CHAPTER - 4
PLAN AND PROCEDURE

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CHAPTER – 4
PLAN AND PROCEDURE

4.1 Introduction

Design is an essential step in the process of research. It plays a crucial role in the success of the study and also provides supports to the investigator. Research design is a blueprint on the paper like an architect’s plan. The purpose of a research design is to impose controlled restrictions on observations of natural phenomena. It guides the investigator throughout the study. The factor that most often differentiates between a good and a poor research is not the funds available, the size of sample or sophistication of the statistics, but it is the care and thought that goes into the research plan. According to Burroughs (1975), “The hypotheses formulated act as a guide to what one is proposing to test. The purpose of the design is to show how to do it. The data needs to be collected in a way that valid conclusion and results may be drawn. There are many elements to be taken into consideration at this stage not all of which are compatible.”

Thus, a reliable research cannot just happen. It is not the fruit of a few hours or days. It encompasses number of operations, carried out with patience, accuracy and industriousness for months and years. For such a long process, planning demands utmost care and insight. The product of research depends upon the quality of its design. A good research work cannot be done if the design has faults. Therefore, proper design is needed for valid analysis. Certain fundamental steps of research design must be given due importance when it proposed to be used. The operation of the design, that is planning must be carried out with patience and accuracy.

4.2 Research Method

The methods used to carry out research are called as research methods. Researchers use research methods in performing research operations. In other words, the methods that are used by the researcher during the given time span to study his / her research problem are termed as research methods. The purpose of the research work is to arrive at a solution for a given problem, the available data and the unknown aspects of the problem have to be related to each other to make solution possible.
4.3 Research Design

Research design provides the glue that holds the research project together. A design is used to structure the research, to show how all of the major parts of the research project the samples or groups, measures, treatments or programs, and methods of assignment work together to try to address the central research questions.

The research design is the basic plan for a piece of research. The research design situates the researcher in the empirical world, and connects the research questions to data. Decisions regarding what, where, when, how much, by what means concerning a research study constitute a research design. Miller (1991) has defined ‘designed research’ as ‘the planned sequence of the entire process involved in conducting a research study’. According to Claire Sellitz and others (1962, p.50) research design means ‘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’.

Different research designs can be conveniently described by categorizing them as:

1. Research design in case of exploratory research studies
2. Research design in case of descriptive and diagnostic research studies
3. Research design in case of hypothesis – testing research studies

According to Festinger, L. (1952), “The essence of an experiment may be described as observing the effect on a dependent variable of the manipulation of an independent variable.”

Greewood, E. (1945) states, “An experiment is a proof of a hypothesis which seeks to look up to factors in a causal relationship through the study of contracting situations which have been controlled on all factors except the one of the interest the later being either the hypothetical case or the hypothetical effect.”


In the present study, the investigator has used experimental method. Control – Experimental Group only Post-test Design was used.
The research design for the present study is depicted below.

Table 4.1
Research Design for the present study

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>-</td>
<td>Traditional Approach</td>
<td>( T_2 )</td>
</tr>
<tr>
<td>Experimental Group – 1</td>
<td>-</td>
<td>Project Based Learning Approach</td>
<td>( T_2 )</td>
</tr>
<tr>
<td>Experimental Group – 2</td>
<td>-</td>
<td>Cooperative Learning Approach</td>
<td>( T_2 )</td>
</tr>
</tbody>
</table>

4.4 Population of the study

For any good research, it is mandatory on the part of investigator to study and define the population and sample vis-à-vis the area of research and its objectives. According to Sindh, K.S. (1999), “By population we mean the aggregate on totality of objects or individuals regarding which inference are to be made in sampling study. A population is any group of individual that have one or more characteristics in common that are of the research.”

It is not possible to examine every item in population. However, based on the sample the generalization is made. For this a sample is drawn from the population. Such a section of the population is called sample and the process of selection is called sampling. A sample is the reflection of the universe and bears all characteristics of the universe.

According to Elhance, D.N. (1923), “The main aim of sampling studies is to obtain maximum information about the phenomenon under study with the least sacrifice of money, time and energy.”

The population for the present study comprised of English Medium Schools of Gujarat State. The description of the sample is stated in the subsequent section.
4.5 Sampling Techniques

The process of sampling makes it possible to draw valid inferences or generalizations on the basis of careful observation of variables within a relatively small proportion of the population. Sampling is simply the process of learning about population on the basis of a sample drawn from it. Under this method a small group of the universe is taken as the representative of the whole mass and the results are drawn. It is a method to make social investigation practicable and easy.

According to Young, p. (1980), “A statistical sample is a miniature picture or cross section of the entire group or aggregate from which the sample is taken.” A sample is the reflection of the universe and bears all the characteristics of the universe.

4.5.1 Types of Sampling Techniques

The primary objective of the sample is to obtain accurate and reliable information about the universe with minimum cost, time and energy and to set out the limits of accuracy of such estimates.

According to Garrett, H.E. (1981), “Various techniques have been devised for obtaining a sample which will be representative of its population.”

The different types of sampling techniques used to draw a sample are

1. Random Sampling
2. Stratified Random Sampling
3. Double Sampling
4. Cluster Sampling
5. Convenience Sampling
6. Purposive Sampling
7. Systematic Sampling
8. Sequential Sampling
9. Sampling by Matching Pairs
10. Multi Stage Sampling

In the present study the investigator has selected one English Medium School using convenient sampling technique.
4.5.2 Sample for the Present Study

In the present study, sample was selected using cluster sampling technique. Three divisions of STD IX of I. B. Patel English Medium School viz. class IX– A, IX - B, and IX - D comprised as the sample for the present study. There were three groups out of which one was control group and two were experimental groups. Each division consisted of 36 students i.e. the total sample consisted of 108 students.

The sample description is mentioned in the table below for the treatment of Instructional Approaches viz. Traditional Approach, Project Based Learning Approach and Cooperative Learning Approach.

Table 4.2
Sample Distribution for Instructional Approaches

<table>
<thead>
<tr>
<th>Approaches</th>
<th>Class</th>
<th>No. of Students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Approach</td>
<td>IX – A</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Project Based Learning</td>
<td>IX - D</td>
<td>36</td>
<td>108</td>
</tr>
<tr>
<td>Cooperative Learning</td>
<td>IX – B</td>
<td>36</td>
<td></td>
</tr>
</tbody>
</table>

4.6 Tools for Data Collection

Research tools help investigators to collect data. They help the investigator to collect qualitative as well as quantitative data. Investigator gave research tools to school teachers, teacher educators teaching Science and also language teacher educators for validation process. The descriptions of the research tools for the present study are mentioned below.

1. Teaching Learning Material:

a) Lesson Plans based on (GLA) i.e. CLA and PBLA

A lesson plan is a blue print for the teacher. The investigator has prepared lesson plans on GLA viz. (CLA and PBLA) to get an idea of how to proceed in the classroom step by step while teaching the subject Science and Technology. The lesson plans based on CLA were prepared and was given to the experts for validation. The views, suggestions and comments of the experts were incorporated in the lesson plans.
and were finalized. The lesson plans were based on the GLA namely CLA and PBLA. The aim of the present study was to evaluate the effectiveness of GLA. The investigator prepared lesson plans based on CLA given by Johnson, Johnson and Holubes (1989). The guidelines for planning a cooperative lesson as prescribed by Johnson and Johnson (1987) were also followed by the investigator. The lesson plans were prepared in Physics, Chemistry and Biology portions of the subject Science and Technology, STD IX (GSEB) using different Cooperative Learning Strategies viz. Picture Perfect, Jigsaw, Students Team Achievement Division and Round Robin Brainstorming Style (Appendix -2). The lesson plan format given by Chotalia (2007) was considered as a model lesson plan format to prepare lesson plans based on PBLA (Appendix - 4).

The Components Included in Preparing Cooperative Learning Lesson Plans:

The investigator prepared CLA lesson plans based on the Instructional Objectives, Social Objectives, Material needed, Group Size, Arrangement of room, Assignments of students to groups, Roles, Assigning or explaining the task, Criteria for success, Components of cooperative learning (Positive interdependence, Individual accountability, Intergroup cooperation, Equal Participation, Simultaneous interaction, Expected behavior), Monitoring and intervening, Assessing and processing (Small group processing, Whole class processing) and Celebration.

The Components Included in Preparing PBLA Lesson Plans were:

The investigator prepared PBLA lesson plans based on Instructional Objectives, Defining problem, decide the sources for information, Group Formation, Groups Pre-planning, Providing Guidance to the group, Project presentation in the classroom and Evaluation of the project.

b) Power Point Presentations:

The investigator prepared power point presentations on selected topics from all the three portions i.e. Physics, Chemistry, Biology of Science & Technology Textbook STD IX (Appendix -12).
c) Handouts:

The investigator prepared handouts and tasks for the students to work in groups using both CLA and PBLA. (Appendix – 2 & 3)

2) Learning Style Inventory

The Learning Style Inventory constructed and standardized by Ketan Gohel’s was applied. The investigator translated the Learning Style Inventory and then it was given to experts for validation. The views, suggestions and comments were incorporated in the inventory and the tool was finalized. The aim of using this inventory was to know the learning styles of the students. The inventory contains 25 items with different situations related to classroom and daily life. For each situation three options were given (Appendix – 6).

3) Social Skills Inventory

The investigator constructed Social Skills Inventory and was given to the experts for validation. The views, suggestions and comments of experts were incorporated in the inventory and tool was finalized. The aim of constructing this inventory was to obtain data related to the social skills and to know the social behavior of the students while working in groups. The inventory contained 56 statements out of which 36 were positive statements and 20 were negative statements. Five points rating scale was used viz. Strongly Agree (SA), Agree (A), Uncertain (U), Disagree (D) and Strongly Disagree (SD). The statements were based on Relationship, Tolerance, Conversation, Social Responsibility, Encouraging members and Helping others. For the positive statements Strongly Agree – 5 points, Agree – 4 points, Uncertain – 3 points, Disagree – 2 points and Strongly Disagree – 3 points. For negative statements Strongly Disagree – 5 points, Disagree – 4 point, Uncertain – 3 points, Agree – 2 points and Strongly Agree – 1 point (Appendix – 8).

4) Problem Solving Inventory

The Problem Solving Inventory was constructed by the investigator and given to the experts for validation. The views, suggestions and comments of experts were incorporated in the inventory. The aim of constructing this inventory was to obtain data regarding problems to solve when the students were working in groups. The
inventory contained 36 items out of which 13 were positive items and 23 were negative items. Five points rating scale was used viz. Strongly Agree (SA), Agree (A), Uncertain (U), Disagree (D) and Strongly Disagree (SD). The statements were based on handling problems, working in a group and decision taking. For the positive statements Strongly Agree – 5 points, Agree – 4 points, Uncertain – 3 points, Disagree – 2 points and Strongly Disagree – 3 points. For negative statements Strongly Disagree – 5 points, Disagree – 4 point, Uncertain – 3 points, Agree – 2 points and Strongly Agree – 1 point (Appendix – 7).

5) Achievement Test
The achievement test in Science and Technology subject of STD IX was constructed and given to the experts for validation. The items were both close ended and open ended. The aim of the achievement test was to obtain numerical scores regarding the understanding and learning the concepts taught using GLA viz. CLA and PBLA for statistical analysis. The Achievement Test was of 50 marks. The test included objective, short answer and essay type of items (Appendix – 5).

6) Feedback Questionnaire
The Feedback Questionnaire was constructed and given to the experts for validation. The items were both closed and open ended. The aim of the Feedback Questionnaire was to get feedback from the students about the group learning approaches viz. CLA and PBLA. In total, there were 8 items in the feedback questionnaire. These items were based on classroom atmosphere, difficulties faced while studying in such atmosphere, change in one’s personality, methods of teaching, implementation of group learning approaches from the beginning of education, personal feelings while studying in such atmosphere (Appendix – 9).

7) Social Skills Observation Form
Social Skills Observation Form prepared by Nagar, N. (2009) was used to observe the behavior of the students within their groups while working cooperatively. Social skills needed for interaction within a group were discussed, demonstrated and taught to the students. The students were then observed for the skillful usage of the social skills required during the cooperative learning activities. A lot of skills are needed to work cooperatively and it would be difficult to observe and record all of them
simultaneously within a short span of time. So to simplify it, a few of the basic skills required during an interaction were taken up by the researcher, observed and recorded for further utilization viz. ‘Asking for Help’, ‘Giving Help’, ‘Encouraging Others’, ‘Taking Turns’, ‘Asking for Help / Clarification’, ‘Helping the other group remember’ and ‘Checking for understanding by demanding verbalization’. The performa of the form consists of a column in which the social skills to be observed were mentioned. The behavior of the individual to be observed was categorized into four categories namely ‘Amateur’, ‘Acceptable’, ‘Admirable’, and ‘Exceptional’ against those skills. The individual members of the groups were observed for demonstrating social skills one by one during the cooperative activity and then their behavior was recorded on the social skill observation form objectively (Appendix – 8).

8) Field Diary

The investigator maintained field notes to record field based observations. The interaction between the student/s – teacher and student/s – student/s as well as details of the sessions related to the group learning approaches for various concepts of Science and Technology were noted. The points that were kept in mind while recording the field notes are mentioned below.

- Student/s – student/s classroom interaction.
- Students taking turns for performing task.
- Students encouraging others to reinforce members for completing assigned task.
- Students asking for help / clarification with respect to the assigned task.
- Students helping the group members to achieve a common goal.
- Students check for understanding of content by sharing responses.
- Students listen each other’s view without criticizing.
- Each and every student gets equal chance for expressing the views.
- Students made attempts to accomplish the assigned task in the group.

4.7 Experts Opinion for the Tools of Present Study

The tools for the present study were given to the experts viz. School Science teachers, Teacher Educators and language experts. Experts’ suggestions, comments and views
on statements, content, illustrations, objectives, tasks, lesson planning, instructions, grammatical errors, etc. were incorporated and tools were modified.

4.8 Plan and Procedure for the Present Study

The study was spread over a span of four years beginning with the academic year 2009 – 10 and continuing until 2013 - 14.

Stages of Development for the Present Study

Descriptions of the stages of development of the study are given below.

Stage – 1: Reviewing of past studies related to the present study:
The investigator studied and reviewed past studies and articles related to the present study and strengthened the conceptual understanding vis – a – vis the study.

Stage – 2: Selection of the concepts
The investigator had informal talk interaction with the Science teachers of English Medium Schools of Anand District and Science Teacher Educators of B.Ed. Programme to select the concepts that can be taught using GLA.

Stage – 3: Selection of sample for the treatment
School was selected using the convenient sampling technique and divisions of STD IX class were assigned / allocated by the Principal for the experiment.

Investigator collected students’ previous year achievement scores in the subject Science and Technology from the Principal.

Stage – 4: Construction of research tools and its Validation by experts
Lesson plans along with the handouts, activities, worksheets and power point presentations for overview of the content were prepared and given to experts for their valuable suggestions/ views and comments. The suggestions of the experts were incorporated and thereby the lesson plans, handouts, activities, worksheets and power point presentations were finalized. The investigator prepared the cooperative learning approach lesson plans based on Instructional Objectives, Social Objectives, Materials needed, Group Size, Arrangement of room, Assignments of students to groups, Roles,
Assigning or explaining the task, Criteria for success, Components of cooperative learning (Positive interdependence, Individual accountability, Intergroup cooperation, Equal Participation, Simultaneous interaction, Expected behavior), Monitoring and intervening, Assessing and processing (Small group processing, Whole class processing) and Celebrating. The investigator prepared the project based learning approach lesson plans based on Instructional Objectives, Defining problem, Sources for information, Group Formation, Groups Pre-planning, Providing Guidance to the group, Presentation of project in the classroom and Evaluation of the project.

The necessary data collection tools viz. Learning Style Inventory, Problem Solving Inventory, Social Skills Inventory, Achievement Test, Social Skills Form, Feedback Questionnaire were prepared and were given to the experts for validation. The tools were modified according to suggestions, views and comments given by the experts.

**Stage – 5: The experiment**

The experiment was conducted in STD IX divisions A, B, and D of I.B. Patel English Medium School. **The treatment was given to all the three groups using instructional approaches** i.e. control group – TA, experimental group – PBLA and experimental group – 2 CLA.

**Treatment in Control Group:**

The control group was taught using traditional approach. The details of each step are as under:

a) Units / Topics related to the subject Science and Technology were explained using traditional method to STD IX A students. Important points were written on the blackboard. Students were asked to take notes of the important points.

b) Post-test viz. achievement test, learning style inventory, problem solving inventory and social skills inventory was administered after completion of teaching of selected topics/ units / concepts.

**Treatment in Experimental Group -1:**

The experimental group – 1 was taught using PBLA. The details of each step are as under:
a) The experiment was carried out in STD IX – D. Subject topics were introduced using power point presentation. Pictures were given to students to think and raise the questions based on practical life.

b) Discussed and decided available sources like internet browsing, reference books from library, informal talking with people for getting information to solve the raised questions. List of questions were prepared by the students for getting primary information. Some more questions were added, when needed, by the investigator.

c) Heterogeneous groups based on previous year achievement scores in the subject Science and Technology were formed. Each group was asked to name itself.

d) Group members were asked to discuss in groups and to do the pre-planning of the project that should include project title, objective of doing project, requirement of the resources, collection of information, solving the answer of raised questions, presentation of the project, time duration required and necessary guidance.

e) Groups were asked to do the final planning based on pre-planning. Answers were checked, discussed and inputs were given by the investigator. Guidance was provided by the investigator in getting reference material for working on the project.

f) One or two members from each group were asked to present the project. Other group members were free to ask questions to the presenters.

g) The project of each group was evaluated using criteria.

h) Post-test was administered viz. achievement test, learning style inventory, problem solving inventory and social skills inventory after completion of teaching of selected topics/ units / concepts.

**Treatment in Experimental Group – 2:**

The experimental group was taught using CLA. The details of each step are as under:

a) Social skills were taught to students of STD IX B. Group of 5 students were made.

b) Each group was asked to form a story. Group members were asked to note the qualities of their peer members while working on the assigned task and to prepare a comprehensive list of the same.

c) Name of various social skills were written on the blackboard and some of the remaining skills were added to the list by the investigator and placed into the four
categories of social skills namely – Forming skills, Functioning Skills, Formulating Skills and Fermenting Skills. These were explained to the students one by one emphasizing on their need and importance.

d) One social skill was selected from this comprehensive list and was then taught to the students through ‘T’ chart. In this chart in one column the heading given was ‘Looks Like’ and in the second part the heading given was ‘Sounds Like’.

e) Then the students brainstormed to list what they should do and say while demonstrating social skills. The things that students listed to do were listed in the ‘Looks Like’ column because this is what the skill would look like to others when it is demonstrated (Non-verbal behavior). The things that students listed to say were listed in ‘Sounds Like’ column because this is what the skill would sound like to others when it is demonstrated (Verbal behavior).

f) Different social skills were selected and demonstrated to the students using ‘T Chart’. After this the students were advised to practice different skills in groups using the ‘T Chart’ and using those skills while communicating with each other.

g) Distribution of materials and sitting arrangements were made for each group to have face to face interaction.

h) Heterogeneous groups were formed using various strategies.

i) Each member of the groups was assigned roles.

j) The assigned task was explained to the students.

k) The assigned task and team work was monitored through formal and informal observations.

l) Students were informed about assessment of learning i.e. criteria for success and celebrate.

m) Post–test viz. achievement test, learning style inventory, problem solving inventory and social skills inventory were administered after completion of teaching of selected topics/ units / concepts.

4.9 Implementation of Instructional Approaches

The main purpose of the present study was to study the effectiveness of group learning approaches in teaching of the subject Science and Technology to the students of STD IX.
The investigator conducted the experiment on the students of STD IX of I.B. Patel English Medium School, Vallabh Vidyanagar. The study was control – experimental group only post-test design.

The daywise detailed plan and implementation for the group learning approaches is given below.

1. Time Span: 24 days excluding public holidays
2. 68 hours of teaching
3. The investigator had informal talk with Science teachers and Science teacher educators. The investigator, while talking informally with the teachers and teacher educators, came to know that students get confused in the abstract concepts like force and its effects, laws of motion, properties of matter and its types, diffusions, solutions and its types, diseases and its types, spreading of diseases, health, etc. They were unable to comprehend and put the concepts into practice in their daily life. After discussion vis-à-vis topics / concepts that students find difficult, the investigator selected three units from the subject Science and Technology STD IX from each physics, chemistry and biology portion. Three divisions of STD IX viz. A, B and D were selected for the experiment. STD IX – A students were taught using TA, STD IX – B students were taught using CLA and Class IX – D students were taught using PBLA of I.B.Patel English Medium School, Vallabh Vidyanagar.
### Table 4.3
Summary of the Topics, Instructional Approaches and Duration

<table>
<thead>
<tr>
<th>Topics</th>
<th>IX – A</th>
<th>IX – B</th>
<th>IX – C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Traditional Approach)</td>
<td>(Cooperative Learning Approach)</td>
<td>(Project Based Learning Approach)</td>
</tr>
<tr>
<td>Teaching Social Skills</td>
<td>-</td>
<td>2 hours</td>
<td>-</td>
</tr>
<tr>
<td>Force and Laws of Motion</td>
<td>1 hour</td>
<td>13 hours</td>
<td>13 hours</td>
</tr>
<tr>
<td>Properties of Matter</td>
<td>1 hour</td>
<td>10 hours</td>
<td>10 hours</td>
</tr>
<tr>
<td>Why Do We Fall ill</td>
<td>1 hour</td>
<td>7 hours</td>
<td>7 hours</td>
</tr>
<tr>
<td>Post-test</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1. Achievement Test</td>
<td>1 and half hour for all three divisions of STD IX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Social Skills Inventory</td>
<td>-</td>
<td>Half an Hour for all three divisions of STD IX</td>
<td></td>
</tr>
<tr>
<td>3. Problem Solving Inventory</td>
<td>-</td>
<td>Half an Hour for all three divisions of STD IX</td>
<td></td>
</tr>
<tr>
<td>4. Learning Style Inventory</td>
<td>-</td>
<td>Half an Hour for all three divisions of STD IX</td>
<td></td>
</tr>
</tbody>
</table>
Day-wise detailed work is depicted below:

**Day - 1**

The investigator established rapport with the students of experimental group – 2. Groups of four students were formed. They were assigned the task viz. story writing in the group. Time given to each group for completing the task was of 15 minutes. Students were asked to write social behavior of each student in their group. The skills were defined in terms of verbal and non-verbal behaviors and explained thoroughly what students have to do. This was done using the ‘T – chart’. After listing the skills, (e.g. check students’ understanding) the class was asked: ‘What would this skill look like?’ (Non –verbal behavior) and ‘what does this skill sound like?’ (Verbal behavior). Skills were demonstrated to the students. They practiced skills until it seemed to be a natural action.

**Day – 2**

The concepts related to Force and Laws of Motion were taught to the students of control group by traditional approach. The content of the concepts is attached in the Appendix - 3. The investigator made power point presentation to give an overview of the concept of Force and Laws of Motion to students of both experimental group – 1 and experimental group - 2. (Appendix – 15). The meaning and definition of force, forces in everyday action, effect of force, types of forces and Newton’s laws of motion were dealt with one by one. The slides were interactive with concepts and laws depicted through pictures, videos and examples to give a clear understanding of the content.

**Day – 3**

In experimental group – 1, students were asked to form groups of four students of their choice. Pictures were given based on the concept Force and Laws of motion to each group to think and raise questions on everyday experiences. Each group was asked to discuss and decide on the available sources like internet, reference books from library, and informal talks with people for getting information and to solve the raised questions. In short, the students were told to do pre-planning for the group projects wherein they had to decide the project title, objectives of the project, resources required to accomplish project, collection of information, answering the
raised questions, project presentation, time duration required and necessary guidance (Appendix – 5).

In experimental group – 2, the investigator formed mixed groups of 4 to 5 students. Each group was provided with a set of pictures based on concept of Force and Laws of motion to be shared amongst them. Each group’s team members were asked to play the role of exhibitor, viewer, checker and recorder in rotation. The exhibitor was instructed to show the pictures to the viewers one by one. The exhibitor was to read out the matter written along with the picture on the card and explain it to the viewer. Checker was instructed to check the process being followed correctly and the recorder was instructed to keep the tally of the procedure (Appendix – 3 and 4).

The procedure of learning with the pictures was followed till all the students of a group had completed viewing the cards.

**Day – 4**

In experimental group – 1, the investigator helped each group in preparing the final plan based on their pre-plan, checked the answer for the questions raised, discussed it and gave inputs to make the project fruitful.

In experimental group – 2, learning with pictures was continued in the same way as on the previous day so as to allow the remaining students to complete their learning with the pictures. Again, students were instructed to play the same roles. This time exhibitor showed the pictures to the viewers hiding all the written matter and caption, the viewers had to recognize the picture, recall its caption and explain to all the team members what was depicted in the picture. The checker had to check the correctness of the response and the recorder had to keep a tally of the correct responses made by the viewer. The process was repeated till the viewer gave correct responses to all the pictures.

Each student of the team was to play the roles on a rotational basis so that each one got an equal chance and experience. This procedure was followed till all the students of a team were able to recognize and recall all the pictures.
Day – 5
In experimental group – 1, the investigator told one or two students from each group to make presentation on the projects carried out by them. The duration for the presentation was 20 minutes. During their presentation, they focused on objectives, planning, sources required for collecting information, how was the problems solved, what type of assistance was asked for and what the learning outcome were. The other group members asked questions to the presenter group for further clarification when required. Each group was evaluated keeping in mind the following aspects. Importance of the project topic (05 marks), Group pre-planning (10 marks), Communication between group members (05 marks), Field visit if any (40 marks), arrangement of the information viz. logically, originality, creativity and quantity (20 marks), presentation in the classroom (10 marks), group behavior (10 marks) and accomplishment (10 marks).

In experimental group – 2, a discussion was carried out by an investigator to check the conceptual understanding of the students. Questions were put up randomly to the individual members of the groups which they had to answer individually and also to groups as a whole which they had to answer after discussing within their groups. Doubts or difficulties were cleared by the investigator.

Day – 6
In the experimental group – 1, presentations and its evaluation were continued for the remaining groups.

In experimental group – 2, the investigator shuffled all the pictures of concepts of Force and Laws of Motion and mixed them together. All captions and written matter were hidden only the picture was visible. Each group was given a set of such mixed pictures. Again the students were asked to take up the role of exhibitor, viewer, checker and recorder on rotational basis and perform their duties efficiently. The students were then asked to identify the pictures belonging to the concepts separately, arrange them and along with that write down the caption / theme / event / relevance depicted in the picture on a piece of paper. All the students of each group followed the same procedure one by one till everyone finished the work.
Day – 7
In experimental group - 1, group presentation on the projects and its evaluation was continued for the remaining groups.

In experimental group – 2, the Investigator gave assignment on “Application of force and Laws of Motion” to each group. The group discussed amongst themselves and prepared a common write up to be submitted to the investigator for assessment. The students were informed that on the coming day, they would be evaluated for their knowledge and understanding of the concepts of Force and Laws of Motion and that how they would have to prove themselves individually i.e. what they have learnt as a group, they would have to apply it individually. The individual scores would be added and the team with the highest score would be adjudged as the ‘Best Performing Group’ and their names would be displayed on the notice board. Within a group, if all of its members’ score more than 80%, then they would be given five bonus points. So, the students were advised to come well prepared. When members of the groups were working cooperatively, they were formally observed for their social skills of helping the group member and checking for understanding by demanding verbalization.

Day – 8
In experimental group – 1 the students were asked to form group of four students of their choice. Questions based on application of force and Newton’s laws of motion were raised on everyday experiences. Each group was asked to discuss and decide on the available sources like internet, reference books from library, informal talks with people for getting information and to solve the raised questions. In short the students were told to do pre planning for the group projects where in they have to decide the project title, objectives of the project, resources required to accomplish project, collection of information, answering the raised questions, project presentation, time duration required and necessary guidance (Appendix – 5).

In experimental group – 2, the investigator formed mixed group of 6 to 7 students. The class was organized into home groups and the topic was introduced. Each member in the home group was given experiment sheets to be explored. Each group’s team members were asked to play the role of a leader, researcher, observer, recorder, encourager, viewer, demonstrator each, turn by turn. The researcher was instructed to get the needed materials for the group. The observer was instructed to keep track of
how well the group is cooperating. The recorder was instructed to write group proceedings. The encourager was instructed to reinforce member’s contribution. Demonstrator was instructed to demonstrate an experiment / activity to the viewers one by one (Appendix – 3 and 4).

**Day – 9**

In experimental group – 1, the investigator helped each group in preparing final plan based on the pre-plan, check the answer for the questions raised, discussed it and gave inputs to make the project fruitful.

In experimental group – 2, instruction was given to the students to reorganize and form the focus groups as per the given task. Members of each focus group worked together to learn about an experiment / activity and build understanding together. Students were encouraged for exploratory writing. Guided set of questions were provided to help students to explore their ideas in for their assigned task.

**Day – 10**

In experimental group – 1, the investigator told one or two students from each group to make presentation on the projects carried out by them. The duration for the presentation was 20 minutes. During their presentation they focused on objectives, planning, sources required for collecting information, how were the problems solved, what type of assistance was asked for and what were their learning outcome. The other group members asked questions for further clarification when required to the presenter group. Each group was evaluated keeping in mind Importance of the project topic (05 marks), Group pre-planning (10 marks), Communication between group members (05 marks), Field visit if any (40 marks), arrangement of the information viz. logically, originality, creativity and quantity (20 marks), presentation in the classroom (10 marks), group behavior (10 marks) and accomplishment (10 marks).

In experimental group – 2, each member of the focus group returned to their home groups to describe the ideas generated in their focus groups after building understanding. Conceptual understanding was reshaped by each member of the home group. Each student was evaluated by assigning them a demonstration task in their home groups. After completion of the assignment, each student will be judged individually through an achievement test.
**Day – 11**

The concepts related to Properties of Matter were taught to the students of control group by traditional approach. The content of the concepts has been attached in the Appendix – 3. The investigator made power point presentations to give an overview on the concept of Properties of Matter to students of both experimental group – 1 and experimental group - 2. (Appendix – 15). The meaning and definition of Matter and its classification, Effects of change in temperature and pressure and solutions were dealt with one by one. The slides were interactive with concepts and laws depicted through pictures, videos and examples to give a clear understanding of the content.

**Day – 12**

In experimental group – 1, students were asked to form group of four students of their choice. Key words based on the concept Properties of Matter were given to each group to think and raise the questions on everyday experiences. List of questions were prepared. Each group was asked to discuss and decide on the available sources like internet, reference books from library, informal talks with people for getting information and to solve the raised questions. In short the students were told to do pre planning for the group projects where in they have to decide the project title, objectives of the project, resources required to accomplish project, collection of information, answering the raised questions, project presentation, time duration required and necessary guidance. (Appendix – 5)

In experimental group – 2 Investigator formed mixed group of 5 students. Each group was provided with the set of worksheets based on concept of Properties of Matter to be shared amongst them. Each group members were asked to play a role of a leader, researcher, recorder, encourager and facilitator. The leader was instructed to make sure that every voice is heard. The researcher was instructed to get the needed materials for the group. Recorder was instructed to take notes of the group’s discussion. Encourager was instructed to reinforce members’ contribution for group work. Facilitator was instructed to keep the group on task. (Appendix – 3 and 4).
Day – 13
In experimental group – 1, the investigator helped each group prepare their final plan based on the pre-plan, check the answer for the questions raised, discuss it and give her inputs to make the project fruitful.

In experimental group – 2, learning with worksheets were continued in the same way as on the previous day so as to allow remaining students to complete their learning with the worksheets till each member of the group attained mastery. Again students were instructed to play the same roles. Each student of a team was to play the roles on a rotational basis so that each one gets an equal chance and experience. This procedure was followed till all the students of a group achieve mastery over the content.

Day - 14, 15 & 16
In experimental group – 1, the investigator told one or two students from each group to make presentation on the projects carried out by them. The duration for the presentation was 20 minutes. During their presentation they were supposed to focus on objectives, planning, sources required for collecting information, how did they solve the problems, what type of assistance did they asked for and what were their learning outcome. The other group members could ask questions for further clarification when required to the presenter group. Each group was evaluated keeping in mind Importance of the project topic (05 marks), Group pre-planning (10 marks), Communication between group members (05 marks), Field visit if any (40 marks), arrangement of the information viz. logically, originality, creativity and quantity (20 marks), presentation in the classroom (10 marks), group behavior (10 marks) and accomplishment (10 marks).

In experimental group – 2, learning with worksheets were continued in the same way as on the previous day so as to allow remaining students to complete their learning with the worksheets till each member of the group attained mastery. Again students were instructed to play the same roles. Each student of a team was to play the roles on a rotational basis so that each one gets an equal chance and experience. This procedure was followed till all the students of a group achieve mastery over the content.
Day – 17
In experimental group – 1, group presentation on the projects and its evaluation were continued for the remaining groups.

In experimental group – 2, each group member was evaluated through individual quiz.

Day – 18
The concepts related to Why Do we Fall Ill were taught to the students of control group by traditional approach. The content of the concepts is attached in the (Appendix - 3). The investigator made power point presentation to give an overview on the concept of Why Do We Fall Ill to the students of both the experimental group – 1 and the experimental group – 2 (Appendix – 15). The meaning and definition of health, diseases and its causes and types of diseases were dealt with one by one. The slides were interactive with concepts and laws depicted through pictures, videos and examples to give a clear understanding of the content.

Day – 19
In experimental group – 1, the students were asked to form groups of four students of their choice. Topics for survey based on Why Do we Fall Ill were given to each group. Each group was asked to collect information. Each group was asked to discuss and decide on the available sources like internet, reference books from library, informal talks with people for getting information and to solve the raised questions. In short, the students were told to do pre-planning for the group projects wherein they had to decide the project title, objectives of the project, resources required to accomplish project, collection of information, answering the raised questions, project presentation, time duration required and necessary guidance. (Appendix – 5).

In experimental group – 2, the investigator formed mixed groups of 6 students. Each group was provided with a question based on the concept of Why Do We Fall Ill with many answers. Each member was given time to think of answers for the posed questions. Each group member was asked to play the roles of leader, gate keeper, recorder, encourager and facilitator. The leader was instructed to make sure that every voice was heard. The gate keeper was instructed to equalize participation. The recorder was instructed to take notes of the group’s discussion. The encourager was
instructed to reinforce members’ contribution for the assigned group work. The facilitator was instructed to keep the group on task (Appendix 3 and 4).

After the given think time, members of the groups shared their responses with one another, round robin style. The recorder will write the answers of the group members. The person next to the recorder started and each person in the group, in the same order, gave an answer until the time is called.

**Day – 20**

In experimental group – 1, the investigator helped each group in preparing final plan based on the pre-plan, checked the answer for the questions raised, discussed it and gave her inputs to make the project fruitful.

In experimental group – 2, learning with questions were continued in the same way as on the previous day so as to allow the remaining students to share their answers. Again the students were instructed to play the same roles. Each student of a team was to play the roles on a rotational basis so that each one gets an equal chance and experience. After the given think time, members of the groups share their responses with one another, round robin style. The recorder wrote the answers of the group members. The person next to the recorder starts and each person in the group, in the same order, gave an answer until the time is called.

**Day – 21 & 22**

In experimental group – 1, the investigator told one or two students from each group to make presentation on the projects carried out by them. The duration for the presentation was 20 minutes. During their presentation they focused on objectives, planning, sources required for collecting information, how did they solve the problems, what type of assistance did they ask for and what were their learning outcome. The other group members could ask questions for further clarification when required to the presenter group. Each group was evaluated keeping in mind the Importance of the project topic (05 marks), Group pre-planning (10 marks), Communication between group members (05 marks), Field visit if any (40 marks), arrangement of the information viz. logically, originality, creativity and quantity (20 marks), presentation in the classroom (10 marks), group behavior (10 marks) and accomplishment (10 marks).
In experimental group – 2, one or two students from each group shared answers with the group members for the given question.

**Day – 23**
The students of experimental group 1 and 2 were dispersed within the classroom so that no team members were sitting next to each other. The students of control group were also randomly seated. The students were provided with the question paper on which they were instructed to write their name, and STD, roll number. They were instructed to write their answers in the space provided in the question paper only. The students were informed that they would be given one and a half hours’ time to complete the task after which they would have to submit their answer sheets to the researcher for evaluation. The question paper consisted of objective type questions, short answer type questions and essay type questions (Appendix – 6).

**Day – 24**
The students of the control group, the experimental group – 1 and the experimental group – 2 were post-tested for different variables. These tests included Ketan Gohel’s Learning Style Inventory translated version, Social Skills Inventory and Problem Solving Inventory (Appendix -. 7, 8 and 9)

### 4.10 Method of Data Collection
The data was collected over a period of time that can be divided into two phases.

**Phase – 1 Construction and Validation of the Tools**
The necessary tools viz. Lesson plans with activities, handouts, tasks, power-point presentations, learning style inventory, problem solving inventory, social skills inventory, social skills form, feedback questionnaire were constructed and validated by the experts. The tools were modified as per suggestions given by experts.

**Phase – 2 Implementation of Instructional Approaches**
Students were taught by using Instructional approaches viz. TA and GLA i.e. CLA and PBLA. Achievement test (Post-test) was administered for data collection. Effectiveness of group learning approaches was found in context to other variables
like Gender, Learning Style (Audio, Visual and Kinesthetic), Problem Solving, Social Skills, Achievement Level (High, Middle and Low) of the students.

4.11. **Analysis of Data**

The data obtained through feedback questionnaire, students’ experience and field dairy were analyzed qualitatively using content analysis technique (both ongoing day to day analysis as well as end – analysis).

The data gathered through Post-test viz. Achievement Test, Learning Style Inventory, Problem Solving Inventory, Social Skills Inventory, Social Skills Form, Feedback Questionnaire were analyzed statistically using F-test, Percentage analysis and Chi-square.

The next chapter focuses on data analysis and interpretation of the data.