CHAPTER IV

DATA ANALYSIS, INTERPRETATION AND DISCUSSION

4.0.0 INTRODUCTION

Data analysis is a process to transform, remodel and revise data with a view to arrive at certain conclusions. Data analysis provides us some meaningful value that is comparable, and can be understood and interpreted easily. Data analysis also helps researcher either to accept or reject the research hypothesis. It helps researcher to formulate the theory. Without data analysis any researcher cannot give meaningful solution to his problem. This chapter deals with the data analysis and interpretation of the data collected through Achievement Test and Reaction Scale used in the present study.

The present study is an experimental study conducted with a quasi-experimental research design. The researcher has collected data by administering achievement test on both experimental and control groups. Pretest scores were used to make both groups equivalent. After making both groups equivalent the sample size of the both groups became 22 on which post test was administered after the experimentation. The data obtained by posttest was analyzed to achieve the objectives of the present study. As the study was quantitative in nature, the researcher used the quantitative statistical techniques for the analysis of the data. The statistical techniques like Mean, Standard Deviation (SD), Standard Error of Mean (SE), Mann-Whitney U- Test, percentage and Intensity Index (II) were used.

The selection of the sample was purposive and assumption of parametric statistics cannot be used for the present data. Therefore, the researcher used Mann- Whitney U-Test for the data analysis which is presented as below.

4.1.0 ACHIEVEMENT OF EXPERIMENTAL AND CONTROL GROUP IN BIOLOGY

To achieve objective 3 of the present study i.e. “To study the effectiveness of Constructive Learning Strategies (CLS) in terms of student’s achievement in Biology” and to test the null hypothesis i.e. “There will be no significant difference between the mean Biology post-test achievement scores of students of experimental and control groups those are made equivalent (paired) with the help of their pre-test

score in Biology", the analysis of data was done using statistical technique like, Mean, Standard Deviation and the Mann-Whitney U-Test. The detailed analysis is given in table 4.1 and 4.2.

Table 4.1: Mean, Standard Deviation (SD) and Standard Error of Mean (SE) of Achievement of students of Experimental and Control groups in Biology.

Groups	N	Mean	SD	SE
Experimental	22	149.6	3.34	0.71
Control	22	80.6	4.87	1.08

From table no 4.1 it was found that the mean achievement of experimental and control group in biology were 149.6 and 80.6 respectively out of total score of 200. The standard deviations from the mean were 3.34 and 4.87 for experimental and control groups, whereas, the standard error of mean were 0.71 and 1.08 respectively. Considering the mean achievement score of experimental and control groups, it can be said that both the groups did good in biology with more or less similar standard deviations and equally low level of standard error of means. Further, comparing the mean achievement scores of biology, it was found that the mean achievement score of the experimental group was higher than that of control group. From the standard deviation and standard error of mean of the both groups, it was also observed that in terms of homogeneity in the achievement, the experimental group was found more homogenous in comparison to the control group. The higher mean achievement score of experimental group in biology in comparison to control group may be due to effect of Constructive Learning Strategies (CLS). To find whether the difference in the mean was significant or by chance and to test the Null Hypothesis i.e. "There will be no significant difference between the mean biology post-test achievement scores of students of experimental and control groups those are made equivalent (paired) with the help of their pre-test score in biology", Mann-Whitney U-Test was used as the sample was taken purposively. The summary of the Mann-Whitney U-Test is given in table 4.2 which is followed by analysis.

Table 4.2: Summary of Mann-Whitney U- Test for Biology Achievement of Experimental and Control group students with Sample Size (N), Sum Ranks (∑R), U- Value, z- Value and Probability (p)

Group	N	∑R	U- Value	z- Value	Probability(p)
Experimental	22	699	39	4.77	0.00003
Control	22	292			

From table 4.2, it was observed that the sum of the ranks of the experimental group and the control group in Biology achievement were 699 and 292 respectively with 22 students in each group. The U value and z –Value were found to be 39 and 4.77 respectively. Referring the table for normal probability (Table A of Sigel, 1956) under null Hypothesis (H_0) of z, for z<=4.77, the two tailed probability was found to be 0.00003 which was lesser than our decided significance level (α) i.e. 0.01. Hence the Null Hypothesis i.e. "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" was rejected and it could be believed that experimental and control group students differ significantly in terms of their achievement in Biology. From table 4.1 it was also established that the mean achievement of the experimental group in Biology was more than the mean achievement of control group which can be attributed due to teaching Biology through Constructive Learning Strategies (CLS). Hence, it can be said that teaching Biology through Constructive Learning Strategies (CLS) was effective in enhancing students' achievement in Biology in comparison to teaching Biology through traditional approach. Thus it can be concluded that the developed CLS in Biology were found to be significantly effective in terms of enhancing student's achievement in Biology in comparison to teaching Biology through traditional approach.

4.2.0 REACTION OF STUDENTS TOWARDS CONSTRUCTIVE LEARNING STRATEGIES

The researcher taught Biology to experimental group through Constructive Learning Strategies (CLS). The reaction of students towards the implementation of CLS were

measured with the help of a reaction scale. This measurement of reaction of students towards the CLS will also help researcher to achieve objective 4 of the present study i.e. “To study the effectiveness of CLS in terms of students’ reaction towards the Teaching of Biology using CLS”. Students’ reaction may help the researcher to find out and determine the utility of these Constructive Learning Strategies for teaching of Biology to standard XI students. The reaction of students were analyzed using percentage and Intensity Index (II) which is given in Table No. 4.3 as follow.

Table-4.3 Percentagewise reaction of the students towards different components of the Constructive Learning Strategies (CLS) along with the Intensity Index (II)

Sl. No.	Statements	SD	D	N	A	SA	II
1	Brainstorming helps to develop knowledge in depth	2.86	5.71	22.86	45.71	22.86	3.8
2	Brainstorming helps in understanding the topics	2.86	5.71	34.29	45.71	14.29	3.7
3	Brainstorming encourages thinking	5.71	2.86	28.57	40	17.14	3.4
4	Brainstorming helps in organizing ideas	5.71	2.86	20	31.43	40	4
5	Brainstorming helps to generate new ideas	2.86	2.86	14.29	31.43	48.57	4.2
6	Visit to botanical garden and zoological park help in developing better understanding of living diversity	8.57	2.86	5.714	40	42.86	4.1
7	Visit to botanical garden and zoological park encourage investigation, observation, and thinking.	5.71	5.71	14.29	37.14	37.14	3.9
8	Visit to botanical garden and zoological park were helpful for gathering various information about the characteristics of plants.	2.86	5.71	5.714	48.57	37.14	4.1
9	Visit to botanical garden and zoological park provide time to interact with nature.	5.71	5.71	5.714	42.86	40	4.1

Sl. No.	Statements	SD	D	N	A	SA	II
10	Visit to botanical garden and zoological park help students to communicate their understanding of concepts with their parents, peer, and teachers.	5.71	5.71	14.29	37.14	37.14	3.9
11	Laboratory investigation promotes skills of anatomical investigations	2.86	8.57	8.571	40	40	4.1
12	Laboratory investigation helps in handling laboratory instruments and materials with care	2.86	2.86	11.43	31.43	51.43	4.3
13	Laboratory investigation arouses curiosity in observing microscopic pattern	2.86	2.86	11.43	31.43	51.43	4.3
14	Laboratory investigation develops skills of drawing internal anatomy	5.71	8.57	25.71	28.57	31.43	3.7
15	Laboratory investigation helps in identifying different parts of living organisms	2.86	5.71	11.43	40	40	4.1
16	Jigsaw I and II were helpful in sharing ideas	5.71	5.71	11.43	51.43	25.71	3.9
17	Jigsaw I and II develop team spirit among students to complete any project	2.86	5.71	11.43	42.86	37.14	4.1
18	Jigsaw I and II increase reasoning ability of students	2.86	5.71	20	40	31.43	3.9
19	Jigsaw help to respect others ideas.	8.57	5.71	25.71	34.29	25.71	3.6
20	Jigsaw I and II help in better understanding of the content.	5.71	8.57	14.29	37.14	34.29	3.9
21	Animated films help in better understanding of course content.	2.86	8.57	20	22.86	45.71	4
22	Animated films make learning interesting.	2.86	2.86	5.714	31.43	57.14	4.4
23	Animated films make learning faster.	5.71	8.57	11.43	37.14	37.14	3.9

Sl. No.	Statements	SD	D	N	A	SA	II
24	Animated films increase concentration in the classroom.	2.86	5.71	8.571	40	42.86	4.1
25	Animated films make revision easy during examination.	5.71	2.86	11.43	31.43	48.57	4.1
26	Visit to medical college helps in exploring the internal anatomy of human body.	5.71	5.71	2.857	31.43	54.29	4.2
27	Visit to medical college helps to see different types of surgical instruments.	2.86	5.71	8.571	25.71	57.14	4.3
28	Visit to medical college helps in understanding the functioning of hospital.	2.86	5.71	5.714	34.29	51.43	4.3
29	Visit to medical college develops concern for patients.	2.86	8.57	31.43	25.71	31.43	3.7
30	Visit to medical college helps to promote healthy life among students.	5.71	11.4	22.86	31.43	28.57	3.7
31	Constructivist approach helps learning a joyful experience.	2.86	8.57	5.714	48.57	34.29	4
32	Constructivist approach helps in better understanding of concepts.	2.86	5.71	14.29	48.57	28.57	3.9
33	Constructivist approach helps in developing creative ideas.	5.71	8.57	5.714	57.14	22.86	3.8
34	Constructivist approach focuses on construction rather than only giving instruction.	2.86	2.86	31.43	34.29	28.57	3.8
35	Constructivist approach helps to widen the concept of learning within and outside school	2.86	5.71	5.714	42.86	42.86	4.2
Mean Intensity Index							**4.0**

SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree

In terms of reaction of student towards the statement 1 i.e. “Brainstorming helps to develop in depth knowledge” 2.86 %, 5.71 %, 22.86 %, 45.71%, and 22.86 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.8 shows favorable reaction of the students towards the functioning of brainstorming sessions in the development of in-depth knowledge while learning Biology through CLS.

For the statement 2 i.e. “Brainstorming helps in understanding the topics”, 2.86%, 5.71%,34.29%, 45.71% and 14.29% of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.7 shows favorable reaction of the students towards brainstorming sessions for understanding the topics of Biology while learning through CLS.

In terms of reaction of student towards the statement 3 i.e. “Brainstorming encourages thinking” 5.71 %, 2.86 %, 28.57 %, 40.00 %, and 17.14 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.4 shows a neutral reaction of the students towards brainstorming sessions for encouraging their thinking while learning Biology through CLS.

For the statement 4 i.e. “Brainstorming helps in organizing ideas”, 5.71%, 2.86 %,20 %, 31.43 % and 40 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.0 shows favorable reaction of the students towards brainstorming sessions for organizing ideas in learning Biology.

In terms of reaction of student towards the statement 5 i.e. “Brainstorming helps to generate new ideas” 2.86 %, 2.86 %, 14.29 %, 31.43 %, and 48.57 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.2 shows favorable reaction of the students towards brainstorming sessions in generating new ideas in learning Biology.

For the statement 6 i.e. “Visit to botanical garden and zoological park help in developing better understanding of living diversity”, 8.57%, 2.86%,5.71%, 40.00% and 42.86% of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.1 shows favorable reaction of the students towards educational tour in developing better understanding of living diversity in learning Biology.

In terms of reaction of student's towards the statement 7 i.e. "Visit to botanical garden and zoological park encourage investigation, observation, and thinking" , 5.71 %, 5.71 %, 14.29 %, 37.14%, and 37.14 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.9 shows favorable reaction of the students towards educational tour for encouraging investigation, observation, and thinking in learning Biology.

For the statement 8 i.e. "Visit to botanical garden and zoological park were helpful for gathering various information about the characteristics of plants.", 2.86%, 5.71%,5.71%, 48.57% and 37.14% of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.1 shows favorable reaction of the students towards educational tour for gathering various information about the characteristics of plants in learning Biology.

In terms of reaction of student's towards the statement 9 i.e. "Visit to botanical garden and zoological park provide time to interact with nature" 5.71 %, 5.71 %, 5.71 %, 442.86%, and 40.00 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.1 shows favorable reaction of the students towards educational tour by providing time to interact with nature in learning Biology.

For the statement 10 i.e. "Visit to botanical garden and zoological park help students to communicate their understanding of concepts with their parents, peer, and teachers.", 5.71%, 5.71%,14.29%, 37.14% and 37.14% of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.9 shows favorable reaction of the students towards educational tour to communicate their understanding of concepts with their parents, peer, and teachers in learning Biology.

In terms of reaction of student's towards the statement 11 i.e. "Laboratory investigation promotes skill of anatomical investigations" 2.86 %, 8.57 %, 8.57 %, 40.00%, and 40.00% of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.1 shows favorable reaction of the students towards laboratory investigations in promoting skill of anatomical investigations for learning Biology.

For the statement 12 i.e. "Laboratory investigation helps in handling laboratory instruments, materials with care", 2.86%, 2.86%,11.43%, 31.43% and 51.43% of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and

Strongly Agree respectively. The Intensity Index of 4.3 shows favorable reaction of the students towards laboratory investigations in handling laboratory instruments, materials with care for learning Biology.

In terms of reaction of student's towards the statement 13 i.e. "Laboratory investigation arouses curiosity in observing microscopic pattern" 2.86 %, 2.86 %, 11.43 %, 31.43 %, and 51.43 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.3 shows favorable reaction of the students towards laboratory investigations arouses curiosity in observing microscopic pattern in learning Biology.

For the statement 14 i.e. "Laboratory investigation develops skill of drawing internal anatomy", 5.71%, 8.57%, 25.71%, 28.57% and 31.43 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.7 shows favorable reaction of the students towards laboratory investigations in developing skill of drawing internal anatomy for learning Biology.

In terms of reaction of student's towards the statement 15 i.e. "Laboratory investigation helps in identifying differences between different parts of living organisms" 2.86 %, 5.71 %, 11.43 %, 40.00%, and 40.00 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.1 shows favorable reaction of the students towards laboratory investigations in identifying differences between different parts of living organisms in learning Biology.

For the statement 16 i.e. "Jigsaw I and II were helpful in sharing ideas", 5.71%, 5.71%, 11.43%, 51.43% and 25.71 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.9 shows favorable reaction of the students towards Jigsaw I and II in sharing ideas for learning Biology.

In terms of reaction of student's towards the statement 17 i.e. "Jigsaw I and II develop team spirit among students to complete any project" 2.86 %, 5.71 %, 11.43 %, 42.86%, and 37.14 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.1 shows favorable reaction of the students towards Jigsaw I and Jigsaw in developing team spirit among students to complete any project for learning Biology.

For the statement 18 i.e. “Jigsaw I and II increase reasoning ability of students”, 2.86%, 5.71%, 20.00%, 40.00 % and 31.45 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.9 shows favorable reaction of the students towards Jigsaw I and Jigsaw II in increasing reasoning ability of students for learning Biology.

In terms of reaction of student’s towards the statement 19 i.e. “Jigsaw I and II help to respect others ideas” 8.57 %, 5.71 %, 25.71 %, 34.29%, and 25.71 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.6 shows favorable reaction of the students towards Jigsaw I and Jigsaw II help to respect others ideas in learning Biology.

For the statement 20 i.e. “Jigsaw I and II help in better understanding of the content”, 2.71%, 8.57%,14.29%, 37.14% and 34.29% of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.9 shows favorable reaction of the students towards Jigsaw I and Jigsaw II for better understanding of the content in learning Biology.

In terms of reaction of student’s towards the statement 21 i.e. “Animated films help in better understanding of course content” 2.86 %, 8.57 %, 20.00 %, 22.86 %, and 45.71 % of them reacted Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.0 shows favorable reaction of the students towards animated films for better understanding of course content in learning Biology.

For the statement 22 i.e. “Animated films make learning interesting”, 2.86%, 2.86%,5.71%, 31.43% and 57.14% of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.9 shows favorable reaction of the students towards animated film to make learning interesting in learning Biology.

In terms of reaction of student’s towards the statement 23 i.e. “Animated films make learning faster” 5.71%, 8.57 %, 11.43 %, 37.14 %, and 37.14 % of them reacted Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.9 shows favorable reaction of the students towards animated film to make learning faster in Biology.

For the statement 24 i.e. “Animated films increase concentration in the classroom”, 2.86%, 5.71%, 8.57%, 40.00 % and 42.86 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The

Intensity Index of 4.1 shows favorable reaction of the students towards animated film to increase concentration in the classroom in learning Biology.

In terms of reaction of student's towards the statement 25 i.e. "Animated films make revision easy during examination" 5.71%, 2.86 %, 11.43 %, 31.43 %, and 48.57 % of them reacted Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.1 shows favorable reaction of the students towards animated film to make revision easy during examination in Biology.

For the statement 26 i.e. "Visit to Medical College helps in exploring the internal anatomy of human body", 5.71%, 5.71%, 2.857%, 31.43 % and 54.29 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.2 shows favorable reaction of the students towards visit to medical college in exploring the internal anatomy of human body for learning Biology.

In terms of reaction of student's towards the statement 27 i.e. "Visit to medical college helps to see different types of surgical instruments" 2.86%, 5.71 %, 8.57 %, 25.71 %, and 57.14 % of them reacted Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.3 shows favorable reaction of the students towards visit to medical college to see different types of surgical instruments for learning biology.

For the statement 28 i.e. "Visit to medical college help in understanding the functioning of hospital", 2.86%, 5.71%, 5.71%, 34.29 % and 51.43 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.3 shows favorable reaction of the students towards visit to medical college in understanding the functioning of hospital.

In terms of reaction of student's towards the statement 29 i.e. "Visit to medical college develops concern for patients" 2.86%, 8.57 %, 31.43%, 25.71 %, and 31.43 % of them reacted Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.7 shows favorable reaction of the students towards visit to medical college to develop concern for patients.

For the statement 30 i.e. "Visit to medical college helps to promote healthy life among students", 5.71%, 11.40%, 22.86 %, 31.46% and 28.57 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.7 shows favorable reaction of the students

towards visit to medical college in promoting healthy life among students while learning biology.

In terms of reaction of student's towards the statement 31 i.e. "Constructivist approach helps in making learning a joyful experience" 2.86%, 8.57 %, 5.71%, 48.57 %, and 34.29 % of them reacted Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.0 shows favorable reaction of the students towards CLS in making learning a joyful experience while learning Biology.

For the statement 32 i.e. "Constructivist approach helps in better understanding of concepts", 2.86 %, 5.71%, 14.29 %, 48.57 % and 28.57 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.9 shows favorable reaction of the students towards CLS in better understanding of concepts while learning Biology.

In terms of reaction of student's towards the statement 33 i.e. "Constructivist Approach helps in development of creative ideas" 5.71 %, 8.57 %, 5.71 %, 57.14 %, and 22.86 % of them reacted Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.8 shows favorable reaction of the students towards CLS in development of creative ideas while learning Biology.

For the statement 34 i.e. "Constructivist Approach focuses on construction rather than instruction", 2.86%, 2.86 %, 31.43 %, 34.29 % and 28.57 % of students gave their reaction in Strongly Disagree, Disagree , Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 3.8 shows favorable reaction of the students towards CLS on construction rather than instruction while learning Biology.

In terms of reaction of student's towards the statement 35 i.e. "Constructivist Approach helps to widen the concept of learning within and out of school" , 2.86 %, 5.71 %, 5.71 %, 42.86 %, and 42.86 % of them reacted Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree respectively. The Intensity Index of 4.2 shows favorable reaction of the students towards CLS to widen the concept of learning within and out of school while learning Biology.

In terms of overall reaction of the students towards the CLS the one statement was responded as neutral and rest of the statement were favorable. The average intensity index was found to be 4.0 which indicate the overall favorable reaction of students towards the CLS that was used for their learning in Biology.

Hence it can be concluded that students have favorable reaction towards the CLS and it was found to be effective in terms of student's reaction.

4.3.0 FINDINGS OF THE STUDY

On the basis of data analysis and its interpretation following major finding were drawn for the present study.

1. The Constructive Learning Strategies (CLS) were found effective in terms of significantly enhancing students' achievement in Biology.
2. The Constructive Learning Strategies (CLS) were also found effective in terms of the positive reaction of students towards it.

Apart from the given findings, the following points were also observed by the researcher among the students of experimental group.

- Students were found to be curious in learning through CLS.
- Students developed their power of imagination in learning through CLS.
- Students were found to share their experiences with other members of their team as well as with their classmates while learning through CLS.
- Students were found to develop skill of co-operation while learning through CLS.
- Students were found to develop their problem solving skill while learning through CLS.
- Students were found to develop the manipulative skill about using various laboratory instruments while learning through CLS.
- Students were found to concentrate in video films while learning through CLS.
- Students were found to complete the assigned test quickly while learning through CLS.

4.4.0 DISCUSSION

Constructive teaching is based on constructive learning theory and on the belief that learning occurs as learners are actively involved in the process of knowledge construction as opposed to passively receiving information. 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 that films, 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.