CHAPTER V

DATA ANALYSIS AND INTERPRETATION

5.0 Introduction

The previous chapter dealt with the development and implementation of instructional designs based on constructivist approach to teach physics at diploma engineering level. The present chapter attempts to convey the essential characteristics of the collected data by arranging the data into an interpretable form. The analysis and interpretation of the data was done objective wise pertaining to the respective hypothesis constructed. The data was analyzed using suitable statistical techniques and the same is presented in the following sections.

5.0.1 Assessing Equivalence of Experimental and Control Group

As the study concerned with the naturally existing groups, it was necessary to check if the two groups were at par. This was done for both achievements in the qualifying standard X Board Examination Scores in science and for ability by assessing their levels of intelligence IQ Scores by administering J.C Raven's Standard Progressive Matrices Test (1958).

In order to study the effectiveness of the instructional design prepared by the researcher based on constructivist approach, the content was divided into three units. The units were 1) SI Units and Measurement 2) Waves and Sound and 3) Light. The units were followed by a respective unit test. At the end of teaching all the three units a comprehensive test was also conducted. Also Researcher's observation of students during instructional process were noted. A Semi-structured Interview for students was conducted to find out their view of learning physics the way teaching was conducted. To test the retention ability, delayed comprehensive post-test was conducted which was administered after one month. All the tests were constructed by the researcher.

5.0.1.1 Assessing Equivalence with respect to Intelligence Test Scores of both the groups

To obtain IQ scores of students, Intelligence Test was administered based on J.C Raven's Standard Progressive Matrices Test (1958) to control group and

experimental group. Detailed analysis of IQ Scores of both the groups are presented in table 5.1

Table: 5.1: Mean IQ Scores of students

Group	N	Mean
Experimental Group	30	47.47
Control Group	30	46.00

Analysis and Interpretation of Intelligence Scores of both the groups:

Table 5.1 reveals that there were 30 students in experimental group and control group respectively. The mean of IQ Scores of students was found to be 47.47 and 46.00 of experimental and control groups respectively. It can be seen therefore from the mean scores that mean of IQ Scores of students in both the groups are nearly equivalent. Both the group were at par in terms of the abilities.

5.0.1.2 Assessing Equivalence with respect to achievement of students in standard X Board Examination in science.

Standard X comprehensive scores of students in science of both the groups were considered to find out if both the groups were homogenous in academic performance. The summary is presented in following table.

Table: 5.2: X Board Examination Mean of students of Science subject of both the groups

Group	N	Mean	S.D.	t-Value	Df
Experimental Group	30	65	6.77	1.29	58
Control Group	30	62	13.8		
Table value of t is 2.00 for df=58					

Analysis and Interpretation of X Board Examination Mean of students of science subject of both the groups

Table 5.2 reveals that there were 30 students in the experimental group and 30 students in the control group. The mean of standard X Science scores of students was found to be 65 and 62 of Experimental and Control group respectively. The Standard Deviation was 6.77 and 13.8 for experimental and control group respectively. The computed t- value was 1.29 and the table value of t was 2.00 at 58 degree of freedom.

The mean score of both the group is three points whereas standard deviation shows higher difference of seven points. This could be due to a large difference between the lowest scores and highest scores of students in the control group. The computed t- value was 1.29 which was less than the table value of t namely 2.00 at 58 degree of freedom. It can be considered therefore that standard X Science Scores of both the groups are equivalent. Both the groups may be said nearly equivalent and at par in terms of achievement in science subject. The data is presented graphically in Figure 5.1.

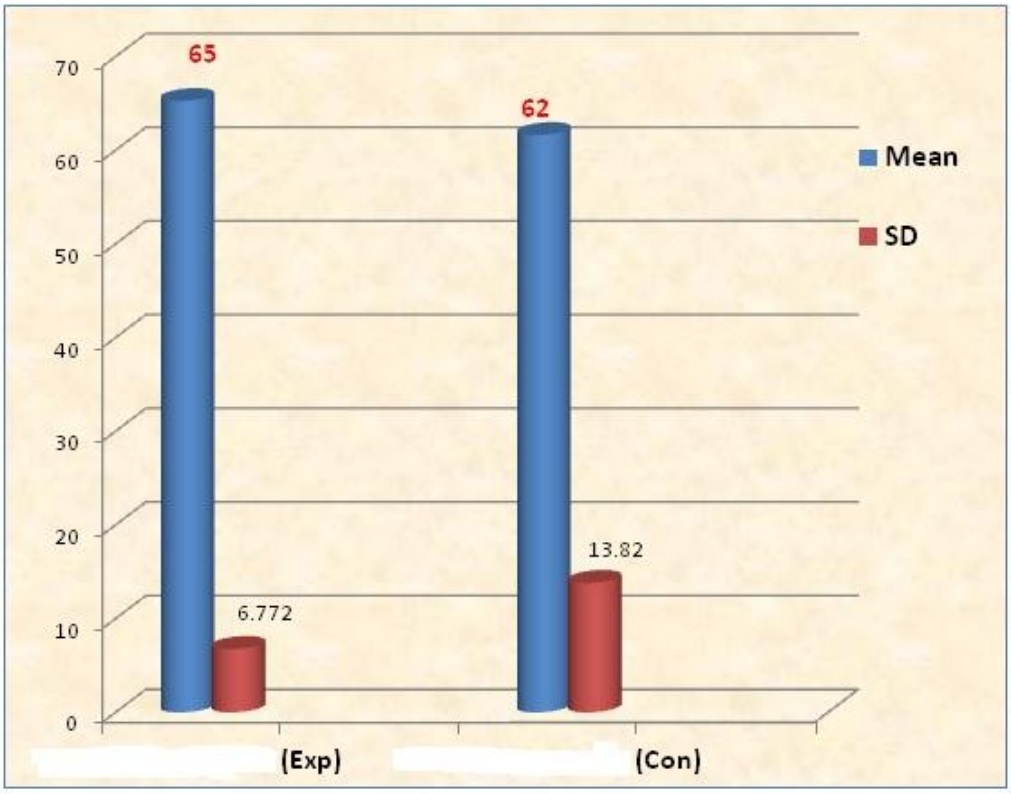

Figure 5.1 Mean and Standard Deviation of scores in science of students of Experimental and Control Groups in Standard X Board Examination

The graph shows mean of scores in science in standard X Board Examination of students is 65 and 62 of experimental and control group respectively. Also the standard deviation of students is 6.772 and 13.82 in science of experimental and control group.

5.1 Data Analysis in Objective 3 formulated for the study to determine the effectiveness of the instruction

By comparing mean achievement scores of Experimental and Control Group.

- By comparing mean achievement scores of Experimental and Control Group.
- By comparing post-test mean achievement scores of experimental and control group on delayed comprehensive post-test.
- By comparing student involvement and interest in learning.
- By studying opinion of students regarding the instructional design.

5.1.0 Data Analysis of Post test of Unit I: SI Units and Measurements

To determine the effectiveness of Instructional Design based on Constructivist Approach for Unit 1 teacher made achievement test was administered as post test to experimental group and control group. The null hypothesis was formulated, 'There will be no significant difference between the mean achievement scores of the Control and Experimental groups on test conducted on the contents of Unit I', independent t-value was calculated.

Table: 5.3: N, Mean, SD and t-value of the Experimental and Control Groups for post- test 1

Group	N	Mean	S.D.	t-Value	Df
Experimental Group	30	15.33	2.15	7.2	58
Control Group	30	10.9	2.60		
Table value t-2.00 for 58 df at 0.01 level of significance.					

5.1.1 Analysis and Interpretation of N, Mean, SD and t-value of the Experimental and Control and Groups for pos t-test 1

From the table 5.3, it was revealed that there were 30 students each in experimental and control group. The calculated mean were 15.33 and 10.9 with standard deviation of 2.15 and 2.60 respectively for experimental and control group. For further analysis to study whether the difference in mean and standard deviation is significant or by chance, t-test was calculated. Table 5.3 also revealed that the calculated t-value of 7.2 was significantly greater than table value of t which is 2.00 at 0.01level of significance, for 58 degree of freedom. Hence, the null hypothesis that 'There will be no significant difference between the mean achievement scores of the Control group and Experimental group on test conducted on the contents of unit I' was rejected and it can be said that constructivist approach to teach physics to diploma engineering level for unit 1 was effective. The data is presented graphically in Figure 5.2.

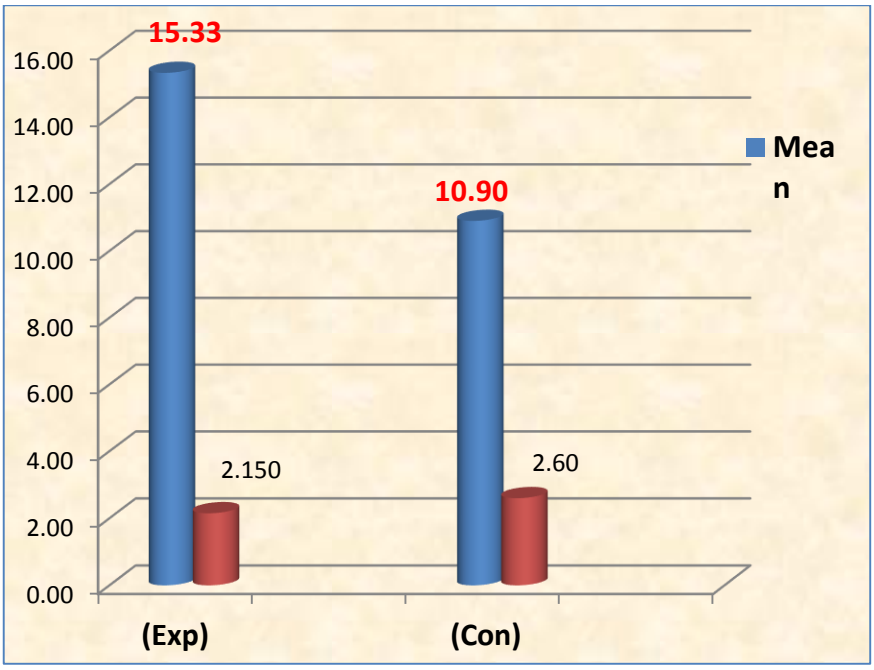

Figure 5.2: Mean and SD of scores of unit test 1 of experimental and control group respectively.

The graph shows mean scores of 15.33 and 10.90 of experimental and control group respectively. Also the standard deviation of 2.150 and 2.60 is shown.

5.2 Data Analysis of Post test for Unit II: WAVES

To determine the effectiveness of Instructional Design based on Constructivist Approach for Unit II teacher made achievement test administered as post test to experimental group and control group. The null hypothesis was formulated. To test the hypothesis 'There will be no significant difference between the mean achievement scores of the Control group and Experimental group on test conducted on the contents of unit II', independent t- value was calculated. Detailed analysis is given in table 5.4.

Table 5.4: N, Mean, SD and t-value of the Experimental and Control and Groups for post-test 2.

Group	N	Mean	S.D.	t-Value	df	Level of Significance
Experimental Group	30	14.57	1.99	8.45	58	0.01
Control Group	30	10.07	2.13			
Table value t-2.00 for df=58 at 0.01 level of significance.						

5.2.1 Analysis and Interpretation of N, Mean, SD and t-value of the Experimental and Control and Groups for Post-test II

From table 5.4, it was revealed that there were 30 students each in the experimental and control groups. The mean were found to be 14.57 and 10.07 with standard deviation of 1.99 and 2.13respectively for experimental and control group. From this figure of mean and standard deviation it can be said that the mean of experimental group is significantly greater than that of control group. For further analysis to study whether the difference in mean and standard deviation is significant or by chance, t-test was calculated. Table 5.4 also revealed that the calculated t-value of 8.45 was significantly greater than table value of t which is 2.00 at 0.01 level of significance, for 58 degree of freedom. Hence, the null hypothesis that 'There will be no significant difference between the mean achievement scores of the Control group

and Experimental group on test conducted on the contents of unit II' was rejected and it can be said that constructivist approach to teach physics to diploma engineering level was effective. The data is presented graphically in Figure 5.3.

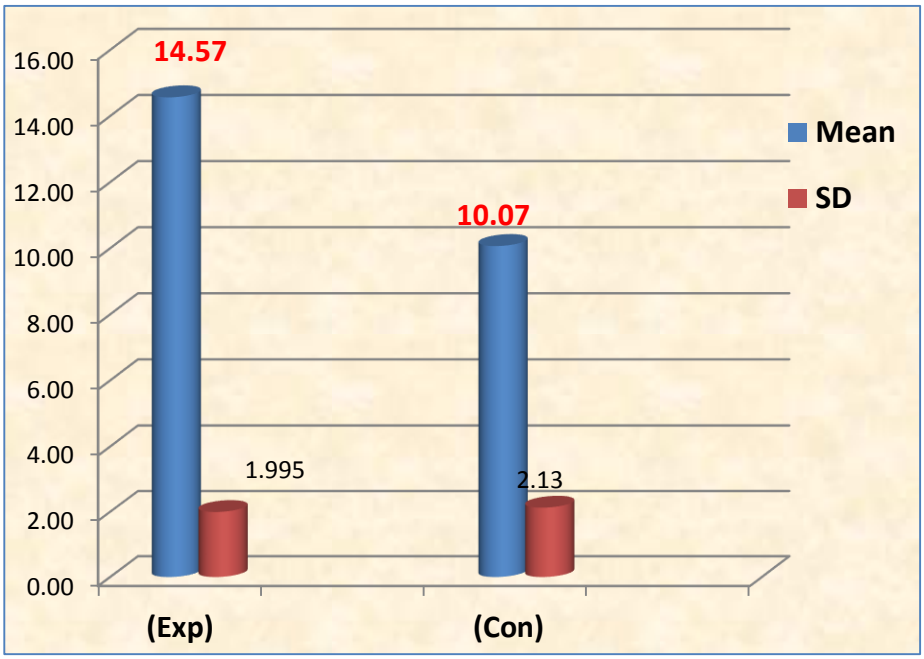

Figure 5.3: Mean and Standard Deviation of unit test II of experimental and control group respectively.

The figure 5.3 shows of mean scores of 14.57 and 10.07 of experimental and control group respectively. Also the standard deviation of 1.995 and 2.13 is shown for both the groups.

5.3 Data Analysis of Post test for Unit III: LIGHT

To determine the effectiveness of Instructional Design based on Constructivist Approach for Unit 3 teacher made achievement test administered as post test to experimental group and control group. The null hypothesis was formulated. To test the hypothesis 'There will be no significant difference between the mean achievement scores of the Control group and Experimental group on test conducted on the contents of unit III', independent t- value was calculated. Detailed analysis is given in table 5.5

Table: 5.5: N, Mean, SD and t-value of the Experimental and Control and Groups for post-test 3.

Group	N	Mean	S.D.	t-Value	df	Level of Significance
Experimental Group	30	14.83	2.49	5.55	58	0.01
Control Group	30	11.37	2.34			
Table value t- 2.00 for df=58 at 0.01 level of significance.						

5.3.1 Analysis and Interpretation of N, Mean, SD and t-value of the Experimental and Control and Groups for pos t-test III

From table 5.5, it was revealed that there were 30 students each in experimental and control group. The mean were found to be 14.83 and 11.37 with standard deviation of 2.49 and 2.34respectively for experimental and control group. From this figure of mean and standard deviation it can be said that the mean of experimental group is significantly greater than control group. For further analysis to study whether the difference in mean and standard deviation is significant or by chance, t-test was calculated. Table 5.5 also revealed that the calculated t-value of 5.55 was significantly greater than table value of t which is 2.00 at 0.01 level of significance, for 58 degree of freedom. Hence, the null hypothesis that 'There will be no significant difference between the mean achievement scores of the Control group and Experimental group on test conducted on the contents of unit III' was rejected and it can be said that constructivist approach to teach physics to diploma engineering level was effective. The data is presented graphically in Figure 5.4.

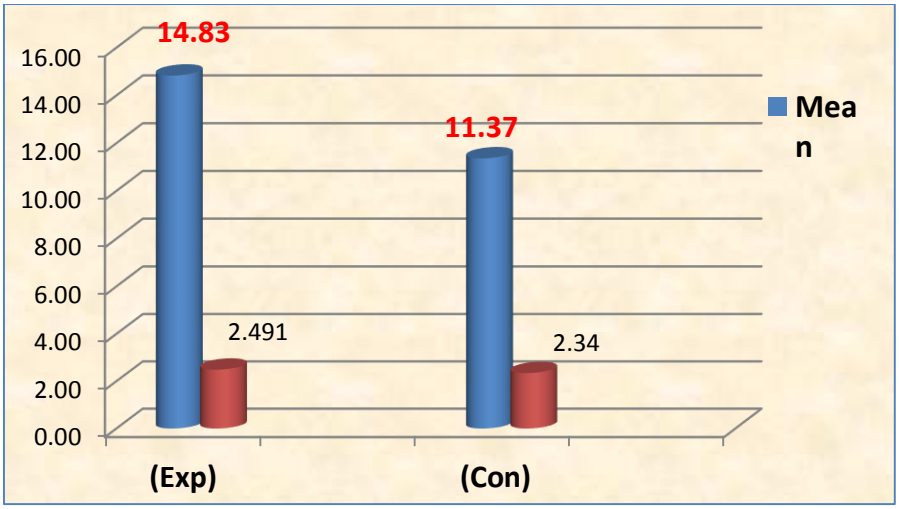

Figure 5.4: Mean and SD of scores of unit test III of experimental and control group respectively.

The graph shows mean scores of 14.83 and 11.37 of experimental and control group respectively. Also the standard deviation of 2.491 and 2.34 is shown for both the groups.

5.4 Data Analysis of Comprehensive Post test for Unit I, II and III

To determine the effectiveness of Instructional Design based on Constructivist Approach for Comprehensive teacher made achievement test as Post-test of Unit I, II, and III administered as post test to experimental group and control group. The null hypothesis was formulated. To test the hypothesis 'There will be no significant difference between the mean achievement scores of the Control group and Experimental group on test conducted on the contents of unit I, II and III, independent t- value was calculated. Detailed analysis is given in table 5.6

Table: 5.6: N, Mean, SD and t-value of the Experimental and Control and Groups for Comprehensive post-test for Unit I, II and III.

Group	N	Mean	S.D.	t-Value	df	Level of Significance
Experimental Group	30	23.83	2.8	6.00	58	0.01
Control Group	30	19.43	2.9			
Table value of t is 2.00 for df=58 at 0.01 level of significance.						

5.4.1 Analysis and Interpretation of N, Mean, SD and t-value of the Experimental and Control and Groups for comprehensive tests

From table 5.6, it was revealed that there were 30 students each in experimental and control group. The mean were found to be 23.83 and 19.43 with standard deviation of 2.8 and 2.9 respectively for experimental and control group. From this figure of mean and standard deviation it can be said that the mean of experimental group is significantly greater than control group. For further analysis to study whether the difference in mean and standard deviation is significant or by chance, t-test was calculated. Table 5.6 also revealed that the calculated t-value of 6.00 was significantly greater than table value of t which is 2.00 at 0.01 level of significance, for 58 degree of freedom. Hence, the null hypothesis that 'There will be no significant difference between the mean achievement scores of the Control group and Experimental group on test conducted on the contents of comprehensive tests' was rejected and it can be said that constructivist approach to teach physics to diploma engineering level was effective. The data is presented graphically in Figure 5.5.

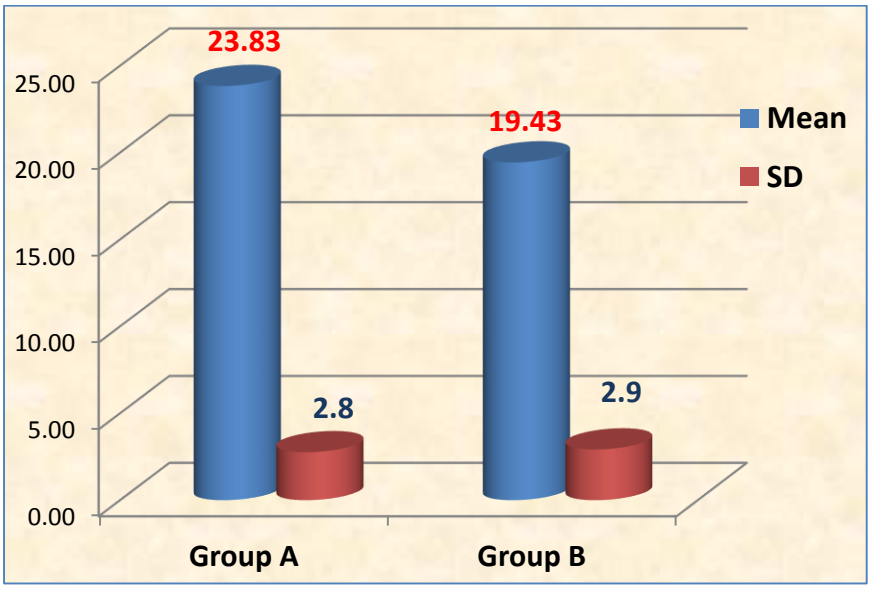

Figure 5.5: Mean and SD of scores of comprehensive unit test I, II and III of experimental and control group respectively

Figure 5.5 graph shows mean scores of 23.83 and 19.43 of experimental and control group respectively. Also the standard deviation of 2.8 and 2.9 is shown.

5.5 Data Analysis of Delayed comprehensive Post-test for unit I, II and III

To determine the effectiveness of Instructional Design based on Constructivist Approach for delayed response administered as post test to experimental group and control group. The null hypothesis was formulated. To test the hypothesis 'There will be no significant difference between the mean achievement scores of the Control group and Experimental group on test conducted on the delayed comprehensive post-test for unit I, II and III', independent t- value was calculated. Detailed analysis is given in table 5.7

Table 5.7: N, Mean, SD and t-value of the Experimental and Control and Groups for Delayed comprehensive Post-test for unit I, II and III.

Group	N	Mean	S.D.	t-Value	df	Level of Significance
Experimental Group	30	22	3.3	4.23	58	0.01
Control Group	30	20	1.7			
Table value of t is 2.00-value for df=58 at 0.01 level of significance.						

5.5.1 Analysis and Interpretation of N, Mean, SD and t-value of the Experimental and Control and Groups for delayed comprehensive post-test

From the table 5.7, it was revealed that there were 30 students each in experimental and control group. The mean were found to be 22 and 20 respectively with standard deviation of 3.3 and 1.7 respectively for experimental and control group. From this figure of mean and standard deviation it can be said that the mean of experimental group is significantly greater than control group. For further analysis to study whether the difference in mean and standard deviation is significant or by chance, t-test was calculated. Table 5.7 also revealed that the calculated t-value of 4.23 was significantly greater than table value of t which is 2.00 at 0.01 level of significance, for 58 degree of freedom. Hence, the null hypothesis that 'There will be no significant difference between the mean achievement scores of the Control group and Experimental group on test conducted on the contents of delayed comprehensive

post-test' was rejected and it can be said that constructivist approach to teach physics to diploma engineering level was effective. The graphical presentation is done below:

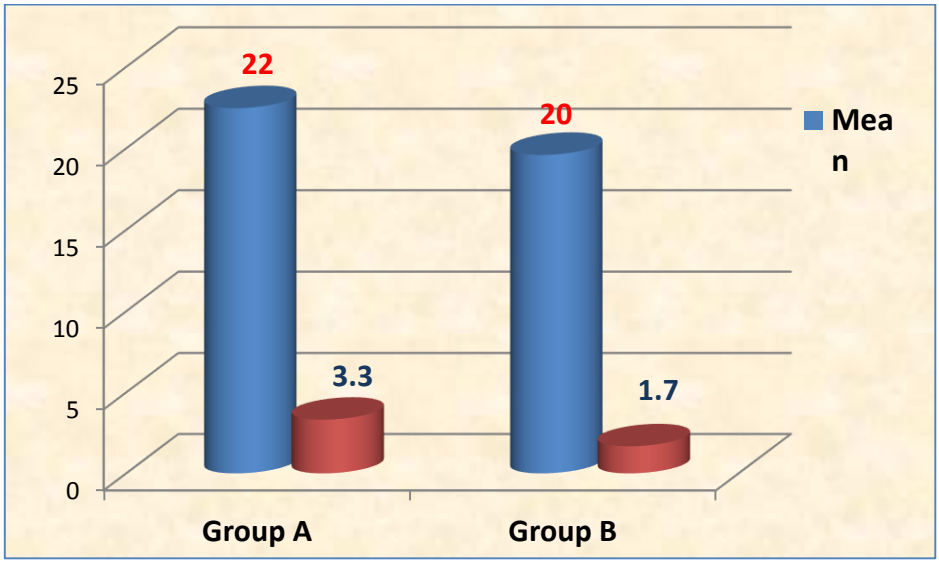

Figure: 5.6: Mean and SD of scores of delayed comprehensivepost-test for unit I, II and III of experimental and control group respectively.

Figure 5.6 shows graph of mean scores of 22 and 20 and also the standard deviation of 3.3 and 1.7 of delayed response post-test experimental and control group respectively.

5.6 Researcher's Observations of students during Instructional Process

The following is the summary of observations noted down by the researcher while implementing the prepared instructional designs.

- Most of the students were interactive during the group activities.
- There were a few students in each group who were initially hesitant to speak up. But the support of the group helped them to participate.
- The very structure of group and the changing roles of students in the group, namely, someone had to lead the group, someone had to report the proceedings, and someone had to conduct the activities made everyone get active.

- The students built personal experience, took the readings in activity sheets to understand more about reflection and connect this scientific concept to a real-life activity.
- Students worked well in groups, were more engaged when presented with hands-on activities and struggled with putting ideas into words.
- In the Engage step, students were activated with prior knowledge and brainstorming to understand the power point presentations.
- In Explore session they focused on concrete information and exploration of the concepts.
- In Explain step teacher explained the content of the Instructional Design wherein students attentively were engaged in understanding the content of the units.
- In Elaborate step, students were engaged in extended understanding activities based on real life applications.
- In Evaluate step, students finished the project file task as home work by using books, internet sources. Evaluation strategies included both informal and formal methods. Teacher observations and classroom discussions provided immediate, informal feedback.
- The motivational level of students and their tempo to learn and bring something innovative among the whole class.
- Students were found very enthusiastic in Elaborate phase.
- Students also tried to enhance their knowledge and made project files on their own. They also related the radiations of waves used in movies like X-Man, Mr. India.
- Students measured the given materials and recorded the observations in the activity sheets provided to them.
- Students were actively involved in activities like taking readings from Vernier Calliper to measure the thickness of the materials provided to them.

- Students tried to make meanings from the concepts shared by their group members and arrived at complete understanding on the content of the discussion.
- Students shared the observations in their groups.
- Presentation was made by students in front of whole class by speakers of each group.
- Students reflected on each other's ideas and helped in answering questions in the activity sheets given to their group members.
- Students shared their experiences in groups and constructed the knowledge socially.
- Students motivated other group members to share their experiences of different types of unit and reflected on them.
- Students answered by reflecting on their prior knowledge on SI system to questions posed by the researcher.
- Students measured the size of screen of the appliances given in evaluation.
- The students taught with traditional approach of the control group were found attentive while teaching was held.
- They noted down the points written on black board and were able to draw the respective figures of the content.
- Few students were more interested in teaching-learning process and suggested and shared their ideas on the contents of the units on behalf of whole class.

5.7 Semi-Structured Interview for Students

Learning is the result of what learners do, which was noted down by the researcher in the previous section 5.6. In this section, the focus shifts to the learners' own experience in learning process. Student interview was conducted after the completion of the semester examination. Individual interview was conducted. The data was recorded on the sheets in open ended questions given to students by the time

they competed their entire syllabus. The students were asked to share their experience and the following is the summary of what they said:

Table 5.8: Students' view on learning following constructivist instructional designs

Sr. No.	Questions	Frequency response in percentage
1	How was the teaching-learning in physics different for the units of SI Measurement, Waves and Light?	100% of the students responded yes in terms of the activities they did, power point presentations shown, searching web sites, and working in groups.
2	How was it different from the teaching other units?	86% of the students said in terms of activity sheets of the content they got. 70 % of the students said in terms of evaluation by searching applications on real life and 60 % of the students said in terms of the beginning power point presentations shown in the class, 90% of the students said in terms of group activities and roles they played of speaker, recorder and performers, 78% said they got hand outs and then teacher explained, 100 % of the students said they enjoyed learning in the class.
3	Do you use some skills you acquired during that classes in your present studies?	70 % of the students said they use websites for further clarification of topics and 30 % of the students said they use concept mapping to organize learning of the topics and 70% of the students said they do group discussions for clarification of the knowledge.
4	Do you ask questions to your present faculties at present with respect to the clarity of the concepts?	70% of the students said yes and 30 % of the students said no they don't ask any questions to their faculties.

5	Do you use your understanding of new knowledge in application of real life examples?	100 % of the students said yes they use their understanding in real life applications.
6	What were the activities you liked most during teaching-learning of the three units?	60 % of the students said they liked discussion and sharing ideas and prior knowledge in group (Explore session), 80% of the students said they liked ppt in beginning (Engage session), 70 % of the students said they liked evaluation.
7	What new things you tried based on the activities implemented during those sessions?	90 % of the students said they gained their knowledge by searching on websites and making project files.
8	Were you able to connect the content taught with your prior knowledge with the new learning?	75% of the students said yes they could connect the content of physics taught with their prior understanding of physics concepts while 25 % of the students said they did with the help of discussion among their group members and when teacher explained the content.
9	Did you have the chance to work independently?	100 % of the students said yes.
10	Did you gain conceptual clarity?	80% of the students said yes and 20 % of the students said with the help of their group members during discussion and with teacher explanation.

5.7.1 Analysis of students semi-structured interview data

- 100% of the students agreed that there was a difference in teaching-learning of physics and they enjoyed learning of physics, and that they used their concepts of physics in real life applications.

- 80% to 100% students said that teaching learning in physics was different in terms of activity sheets, different roles played by students in groups like those of speakers, recorders and performers, hand outs of the content of physics they got

and they searched websites to understand the concepts of the subjects taught to them.

- 60% to 80% of the students said they asked the questions to their present faculties in the teaching-learning process, they liked the discussion in groups, cleared their understanding linking prior knowledge with the new gained knowledge, they liked power presentation shown in the constructivist sessions and got the chance to work independently.

5.7.2 Interpretation of Students' view on learning following constructivist instructional designs

From the view of students it can be said that the constructivist sessions helped in learning physics at diploma engineering level. Most of the students were able to perform the activities during constructivist sessions, while those students who were not able to connect the prior knowledge with the new knowledge took help of their group members and were collectively successful in gaining the new insight to the content. The understanding of the students on the concepts were clearer when they got a chance to work independently. Students learnt the writing skills, surfing on internet about the real life applications of the content of physics and with discussion in group by sharing their prior knowledge on the content of physics taught.

5.8 Discussion on Data

Constructivist Approach refers to the learner centered approach of teaching-learning process wherein suitable activities are planned in which students learn by reflecting on their own experiences, constructing insights into their understanding of learning. The instructional design was based on the activities organized around five sequences of stages known as 5 Es namely Engage, Explore, Explain, Extend and Evaluate to teach the contents of physics at Diploma Engineering Level. As the sources of knowledge have increased with the technology and internet, individual construction of knowledge has become important in learning. Due to many available sources of information, knowledge has become digitalized and therefore it is uniquely created by each individual brain. Thus, Knowledge of students is created within. Student learns the subject internally. So constructivist approach wherein knowledge is created internally and linked with prior knowledge becomes important. It enhances

the learning by logical and conceptual growth. And thus constructivist approach can be suitable with the technological advances, wherein the students' prior knowledge is linked with the new gained knowledge and the students share their knowledge by discussions, negotiation and meaning making process of their learnt concepts. In the present study the researcher has developed and implemented the instructional designs based on constructivist approach to teach physics at diploma engineering level. After the implementation phase the data were collected by employing student t- test to the achievement scores of the separate unit test, comprehensive test of three units taken together and student delayed comprehensive post-test. Also the students view was found by semi-structured interview schedule and Researcher's observation of students during instructional process was also done by the researcher to check the students learning involvement and interest.

The present study focused on developing and implementing instructional designs based on constructivist approach to teach selected common units physics at diploma engineering level. Three units which were common for civil and electrical engineering for the year 2013-14 were chosen for developing the instructional designs based on constructivist approach. The effectiveness of the instructional designs was determined by the post-test conducted after implementing the instructional designs for separate three units, comprehensive unit test for all three units taken together and by comparing students view on learning following constructivist instructional designs and by researchers observation of students during instructional process.

The findings of the study revealed that instructional designs based on constructivist approach were effective with respect to the achievement scores of students on post-test on separate units and on comprehensive unit test of all three units taken together. It is evident through the findings that the constructivist approach to teach physics at diploma engineering level was effective in terms of student's achievement scores, connecting their prior knowledge with the new knowledge of engineering as researchers observation of students during instructional process and retention of learning over a period of time. Also as observed by the researcher during implementation of instructional designs that most of the students were interactive during the group activities. The very structure of group and the changing roles of the students in the group, namely, someone had to report the proceedings and someone

had to conduct the activities made everyone got active. This was also reported in students semi structured interview that they got the chance to work independently as well as in group for sharing their ideas and contents of physics taught. The students reflected on each other's prior conceptions and constructed a new knowledge by sharing their experiences.

What accounts for the effectiveness of the approach is a question that needs consideration. From the researcher's point of view, the difference that mattered was in the very structure of the constructivist design. It was the students who were active throughout the teaching period by doing activities, discussing sharing and following up their learning either in the library or checking up references on internet. We know learning is personal and learning results from doing. This is the single most important aspect of the constructivist learning that seems to have contributed to the observed data.

The reviewed studies also showed that constructivist approach increased the achievements and interest of students. The findings of Bijas, J. (2007) suggest that constructivist pedagogy provides opportunity for students to construct relevance of the content by relating new learning to students' personal experiences and prior knowledge. The findings of the present study also match with findings of Templeton (2011) wherein students reported that the constructivist approach did increased their confidence, excitement and ability to develop and use resources for science instruction.

As The Experimental studies by Pathak, J. (2008), Remould, J. (2006), Patel, A. (2014), Karl, M. (2007) and Donkor, A. (2010) conducted on pre service teachers using instructional strategies matched with the findings of the present study. Findings of the studies revealed that instructional designs were effective with respect to students' achievement. Also positive impact and sustained, collaborative professional development programs have significant role on student achievement, indicating that programs of this nature could be a means to narrowing or eliminating achievement gaps in different subjects. The study of Linda, J. (1991) was a case study in which Science teacher beliefs and their influence on curriculum implementation was studied. It included beliefs about how students learn, a teacher's role in the classroom, the

ability levels of students in a particular age group, and the relative importance of content topics matching with the present study.

The above reviewed studies have highlighted advantages of constructivism based instruction in relation to positively impacting attitudes and feelings towards the science subject taught. The studies of Cook, M. (2007) and Templeton, K. (2007) suggests teachers to adopt constructivist lessons in teaching and using by making cooperative groups adopting problems-based learning and motivate enquiry questions for students to learn the subject matter. And Templeton's study also indicated that the students reported that the constructivist approach did increase their confidence, excitement and ability to develop and use resources for science instruction. The studies of Seimears, C. (2007) and Avila, L. (2006) suggest that English Language Learners are learning better by constructivist teaching and understand science positively and also students' performance increases positively. The common feature found in the above studies is that the learning by constructivist approach shows to have significant relevance and effectiveness in learning of science similar to the findings of the present study.

The studies of Diane, J. (2005) and Esmaiel, Y. (2006) The studies of Bosbea, Amanda (2006), Kim (2005) and Thomas (2013) pointed out that constructivism encourages and values the personal understanding/knowledge construction by the learner and the design of learning is student-centered and the constructivist approach enhances the students' learning found in Investigato's observation of students during instructional process of the present study. Also the studies of Bonnie, S. (2007), Warren, J. (2008) and Bijas, J. (2007) conducted studies using constructivist approach at middle school level and reported its significance as positive effect on the learners. Bosbea, S. (2006) has pointed out that the art appreciation instructors have an opportunity to facilitate high levels of student thinking and encourage metacognitive skills through constructivist method that helps in understanding multiple ways of knowledge construction. The findings of the study of Jennifer (2009), pointed reference that the students developed an appreciation for constructivist practice and viewed learning as a process of constructing knowledge. Akanwa, M., Alphonsus, J. and Ovute, M. (2014) studied the effect of Constructivist Teaching Model on Senior Secondary School (SSS) Physics Students' Achievement and Interest and its findings

revealed that constructivist approach had a significant effect on both the achievement and interest of SSS physics students similar to the findings of the present study.

In concluding it could be said that the present study based on Instructional Design based on Constructivist Approach was found effective in teaching physics at Diploma Engineering Level.