

CHAPTER 3:

RESEARCH METHODOLOGY

“Educational research is that activity which is directed towards development of a science of behavior in educational situations. The ultimate aim of such a science is provide knowledge that will permit the educator to achieve his / her goals by the most effective methods”.

- **Robert M.W. Travers (1958)**

3.1 Introduction

Methodology includes the description of the techniques, methods and tools that the researcher has used for collecting, organizing, analyzing and interpreting data. It describes the various steps of the plan of action to be adopted in solving the research problem. Thus, Research methodology involves ways of organizing the fund of available knowledge as well as of exploring, creating new knowledge, adoption of appropriate techniques and adoption of suitable statistical procedures (Best, 1983).

The purpose of this chapter is to set out, as clearly as possible, the process through which the data was gathered, so that the work can be contextualized within the framework of Science Teaching at the Upper Primary Stage. It begins with rationale, then objectives, hypothesis and explanation of the terms. This was followed by the Research methods including population, sample, location and context of the study, selection of students, selection of the school, data collection methods, process of data collection and data analysis.

The present study was primarily intended to investigate the effectiveness of Art-Integrated Learning method of classroom teaching on academic achievement on selected units in science for the students of upper primary level. The first phase of this study was concerned with the development of Art-Integration Learning Modules on selected units and in the second phase, an experiment was conducted to determine the effectiveness of Art-Integrated Learning and traditional lecture method on Academic Achievement of class VIII students in Science Subject.

As part of this study, discussions were made with resource people, principals and teachers by the investigator. In order to discover the extent of necessity and use of art-integrated approach, a preliminary inquiry was made among the primary school teachers. It was meant for getting the views and opinions of primary school teachers regarding the implementation of art-integrated instructional approach and the difficulties if any. The investigator discussed with primary school teachers for their suggestions, and modifications were made in the light of their relevant suggestions. Feedback from the preliminary inquiry proves the necessity of Art-Integrated Instructional Approach for Science teaching at Upper Primary level and also helped the investigator to gain familiarity and clarity with the topic of study.

The details of the method adopted, variables of the study, tools used, and samples selected, and procedure adopted in the administration of the tools and statistical techniques used for the analysis of the data are given below.

3.2 Method Adopted

Since the study was intended to find the effectiveness of Art-Integrated Instructional Approach on academic achievement in science at upper primary level, Experimental Method has been used for the study. It is the most sophisticated, exact and powerful method for discovering and developing an organized body of knowledge (Best, 1992).

Experimentation is the name given to the type of educational research in which the investigator controls the educative factors to which a child or group of children is subjected during the period of inquiry and observes the resulting achievement. As this method provides much control it helps to establish a systematic and logical association between manipulated factors and observed effects.

3.3 Design Selected

Experimental design attempts to ensure valid casual inferences from randomized experiments conducted within practical constraints of available resources and time. "Experimental design is the blue-print of the procedures that enables the researcher to test hypotheses by reaching valid conclusions about the relationship between independent and dependent variables" (Best & Kahn, 2004).

In the present study, the pre-test – post-test experimental group design was used. One group is usually referred as the experimental group and the other group as the control group. The experimental group was taught through art-integrated learning method and the control group taught through traditional method. This design is often used in classroom experiments when experimental and control groups are such naturally assembled groups as intact classes, which may be similar (Best & Kahn, 2004).

A figurative representation of the design is given in Table 3.1.

Table No: 3.1
Design of the Study

Groups	Pre-Test	Independent Variables	Post-Test
Experimental (EXP)	Achievement Test scores before treatment	Art-Integrated Learning Approach	Achievement Test scores after treatment
Control (CON)	Achievement Test scores before treatment	No Intervention (Traditional Approach)	Achievement Test scores after treatment

3.4 Different Stages of the Study

Stage 1: The students in all the groups were compared on the basis of their:

- a) Pre-test Achievement scores in science.
- b) Initial Knowledge in Science.

Stage 2: This was the treatment stage in which the Experimental Group was taught using Art-Integrated Learning method, and the Control Group was taught in the Traditional method.

Stage 3: After completing the experimental treatment, the students in the Experimental Group and Control Group were tested on academic achievement in science through self-made achievement test.

Table No: 3.2
Stages of the Study

Stages	Experimental Group	Control Group
Pre-Test	Measurement of	Measurement of
	Achievement scores in science before the treatment.	Achievement scores in science before the treatment.
Treatment	Teaching Science using Art-Integrated Learning based Instructional Strategy.	Teaching Science using Traditional Method.
Post-Test	Achievement scores in science after the treatment.	Achievement scores in science after the treatment.

3.5 Variables Used in the Study

Variables are the conditions or characteristics that the experimenter manipulates, control or observes (Best, 1995). In the present study, investigator takes into consideration mainly two types of variables independent and dependent variable. According to Domato (1970), variable may be defined as those attributes of objects, events, things and beings, which can be measured. 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 effects. All the two kinds of variables have been discussed below.

3.5.1. Independent Variables

The variable, which is manipulated by the experimenter or the variable which is suspected of being the cause in the experiment is called independent variable. "It is under the direct control of the experimenter who may vary it in any direction" (Sax, 1979). In this experiment, both the teaching methods are taken as independent variable. The Art-Integrated method of teaching and the Traditional Method of teaching are the two independent variables adopted in the study.

3.5.2. Dependent Variables

A dependent variable is that which is measured in the experiment. The dependent variable is the condition or characteristic that appears, disappears, or changes as the experimenter introduces, removes, or changes independent variable. The

dependent variable used in this study is Academic Achievement of the Class 8 students in science.

3.5.3. Duration of the Treatment

Both groups were taught for 20 days of 40 minutes period.

Table No: 3.3
Variables of the Study

Independent Variables	Art-Integrated Method of teaching
	Traditional Method of teaching
Dependent Variables	Academic Achievement

3.6 Population of the Study

The population of the study consists of all the students studying in Standard VIII of Saint Xavier's School, Jajpur Road, Jajpur District of Odisha state. In standard VIII A, there were 34 students. In standard VIII B, there were 32 students. Hence, the total population selected for the study is 66 which is represented below in the table 3.4.

Table No: 3.4
Population of the Study

School Name	Class selected for the Study	No. of Students	Total Population
Saint Xavier's School	VIII A	32	66
	VIII B	34	

3.7 Sample selected for the Study

Since, the population, being usually too large, a smaller is chosen as representative of the population which is known as sample. A sample is a small proportion of the population that is selected for observation and analysis and by observing the sample, one can make certain inferences about the characteristics of the population from which it was drawn (Best and Kahn, 2004). The random sampling technique was used by the investigator to select the sample. Out of 66 population, the researcher selected 40 students as sample, comprising 20 students in each group (control and experimental group).

Table No: 3.5
Sample of the Study

Sl. No.	Groups	Total No. of Students
1	Experimental (EXP)	20
2	Control (CON)	20
	Total	40

The sample chosen for the study consists of 20 students of standard VIII for the control group (Traditional Method of teaching) and 20 students of standard VIII for the experimental group (Art-Integrated mode of teaching) from St. Xavier's School, Jajpur Road, located at district Jajpur in the state of Odisha. The two groups of students were chosen through Random Sampling technique. The Control Group (CON) was taught two chapters from science textbook through the traditional method (chalk and talk method) and the Experimental Group (EXP) was taught the same chapters through the Art-Integrated mode.

3.8 Tools used in the Study

Collection of data is essentially an important part of the research process so that the inferences, hypotheses or generalizations tentatively held may be identified as valid, verified as correct, or rejected as untenable (Koul, 2011). By giving due consideration to the objectives of the study, the investigator prepared the question paper for achievement test as the tool. In the present study, the tool used for the purpose of collecting data was:

- Academic achievement test developed by the investigator herself was used to measure the achievement of students in science.

3.8.1 Achievement Test

Achievement test is a test of development skill or knowledge. The most common type of achievement test is a standardized test developed to measure skills and knowledge learned in a given grade level, usually through planned instruction. Achievement test scores are often used in an education system to determine what level of instruction for which a student is prepared. According to Ebel and Frisbie (1991), Achievement test is helpful (i) in measuring educational progress and attainment and (ii) to motivate the students. This test constructed specially for the purpose of

investigation, in order to test the present status of achievement among the students in science. Therefore, the need was felt to construct the achievement test for the students of class 8. This test helped the investigator to get a wider and true picture of the academic knowledge of the students in science. Planning of the test consist of advance decisions about the units of content, instructional objectives, the type of test items to be used in the test and the weightage to be given to various aspects.

The investigator kept the following aspect in mind for planning the test:

- a. To whom was the test to be administered?
- b. What is to be measured?
- c. How to measure

On the basis of these planning strategies and on the basis of nature of the problem it was decided that:

1. The test was meant for the students of age group of 12-14 years studying in class 8th where the medium of instruction was English.
2. Acquisition of science concept is to be measured and cognitive domains of objectives to be realized are knowledge, understanding and application.
3. Measurement of the achievement takes place before the experiment begin (pre-test) and immediately after the completion of the experiment (post-test).

3.8.1.1 Construction of Achievement Test in Science:

Since the aim of the study was to find out the effectiveness of Art-Integrated Learning Approach on academic achievement in science of students at upper primary level, the investigator prepared an Achievement Test in Science. The chapters (chapter 8 'Cell- Structure and Functions' and chapter 13 'Sound') were taken from Class 8 science textbook of CBSE syllabus prescribed by NCERT. The investigator administered it to the experimental group and control group as pre-test and post-test. Before preparing the items in the test, the content was thoroughly analyzed.

The achievement test consists of fill in the blanks, true/false, and multiple choice related to the special topics were devised by the investigator, keeping in mind the objective and contents of the items. It was assured that no objective remained untested. In the preparation stage, the test items were written in the light of following considerations.

- a) The language used was simple.

- b) Textbook language was avoided.
- c) Interdependence among the items was avoided.
- d) Items providing a clue to the answers were avoided.

In the preparation of the Achievement Test, the following sequence was adopted.

1. Planning the test
2. Preparation of the Design
3. Preparation of the Blueprint
4. Writing of items
5. Preparation of the Scoring Key

3.8.1.1.1 Planning the test

It was decided to construct a test for Class VIII students based on two chapters (Chapter 8 and 13) of science subject. It was designed to measure behavioral outcomes in terms of the Instructional Objectives in science namely, Knowledge, Understanding, Application, Analysis, Synthesis and Evaluation. The test consisted of objective type items only and the maximum mark fixed was 40. The duration of the test was 60 minutes.

3.8.1.1.2 Preparation of the Design

The investigator prepared a design for the test by giving due weightage to the various objectives, content areas and difficulty level. The test items were prepared by considering the objectives of the cognitive domain listed by Dr. Benjamin S. Bloom (1956). The details of the weightage given to objectives, content, difficulty level and form of questions, details of the blueprint and scoring are given below:

3.8.1.1.2.1 Weightage to objectives

Due weightage has been given to the objectives namely, Knowledge, Understanding, Application, Analysis, Synthesis and Evaluation in the construction of the achievement test. The weightage given to different objectives in the achievement test are presented in Table No: 3.6

Table No: 3.6
Weightage to Objectives

Sl. No.	Instructional Objectives	Marks	Percentage of Marks	Number of Questions
1	Knowledge	9	22.5	9
2	Understanding	12	30	12
3	Application	13	32.5	13
4	Analysis	2	5	2
5	Synthesis	2	5	2
6	Evaluation	2	5	2
Total		40	100	40

3.8.1.1.2.2 Weightage to Content

During the preparation of the test items, proper weightage was given to both the chapters. The content area included two chapters, which was again divided into 20 lessons. The weightage given to each unit is given in Table No: 3.7

Table No: 3.7
Weightage to Content

Sl. No.	Chapter	Marks	Percentage of Marks	Number of Questions
1	Sound	20	50	20
2	Cell- Structure and Functions	20	50	20
Total		40	100	40

3.8.1.1.2.3 Weightage to Difficulty Level

Proper weightage was given to the level of difficulty of the items. Due consideration was given to the bright, average, and dull students. The weightage given to difficulty level of the test is shown in Table No: 3.8

Table No: 3.8
Weightage to Difficulty Level

Sl. No.	Difficulty Level	Marks	Percentage of Marks	Number of Questions
1	Easy	10	25	10
2	Average	20	50	20
3	Difficult	10	25	10
	Total	40	100	40

3.8.1.1.2.4 Form of Questions

All the test items included were of objective type. A distracter analysis was also done by the investigator at the time of preparing the test to eliminate the chances of guessing.

3.8.1.1.3 Preparation of the Blueprint

The blueprint is a three-dimensional chart showing the distribution of marks among the three dimensions, namely objectives, content, and form of questions. The blueprint prepared for the test is shown in Table No: 3.9

Table No: 3.9
Blueprint of the Achievement Test

Sl. No.	Objectives	Known	Understan	Applicat	Analysis	Synthesis	Evaluati	Total
	Ques Form Content	ge Objective Type	ding Objective Type	ion Objective Type	Objective Type	Objective Type	on Objective Type	
1	Cell- structure and functions	4(4)	6(6)	7(7)	1(1)	1(1)	1(1)	20
2	Sound	5(5)	6(6)	6(6)	1(1)	1(1)	1(1)	20
	Total	9	12	13	2	2	2	40

Number outside the bracket shows the marks.

Number inside the bracket shows the number of questions.

3.8.1.1.4 Writing of Items

The items were written as per the prepared blueprint and due weightage to the objectives, content and difficulty level was ensured. The items were presented before

the experts (guide and subject teachers) and based on their comments and feedback necessary modifications were made.

3.8.1.1.5 Preparation of Scoring Key

It is prepared to make the scoring process objective. A scoring key consists of the correct answers to the items in the achievement test and marks allotted to each item. The final form of the Scoring key and Response sheet given to students are included as Appendices.

3.9 Procedure Adopted in Experimentation

The present experiment was conducted to study the effectiveness of Art-Integrated Learning Approach on achievement in Science of students at Upper Primary level. After taking decision about the sample and tools to be used, the investigator obtained permission from the school authorities to conduct the study. After the selection of the two parallel groups, the investigator started the experiment to collect the data. The tools used was an achievement test prepared by the researcher on the chapters of Class VIII Science textbook (NCERT). The steps followed in the experimentation are as follows.

3.9.1 Pre-test conducted.

3.9.2 Learning by the experimental group.

3.9.3 Learning by control group.

3.9.4 Post-test administered.

3.9.1 Pre-test Conducted

The experiment was conducted on a final sample of 40 students at primary level. After selecting the sample through random sampling technique, the investigator assigned one division as experimental group and the other as control group. After getting permission from the head of the school, the investigator administered the Achievement test, as pre-test to the two groups. Proper instructions were given to the students before the administration of each test. The responses were collected back for scoring and tabulation.

3.9.2 Learning by Experimental Group

After administering the Pre-test, the experimental group was taught using Art-Integrated Learning Approach by the investigator. There were 20 lessons, and the

duration of each lesson is 40 minutes. The researcher gave a clear explanation of basic elements and principles in drawing and how to make drawings on concepts, themes, imaginations, objects etc. which the students practice collectively and individually and eventually master the skill. The investigator guided them through proper channels as and when needed.

3.9.3 Learning by the Control Group

After administering the Pre-test to control group, they were taught the content using the Traditional method. The investigator explained the facts, concepts, principles etc. connected with the topic. Equal time and effort were taken for the control group also. The investigator took 20 periods of 40 minutes duration to complete the whole topics selected.

3.9.4 Administration of Post- test

After the completion of the lessons to the experimental and control groups, the investigator administered the same tool as post-test. Separate question papers were given to each student. The investigator also gave additional instructions to the students. The responses were collected back, and the test was scored with the help of the scoring key and the scores were gathered and subjected to statistical analysis.

3.10 Statistical Techniques Employed

Keeping in view the objectives and design of the study, the statistical technique employed to analyze the data was t-test (Student's t-test). The data is presented in the tabulated form ahead in the next chapter. All calculations were made by using MS Excel version 2019.

3.10.1 The t-test

The t-test assesses whether the means of two groups are statistically different from each other. It is one type of inferential statistics. It is used to determine whether there is a significant difference between the means of two groups. So, when the difference between two population averages is being investigated, a t-test is used. In other words, a t-test is used when we wish to compare two means.

In the present study, the responses given by the students were tabulated systematically. The critical ratio was found out for academic achievement of class VIII students.

The details of analysis and interpretation of data using the above-mentioned statistical techniques are given in the next chapter.

3.11 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 ensured by establishing rapport with the students, maintaining natural setting, conducive environment, providing sufficient time for various activities in the experimentation and the like.
- It was ensured that the topics on contents of treatment had not been previously taught to the students or during the course of experiment in both the experimental group and the control group.
- During instructional treatment, attempt was made to stick to limits of the specific teacher directed instructions in both groups and not to deviate from the steps made in lesson plans of the treatment during execution.
- Care was taken to keep the 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.

3.12 Constraints and Difficulties faced during Experiment

It may not be out of place to mention some of the difficulties faced or the constraints of the experiment that need to be taken note of these included:

- Efforts are needed to convince teachers and principal about the importance of the experiment to make them agree to cooperate in the experiment.

- In the experimental group, sometimes few subjects were not present or were irregular. It is an essential requisite for every experiment that the treatment be fully provided to every student. Therefore, subjects kept in the sample were more than the required number and it was ensured that the sample groups regularly attended the school.
- Some difficulty was faced during the orientation of students towards art-integrated learning. In the beginning, some weak students had problems in following the conditions of art-integrated learning, mainly in the management of groups. But with the passage of time and the encouragement given by the investigator, students were motivated to take interest in teaching-learning activities.

The researcher had to adjust the time accordingly, as the students were pursuing a regular course of studies. The method of art-integrated learning takes more time and when some difficult topic is taught some students generally lose interest in the class. Also, some students might have felt fatigued. It is not the time to lose heart. Such students repeatedly need encouragement. The researcher has to make sure to encourage them from time to time.