

## **Chapter III**

### **Research Methodology**

#### **3.0 Introduction**

Research means the unfolding of a hidden truth by following a specific and systematic process or an approach. This systematic approach is nothing but research methodology. Research methodology, in simple words, is a systematic design or an orderly organized plan of action which results in a valid and reliable conclusion in the form of research findings. Research methodology encompasses different steps which need to be followed by the Researcher while conducting research. These steps include framing research objectives and hypotheses, identifying population and rationalizing samples from a population, collecting, and then analysing required data, and finally interpreting results of the research. Research methodology, always contemplated as a torch-bearer during the process of any investigation.

After analysing the research gaps in previous research, reviewed literature presented in the second chapter (Review of Related Literature), guided, and directed the Researcher about the framework of the present research methodology. In this chapter, the Researcher made every effort to put forward all the essential aspects of methodology necessitated during this research.

#### **3.1 Research Design**

Research design embraces different steps followed by the Researcher to execute research in a logical sequence: deciding population, deciding sample, finalizing tools and techniques, data collection, and analysis of data. It could also be referred to as the "blueprint of practical work in research". Gay & Airasian (2000) stated that "A design is a general strategy for conducting a research study" (cited by Best, 2006:.29).

For constructive and successful accomplishment in any research, the proper layout is essential, and the nature of the study decides that layout. The present study was experimental, as it includes experimental and controls group along with treatment (life skill-based activities) plans as the variables. The study was implemented in an actual classroom situation with the experimental and control group as separate intact classes. One group considered the experimental group, was executed with the program, and the other was a control group for comparison of results and studied the effectiveness of the implemented program. The program was directed to an intact class and not to the

individuals, as it would be challenging to implement treatment randomly to the individuals in an actual classroom situation. Hence, considering the practical limitations of the real classroom, a quasi-experimental design was selected for the study. The pre-test post-test non-equivalent group design was followed in this research.

The design of the study is presented as follows:

O1      X      O2

O3      C      O4

Whereas O1 and O3 are pre-tests, O2 and O4 are post-test, X stands for Experimental Group, and C stands for Control Group.

The Researcher took one control and one experimental group as intact classes. Developed program in the form of life skill-based activities was planned for experimental group only, and control group was taught through the regular method. Achievement test (pre-test and post-test) was used to measure the effectiveness of the program in terms of understanding the concepts of science and technology subject by comparing the scores of the experimental and control group. The effectiveness with respect to life skills was studied with the help of worksheets and field notes (grading was done to analyse the worksheets). This design is one of the most effective in minimizing the threats to experimental validity and extraneous variables.

### **3.2 Variables in the Study**

As the word defines itself, variable means anything which changes or varies concerning changing conditions. For experimental studies, variables indicate any characteristics, situation, event, treatment, attribute, or any aspect which explores the cause-and-effect relationship. It could be manipulated, controlled, and accordingly observed within a study. Different books and different educational researchers mentioned the number of types of variables, but mainly two types of variables are highlighted for any experimental studies. These are independent and dependent Variables. The current work intended to develop and implement an activity-based program and study its effect in terms of achievement tests (pre and post-test); accordingly, the variables were defined below.

#### **3.2.1. Independent Variables**

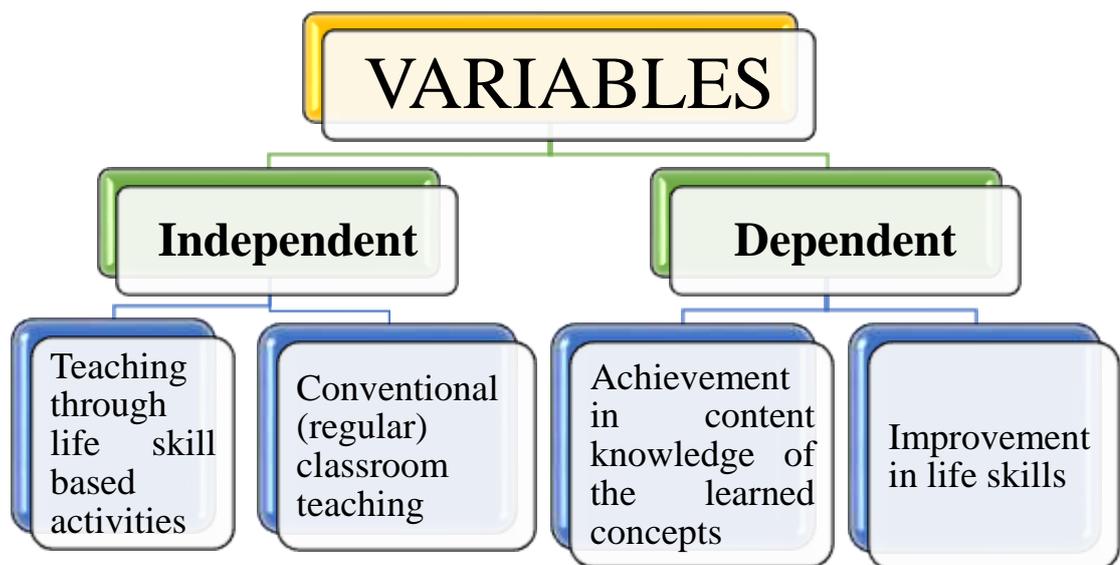
A variable that is independent and could be manipulated within the experiment could be defined as an Independent variable. In the present study, the independent variable denotes teaching through life skill-based activities and conventional (regular) classroom teaching. Developed program in the form of life skill-based activities, considered as one

of the independent variables, was implemented in the experimental group to analyse its effect on the achievement in content knowledge of the concepts taught (topics of science and technology subject) and life skills. Another independent variable was conventional or standard classroom teaching, which was taken care of as a control group.

### 3.2.2. Dependent variable

The variable which is influenced by the fluctuations in the independent variable could be the layman explanation for the dependent variable. In other words, any adjustments or alterations in the independent variable may directly affect the dependent variable. In any study, the dependent variable is a variable that is supervised to conclude the results of the other variable. For the present study, the dependent variable includes achievement in content knowledge of the concepts taught (topics of science and technology subject) and life skills.

**Figure 3.1: Variables for the Present Study**



### 3.3 Control to the Threats of Experimental Validity

There are several extraneous variables in any experimental design, which are not of much relevance but still effects the genuineness of the experiment. These are minded as threats to the validity of any experimental design. As explained by Best, Kahn & Jha (2017), "in educational experiments several extraneous variables are present in the situation or are generated by the experimental design and procedures. These variables influence the results of the experiment in ways difficult to evaluate..... Although these

extraneous variables usually cannot be eliminated, many of them can be identified and can be taken care of by minimizing their influence".

According to Campbell and Stanley (1966), experimental validity is of two types: internal and external validity (as cited by Best, Kahn & Jha, 2017). Accordingly, the threats are categorized as threats to internal validity and threats to external validity. The Researcher has tried all the viable efforts to minimize the maximum possible threats to the experimental validity to ensure internal and external validity to the current work.

### **3.3.1 Restraining Threats to Internal Validity**

Threats to internal validity mainly were related to the sample group (participants of the experiment) and instrumentation. The Researcher has ensured the internal validity of the investigation by taking care of different aspects. Most of the threats like history, selection biases, and maturation were controlled by taking the control group. Both experimental and control groups were in the same class, which almost nullified the effect of maturation, as it is generally assumed that children grow similarly in the same age group. The impact of testing was minimized by taking a post-test parallel to the pre-test. The students from both groups were not acquainted with the purpose of taking the pre-test and implementing the activities, which neutralizes any effect due to testing. The two schools, selected as experimental and control groups, were far distant from each other, and students of both the groups had zero chance of interaction, so threats owing to interaction were not possible. Experts validated the tools; both the groups took both (pre-test and post-test) the test and were supervised personally by the Researcher, so the threat to unstable instrumentation was also taken care of. Irrespective of any baseline score or pre-test score, the two intact classes were considered for the study; accordingly, statistical regression was accounted for. Attrition and mortality did not affect the experiment results, as the number of participants remained the same throughout the program in both groups.

### **3.3.2 Restraining Threats to External Validity**

Factors influencing the external validity of an experimental study were generally related to the population. These factors mainly, if not taken care of, may affect the generalization of the results. In the present study, the natural aspect of the experiment was introduced by selecting a regular classroom for the investigation and implementing the program in standard classes. Pre-test post-test non-equivalent group design was chosen for the current study, and each group was given one treatment as an intact group and not

randomizing to individuals in the group. This reduced the multiple treatment interference during the conduct of the study.

Thus, every best effort was made by the Researcher to control and restrain the expected threats during the experiment—this assisted in assuring the validity of the present experimental study.

### **3.4 Population**

The population can be considered a total number of individuals (exhibiting similar characteristics) knowingly or unknowingly being a part of the research, participating in the research through their representation (sample), and to whom the whole investigation was carried out. For the present study, the population constituted the number of students studying in IX standard in CBSE schools of Vadodara city for the session 2015-2016.

CBSE Annual report (2014-15) mentioned 317 CBSE affiliated schools in Gujarat state. The number of schools in Vadodara city, affiliated to CBSE in 2015, was 22. The population for the study was comprised of all the IX class students studying in these CBSE English medium secondary schools of Vadodara city during the year 2015-16

### **3.5 Sample**

A small portion of the population, on which observations were made and generalized to the entire population, could explain the sample in any research.

The current study focused on developing and implementing life skill-based activities for IX standard students of CBSE schools. As the study was experimental, it needs pre-requisites essential for the research. Based on these pre-requisites, the sample of the study was selected purposively.

**Two secondary schools, both affiliated to CBSE, were selected purposively based on the following criteria:**

1. Availability and accessibility of computer laboratory along with smart boards for PowerPoint presentations.
2. Students at the school had enough exposure to computer laboratories and smart boards.
3. Well-equipped science laboratories (Physics, Chemistry, and Biology).
4. Playground, indoor and outdoor space for activities, and any other educational constructive work.
5. Co-operation from principal, teachers, and other administration for the operational success of the program.

6. The selected schools have all the infrastructural facilities (smartboards linked with computers and well-equipped science labs) and fulfilled other requirements important for implementing the program. The school readily consented to provide those facilities to the Researcher for the effective implementation of the program.

There were forty-five students in the class selected for the experiment and forty-two students in the control group. As the experiment was conducted at the start of the session, final marks achieved by the experimental and control group students in science subject at the eighth standard were compared to match the groups. Based on last scored marks in science subject, 40 students from each experimental and control group were considered samples for the current study. Students of the experimental group were taught (science and technology through life skill-based activities) in the academic year 2015-16 for one semester by the researcher while the students of control group were taught by their teacher in usual method.

### **3.6 Different Phases of the Research Design**

The research design for the present study includes different stages such as developing the program and data collection tools, implementing the program, and collecting required data for the analysis.

A detailed explanation of the research design for the present study is elaborated under the following phases:

### **3.7 Phase I: Development of the Program and Tools**

#### **3.7.1 Development of Program**

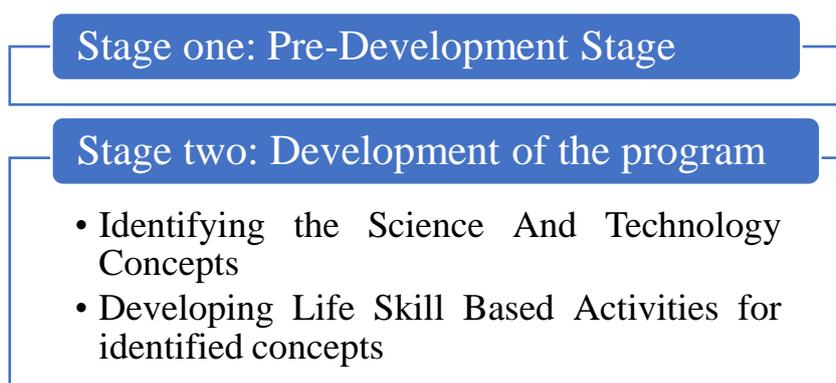
A thorough review of past literature on life skill education and science and technology subject apprised that tremendous amount of work has been done earlier in both the fields (life skill education and science and technology subject). However, the integrated approach was still needed to be explored. The present research work applied a unified strategy for developing a program (life skill-based activities) for the research. The focus of the study was not only on the Development of life skills but also aid students with an in-depth understanding of science concepts. They grasped life skills from these concepts by applying and realizing importance of these science concepts in their (students') daily life.

After an extensive review of related literature on life skills and science and technology subjects, the researcher formulated the framework for the program. CBSE Teacher's Manual on Life Skills classes IX-X (2010), Continuous and Comprehensive evaluation

Manual by CBSE, reports of WHO and UNICEF on life skill education, and reviews from related literature were explored and analysed for the Development of program and tools for data collection.

For a detailed explanation, the entire process was divided into different stages systematically presented below.

**Figure 3.2: Stages of Development of the Program**



#### **3.7.1.1 Stage one: Pre-Development Stage**

The Development of any program needs a complete understanding and analysis of the problem. To comprehend and analyze the current scenario in teaching-learning of life skill education in the CBSE schools of Vadodara City, the researcher visited some of the CBSE schools with a list of questions in the form of a survey. The survey has five questions related to teaching life skill education and science and technology subjects. The researcher has visited ten CBSE schools of Vadodara city. After analyzing the responses obtained from the teachers of those schools, the researcher concluded that life skill classes were taken as a separate subject in most schools, and even in some of the schools, there was no subject or period related to life skills education. The researcher also assessed a considerable gap between the life skills manual and the implementation of that manual in schools. For science teaching, generally lecture cum demonstration method was in practice. There was hardly any hands-on experience given to the students even though schools have extensive laboratories. All these reviews guided the researcher to develop such a program that would help develop life skills among students and the concept knowledge.

#### **3.7.1.2 Stage Two: Development of the Program**

As presented in the previous section, the study deliberated to develop a program including activities based on life skills and science and technology subject concepts from the first semester of IX standard in CBSE schools of Vadodara city. The program

includes two subjects (life skill education and science and technology) integrated, so both the subjects were analysed separately. After a detailed discussion with the guide and other experts (in life skill education) and studying the review findings, it was finalized that all the ten life skills adopted by CBSE were taken care of in the program. Considering all the ten life skills mentioned in the CBSE Manual of life skill education for IX-X, further activities were developed as an essential base of the program.

The development part was divided into two steps, detailed below:

#### **3.7.1.2.1 Step 1: Identifying Science and Technology Concepts.**

Before developing the program, the NCERT book of Science and Technology subject for IX standard was thoroughly analysed by the researcher and discussed with the guide and science teachers of IX standard to find the most appropriate topics for the study. It helped the researcher understand the content competencies and provided the idea to develop life skills among students through the concepts of science and technology subject. After detailed scrutiny, the researcher selected fifteen topics from the first term course syllabus for developing the program. The topics were set based on specific criteria related to daily life; possible life skill-based activities could be designed and integrated with life skill education. The selected subjects were cell, cell organelle, Tissue, animal tissue, Mixture, separation of Mixture, types of tissues, water, evaporation, life history of Newton, conservation of energy, states of matter, crop production, crop variety. After determining and evaluating selected topics, activities were developed on the issues chosen by the researcher. The developed activities were grounded on content (selected topic) knowledge and helped build life skills among students.

#### **3.7.1.2.2. Step 2: Developing Life Skill Based Activities for identified concepts.**

Life skill-based activities integrated with science concepts were developed in the form of a program. The program was implemented during 2015-16 for the first semester of IX standard in two selected CBSE schools of Vadodara city.

A detailed description of the Development of the program was presented in this section.

The final draft of the program was developed after going through the following stages:

1. In an integrated approach, various activities were developed considering the content knowledge of selected science concepts and life skills (all the ten core life skills adopted by CBSE).
2. Activities were planned to keep in mind the objectives of science teaching and life skill education at IX standard.

3. The rough framework of the program was formulated with possible activities. Since all the three categories of life skills (thinking, social and emotional skills) were included in the study, it was ensured in each activity that one or more components (ten core life skills) from each category should be taken care of.
4. The rough draft of the developed program was given to the three experts from the field of life skill education and science to analyse the appropriateness of the activities to the level of students and validate its content and methodology.
5. After expert validation and getting comments and feedback from them, the final draft of the program was developed. The modified program was all set for the execution of the experimental group.

The activities developed on selected topics of science subjects were categorized as activity 1, activity two, unto activity 15. Different activities were designed for a different topic chosen, such as activity one was about Tissue and activity two was on Types of Tissue. Similarly, other activities were developed on all other selected topics and named activity 3, activity 4, and so on.

**Table 3.1 Details of Developed program**

Sr. No.	Activity	Topic	Total Time	Life Skills
1	Pre-test		80 mins	
2	Activity 1	Tissues	80 mins	Thinking Skills: Creative Thinking, Critical Thinking, Decision Making. Social Skills: Communication, Interpersonal Relationship. Emotional Skill: Coping with Stress.
3	Activity 2	Types of Tissues	90 mins	Thinking Skills: Creative Thinking, Critical Thinking, Decision Making. Social Skills: Communication. Emotional Skill: Coping with Stress, Empathy.
4	Activity 3	Force, Balanced and Unbalanced force	120 mins	Thinking Skills: Decision Making. Social Skills: Empathy, Interpersonal Relationship. Emotional Skills: Coping with Stress, Self-Awareness.
5	Activity 4	Cell	90 mins	Thinking Skills: Decision Making, Critical Thinking, Creative Thinking, Problem Solving. Social Skills: Communication, Empathy, Interpersonal Relationship. Emotional Skills: Coping with Stress.

6	Activity 5	Cell Organelles	90 mins	Thinking Skills: Decision Making, Critical Thinking. Social Skills: Communication Emotional skills: Coping with Stress.
7	Activity 6	Water	120 mins	Thinking Skills: Decision Making, Critical Thinking, Creative Thinking, Problem Solving. Social Skills: Communication, Empathy, Interpersonal Relationship. Emotional skills: Coping with Stress.
8	Activity 7	Evaporation	90 mins	Thinking Skills: Critical Thinking, Creative Thinking, Problem Solving. Social Skills: Communication, Empathy, Interpersonal Relations. Emotional Skills: Self-Awareness, Coping with Emotions, Coping with Stress.
9	Activity 8	Life history of Newton	90 mins	Thinking Skills: Decision Making, Critical Thinking, Creative Thinking, Problem Solving. Social Skills: Empathy, Interpersonal Relationship, communication. Emotional Skills: Coping with Stress, Coping with Emotions, Self-Awareness.
10	Activity 9	States of Matter	120 mins	Thinking Skills: Decision Making, Critical Thinking, Creative Thinking, Problem Solving. Social Skills: Communication, Empathy, Interpersonal Relationship. Emotional skills: Coping with Stress.
11	Activity 10	Mixtures	120 mins	Thinking Skills: Decision Making, Critical Thinking, Creative Thinking, Problem Solving. Social Skills: Communication, Empathy, Interpersonal Relationship. Emotional skills: Coping with Stress.
12	Activity 11	Crop Production Management	120 mins	Thinking Skills: Decision Making, Critical Thinking, Creative Thinking, Problem Solving. Social Skills: Communication, Empathy. Emotional Skills: Coping with Stress, Coping with Emotions, Self-Awareness.
13	Activity 12	Separating the Components of the Mixture	120 mins	Thinking Skills: Critical Thinking, Problem Solving, Decision Making. Social Skills: Communication, Interpersonal Relationship. Emotional Skills: Self-Awareness, Coping with Stress.

14	Activity 13	Animal Tissue	90 mins	Thinking Skills: Decision Making, Creative Thinking, Critical Thinking. Social Skills: Communication, Empathy, Interpersonal Relationship. Emotional Skills: Coping with Stress
15	Activity 14	Conservation of Energy	90 mins	Thinking Skills: Problem Solving, Critical Thinking, Decision Making. Social Skills: Communication. Emotional Skill: Coping with Stress, Self-Awareness
16	Activity 15	Crop Variety	180 mins	Thinking Skills: Critical Thinking, Decision Making. Social Skills: Communication, Interpersonal Relationship, Empathy Emotional Skill: Coping with Stress, Self-Awareness.
17	Post-test		80 mins	

### 3.7.2 Development of Tools

The researcher prepared different tools for data collection to evaluate the effectiveness of the developed program. All the developed tools were detailed as under:

**Pre- and post-achievement test:** The test was constructed by the investigator. Experts validated it. To achieve the objectives of the present study, a test comprised of multiple short answer questions was prepared and validated by the subject experts. Achievement test was based on subject and administered on experimental as well as control groups. The test has situation based questions related to the topics from the science and technology subject covered under the study (such as cell, tissue, force, cell organelles). The test has eleven questions and one comprehension, which has three sub-questions. Most of the questions have two or more sub-questions and carry different marks. The test was subjective (short answer type) and included questions that needed different life skills and subjective knowledge.

**Worksheets:** Five Worksheets based on different activities were prepared by the Researcher for appraising Life skills. These worksheets were assessed using a checklist given by CBSE in Chapter IV of Teacher's Manual on Continuous and Comprehensive Evaluation, classes IX-X for assessing Life Skills, along with the help of field notes.

**Field Notes:** Record of the activities were maintained in the form of field notes. Field notes also include students' reviews, specific observations, and their behaviour during and after each activity. Field notes helped the Researcher keep track of the students' participation during the activity in the form of queries raised and answered, deducing,

and inferring content knowledge, enthusiastically reflecting their views and experiences related to the concepts taught and life skills during the discussion session.

**Checklists:** Checklists framed by the researcher were based on the checklist given in Chapter 4 of CCE Manual By CBSE. Further, CBSE has clustered the ten core Life Skills into three major Skills: Thinking, Emotional, and Social skills and highlighted different indicators to assess these Life Skills. These checklists were based on the indicators detailed in CBSE CCE Manual. Some of the Indicators were: students' creativity, motivation, concept clearing abilities, problem-solving, patience, appreciating others, comfortable in every situation, healthy completion, argumentative, showing respect, stress management, anger control, imaginative, responsible, flexible, analyse problems, active listener, question raisers, empathetic, co-operative, creative, coping with stress, etc. These checklists are further graded based on a five-point grading scale as given in the Chapter 4 of CCE Manual By CBSE.

The grading scale includes A\*, A, B, C, and D.

Grading Scale: The five-point grading scale is given below

Most indicators in a skill	A*
Many indicators in skill	A
Some indicators in skill	B
Few indicators in skill	C
Very few indicators in skill	D

These grades were given by using descriptive indicators used in the checklist of all the life skills reflected by the students in the worksheets and during the class.

**Opinionnaire:** It was prepared to understand the opinion of the students towards the life skill-based activities (Developed Program) in science and technology subject. The opinionnaire includes open-ended questions seeking students' suggestions and their opinion towards the developed program.

### **3.8 Phase II: Implementation of the Program**

The developed program (Appendix A), which includes various activities, was implemented in the classroom. Investigator took the first-semester course of science subject of 9th standard during the session of 2015-16 to administer the program. In the experimental group, the program was administered, and the control group was taken care of by the traditional method by their regular teachers. Investigator administered the developed program in the first half of the academic session in 2015 as the developed

program includes topics of first-semester course of IX standard. As the Researcher's purpose was to study the development of life skills (if taught through science subject), only the selected topics (mentioned in Phase 1: Development of the program) were taught by the investigator through developed activities (developed program). The class teacher took the remaining syllabus of the first term.

### **3.9 Phase III: Data Collection**

#### **3.9.1 Administration of Pre-test**

Investigator implemented the pre-test in both experimental and control groups. The pre-test was implemented before implementing the developed program in the experimental group and at the same time in the control group. The pre-test was administered at the start of the session in March 2015.

#### **3.9.2 Administration of Worksheet / Field Notes**

Notes were maintained by the researcher to record students' reviews, specific observations, and their participation and behaviour throughout each activity and also during discussion. Worksheets were implemented by the researcher after some of the activities to assess improvement in life skills.

#### **3.9.3 Administration of the post-test**

Investigator administered post-test on both control and experimental groups after the implementation of the program. At the end of the first-semester course in August 2015, the post-test was administered by the investigator on both the control and experimental group.

#### **3.9.4 Administration of the opinionnaire**

Opinionnaire was implemented to know the opinion of the students of the experimental group about the developed program. The opinionnaire includes thirteen open-ended questions framed with a viewpoint to seek students' reactions about the developed program.

### **3.10 Data Analysis**

Data analysis includes analysis of complete data cumulated by the Researcher through different means to study the effectiveness of the developed program in terms of achievement in science and technology subject as well as improvement in life skills. Since the collected data were quantitative as well as qualitative in nature, analysis of the collected data was done using different data analysis techniques. Non-parametric

statistics were applied for quantitative data analysis. Wilcoxon Rank Test and Mann Whitney U test were applied to measure the influence of the intervention.

Qualitative responses collected from the opinionnaire were analysed through quantitative content analysis. Quantitative content analysis was done by coding the set of data provided in the opinionnaire and analysing it through frequency count and percentage.

### **3.11 Conclusion**

This chapter simplified all the details of the research methodology used for the study along with Development and implementation of the life skill-based activities (developed program). After the performance of the expanded program, data were collected through different tools detailed under section 3.7.2.2. The next chapter contributes the analysis and interpretation of the collected data to examine the effectiveness of the developed program in terms of achievement in Science and Technology concepts understanding and the improvement in Life Skills.