CHAPTER III

METHODOLOGY

3.0.0 INTRODUCTION

Research methodology is the systematic plan and procedure to arrive at the conclusion of any research work. All the methods and procedures by which the researcher carries out his work of describing, explaining and predicting phenomenon are called research methodology. The main purpose of the present study was to develop and implement a Constructivist Learning Strategy (CLS) to teach Biology at senior secondary level and to find out its effectiveness. As the present study was experimental in nature, the research design and the methodology of experimental research have been followed for the present study. The details of the methodology have been presented in this chapter. This chapter covers the research design, selection of sample, construction of tools for data collection, development and implementation of programme, process of data collection and methods of data analysis. The objectives and hypothesis of the present study are cited below for comprehensive understanding of the methodology.

3.1.0 OBJECTIVES OF THE STUDY

The present study was designed with the following objectives.

1. To develop a Constructivist Learning Strategy (CLS) to teach Biology at senior secondary level.
2. To implement the developed Constructivist Learning Strategy to teach Biology at senior secondary level.
3. To study the effectiveness of Constructivist Learning Strategy in terms of students achievement in Biology.
4. To study the effectiveness of Constructivist Learning Strategy in terms of students' reaction towards it.

3.2.0 HYPOTHESIS OF THE STUDY

The following hypothesis was formed to be tested at 0.01 level of significance.

Ho: There will be no significant difference between the mean Biology post-test achievement scores of students' of experimental and control group.

3.3.0 RESEARCH DESIGN

As randomization was not used for the selection of both the experimental and control group, quasi experimental design was followed in the present study. The pretest-posttest nonequivalent groups design was selected from the available designs in the quasi-experimental designs for the present study. Best and Kahn (1996) describe, 'this design is often used in classroom experiments when experimental and control groups are such naturally assembled groups as intact classes, which may be similar'. The design of the present study is presented diagrammatically as follow.

$$O1 \qquad X \qquad O2$$
$$O3 \qquad C \qquad O4$$

O1, O3= Pre-tests;   O2, O4= Post-tests;   X = Experiment group;   C = Control group
The pre-test was administered to the students of both the groups before giving treatment. Post-test was conducted after the treatment. As the design does not permit to use the parametric tests like ANCOVA (Analysis of Co-variance) where pre-test scores could be used as covariate, the experimental and the control groups were made equivalent on the basis of pre-test score to make the design more effective and to use the non-parametric test i.e. u-test to find out the difference between the means of experimental and control groups.

3.4.0 POPULATION

All the standard XI English medium students with Biology as the specialization of the schools in Gujarat affiliated to Central Board of Secondary Education (CBSE) constituted as the population of the present study.

3.5.0 SAMPLE

Non-Probability sampling method was adopted by the researcher for the present study as per the requirement of the research design. As per the convenience of conducting the research study, the researcher selected the sample for the present study. P.P. Savani Chaitanya Vidya Sankul, Surat, Gujarat, an English medium CBSE school, was selected purposively as the experimental group in the present study. Delhi Public School (DPS), Dumas, Surat, Gujarat, also an English medium CBSE school, was selected purposively as the control group in the present study. All the standard XI

students with biology as the specialization of both the selected schools constituted as the sample for the present study and served as experimental and control group respectively. There were 23 student in the sample of both experimental and control group. Pre-test of Achievement in Biology was administered to both control and experimental group and the students of the both group were assigned marks in biology i.e. pre-test achievement score. On the basis of pretest score both group were made equivalent and finally each group contained 22 students. These groups can be called as equivalent groups having same group statistics like Mean, Standard Deviation and Standard error of Mean. Hence, sample for the present study comprised of 22 standard XI biology students of CBSE affiliated schools for both experimental and control group.

3.6.0 TOOLS FOR DATA COLLECTION

To achieve the objectives of the present study, an achievement test in Biology and a reaction scale were constructed by the researcher. Detailed procedure followed for the construction of these tools is given as follow.

ACHIEVEMENT TEST

An achievement test in biology was constructed to study the academic achievement of students (both pre and post -test for the both experimental and controlled group). The achievement test constituted the question covering the content of chapter 1 to 22 of Biology Textbook for Class XI prepared by NCERT. The researcher prepared a blueprint for the construction of achievement test in Biology. There were of 100 multiple choice questions in the achievement prepared on the basis of the blue print. The test was of 200 marks as each question carries 2 marks. Questions were selected from all 22 chapters with coverage of knowledge, understanding and application levels. The constructed question paper was shown to ten experts (Teachers) in the field of biology for the purpose of its validation. Suggestions of experts were incorporated in the biology achievement test. Reliability of the test was determined by administering this test to 50 biology student of class XI standard in different CBSE schools of Surat. The reliability coefficient using split half method was found to be 0.94 showing a high level of reliability. The achievement test is given in Appendix III.

REACTION SCALE

A Likert type five point Reaction scale was constructed to collect the reaction of students towards the developed Constructivist Learning Strategy (CLS) to teach Biology. It contained 35 statements covering various activities related to the Constructivist Learning Strategy like, visit to Zoo, Botanical Garden, Medical College, Laboratory Work, Video Films etc. The five points used to get the reactions were Strongly Disagree, Disagree, Agree, Can't Say, Agree and Strongly Agree. Students were asked to give their reaction by putting a tick mark ($\sqrt{}$) in the appropriate box for each statement. To validate the reaction scale, it was shown to ten teacher educators having expertise in designing educational tools for their suggestions and their suggestion were incorporated. The reaction scale is given in Appendix III.

3.7.0 DEVELOPMENT OF CONSTRUCTIVE LEARNING STRATEGIES

The researcher developed Constructive Learning Strategies to create learning situation for experimental group of Biology student for class XI of CBSE affiliated schools. The researcher adopted different strategies as per the demand of the content of the syllabus. Following components were included in the developed Constructive Learning Strategies.

- Education Tour to ZOO: Organizing education tour to zoo to provide learning condition for student to develop skill related to Animal Diversity.
- Education tour to BOTANICAL GARDEN: Organizing education tour to BOTANICAL GARDEN to provide learning condition for student to develop skill related to Plant Diversity.
- Organizing education tour to MEDICAL COLLEGE to provide learning condition for student to develop skill related to Human Physiology and Anatomy.
- Arranging JIGSAW I, II and PUZZLES to provide learning situation for student to learn structure cell and function.
- Exposure to EXTENSIVE LABORATORY EXPERIMENTATION to provide learning condition for the student to develop skill related to morphology and anatomy of plant and animals.

- Presentation of VIDEO FILM to provide learning conditions for the student to develop skill related to plant and animal physiology.

The developed constructive learning strategies were shown to 10 experts. All these experts were asked to give their feedback for the improvement of the developed strategies. On the basis of their feedback and suggestion the strategies were modified and made it ready for the experiment.

A Pilot study is a small and prior experiment designed to test the feasibility of the prepared strategy. The Pilot study of the Constructive Learning Strategies (CLS) was done with class XI Biology student of session 2011-2012 of the same School. On the basis of the interaction with students, resource persons of Zoological Park, Botanical Garden, Medical College and Computer Operators, laboratory Assistants etc. Necessary changes were done in the designed strategies. Detailed CLS is given in Appendix-1

3.8.0. IMPLEMENTATION OF THE CONSTRUCTIVE LEARNING STRATEGIES

The researcher implemented the developed Constructive Learning Strategies on the Standard XI Biology students of the P.P. Savani Chaitanya Vidya Sankul, Surat during the academic Session 2012-2013. Details of the activities conducted is given as follow.

Tour to Sarthana Nature Park (Sarthana, Nana Varachha, Surat)

The researcher selected some spots to provide learning situation about Biology contents related to plant, animal diversity and deep understanding of human physiology and anatomy. One day educational tour was organized to Sarthana National Park, Surat, Gujarat It is an eighty one acres land of Nature Park fully vegetated with big trees. The existing open land was utilized for mass plantation with trees like, Casurina, *Acacia,* Teak, Albizziaetc which have now been fully grown to give a look like forest. It has enclosures of mammals, reptiles and birds. These enclosures are designed and placed according to habits and behaviors of different animals. Individual design of enclosure is also prepared with natural environmental

condition moat type design concept. Overall view of animal's habitat was like a natural habitat. The species which were displayed were as below.

- **Mammals:** Lion, Tiger, Panther, Four Horned Antelope, Deer/ Manipuri Deer, Chinkara, Black Buck, Wolf, Wild Ass, Hyena, Sloth Bear, Hog Deer, Himalayan Bear, Otter, Indian Wild Buffalo, Nilgai, Samber, Lion Tailed Macaque, Spotted Deer, Hippo etc.
- **Birds:** Pelican, Flamingo, Pheasants, Parrot, Stork, Crane, Cassowary, Cuckoo, Dove, Falcon, Lorry Dusky, Macaw, Lorikeet, Rainbow Moorhen Purple, Peacock, Emu etc.
- **Reptiles:** Crocodile, Ghariyal, Tortoise, Python, Snakes etc.

Tour to Waghai Botanical Garden

The researcher has organized one day educational tour to WAGHAI Botanical Garden after taking due permission from the authorities for deeper understanding of plant diversity among students of experimental group. The botanical garden is spread over an area of 24 hectare and named after the nearby town Waghai situated about 2 km away from it. Waghai botanical garden is one of the prime gardens in the state of Gujarat. The garden is famous for nurturing endangered, exceptional and widespread species of 1400 plants with diverse range. It was made in 1966 to house about 1077 genera of nearly 100 plant families. The garden is helpful to provide wide range of learning situations for student to know about native and exotic plant samples. They learnt the techniques to identify plants, their uses as food, medicines etc.

Tour to Surat Municipal Institute of Medical Education and Research-SMIMER Surat, Gujarat, 395010

The researcher organized one day educational tour to SMIMER for creating learning situation for the experimental group to develop their understanding about human Anatomy and Physiology after due permission from authorities. It was established in the year 2000 to provide tertiary level health care to citizens and for quality medical education to the student's community. The campus is spread in an area of 25 acres as per the guidelines and regulation prescribed by the Medical Council of India. Presently this institute has all infrastructural facilities including buildings, equipment and instruments, staff and material required for patients to cater to the health needs of both outdoor and indoor patients and to provide educational facilities to an annual

intake of 150 students. It is conducting both undergraduate and post graduate courses. Student of experimental group were asked to visit the labs, museums of various department like department of Anatomy, Physiology, Forensic Medicine and Toxicology and Blood Bank under the supervision of Resource Person appointed by various departmental heads. Students were asked to submit report in detail about their experience and skill acquired after visiting the SMIMER.

Arranging Jigsaw I and II and Puzzles to Provide Learning Situation for Student to Learn Cell: Structure and Function

The researcher developed cross word puzzle as per the requirement of the syllabus. The puzzle sheet was distributed in six groups. Each group was having four students except last which was having only three students. Groups were formed as per the skill level without any disparity. Each group has to solve their puzzle sheet then they can submit their report to the researcher. In this way researcher have allowed student to solve the entire sheet and discuss it first in their group then they were allowed to help other group to solve the puzzles. Student has to share their skill in very co-operative manner without any indiscipline.

Extensive Laboratory Experimentation to Provide Learning Condition for the Student to Develop Skill Related To Morphology and Anatomy of Plant and Animals

The researcher provided various instrument, guidelines to perform extensive laboratory work related to various contents of their syllabus. Experiments were performed at individual levels under the supervision and guidance of the researchers. Each student was asked to perform experiment as per the level of their curiosity. They were asked to share their methodology with one another and closely observe the result and finding of their experiment. They were asked to draw the diagram of microscopic structure of various parts of plant and animals and present a detail report to the researcher.

Presentation of Video Film to Provide Learning Conditions for the Student to Develop Skill Related to Plant and Animal Physiology

The researcher downloaded various video films from YouTube considering the content and quality of the video. These video were shown to student in comfortable classroom conditions and timing. Students were asked to raise question freely wherever they were having doubts. When doubts were asked the researcher gave

chance to other student to clear doubt and their answer were reinforced and corrected by researcher as per the demand of the question in a very friendly environment. In the last doubt session were organized to clear all the doubts. Finally a quiz was organized to test the understanding and knowledge of the student by dividing student in two groups.

3.9.0   PROCEDURE OF DATA COLLECTION

Data were collected in the following three steps namely Pretesting, Implementation and Post Testing Steps.

STEP 1: PRE TESTING

The researcher administered the achievement test to both experimental and control group who were informed one week earlier. The time duration of the test was two hours thirty minutes. The questions were of Multiple Choice Question (MCQ). Each question carrying 2 marks each. Both the group were made equivalent on the basis of their pretest scores. Ultimately 22 students were selected in each group for the present study.

STEP 2: IMPLEMENTATION

The researcher being Biology teacher in the same school implemented the developed CLS after taking permission from authorities in the whole session 2012-13., starting from June 2012 to February 2013. Throughout the session the researcher provided and created various learning situation which enabled student to constructive their own knowledge about various contents of their syllabus. The researcher worked as moral supporter, friend, guide and motivated student of experimental group to experience the generation of knowledge rather than mugging it from the text books. During the same time the control group was taught by their teacher through traditional methods. Few pictures are added here showing the student and researcher busy in completing their tasks.

Figure No. 3.1: The Researcher with his Team of Learner

Figure No. 3.2: The Researcher with his Team of Learner inside Bus

Figure No. 3.3: The Researcher with his Team of Learner in SMIMER Campus

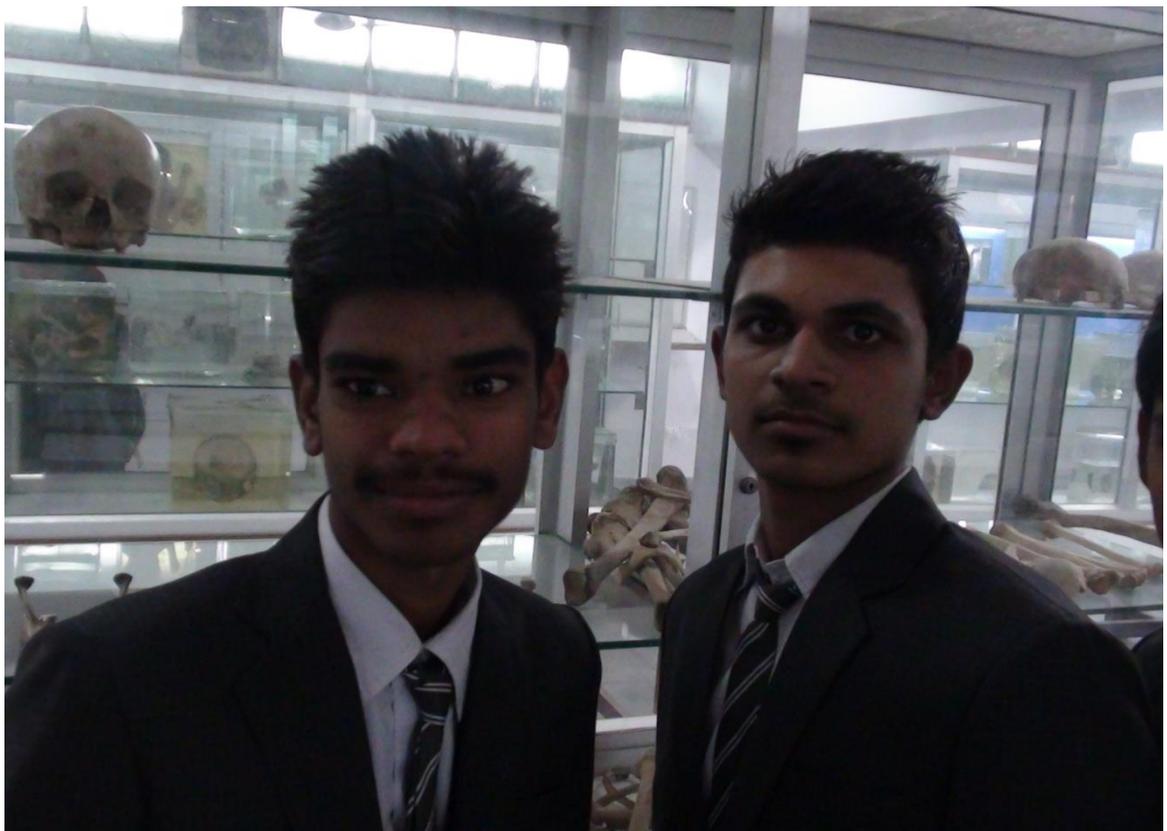**Figure No. 3.4:** Learner Getting Hands on Experiences

Figure No. 3.5: Learner developing the Observation Skills

Figure No. 3.6: Learner Developing Advance Scientific Methods Skill

Figure No.3.7: Learner Showing Confidence in Learning New Skill

Figure 3.8: Butterfly Giving Pose for Student

Figure No. 3.9: Duck Showing Emotional Attachment among them

3.10.0 DATA COLLECTION

Pre-test of Achievement in Biology was administered to both control and experimental group and On the basis of pretest score both group were made equivalent. The researcher administered the same developed achievement test used during pre-test in both the experimental and control group for post testing. The developed Reaction Scale was also administered in the experimental group to know student reaction towards CLS.

3.11.0 PROCEDURE FOR THE DATA ANALYSIS

The researcher used quantitative data analysis techniques to analyze the data obtained by pre/post testing. Pre- test achievement test scores were used to make experimental and control group equivalent. Standard Deviation, standard error of mean and Mann – Whitney U test were used by researcher to analyze the post- test achievement test. The non-parametric Mann-Whitney U test was used as the sample was selected purposively. Reaction Scale data was analyzed quantitatively by percentage analysis and intensity index.