitrogen fixing bacteria.	

Period	Content	Media
	vi) Decomposition of dead plants and animals and production of humus.	Transparencies and tape recorder.

Package

1. Flashcard
2. Activity.
3. Group discussion.
4. Transparencies
5. Tape recorder.

TABLE 3

Sub-unit 3 - Nuiscance Micro-organisms.

Period	Content	Media
Nuiscance Micro-organisms (6th period)	i) Definition of Nuiscance micro-oranisms.	
	ii) Spoilage of Curd, Vegetables, dal, rice and other eatables which gets spoiled in summar due to microbial growth.	Transparencies
	iii) Microbes grow quickly on eatables which contain more water.	
	iv) Spoilage of food produces poisonous substance and causes food poisoning.	Transparencies.

Period	Content	Media
	v) **Staphylococcus** bacteria causes food poisoning.	
	vi) Clostridium bacterium grows in canned food.	Group discussion.
	vii) Microbial spoilage of other articles - decay of leather, wood etc.	
	viii) **Leather and wooden** articles can be sprayed and coated with paint or varnishes.	

Package

1. **Transparencies**
2. Group discussion.

TABLE 4

Sub-unit 4 - Protection and Preservation of food and other articles.

Period	Content	Media
Protection and preservation of Food. (7th period)	i) Food can be protected from microbial growth in a number of ways. ii) Micro-organisms grow best at a temperature of 21° C. iii) Refrigeration helps in the preservation of food as the temperature is less than 5° C iv) Adding of sugar and Salt to eatables help in their preservation.	Transparencies. and flashcards.

Period	Content	Media
	v) Chemicals like sodium benzoate , Vinegar are used as preservatives. vi) Above chemicals are added to jams, sauces, to preserve them. vii) Boiling and heating also helps in preservation. viii) Micro-organisms are destroyed at a temperature of 65° C. to 70° C. ix) Artificial and Natural preservatives.	
Review of the lesson and exercise. (7th and 8th period)	Summary of the lesscn and exercise.	Group discussion.

Package
1. Transparencies.
2. Flashcards.
3. Group discussion.

Unit No. II

Conservation and Preservation of Natural Resources.

This unit dealt with the various natural resources, uses of this natural wealth to man, their exploitation, need for its conservation and how these can be conserved and preserved for the future generation.

There were six sub-units in this unit. The topic was an interesting one and focused on the problems which were global in nature and required attention in the new millennium.

This unit was studied under the following headings.

1. Uses of Natural resources.
2. Types of Natural resources.
3. Renewable and Non-renewable resources.
4. Illeffects of wastage of Natural resources.
5. Planned use of Natural resources.

Unit - II - NATURAL RESOURCES AND THEIR CONSERVATION.

Sub-unit 1 - Uses of Natural Resources.

TABLE 5

Period	Content	Media.
Introduction (9th period)	i) Primitive man lived in caves and modern man lives in houses.	
	ii) Distinction between their style of living.	
	iii) Raw materials needed to fulfil the needs of men comes from nature.	Poster and charts.
	iv) Definition of Natural resources.	
	v) Sun- the chief source	
	vi) Three types of Natural resources.	
	vii) Natural resources - obtained from earth, air, and water.	

Period	Content	Media
Uses of Natural resources. (9th and 10th period)	i) Uses of Natural resources to animals and plants. ii) Man is largest consumer of natural resources. iii) Plants and animals are also natural resources.	- Discussion. - Computer aided instructions.

Package

1. Poster.
2. Charts.
3. Discussion.
4. Computer aided instructions.

TABLE 6

Sub-unit 2 - Types of Natural Resources

Period	Content	Media
Types of Natural Resources. (11th period)	i) Natural resources are available on land, air and in water. ii) Resources from land. iii) Resources from water.. iv) Resources from air. v) Plants and animals as natural resources. vi) Fauna and Hora in certain places in the world become integrated into the cultural life of a place.	**Transparencies** **Posters.** Slide projector and Group discussion.

Package

1. **Transparencies**
2. Posters.
3. Slide projector.
4. Group discussion.

TABLE 7

Sub-unit 3 - Renewable and Non-renewable resources.

Period	Content	Media
Renewable and Non-renewable resources. (12th period)	i) Definition of renewable resources. ii) Definition of Non-renewable resources. iii) Difference between renewable and Non-renewable resources. iv) Various types of renewable and Non-renewable resources.	Tape recorder and Transparencies.

Package

1. Tape recorder.
2. Transparencies.

TABLE 8

Sub-unit 4 - Proper use of Natural resources.

Period	Content	Media
Proper use of Natural resources. (13th period)	i) Very fast increase in the population. ii) Growing use of Natural resources. iii) This had lead to the problem of scarcity. iv) Careless use of Natural resources causes wastage. v) Causes of wastage of Natural resources. vi) Illustrations from students, how they have contributed to this national wastage	Transparencies. Tape recorder. Printed material in Newspapers and magazines.

Package

1. Transparencies.
2. Tape recorder.
3. Printed material.

TABLE 9

Sub-unit 5 - Illeffects of Wastage of Natural resources.

Period	Content	Media
Effect of wastage of Natural resources. (14th period)	i) Rapid deforestation. ii) Consumption of fuel had led to increased percentage of Co_2 iii) Melting of ice in the polar region will cause flood in recent times due to global warning. iv) Depletion of the ozone layer. v) Reasons for the depletion of the ozone layer. vi) Use of the ozone layer and its depletion will endanger human and animal life.	Printed material. Transparencies.

Period	Content	Media
	vii) Timely steps need to be taken to avert these calamities.	

Package

1. Printed Material
2. Transparencies

TABLE 10

Sub-unit 6 - Planned Use of Natural resources.

Period	Content	Media
Planned use of Natural resources. (15th period)	i) Every person should resolve to use the resources properly.	Transparencies
	ii) Plantation and conservation of trees.	Tape recorder.
	iii) Steps to be taken to by the government.	Group discussion.
	iv) Efforts to use the resources in a planned way.	
	v) Nations to pledge the prevention of war.	
	vi) How can one contribute towards the conservation and prevention of these varied Natural resources.	

Package

1. Transparencies
2. Tape recorder.
3. Group discussion.

13. Preparation of the Media Package :

The researcher fixed the media according to the content and then prepared the media package. The investigator herself developed charts, posters, transperancies, flashcards, group discussion, materials etc. The investigator made available taped cassettes especially prepared for standard VIII on the topic. The hardware like computer, tape recorder, flannel boards were available in the school. But the overhead and slide projector was borrowed from the wheat research institute, situated at Mahabaleshwar. The investigator obtained the slides of fauna and flora from the forest department in Panchgani.

Thus the researcher collected required materials from different and varied sources and prepared media packages for the experiment. The experience gained by the investigator in preparing and collecting these varied modern teaching aids was worth mentioning.

14. Lesson Plans :

The investigator had selected two units for the experiment. These two units were split into lesson plans. These lesson plans gave a sense of direction to the investigator and also served as a guiding light. It also helped in conducting the experiment in a systematic and planned manner. It helped in observing the behavioural changes which were expected to occur through teaching and the changes it was desired to produce made the lessons more effective.

The lesson plans also contained the evaluation part and the questions which were to be asked after completion of every sub-unit. The details of the lesson plans are furnished in the appendix.

15. Conducting the Experiment.

After the analysis of the syllabus, study of the text-book, deciding the units to be taught, selection of suitable media according to the content, provision of the media, preparation of the lesson plans, the next task on hand was framing a time schedule for the experiment. The investigator decided on the following time schedule of the experiment.

A ten mark test was conducted after each sub-unit which provided feedback to the investigator. A forty marks comprehensive unit test was taken at the end of each unit.

TABLE 11

SCHEDULE OF THE EXPERIMENT

Unit I - Beneficial and Nuiscance Micro-organisms.

Title of the Subject.	Period	Date	Groups C	Groups E
I a Microbial Fermentation.	1st	12.11.99	10.00/ 10.35	10.35 11.10 a.m.
Preperation of foodstuffs.	2nd	13.11.99	10.00/ 10.35	10.35 11.10 a.m.
Preparation of Medicines and Chemicals.	3rd	15.11.99	"	"
Test based on Sub-unit (10)		16.11.99	"	"
I b Microbial fixing of Nitorgen.	4th	17.11.99	10.30/ 10.35	10.35 11.10
Production of Humus.	5th	18.11.99	10.00 10.35	10.35 11.10
Test based on sub unit.		19.11.99	"	"

Title of the subject.	Period	Date	Groups C	Groups E	
I c. Nuiscance Micro-organism.	6th	20.11.99	10.00/ 10.35	10.35 11.10	a.m.
Microbial spoilage of other articles.	7th	22.11.99	"	"	
Test based on sub-unit (10)		23.11.99	"	"	
I d Protection and preservation of food.	8th	24.11.99.	"	"	
Test based on sub-unit (10)		25.11.99	"	"	
I e Summary and Exercise.	9th	26.11.99.	10.00/ 10.35	10.35 11.10.	
Comprehensive unit test No.1 (40)		26.11.99	1.00 2.00	1.00 2.00	p.m.

Unit II

Conservation and Preservation of Natural Resources

Title of Subject.	Period	Date	Group C	Group E
II a Uses of Natural Resources Introduction.	10th	27.11.99.	10.00/ 10.35	10.35 11.10 a.m.
Uses of Natural resources.	11th	29.11.99.	"	"
Test based on above Sub-unit (10)		30.11.99	"	"
II b Types of Natural resources.	12th	01.12.99.	10.00 10.35	10.35 11.10
Test based on above Sub-unit (10)		02.12.99.	"	"
II c Renewable and Non-renewable resources.	13th	03.12.99	"	"
Test based on above Sub-unit (10)		04.12.99	"	"
II d Proper use of Natural resources.	14th	06.12.99	"	"
Test based on above Sub-unit (10)		07.12.99	"	"

Title of the subject.	Period	Date	Group C	Group E
II e Illeffects of wastage of Natural resources.	15th	08.12.99.	10.00 10.35	10.35 11.10 a.m.
Test based on above Sub-unit (10)		09.12.99.	"	"
II f Planned use of Natural resources.	16th	10.12.99	"	"
Test based on above Sub-unit (10)		11.12.99.	"	"
II g Summary reviews and Exercises.	17th	12.12.99	"	"
Comprehensive Unit test based on entire unit test. No. 2 (40)		13.10.99	10.00/ 11.00 a.m.	10.00 11.00 a.m.

Figures in the bracket indicates marks alloted for each test.

17. Development of Tools :

The investigator distributed the content periodwsie. She has conducted a test of ten marks after each sub-unit. This short test provides the necessary feedback to the investigator in terms of the students performance. A comprehensive unit test of forty marks was administered to the students at the end of each unit. Tools were developed to study the achievement of the learners. The weightage to the objectives, sub-units and the types of questions were considered during construction of tests. The investigator first prepared the blueprints of the test and took expert opinion regarding the same. She then modified the blueprint according to their suggestions and then the final question-papers were set.

18. Conclusions :

This chapter explains the research design selected by the investigator, the sampling and the procedure. The researcher has also analysed the syllabus of science for standard VIII and has thoroughly studied the text-book. She has chosen two units from the

text-book, appropriate for media use and has determined the media package according to the content. The chapter also includes the schedule of the experiment and describes various tools for collection of data.

The data collected during the experimentation was then subjected to analysis and interpretation by the investigator, a description of which is provided in the succeeding chapters.

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