CHAPTER-III
METHODOLOGY

3.0.0 INTRODUCTION

The first chapter deals with the introduction, conceptual framework, rationale of the study, objectives, hypotheses and delimitations of the research. The second chapter deals with the review of related literature. The present chapter is to develop the methodology, sample, design, tools and procedure of data collection and statistical techniques. The purpose of this study will be to develop a learning progression in science for the class IX student. that will consist of all the components necessary for teaching science effectively. Teachers will be able to use this tangible project as a reference to apply when they develop their own science lesson plans. This is important because there are many pieces to the puzzle in the development of an effective science lesson plan for class 9^{th} students and drag their attention in studies. Moreover, because science is a part of everyday life, it is vital that students have adequate knowledge in basic science topics.

3.1.0 ORIGIN OF THE STUDY

Initially researcher had gone for literature review of Learning progression in science and visited e-content of various university libraries as well as libraries of education departments; Internet resources also provide wide range of the subject. For the study of effectiveness of learning progression, researcher advised to work with Constructivist approach which rely on learning progression in science development. Researcher had studied Constructivist approach in her Master's in Education as a part of curriculum with practical experience in internship programme. When working on Constructivist approach researcher find it interesting. Guide of researcher suggested that better to work on topic you are most interested. Researcher had also completed masters in Chemistry so it is better to apply Knowledge and understanding of science-content with illumination of 5-E model. "Matter in our surrounding" is a very important basic topic at secondary level science. The topic "Matter in our surrounding" is included in Central Board Secondary Education (CBSE), National Council of Educational Research and Training (NCERT) and many other state board's Textbooks. So, the researcher had decided to apply Constructivist approach to the teaching of "Matter in our surrounding" in science of standard ninth.

Also, researcher interested to study the attitude towards science in ninth grade students

3.2.0 SELECTION OF RESEARCH METHOD

In the present study, Study of Learning Progression in Science, researchers used a Learner-Centered approach to the teaching of "Matter in our surrounding" in science of standard ninth was required to be checked, so an experimental research method was necessary to be used. Therefore, the researcher determined to select two groups. Hence 'Two groups only post-test design' of the experimental method was used.

Experimental design of the present study

The experimental-design is most important in experimental research work, in which conclusions can be derived from the observed data through systematic analysis. Thus, the selection of the experimental strategy was planned systematically. The types of experimental design are (i) Pre-Experimental Design, (ii) True Experimental Design (iii) Quasi Experimental Design and (iv) Statistical Design.

Descriptive Research Design

In Descriptive Research Design, the scholar explains/describes the situation or case in depth in their research materials. This type of research design is purely on a theoretical basis where the individual collects data, analyses, prepares and then presents it in an understandable manner. It is the most generalised form of research design.

Experimental Research Design

Experimental Research Design talks about the cause and effect of the situation and their relationship with each other. It is done under the proper observation of independent variables on the dependent variable. The independent variable is always changed or manipulated by the researcher in order to change the discourse of the research and to gain control over the research methodology.

Correlational Research Design

In this type of research design, the scholar establishes a relationship between two connected variables in the research project. Further, it is also completely non-experimental in nature and the variables are dependent on each other.

Quasi-Experimental Research Design

A Quasi-Experimental Research Design is referred to as a true experiment because it aims to intricately build a cause-and-effect relationship between an independent variable with a dependent variable. One unique aspect about this research design is it doesn't base itself on a random assignment but rather it assigns subjects to diverse groups on a non-random basis.

In the present study **Non-equivalent control group design** is employed for this study. In the present study of the effectiveness of independent variables, method of teaching (two levels): (1) Constructivist approach method (2) traditional teaching method was required to be checked on dependent variable (achievement), Student achievement was measured using pr-test/post-test design. The pre-test data were collected from students eighth class yearly science test scores from the school. The post-test data was collected from student's achievement science test scores taken by the investigator. thus, the researcher decided to use non-equivalent control group design.

3.3.0 TARGET POPULATION

In any research work, the purpose of the researcher is to find out such conclusions which can be applied universally. The characteristics of the population are to show the marked variations from place to place, and from time to time. Therefore, the researcher has to identify the population, in order to cover the conclusion that is applicable to the population.

Students of standard nine of all secondary schools of Kendrapara district, Odisha constituted the population for the present study. Other specifications are:

1) Area: Kendrapara
2) Medium of instruction: English
3) Standard: IX
4) Time period: Academic Year 2020-2021 and
5) Gender: Boys and Girls.

3.4.0 SAMPLE SIZE

Sample means, a selected group of subjects from the population which represent the population. The study was conducted by means of the sample. The generalization applicable to the population, for which the sample was obtained, largely depended upon the technique of sampling.

Stratified random sampling techniques were used for the selection of the school for the study. The sample was selected from the Kendrapara district, Odisha. One school was selected, randomly. The experiment was conducted in the session 2021.The school was selected, randomly. Two sections 'A' and 'B' of class IX were selected. Section A was taught through the Constructivist approach and section 'B' was taught through a traditional approach. Section A was designated as experimental group and section B was designated as control group.

Table-3.1: Group-wise and Gender-wise Distribution of Sample

GROUP	Boys	Girls	Total
Experimental Group	12	18	30
Control Group	15	12	27
Total	27	30	57

3.5.0 SAMPLING TECHNIQUES

Sampling is a technique of selecting individual members or a subset of the population to make statistical inferences from them and estimate characteristics of the whole population. Sampling in market research is of two types – probability sampling and non-probability sampling. Let's take a closer look at these two methods of sampling.

Probability sampling: Probability sampling is a sampling technique where a researcher sets a selection of a few criteria and chooses members of a population randomly. All the members have an equal opportunity to be a part of the sample with this selection parameter. Probability sampling methods include simple, stratified systematic, multistage, and cluster sampling methods. **Non-probability sampling:** In non-probability sampling, the researcher chooses members for research at random. This sampling method is not a fixed or predefined selection process. This makes it difficult for all elements of a population to have equal opportunities to be included in a sample. Non-probability sampling methods include purposive, quota, convenience and snowball sampling methods.

In the present study, samples were selected by **'Stratified random Sampling Technique'**. As the researcher decided to work at the secondary level of school, she selected the sample from standard Nineth. The researcher selected the students of standard nineth from the sample school.

As the present study was an experimental one, the researcher had decided to select one school from the population. The researcher selected **stratified random sampling techniques** in the selection of schools. One school of Kendrapara district was selected for the present study: St. Xavier High School, Gopa, Kendrapara for the experiment. The details of the selected population and sample is given below.

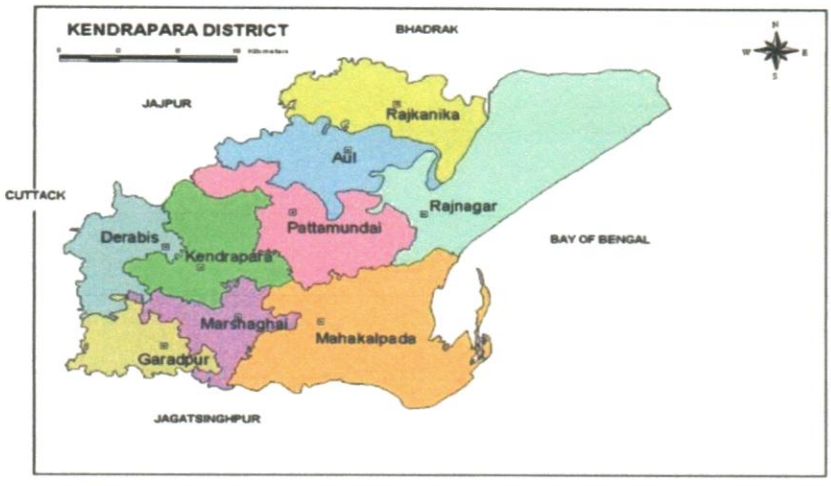

Figure 3.1: Population and sample of the study

Table 3.2: Sample Schools of the Study

S.NO	NAME OF THE SCHOOL	NO. OF STUDENTS AS SAMPLE OF THE STUDY
1	St, Xavier High School, Gopa, Kendrapara	57 (30 EXPERIMENTAL GROUP + 27 CONTROL GROUP)

In Table 3.2 sample school and number of students in the sample is presented. In the experiment 30+27 students were selected in the experimental and control group of IX grade including section A and section B.

3.6.0 TOOLS DEVELOPMENT FOR THE STUDY

Tools are nothing but instruments that help researchers to gather data. Naturally the type of information depends upon the kind of tools used for the purpose. The selection of tools depends upon the objectives and design of the study, and the type of respondents intended to cover. In order to draw any conclusion from the research, tools used for the measurement of variables should be reliable and valid. This requirement is usually met by employing standardised tests.

Two tools, such as Achievement test in science and Attitude towards science scale – Prof. Abinash Grewal (1978) were used for the study. The Achievement test in science was developed by the investigator taking into consideration the content taught. Attitude towards

science was measured by administering the Attitude towards science scale of prof. Abinash Grewal (1978). The description of the tools are as follows.

Development of Constructivist approach teaching model-

The researcher used the Science Learning Cycle in the development of constructivist models. A learning cycle is a method for planning lessons, teaching learning process and curriculum development. The learning cycle is a way of thinking and acting that is consistent with how a pupil learns. It provides an excellent approach for planning science instruction effectively. The science learning cycle originally consisted of a 5-E learning cycle: (a) engage (b) exploration, (c) explanation, (d) elaboration and (e) evaluation.

The aim of the program was to prepare a model for teaching of the chapter **"Matter in our surroundings"**. To fulfil this aim, an instructional program is developed with special science content which can justify the Constructivist approach aspect of teaching and learning. Secondly researchers have to implement Constructivist model teaching for the teaching of the chapter "Matter in our surroundings". And then to compare the effectiveness of special science content Constructivist approach model of teaching with traditional teaching model for the study of the Learning progression in science of students.

Implementation of Traditional Teaching Model-

In traditional teaching groups students were taught topics of "Matter in our surroundings" by traditional teaching methods. Traditional teaching program was applied to control group students as per the regular timetable of the school. Traditional teaching programs included/ involved Classroom teaching, Practical/Demonstration in the Chemistry laboratory. The class room teaching was with teacher talk, questioning.

3.6.1 ACHIEVEMENT TEST IN SCIENCE

An achievement test is a test of developed skills or knowledge in a given grade level. Students are regularly examined to demonstrate their learning and proficiency in the subject. In the present study to study the learning progression through special content in science by the Constructivist approach teaching model, the researcher measured the achievement of learners with the help of achievement test after completion of chapter. In this regard the researcher developed an achievement test on the topic Matter in our surrounding of the science subject. To prepare the test, the researcher followed the points such as:

1) Deciding the objective of the test
2) Content Analysis

3) Preparing blueprint
4) Writing of the test items
5) Expert opinions on the test

The test questions were arranged like this, there were (04) questions. Each question had many items. The items like fill in the blanks, true/false, short questions and long questions. The questions were based on knowledge, understanding, application, analysis and evaluation. The maximum marks for the test were 40. Time allowed was 90minutes. The questions were written in English language.

Descriptions of the test are as follows:

Table – 3.3 Description of the Achievement Test in Science

Sl.No.	Names of the Section	No. of Questions	Marks
1	Fill in the blanks	01	06
2	True/False	01	05
3	Write the short Notes	01	09
4	Long questions	01	20
Total		04	40

3.6.2 ATTITUDE TOWARDS SCIENCE SCALE-Prof. ABINASH GREWAL (1978)

The Science Attitude scale was constructed by Prof. Abinash Grewal, in this scale he has defined attitude as the degree of positive and negative effect associated with some psychological object. A psychological object, according to him, may be a person. an institution, a religion, a community, an ideal, a subject, a system, a political party or a minority community. Many attitude scales have been prepared in the past 3 decades to study the attitude of people towards such issues as co-education, capital punishment, communism, U.N.O etc. Recently scales for measuring attitudes of teachers towards teaching (Alhuwalia,1976), guidance services (Baker,1966), towards science and scientists (Sood,1975), towards micro-teaching (Passi,1977) have appeared. Scales for measuring the attitude of students and teachers towards academic disciplines have also become popular. Under the new curriculum science will be a compulsory subject up to high school stage. One of the objectives of teaching science is to

inculcate scientific attitudes among the pupils. The purpose of this scale would be to know whether or not the students have developed favourable attitudes towards science as a discipline.

In this tool, each of ten positive items (S.Nos. 2,4,6,8,10,12,14,16,18,20) are assigned a weight ranging from 4 (strongly agree) to zero (strongly disagree). In the case of ten negative items (S.Nos.1.3,5,7,9,11,13,15,17,19) the scale scoring is reversed ranging from zero (strongly agree) to 4 (strongly disagree). The attitude score of a subject is the sum total of scores on all the twenty items of the scale. For each student a total score on the scale can be obtained by summating his scores for the individual items. The maximum score of the Attitude Test in Science was 80 and the minimum score was 0.

Table.3.4 Scoring Scheme of the Science Attitude Scale

TYPES OF ITEMS	SCORING				
	SA	A	UD	D	DA
Positive Items Items Sr. No. 2,4,6,8,10,12,14,16,18,20	4	3	2	1	0
Negative Items Items Sr. No. 1,3,5,7,9,11,13,15,17,19	0	1	2	3	4

3.7.0 PROCEDURE OF DATA COLLECTION

One school of Kendrapara district was selected randomly and from the school 57 students of class IX were selected randomly. The Researcher personally visited the selected school to collect data. Through the permission from the head of the schools, the Researcher was able to meet with the students. After establishing a rapport with the pupils, the Researcher took 45 days and performed the research as per the respective method mentioned above.

The data collection was done basically in three ways, that are as follows-

1. Achievement test was conducted to see the Learning progression in science in both the sections of class IX. Section A was Experimental group students and section B was Control in design where controlled group was taught in traditional teaching while experimental group was taught by special content in science Constructivist approach

teaching method. 40 marks questions include fill in the blanks, true/false, short questions and long questions. Tests were given parallel to both the groups. Tests were corrected by the researcher and marks were given to each answer paper and data was collected.

2. "Science Attitude Scale" developed by Prof. Abinash Grewal (1978) was selected for the present study to measure Attitude towards Science. After the details about the paper instructed to students of both the sections of class IX were given responses in 30 minutes. Researchers later evaluated the scoring as per the guidelines and data was collected.
3. The annual examination marks standard VIII science subjects of the sample, which were collected from the school before the experiment with the permission of the head of the school. Marks were collected for Experimental group and Control group students. The said scores were considered as the pre-achievement of the sample.

The attitude towards science scale (Grewal 1978) was administered to both the groups. Previous year science achievement marks of the students of respective groups were collected from the school register. An achievement test in science was developed by the investigator and was administered at the end of the treatment of 45 days to both the groups. Both the tools were scored properly and data was analysed using appropriate statistical techniques.

3.8.0 STATISTICAL TECHNIQUES

Statistic is a body of Mathematical techniques or processes for gathering, organising, analysing and interpreting numerical data. Because most research yields such quantitative data, statistics is a basic tool for measuring, evaluating and researching. Statistical technique helps the researcher to systematised the observations, description of the characteristics or events for the purpose of discovering the relationships between variables. The various statistical techniques that are employed in the study are:

i. Percentage frequency – that used to classify the raw scores in degree of the variables (Attitude towards Science and Academic Achievement).
ii. Mean.
iii. Standard Deviation.
iv. Coefficient of Variation
v. 2 x 2 Factorial Design

vi. ANCOVA of unequal size

3.9.0 CONCLUSION

In conclusion it can be said that research methods are of almost importance in a research process. They describe the various steps of the plan of attack to be adopted in solving a research problem. Therefore, it is very much essential to adopt a sound and systematic strategy to carry out any investigation effectively. In Chapter-IV presentation of data, analysis of data, results and their interpretations. Objectives-wise results and its interpretations will be presented under separate captions.