CHAPTER V

SUMMARY

5.0.0 INTRODUCTION

Biological disciplines imply a significant responsibility for the protection and welfare of all living species. There are many species of living organisms which need to be studied. The knowledge about the diversity of life forms and their conservation and exploitation is of great importance for our day by day life. We need to know about various physiological processes taking place inside our own body. When we get ill our doctor should be able to diagnose our illness. We should be familiar with normal organic functions of the living system. The studies on the origin of diseases and plagues are also answerable by means of biology. It is also required to study about the etiology of cancer, infections, functional problems, the damage to fruits, the pathologies of farm animals, plants, trees etc. Food resources and quality, factors that causes illness, plagues, sustainable exploitation of natural resources, the enhancement and development of useful species, the discovery and production of medicines, the study of functions of living beings, their inheritance etc., all are field of research through biology. The food that we consume are materials produced by living beings. In biology we also study about the living being and the processes implied in the production of nutritional substances. Besides, by means of biotechnology, the biologists search for the methods that make to the producers to be more efficient in the elaboration of food and other supplies for humans. The biology covers the study of all living organisms and their interaction into biosphere. This is a very important task because we are able to know the behavior or the functioning of the each population when it faces to other individuals from other population or communities and how the population or the specific sector of the biosphere are affected or benefited by the behavior or functioning of the population into community. The biology also investigates the environmental factors that surround the living beings. The conservational biology by means of conservationism, it seeks for more effective ways to understand the variations or new conditions of the environment that can threaten the existence of living on our planet. Acquiring knowledge and skill about biology are very important to our students and their future. Therefore proper

transaction of biological information is very important to all in general and biology students in particular.

In rapidly changing society the traditional methods of transaction of information are not capable to satisfy demand and requirement of the present generation. The rate of generation of knowledge has increased many a times therefore only knowledge that is prescribed in the text book is not sufficient to satisfy demands. Students have to construct their own knowledge to update themselves as per the technologically fast society. Thus new learning methods are required to help them and here the constructivism give them chance to solve their problems of day to day life. Considering the effectiveness of constructive learning strategies the researcher designed some techniques like Educational Tour to Botanical Garden, Zoological Parks, Medical College, Extensive Laboratory Work, Puzzles and Video Film to help students to construct their own knowledge. The researcher implemented these techniques and asses their effectiveness and efficiency while teaching experimental group of class XI biology of a CBSE affiliated English medium school of Surat city.

5.1.0 THE REVIEW OF RELATED LITERATURE

The researcher has reviewed researches both from India and abroad. Indian researcher like Santosh (2012) studied "A Comparative study of effectiveness of Student –Team Achievement Division (STAD) and Jigsaw methods of Cooperative learning".

Researchers like Beeth, et.al, (1996), Lord, T. (1998), , Switzer, P.V., & Shriner, W.M. (2000),Bollinger D. (2005), Fardanesh H., (2006), Kim J. S, (2006), Karaduman H. and Gultekin M., (2007), Mccray K.,(2007), Dogru M. and Kalender S., (2007), Chindgren T (2008), Koseoglu F. and Tasdelen U (2008), Yorek Nurettin al., (2008), Ngambi & Johnsyson (2009),Drexler W. (2010), Neo M. and Neo T., (2010), have discussed about various aspects of constructivism in teaching learning process.

The laboratory work positively affects students' scientific attitudes, thought and mental faculties supported by Switzer et al. (2000), Hussein (2001), Dikmenli M. (2009), Ensaf George Salameh El-Rabadi (2013), Bethanie C. A. (2015).

Teachers also need educational videos and games as well other educational materials in Biology class. Researchers likeSingh, Y. G. (2010), Aloraini S. (2011), Kumar,

K.S. Kiran (2011), Willmot et al (2012) have extensively work on various aspect of educational video , games and their effect on student learning.

Jigsaw technique play essential role in sharing information within and outside of group and it is supported by the work of Aranson et al. (2011) and Santosh (2012).

Phenomenal memory for facts and things seen and heard in strange sorroudings and under unusual conditions strengthen student's learning through field visit supported by Megan C. L. (2011), Shakil A.F. (2011), Behrendt M. (2013).

5.2.0 RATIONALE

Teaching biology from traditional methods is simply passing outdated bookish knowledge to younger generation. Here the student are considered as empty bottle to be filled with the expired knowledge of teacher. The new generation new knowledge as the outdated knowledge cannot solve the problem of present generation. Biology teaching is very complex process as here the learner have to deal with living organism. It is not as simple as teaching of physical sciences. One mistake in this field may take the life of an organism and can save it. It is very delicate subject which requires deeper understanding about the subject. New methodology need to be adopted while teaching this subject. The constructivist approach is one of the promising methodology which can be very helpful. In this approach every learner is very unique person supported by Wertsch (1997).

The biology at secondary level provide scope for the entry in the medical science therefore the learner need to be very responsible. In the medical field the doctor can save the life and can kill it. As a responsible doctor they have to learn various skills which is also their responsibility. This is also supported by Glaserfeld et al. (1998) where he said that the responsibility for learning should reside increasingly with the learner.

Biology teaching and learning requires longtime to develop the required skill. The learner need to be self-motivated and confident as said by Von Lagerfeld (1989) sustaining motivation to learn is strongly dependent on the learner's confidence in his or her potential for learning.

Biology incorporates learning about various plant and animals. These also have various social importance. Professionals of this field have different roles in their society. They have to follow some social norms and ethics as per the society and

culture of the area. It has been said by social constructivist Wertsch (1997) that the background and culture of the learner throughout the learning process, helps to shape the knowledge and truth that the learner creates, discovers and attains in the learning process.

While teaching learning biology teacher need to facilitate the learning of the student which is supported by Bauersfeld, (1995) when he said that instructors have to adapt to the role of facilitators and not teachers. This dramatic change of role implies that a facilitator needs to display a totally different set of skills than a teacher said by Brownstein (2001). A teacher mostly gives a monologue, a facilitator is in continuous dialogue with the learners opinioned by Rhodes and Bellamy (1999).

The learning environment should also be designed to support and challenge the learner's thinking Di Vesta, (1987). The role of the facilitator in the social constructivist viewpoint is that the instructor and the learners are equally involved in learning from each other as well Willard and Holt (2000). Learners and instructors should develop an awareness of each other's viewpoints and then look to their own beliefs, standards and values, thus being both subjective and objective at the same time Savery (1994). Some studies argue for the importance of mentoring in the process of learning Archee and Duin (1995) Brown et al. (1989). Social constructivism, strongly influenced by Vygotsky's (1978) work, suggest that knowledge is first constructed in a social context and is then appropriated by individuals Bruning et al. (1999), M. Cole, (1991), Eggan & Kauchak, (2004).

In biology teaching sharing of knowledge is very crucial which is supported by social constructivists, the process of sharing individual perspectives-called collaborative elaboration results in learners constructing understanding together that wouldn't be possible alone Greeno et al., (1996). Team work is the key of success in teaching and learning biology which is supported by Kukla (2000) who argues that reality is constructed by our own activities and that people, together as members of a society, invent the properties of the world. Creativity is the bone of learning and teaching biology which is supported by Prawat and Floden (1994) when they said that knowledge is thus a product of humans and is socially and culturally constructed. Biology learning and teaching requires the social understanding among various members which is supported by McMahon (1997) who argues that learning is a social process. He further states that learning is not a process that only takes place inside our minds, nor is it a passive development of our behaviors that is shaped by external

forces and that meaningful learning occurs when individuals are engaged in social activities. Biology learning and teaching requires the integration of difference sciences thus it need to be linked with other subjects as biophysics, biochemistry, biostatistics and many more. It also has root in constructivism where McMahon (1997) and Di Vesta (1987) found that Knowledge should not be divided into different subjects or compartments, but should be discovered as an integrated whole.

Biology teaching and learning is very challenging as the living organism are having capacity to adopt and develop variation. Therefore the learners and teachers are constantly challenged and after overcoming it they develop confidence supported by Brownstein (2001) when he said that previous successes enhance learner confidence. Learners must not only have ownership of the learning or problem-solving process, but of the problem itself Derry (1999).

Emotion is a biological product it need to be handled properly while learning and teaching biology. In biology we have to deals with living systems thus it need to be considered also. The emotions and life contexts of those involved in the learning process must therefore be considered as an integral part of learning. The goal of the learner is central in considering, what is learned Brown et al., (1989) and Ackerman (1996).

Lord (1990) in his study of environmental science discovered that students in constructivist classes performed significantly better on exams and rated the course higher and participated more. Lord, T.R. (1997), found that the constructivist treated group out-performed the traditionally taught cohort on identical evaluations. Lunsford et al. (1997), in a their study of Active Learning in Anatomy and Physiology found that inquiry-based strategies, if properly implemented in the classroom, are not a detriment to future Allied Health students when they take licensing exams.

At senior secondary level biology is a preparatory stage to enter into medical, paramedical and allied fields that why at this level student need proper preparation to develop interest in these fields and for this they should have sound knowledge and background to do well, thus need knowledge and thinking process to do something new and creative. For this, they need different type of teaching learning paradigm which is possible by constructive learning approach; it can help them to have a sound background to enter in medical, paramedical and allied branches.

Class XI and XII both are stages to prepare student for any professional line as class XII is associated with stage end examination (board examination) the researcher has more scope to experiment something new for class XI student hence he has selected class XI for his study . Though this area is having big scope for solving the problems of biology teaching, the area is not much explored in biosciences in India. The demand of 21st century is to adopt innovative teaching method in various field of teaching therefore the researcher is interested in conducting this research. For conducting this research following questions were raised in the researcher's mind which needs to be answered.

5.3.0 RESEARCH QUESTIONS

In the process of formulating the present study, the following research questions strike the mind of the researcher.

- Whether Constructive Learning Approach (CLA) is feasible in teaching biology?
- Whether CLA enhances achievement of student of biology?
- Whether CLA generates interest in teaching biology?

5.4.0 STATEMENT OF THE PROBLEM

TEACHING BIOLOGY AT SENIOR SECONDARY LEVEL THROUGH CONSTRUCTIVIST APPROACH

5.5.0 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 (CLS) to teach biology at Senior Secondary Level.
3. To study the effectiveness of Constructivist Learning Strategy (CLS) in terms of students achievement in biology.
4. To study the effectiveness of Constructivist Learning Strategy (CLS) in terms of students reaction towards it.

5.6.0 HYPOTHESIS

The following hypothesis was formed which was tested at 0.01 level of significance.
There will be no significant difference between the mean biology post-test achievement scores of students' of experimental and control group those are made equivalent (paired) with the help of their pre-test score in biology.

5.7.0 EXPLANATION OF TERMS

Constructivist Learning Strategy (CLS): In the present study CLS means brainstorming session, visit to botanical garden, zoological parks, extensive laboratory work, jigsaw I &II, animated film strips, and visit to a medical college.
Biology Teaching: Here it refers to teaching of biology for class XI CBSE syllabus.

5.8.0 OPERATIONAL DEFINITION OF THE TERMS

Achievement on Biology: Achievement in biology will be the marks secured by the students in achievement test which will be constructed by the researcher.
Reaction of Students: The preference (agree or disagree) of the students towards the statements related to the teaching of biology using CLS in a five point reaction scale prepared by the researcher will be the reaction of students towards the components of teaching biology using CLS. The central point of reactions towards the statements will be the reaction towards teaching biology using CLS.

5.9.0 DELIMITATION OF THE STUDY

The present study is delimited to all five Units of class XI biology curriculum to English medium schools affiliated to CBSE published by NCERT, New Delhi.

5.10.0 METHOD OF THE STUDY

The present study was experimental in its nature. The methodology of the proposed study was consist of the following points.

5.11.0 RESEARCH DESIGN

Considering the experimental nature of the study quasi-experimental design was used for the present study. The pretest-posttest nonequivalent controlled group design was followed in this research. The design of the study is presented as follow.

O_1 X O_2

O_3 C O_4

(Where, O_1 and O_3 are pretest

O_2 and O_4 are posttest

X stands for Experimental Group and

C stands for Control Group)

Following this design, the achievement of students in biology was measured before and after the experimentation. The similar procedure was followed for control group.

5.12.0 POPULATION

All the standard XI English medium students with biology as the specialization of the schools in Gujarat affiliated to CBSE constituted as the population of the present study.

5.13.0 SAMPLE

Non-probability sampling design was adopted by the researcher for the present study. P.P. Savani Chaitanya Vidya Sankul, Surat, Gujarat, which is an English medium CBSE school, was selected purposively as the experimental group in the present study. Delhi Public School (DPS), Surat, Gujarat, which is 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 students in the sample of both experimental and control group. These groups were made equivalent on the basis of their pre-test score and hence, sample comprised of 22 biology students of standard XI of CBSE affiliated schools for experimental group and control group.

5.14.0 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 tools is given as follow.

ACHIEVEMENT TEST

An Achievement test was constructed to study the academic achievement of student. The achievement test constituted the question covering the content of chapter 1 to 22 of textbook " Biology Textbook for Class XI" prepared by NCERT, recommended by central board of secondary education for syllabus completion. The researcher outlined the blueprint of achievement test. It was of 100 multiple choice question. Each question carrying 2 mark thus total of 200 marks. Questions were from all 22 chapters with coverage to knowledge, understanding and application level question. Content validity of the test was determined by Content validity of the test was determined by ten expert teachers in the field of biology from different CBSE schools of Surat. The reliability coefficient using split half method was found to be 0.94.

REACTION SCALE

A Likert type five point reaction scale was developed to assess the reactions of students towards constructive methods of learning. It contained 35 statements covering various activities related to visit to zoo, botanical garden, medical college, laboratory work and video films. The five points of reaction were strongly Disagree, Disagree, Agree, Neutral, Agree, Strongly Agree. The validation of the reaction scale was done by ten teacher educators.

5.15.0 DEVELOPMENT OF CONSTRUCTIVE LEARNING STRATEGIES

The researcher developed constructive learning strategies to create learning situation for experimental group of biology students for class XI of CBSE affiliated schools. The researcher adopted different strategies as per the demand of the contents of the syllabus, which are as below-

- Organizing education tour to zoo to provide learning condition for students to develop skill related to animal diversity.

- Organizing education tour to botanical garden to provide learning condition for students to develop skill related to plant diversity.
- Organizing education tour to medical college to provide learning condition for students to develop skill related to human physiology and anatomy.
- Arranging jigsaw I&II and puzzles to provide learning situation for students to learn structure cell and function.
- Extensive laboratory experimentation to provide learning condition for the students do develop skills related to morphology and anatomy of plant and animals.
- Presentation of video film to provide learning conditions for the students to develop skill related to plant and animal physiology.

5.16.0 PROCEDURE OF DATA COLLECTION

Data was collected in these following three steps.

STEP 1: PRE TESTING

The researcher administered the achievement test to both experimental and control group. Both the group were made equivalent on the basis of the pretest scores and 22 students were selected in each group.

STEP 2: IMPLEMENTATION OF STRATEGY

The researcher being biology teacher in the same school implemented the developed CLS after taking permission from authorities for the whole session (2012-13) starting from June 2012 to February 2013. Throughout the session the researcher provided and created various learning situations which enabled students to constructive their own knowledge about various contents of the 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.

STEP 3: POST TESTING

The researcher administered the same achievement test as post-test in both the experimental and control group. The developed reaction scale was also administered in the experimental group to know students reaction towards CLS.

5.17.0 PROCEDURE FOR THE DATA ANALYSIS

The researcher used quantitative data analysis techniques to analyze the data obtained by pre/post testing. Pre-test achievement scores were used to make experimental and control group equivalent. Standard deviation, standard error of mean and Mann – Whitney (U) tests were used by researcher to analyze the post- test achievement score. 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.

5.18.0 MAJOR FINDINGS OF THE STUDY

Following major finding were drawn from the present study.

1. The Constructive Learning Strategies (CLS) were found to be significantly effective in terms of enhancing student's achievement in Biology in comparison to the traditional approach.
2. The Constructive Learning Strategies (CLS) were also found to be effective in terms of the reaction of students towards it.

5.19.0 SUGGESTIONS FOR FUTURE RESEARCH

The present study was limited to Biology teaching at standard XI in a CBSE affiliated school of Surat in Gujarat. The CLS treatment was given to Biology students only of P.P. Savani Chaitanya Vidya Sankul, Abrama. The researcher would like to suggest some more area and issues for the further studies which are as below.

- Similar study can be conducted into other standards and in different affiliated boards.
- CLS can be implemented in other subjects also.
- Some more CLS can be adopted by future researchers.

5.20.0 CONCLUSION

Constructive teaching is based on constructive learning theory and on the belief that learning occurs as learners are actively involved in the process of learning and knowledge construction as opposed to passively receiving information. Learners are maker of meaning and knowledge. Constructive teaching fosters critical thinking and creates motivated and independent learners. This theoretical framework holds that learning always builds upon knowledge a student already knows; this prior knowledge is called a Schema. Because all learning is filtered through this pre-existing schemata. Constructivists suggest that learning is more effective when a student is actively engaged in the learning process rather than attempting to receive knowledge passively. A wide variety of methods claim to be based on constructive learning theory. Most of these methods rely on some form of guided discovery where the teacher avoids most direct instruction and attempts to lead the students through questions and activities to discover, discuss, appreciate, and verbalize the new knowledge. The present study was an effort in this direction and focused to teach biology through some of constructive learning strategies (CLS).

The major findings of the present study states that the constructive learning strategies (CLS) were found to be significantly effective in terms of enhancing student's achievement in biology in comparison to the traditional approach. The constructive learning strategies (CLS) were also found to be effective in terms of the reaction of students towards it.

Findings of the study conducted by Megan C. L. (2011), Shakil A.F. (2011), Behrendt M.(2013). support the findings of the present study that state that the field experiences as being positively correleated to student achievement and motivation. Study conducted by Salameh (2002) too supports the findings of the present study. He pointed out that planning for the practical lesson is important because it stimulates the students' interest. The students of experimental group scored significantly higher than those of the control group. Study conducted by Aranson et al. (1978), also support the findings of the present study in which they have stated that jigsaw technique is helpful in terms of academic achievement, attitudes towards and self-efficacy in biology teaching. Study conducted by Singh, Y. G. (2010), Aloraini S. (2011), Kumar, K.S. Kiran (2011), Willmot et al (2012)also support the findings of the present study in

which they have pointed out thatfilms,video clips are useful in terms of helping the students better understand the concepts taught. Beside the above studies which support the findings of the present study there are studies that contradict the findings of the present study . The study conducted by Escalada and Zollman (1997), showed that there were no significant differences in the achievement between the experimental and control groups in an introductory college physics course taught by interactice video.

Braund & Reiss (2006) in their study said that science learning outside of school was infrequently substantial. Misconceptions were fostered, and student's motivation was due to entertainment. The reason that could be associated to such findings are the way activities (CLS) might have organized in the past or mere planning might not bring desired result but its implementation matters much. The better achievement scores of experimental group in biology of the present study shows the quality of planning of various CLS and their effective implementation.

The findings of the present study show that the constructive learning strategies (CLS) were more effective than the traditional method of teaching in terms of achievement of students in biology. They may be associated to the facts that teaching by traditional method places students in a passive rather than an active role, which hinders learning. It encourages one way communication, in contrast the CLS is an interactive method where students are actively working with the materials. CLS have provided them wide range of activities which they enjoyed while learning and constructing their new knowledge therefore CLS were found more effective in comparison to traditional methods of teaching and learning.

The reactions of the students toward CLS were favorable. The reason may be attributed to wide range of activities provided to them during their construction of the knowledge. CLS provided them free communication among the team members as well as teacher to discuss their problems and get their doubts resolved easily. CLS also aroused interest of students to the relevant content of their syllabus. It also provided chance to students to test their own ideas, questions and freedom to give their rational comment on the various activities. Students at this level like adventure, experimentation, observation, video film, debate, discussion, puzzles which are very important parts of the implemented CLS and could be attributed for the favorable reaction towards it.

The results of this study have direct implication on the future methodology of teaching biology at senior secondary level and indirect implication for other subjects and levels. This study emphasizes careful planning of constructive learning strategies as per the demand of the syllabus and levels of the students. It emphasizes various activities like systematic organization of educational tour to the demand of the syllabus, extensive laboratory experimentation, organizing quizzes, brainstorming session to engage students in exploring the world of knowledge.