CHAPTER IV

ANALYSIS AND INTERPRETATION

4.0 Introduction

The method followed in conducting the present study has been given in detail in the previous chapter. In this chapter the statistical techniques used for analyzing the data have been presented objective wise. The present chapter is devoted to the presentation of results and interpretation.

This has been done objective wise in the following captions.

SECTION I

a. Analysis of the Efficiency of the Science Lab Talking Device (SLTD).
   i. Efficiency of the Device based on power supply
   ii. Efficiency of the Device based on time

b. Analysis of Software Component of the Science Lab Talking Device (SLTD).
   i. Testing of Error Free Software Programme
   ii. Testing of Time & Space Complexity Software Programme

SECTION II

Factor Analysis from the response of teachers on validity of Science Lab Talking Device (SLTD).

SECTION III

T-test Analysis on Acquisition of Science Concepts introduced before and after introduction of Science Lab talking Device (SLTD) among Group I and Group II students.

SECTION IV

Repeated Measures ANOVA for the Performance of Group I and Group II students in selected Experiments.

SECTION I

4.1 Analysis of Efficiency of the Science Lab Talking Device

4.1.1 Efficiency of the system based on power supply (energy)

Power is taken in x-axis and the system's efficiency is taken in y - axis. The efficiency of the system is depends on the power supply. '***es***' holds good when the sensor has full energy i.e., the device need 4V-5V power supply to work efficiently. When the power less or more than this range then only it will affect the efficiency of the device. Thus the fig 4.1 shows that the efficiency of the SLTD is directly proportional to the energy level. Hence the device operation sustains upto the appropriate power supply.

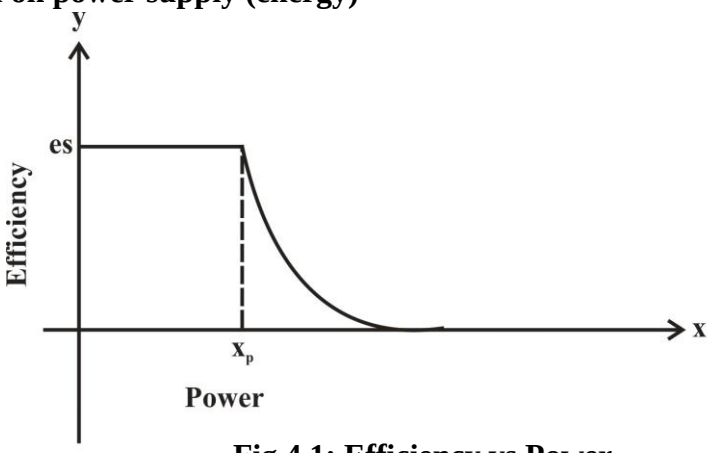


Fig 4.1: Efficiency vs Power

4.1.2 Efficiency of the Device Based on Time

Fig 4.2, depicts the efficiency of the system based on time period. Efficiency of the system also depends on the external factors. '***es***' denotes the efficiency of the system. x_t denotes the maximum time period that the system works without bugs. After reaching the maximum time period, the efficiency of the system decreases. This shows that the system's efficiency depends on time period. The device work upto the maximum efficiency, when the external factors like dropping the device, slip of liquids or any such features are controlled.

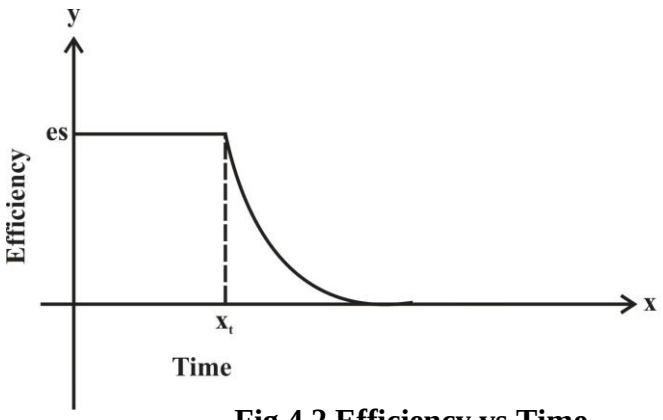


Fig 4.2 Efficiency vs Time

4. 2 Analysis of Software Component of the SLTD

4.2.1 Testing of Error Free Software Programme

The SLTD device operation programmed in Embedded C has been tested using the Arudino IDE platform. The screenshot of the successfully programmed and uploaded embedded programmme is presented in Fig.4.3, proved that the programme is bug free, error free, Hence it is stated as “Done uploading”

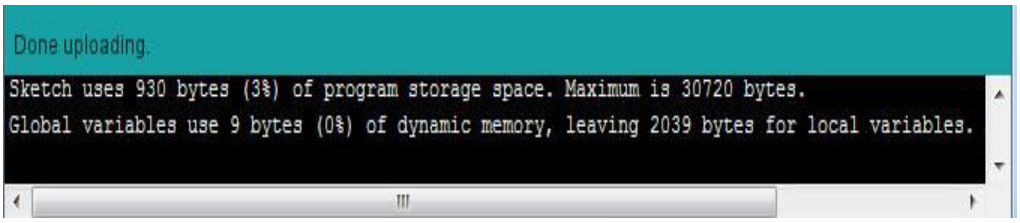


Fig 4.3 Screenshot of the uploaded software programme

4.2.2 Testing of Time and Space Complexity of the Software Programme

Fig 4.4, denotes the Time Complexity of the SLTD programme, as each of these programming modules perform searching in a linear way. So, the time complexity will be

Best case	:	O(1)
Average case	:	O(n)
Worst Case	:	O(n)

The worst case space complexity is O(1). Because the algorithm uses the constant memory space that does not grow with respect of the input size.

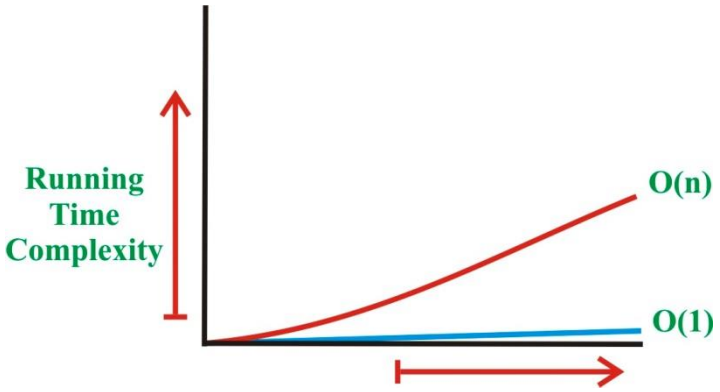


Fig. 4.4 Time Complexity

SECTION II

4.3 Factor Analysis of the response of teachers on the Questionnaire on Device usage

A questionnaire to examine how the teachers perceived the usage of the device for the present study was administered to Sixty teachers who used the device to teach. Twenty five items were pooled on various facets of the device and the responses were presented in a four point scale. The internal consistency was measured using Cronbach Alpha was found to be 0.77. The Kaiser-Meyer-Olkin measure of sampling adequacy was found to be 0.42 and Bartlett's Test of Sphericity was found to be significant; both indicate that the set of variables are at least adequately related for factor analysis.

Table 4.1 Factor Loadings of the Responses by Teachers on the Questionnaire on Usage of the Device

Component Matrix[a]			
Features of the device	**1**	**2**	**3**
VAR00007	**.841**	-.170	-.184
VAR00013	**.803**	-.241	-.112
VAR00010	**.796**	-.310	.204
VAR00011	**.740**	.234	.445
VAR00009	**.721**	-.220	-.132
VAR00001	**.628**	.293	.352
VAR00006	**.618**	-.374	-.005
VAR00025	**.572**	-.111	-.163
VAR00024	**.514**	.470	-.319
VAR00022	**.511**	.273	-.376
VAR00003	**.453**	-.144	.309
VAR00008	**.410**	-.079	.282
Independence of usage			
VAR00019	.092	**.807**	-.007
VAR00017	.150	**.787**	.389
VAR00002	-.086	**.782**	.159
VAR00018	-.002	**.762**	.382
VAR00004	.151	**.668**	.282
VAR00016	.384	**.538**	-.439
VAR00023	.141	**.388**	-.145
Display features			
VAR00014	.005	-.464	**.634**
VAR00015	.392	.374	**.612**
VAR00012	.273	-.390	**.523**
VAR00020	-.323	.404	**.484**
VAR00005	.293	.098	**.398**
VAR00021	-.174	.146	**.345**
Eigen Value	**5.73**	**4.89**	**3.05**
% of total variance	**22.91**	**19.59**	**12.20**
Total Variance			**54.71**

Twenty five statements relating to device were factor analyzed using principal component analysis with varimax rotation. The analysis yielded three factors explaining a total of 54.71% of the variance for the entire set of variables and fitted the measurement criteria. Factor 1 was labelled as "Features of the device" and the first factor explained 22.91% of the variance. The second factor derived was labelled "Independence of usage Disposal "and the variance explained by this factor was 19.59%. The third factor was labelled as "Display features" which explained the variance up to 12.20 % due to high loadings relating to displaying features of the device.

SECTION III

4.4 Analysis of Acquisition of Science Concept among Group I & Group II

The following Tables from 4.2 to 4.4analyze the performance scores pertaining to Science concepts acquired by Group I and Group II students separately before and after introduction of Science Lab Talking Device.

Table 4.2 Testing wise Mean, SD, df and t-value for Science Concepts for Group I

Science Concept	Test	N	df	Mean	SD	t-Value
	Pre	30	29	2.97	2.33	22.49**
	Post	30	29	12.97	2.51	

***** Significant at 0.01 level***

From the Table 4.2, it is evident that the t-value for the performance score for Group I students in Science concept is22.49 with df = 29 which is significant at 0.01 level. It indicates that pre and posttests score of Group I students in Science concepts differ significantly. In the light of this, the null hypothesis stated as ***"there is no significant difference in the mean score of Science Concept before and after introduction of Science Lab Talking Device among Group 1 Students"*** is rejected. It may therefore be concluded that the SLTD helped in improving the Learning of Science Concepts of Group I Students with Visual Impairment.

Table 4.3Testing wise Mean, SD, df and t-value for Science Concepts of Group II

Science Concept	Test	N	df	Mean	SD	t-Value
	Pre	30	29	6.33	4.63	31.45**
	Post	30	29	27.50	3.73	

***** Significant at 0.01 level.***

From the Table 4.3, it is evident that the t-value for the performance score for Group II students in Science concept is 31.45with df = 29 which is significant at 0.01 level. It indicates that pre and posttests score of Group II students in Science concepts differ significantly. It means that there was a significant impact of SLTD on Leaning of Science Concepts among Group II students. In the light of this, the null hypothesis stated as ***"there is no significant difference in the mean score of Science Concept before and after introduction of Science Lab Talking Device among Group II Students"*** is rejected. It may therefore be concluded that the SLTD helped in improving the Learning of Science Concepts of Group II Students with Visual Impairment.

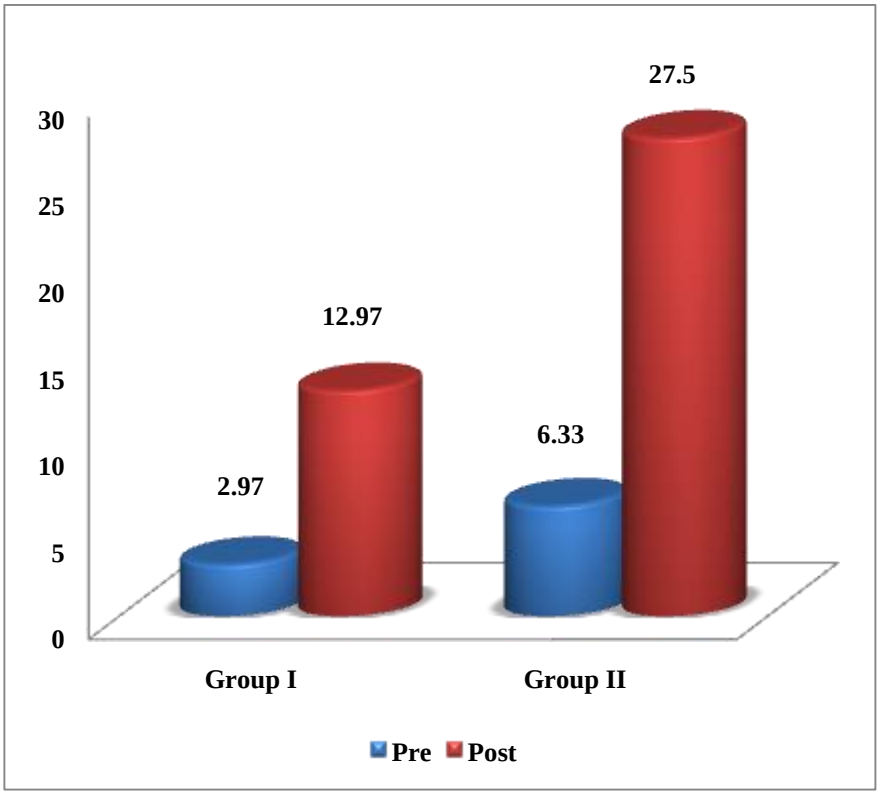


Fig. 4.5 Pre and Post Mean Score of Group I and Group II in Science Concepts

Table 4.4 Testing wise Mean, SD, df and t-value for Science Concepts of Group I and II

Group	Science Concept	Test	N	df	Mean	SD	t-Value
I	Temperature	Pre	30	29	1.47	1.01	19.198**
		Post	30	29	4.57	0.77	
	Acid & Base	Pre	30	29	0.63	0.76	20.89**
		Post	30	29	4.20	0.92	
	Electricity	Pre	30	29	0.93	0.78	21.69**
		Post	30	29	4.30	0.95	
II	Temperature	Pre	30	29	2.43	1.68	8.67**
		Post	30	29	9.50	4.45	
	Acid & Base	Pre	30	29	1.37	1.40	29.48**
		Post	30	29	9.10	1.27	
	Electricity	Pre	30	29	2.57	1.92	24.27**
		Post	30	29	9.20	1.27	

***** Significant at 0.01 level***

From the Table 4.4, it is evident that the t-value for the performance score for Group I students in Temperature Concept is 19.19 with df = 29 which is significant at 0.01 level. It indicates that pre and posttests score of Group I students in Temperature concept differ significantly. It means that there was a significant impact of SLTD on Leaning of Temperature Concepts among Group I students. In the light of this, the null hypothesis stated as ***"there is no significant difference in the mean score Temperature Concept before and after introduction of Science Lab Talking Device among Group I students"*** is rejected. It may therefore be concluded that the SLTD helped in improving the Learning of Temperature Concepts of Group I Students with Visual Impairment.

From the Table 4.4, it is evident that the t-value for the performance score for Group I students in Acid & Base Concept is 20.89 with df = 29 which is significant at 0.01 level. It indicates that pre and posttests score of Group I students in Acid & Base concept differ significantly. It means that there was a significant impact of SLTD on Leaning of Acid & Base Concepts among Group I students. In the light of this, the null

hypothesis stated as ***"there is no significant difference in the mean score of Acid & Base Concept before and after introduction of Science Lab Talking Device among Group I students"*** is rejected. It may therefore be concluded that the SLTD helped in improving the Learning of Acid & Base Concepts of Group I Students with Visual Impairment.

From the Table 4.4, it is evident that the t-value for the performance score for Group I students in Electricity Concept is 21.69 with df = 29 which is significant at 0.01 level. It indicates that pre and posttests score of Group I students in Electricity Concept differ significantly. It means that there was a significant impact of SLTD on Leaning of Electricity Concepts among Group I students. In the light of this, the null hypothesis stated as ***"there is no significant difference in the mean score of Electricity Concept before and after introduction of Science Lab Talking Device among Group I students"*** is rejected. It may therefore be concluded that the SLTD helped in improving the Learning of Electricity Concepts of Group I Students with Visual Impairment.

From the Table 4.4, it is evident that the t-value for the performance score for Group II students in Temperature Concept is 8.67 with df = 29 which is significant at 0.01 level. It indicates that pre and posttests score of Group II Students in Temperature concept differ significantly. It means that there was a significant impact of SLTD on Leaning of Temperature Concepts among Group II students. In the light of this, the null hypothesis stated as ***"there is no significant difference in the mean score of Temperature Concept before and after introduction of Science Lab Talking Device among Group II students"*** is rejected. It may therefore be concluded that the SLTD helped in improving the Learning of Temperature Concepts of Group II Students with Visual Impairment.

From the Table 4.4, it is evident that the t-value for the performance score for Group II students in Acid& Base Concept is 29.48 with df = 29 which is significant at 0.01 level. It indicates that pre and posttests score of Group II Students in Acid &Base concept differ significantly. It means that there was a significant impact of SLTD on Leaning of Acid &Base Concepts among Group II students. In the light of this, the null hypothesis stated as ***"there is no significant difference in the mean score of Acid &Base Concept before and after introduction of Science Lab Talking Device among***

Group II students" is rejected. It may therefore be concluded that the STLD helped in improving the Learning of Acid &Base Concepts of Group II Students with Visual Impairment.

From the Table 4.4, it is evident that the t-value for the performance score for Group II in Electricity Concept is 24.27with df = 29 which is significant at 0.01 level. It indicates that pre and posttests score of Group II students in Electricity Concept of with differ significantly. It means that there was a significant impact of SLTD on Leaning of Electricity Concepts among Group II students. In the light of this, the null hypothesis stated as ***"there is no significant difference in the mean score of Electricity Concept before and after introduction of Science Lab Talking Device among Group I students"*** is rejected. It may therefore be concluded that the SLTD helped in improving the Learning of Electricity Concepts of Group II Students with Visual Impairment.

SECTION IV

4.5 Analysis of Performance in Experiments

Section IV analyzes the scores obtained in experiments namely Temperature Measurement, Acid Base Detection, Electricity Measurement for Group I students and in addition to these three experiments, Measurements of Current in Ammeter and Measurement of Electric Potential in Voltmeter for Group II students were included and scores analyzed.

The Repeated Measures ANOVA was employed to determine whether the Performance Score in the selected experiments differ significantly in the Pretest, PostTest and Delayed Posttest applying statistical methods such as Sphericity Assumed, Greenhouse-Geiser, Huynh-Feldt and Lower-bound. The results are given in the following Tables

Table 4.5 and 4.6 present the analysis of performance in the Temperature experiment among Group I students.

4.5.1 Temperature Measurement Experiment: Group I

The results of the performance of Group I students in Temperature Experiment are given in the following table.

Table 4.5 Repeated Measures ANOVA for Temperature Experiment of Group I

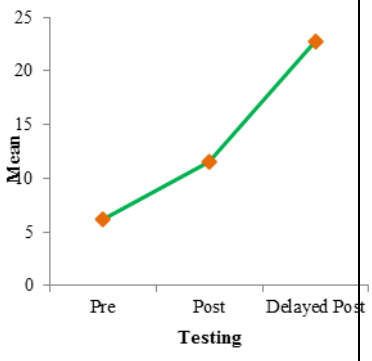
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Temperature Experiment	Sphericity Assumed	3466.022	2	1733.01	530.95	0.00**	0.948
	Greenhouse-Geisser	**3466.022**	**1.84**	**1878.53**	**530.95**	**0.00****	**0.948**
	Huynh-Feldt	3466.022	1.97	1764.12	530.95	0.00**	0.948
	Lower-bound	3466.022	1.00	3466.02	530.95	0.00**	0.948
Error (factor1)	Sphericity Assumed	189.311	58	3.26			
	Greenhouse-Geisser	189.311	53.51	3.54			
	Huynh-Feldt	189.311	56.98	3.33			
	Lower-bound	189.311	29.00	6.59			

***** Significant at 0.01 level***

From the Table 4.5, it is evident that the F value for Temperature Experiment is (2, 1.7) = 530.95, $p<0.01$. This shows the mean scores of Temperature Experiment of Group I students in the Pre, Post and Delayed Post differ significantly. The effect size $\eta 2$ =0.948 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.6 Sidak Post Hoc Test of Temperature Experiment of Group I

Testing		Mean	Men Difference	Std. Error	Sig.
Pre	Post	11.53	5.37	0.51	0.00**
	Delayed post	22.73	16.56	0.49	0.00**
Post	Pre	6.17	5.37	0.51	0.00**
	Delayed Post	22.73	11.2	0.39	0.00**
Delayed Post	Pre	6.17	16.56	0.49	0.00**
	Post	11.53	11.2	0.39	0.00**



***** Significant at 0.01 level***

From the above Table 4.6, it is evident that the significant difference are resulted between: Pre & Post (5.37), Pre & Delayed Post (16.56), Post & Delayed Post (11.2). These results indicate that the students have shown improvement in Temperature Experiment after inroducton of the SLTD.

4.5.1.1 Analysis of Performance of Group I Students in Experiments

Table 4.7 to 4.14, 4.17 to 4.24 & 4.27 to 4.34 analyze the four aspects of experiments namely listing of Materials required for the experiment, Identification of Materials by naming, Setting the Apparatus for experiment and Performing the experiment before introduction, during introduction and after introduction of the SLTD. The scores are noted as pre mean score, post mean score and delayed post mean score. These tables describe the scores of Group I students in three experiments namely Temperature Measurement, Acid and Base Experiment and Current Light Detection Experiment.

Table 4.7 Repeated Measures ANOVA for Listing of Materials in Temperature Experiment of Group I

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Listing of Materials	Sphericity Assumed	40.21	2	20.10	76.23	0.00**	.954
	Greenhouse-Geisser	**40.21**	**1.74**	**23.10**	**76.23**	**0.00****	**.954**
	Huynh-Feldt	40.21	1.84	21.83	76.23	0.00**	.954
	Lower-bound	40.21	1.00	40.21	76.23	0.00**	.954
Error	Sphericity Assumed	15.29	58	0.26			
	Greenhouse-Geisser	15.29	50.47	0.30			
	Huynh-Feldt	15.29	53.42	0.29			

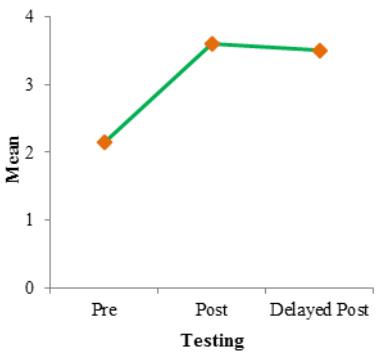
***** Significant at 0.01 level***

From the Table 4.7, it is evident that the F value for Listing of Materials in Temperature Experiment is (2, 1.7) = 76.23, $p<0.01$. This shows the mean scores of Listing of Materials of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2$ =.954 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected.

To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.8 Sidak Post Hoc Test for Listing of Materials in Temperature Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.6	1.45	0.16	0.00**
	Delayed post	3.5	1.38	0.12	0.00**
Post	Pre	2.15	1.45	0.16	0.00**
	Delayed Post	3.5	0.07	0.12	0.922
Delaye d Post	Pre	2.15	1.38	0.12	0.00**
	Post	3.6	0.07	0.18	0.922



***** Significant at 0.01 level***

From the above Table 4.8, it is evident that the significant difference are resulted between: Pre & Post (1.5), Pre & Delayed Post (1.4). These results indicate that the students have showen improvement in Material Required in Temperature Experiment after inroducton of the SLTD. The scores between Post&Delayed Post was found to be at same level.

Table 4.9 Repeated Measures ANOVA for Material Identification in Temperature Experiment of Group I

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Material Identi-fication	Sphericity Assumed	40.21	2	20.10	76.23	0.00**	.954
	Greenhouse-Geisser	**40.21**	**1.74**	**23.10**	**76.23**	**0.00****	**.954**
	Huynh-Feldt	40.21	1.84	21.83	76.23	0.00**	.954
	Lower-bound	40.21	1.00	40.21	76.23	0.00**	.954
Error	Sphericity Assumed	15.29	58	0.26			
	Greenhouse-Geisser	15.29	50.47	0.30			
	Huynh-Feldt	15.29	53.42	0.29			
	Lower-bound	15.29	29.00	0.53			

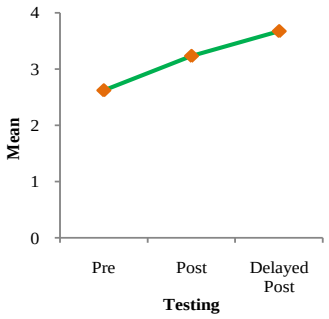
***** Significant at 0.01 level***

From the Table 4.9, it is evident that the F value for Materials Identification in Temperature Experiment is (2, 1.7) = 76.23, $p<0.01$. This shows the mean scores of

Materials Identification of Group I students in the Pre, Post and Delayed Post Test differs significantly. The effect size η2 = .954 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.10 Sidak Post Hoc Test of Material Identification in Temperature Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.23	1.45	0.16	0.00**
	Delayed post	3.67	1.38	0.12	0.00**
Post	Pre	2.62	1.45	0.16	0.00**
	Delayed Post	3.67	0.07	0.18	0.922
Delayed Post	Pre	2.62	1.38	0.12	0.00**
	Post	3.23	0.07	0.12	0.922



***** Significant at 0.01 level.***

From the above Table 4.10, it is evident that the significant difference are resulted between: Pre & Post (1.5), Pre &Delayed Post (1.4) and Post& Pre (1.5). These results indicate that the students have showen improvement inMaterial Identification after inroducton of the SLTD. The scores between Post&Delayed Post was found to be at same level.

Table 4.11 Repeated Measures ANOVA for Setting Apparatus in Temperature Experiment of Group I

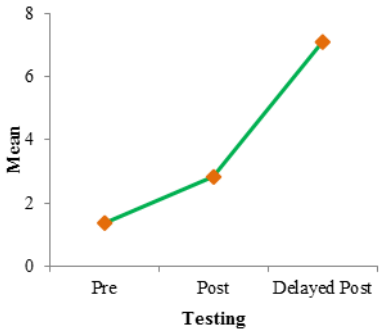
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Setting the Apparatus	Sphericity Assumed	532.27	2	266.13	358.42	0.00	.925
	Greenhouse-Geisser	**532.27**	**1.93**	**276.14**	**358.42**	**0.00**	**.925**
	Huynh-Feldt	532.27	2.00	266.13	358.42	0.00	.925
	Lower-bound	532.27	1.00	532.27	358.42	0.00	.925
Error	Sphericity Assumed	43.07	58	0.74			
	Greenhouse-Geisser	43.07	55.90	0.77			
	Huynh-Feldt	43.07	58.00	0.74			
	Lower-bound	43.07	29.00	1.49			

*****Significant at 0.01 level***

From the Table 4.11, it is evident that the F value for Setting the Apparatus in Temperature Experiment is (2, 1.9) = 358.42, $p<0.01$. This shows the mean scores of Setting the Apparatus of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = .925$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.12 Sidak Post Hoc Test of Setting the Apparatus in Temperature Experiment of Group I

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	Post	2.83	1.47*	0.20	0.00**
	Delayed post	7.10	5.73*	0.24	0.00**
Post	Pre	1.37	1.47*	0.20	0.00**
	Delayed Post	7.10	4.27*	0.23	0.00**
Delayed Post	Pre	1.37	5.73*	0.24	0.00**
	Post	2.83	4.27*	0.23	0.00**



***** Significant at 0.01 level***

From the above Table 4.12, it is evident that the significant difference are resulted between: Pre & Post (1.5), Pre &Delayed Post (5.7), Post & Delayed Post (4.3). These results indicate that the students have showen improvement in Setting the Apparatus after inroducton of the SLTD.

Table 4.13 Repeated Measures ANOVA for Performing Temperature Experiment of Group I

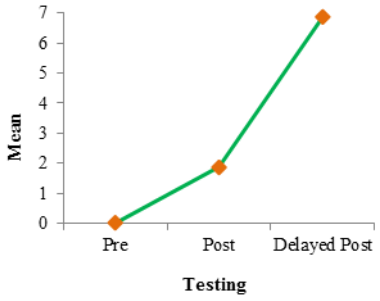
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Performing Experiment	Sphericity Assumed	750.56	2	375.28	878.45	0.00**	.968
	Greenhouse-Geisser	**750.56**	**1.96**	**382.98**	**878.45**	**0.00****	**.968**
	Huynh-Feldt	750.56	2.00	375.28	878.45	0.00**	.968
	Lower-bound	750.56	1.00	750.56	878.45	0.00**	.968
Error	Sphericity Assumed	24.78	58	0.43			
	Greenhouse-Geisser	24.78	56.83	0.44			
	Huynh-Feldt	24.78	58.00	0.43			
	Lower-bound	24.78	29.00	0.85			

***** Significant at 0.01 level***

From the Table 4.13, it is evident that the F value for Performing Experimentin Temperature Experiment is (2, 2) = 878.45, p<0.01. This shows the mean scores of Performing Experimentof Group I students in the Pre, Post and Delayed Post Test differs significantly. The effect size η2 =.968 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.14 Sidak Post Hoc Test of Performing Experiment

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	Post	1.87	1.83	0.18	0.00**
	Delayed post	6.87	6.83	0.16	0.00**
Post	Pre	0.03	1.83	0.18	0.00**
	Delayed Post	6.87	5.00	0.17	0.00**
Delayed Post	Pre	0.03	6.83	0.16	0.00**
	Post	1.87	5.00	0.17	0.00**



***Significant at 0.01 level**

From the above Table 4.14, it is evident that the significant difference are resulted between: Pre & Post (1.8), Pre &Delayed Post (6.8) and Post & Delayed Post (5). These results indicate that the students have showen improvement inPerforming Experiment after inroducton of the SLTD.

4.5.2 Acid & Base Experiment : Group I

Table 4.15 Repeated Measures ANOVA for Acid & Base Experiment of Group I

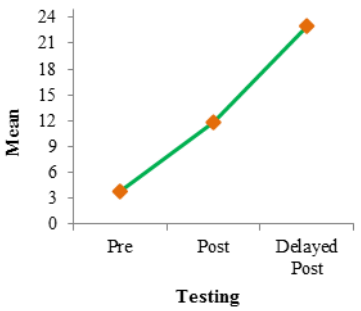
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Acid & Base Experiment	Sphericity Assumed	4496.96	2	2248.48	454.36	0.00**	.940
	Greenhouse-Geisser	**4496.96**	**1.48**	**3151.65**	**454.36**	**0.00****	**.940**
	Huynh-Feldt	4496.96	1.48	3038.67	454.36	0.00**	.940
	Lower-bound	4496.96	1.00	4496.96	454.36	0.00**	.940
Error	Sphericity Assumed	287.04	58	4.99			
	Greenhouse-Geisser	287.04	41.38	6.97			
	Huynh-Feldt	287.04	42.98	6.68			
	Lower-bound	287.04	29.00	9.89			

***** Significant at 0.01 level***

From the Table 4.15, it is evident that the F value for Acid & Base Experiment is (2, 1.5) = 454.36, $p<0.01$. This shows the mean scores of Acid & Base Experiment of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = 0.940$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.16 Sidak Post Hoc Test of Acid & Base Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	11.83	8.03	0.76	0.00**
	Delayed post	23.00	19.92	0.57	0.00**
Post	Pre	3.80	8.03	0.75	0.00**
	Delayed Post	23.00	11.17	0.39	0.00**
Delayed Post	Pre	3.80	19.92	0.57	0.00**
	Post	11.53	11.17	0.39	0.00**



***** Significant at 0.01 level***

From the above Table 4.16, it is evident that the significant difference are resulted between: Pre & Post (8.03), Pre & Delayed Post (19.92), and Post&Delayed Post (11.17). These results indicate that the students have showen improvement in Acid & Base Experiment after inroducton of the SLTD.

Table 4.17 Repeated Measures ANOVA for Listing of Materials in Acid & Base Experiment of Group I

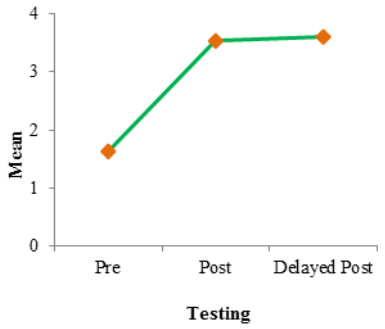
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Listing of Materials	Sphericity Assumed	74.82	2	37.41	68.14	0.00**	.701
	Greenhouse-Geisser	**74.82**	**1.48**	**50.70**	**68.14**	**0.00****	**.701**
	Huynh-Feldt	74.82	1.54	48.71	68.14	0.00**	.701
	Lower-bound	74.82	1.00	74.82	68.14	0.00**	.701
Error	Sphericity Assumed	31.84	58	0.55			
	Greenhouse-Geisser	31.84	42.80	0.74			
	Huynh-Feldt	31.84	44.54	0.72			
	Lower-bound	31.84	29.00	1.10			

*****Significant at 0.01 level***

From the Table 4.17, it is evident that the F value for Listing of Materialsin Acid &Base Experiment is (2, 1.5) = 68.14, p<0.01. This shows the mean scores of Listing of Materialsof Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =.701 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.18 Sidak Post Hoc Test for Listing of Materials in Acid & Base Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.53	1.90	0.24	0.00**
	Delayed post	3.6	1.97	0.19	0.00**
Post	Pre	1.63	1.90	0.24	0.00**
	Delayed Post	3.6	0.07	0.14	0.947
Delayed Post	Pre	1.63	1.97	0.19	0.00**
	Post	3.53	0.07	0.14	0.947



***** Significant at 0.01 level.***

From the above Table 4.18, it is evident that the significant difference are resulted between: Pre & Post (1.9) and Pre & Delayed Post (2). These results indicate that the students have showen improvement in Listing of Materials after inroducton of the SLTD. The scores between Post&Delayed Post was found to be at same level.

Table 4.19 Repeated Measures ANOVA for Materials Identification in Acid & Base Experiment of Group I

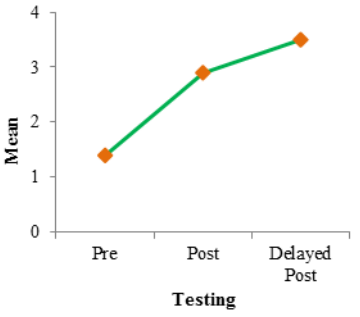
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Materials Identification	Sphericity Assumed	72.02	2	36.01	149.43	0.00**	.837
	Greenhouse-Geisser	**72.02**	**1.73**	**41.65**	**149.43**	**0.00****	**.837**
	Huynh-Feldt	72.02	1.83	39.38	149.43	0.00**	.837
	Lower-bound	72.02	1.00	72.02	149.43	0.00**	.837
Error	Sphericity Assumed	13.98	58	0.24			
	Greenhouse-Geisser	13.98	50.15	0.28			
	Huynh-Feldt	13.98	53.04	0.26			
	Lower-bound	13.98	29.00	0.48			

***Significant at 0.01 level*

From the Table 4.19, it is evident that the F value for Materials Identification in Acid & Base Experiment is (2, 1.7) = 149.43, p<0.01. This shows the mean scores of Material Identification of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =.837 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.20 Sidak Post Hoc Test of Material Identification in Acid & Base Experiment of Group I

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	Post	2.9	1.50	0.15	0.00**
	Delayed post	3.5	2.13	0.12	0.00**
Post	Pre	1.4	1.50	0.15	0.00**
	Delayed Post	3.5	0.63	0.11	0.00**
Delayed Post	Pre	1.4	2.13	0.12	0.00**
	Post	2.9	0.63	0.11	0.00**



*** Significant at 0.01 level.*

From the above Table 4.20, it is evident that the significant difference are resulted between: Pre & Post (1.5), Pre & Delayed Post (2.1), and Post & Delayed Post (0.6).These results indicate that the students have showen improvementin Material Identification after introducton of the SLTD.

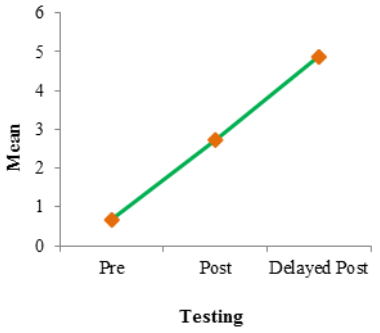
Table 4.21 Repeated Measures ANOVA for Setting the Apparatus in Acid & Base Experiment of Group I

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Setting the Apparatus	Sphericity Assumed	264.62	2	132.31	225.41	0.00**	.886
	Greenhouse-Geisser	**264.62**	**1.76**	**150.73**	**225.41**	**0.00****	**.886**
	Huynh-Feldt	264.62	1.86	142.29	225.41	0.00**	.886
	Lower-bound	264.62	1.00	264.62	225.41	0.00**	.886
Error	Sphericity Assumed	34.04	58	0.59			
	Greenhouse-Geisser	34.04	50.91	0.67			
	Huynh-Feldt	34.04	53.93	0.63			
	Lower-bound	34.04	29.00	1.17			

From the Table 4.21, it is evident that the F value for Setting the Apparatus in Acid & Base Experiment is (2, 1.76) = 225.41, $p<0.01$. This shows the mean scores of Setting the Apparatus of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2$ =.886 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.22 Sidak Post Hoc Test of Setting the Apparatus in Acid & Base Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	2.73	2.07	0.22	0.00**
	Delayed post	4.87	4.20	0.21	0.00**
Post	Pre	0.67	2.07	0.22	0.00**
	Delayed Post	4.87	2.13	0.16	0.00**
Delayed Post	Pre	0.67	4.20	0.21	0.00**
	Post	2.73	2.13	0.16	0.00**



***** Significant at 0.01 level.***

From the above Table 4.22, it is evident that the significant difference are resulted between: Pre & Post (2), Pre &Delayed Post (4.2) and Post&Delayed Post (2.1). These results indicate that the students have showen improvement inSetting the Apparatus after inroducton of the SLTD.

Table 4.23 Repeated Measures ANOVA for Performing Experiment in Acid & Base Experiment of Group I

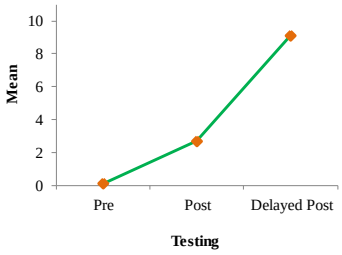
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Performing Experiment	Sphericity Assumed	1289.76	2	644.88	588.30	0.00	.953
	Greenhouse-Geisser	**1289.76**	**1.93**	**669.67**	**588.30**	**0.00**	**.953**
	Huynh-Feldt	1289.76	2.00	644.88	588.30	0.00	.953
	Lower-bound	1289.76	1.00	1289.76	588.30	0.00	.953
Error	Sphericity Assumed	63.58	58	1.10			
	Greenhouse-Geisser	63.58	55.85	1.14			
	Huynh-Feldt	63.58	58.00	1.10			
	Lower-bound	63.58	29.00	2.19			

***** Significant at 0.01 level.***

From the Table 4.23, it is evident that the F value for Performing Experimentin Acid & Base Experiment is (2, 1.9) = 588.30, p<0.01. This shows the mean scores of Performing Experimentof Group I in the Pre, Post and Delayed Post Test differ significantly. The effect sizeη2 =.953 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.24 Sidak Post Hoc Test of Performing Experiment in Acid & Base Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	2.67	2.57	0.29	0.00**
	Delayed post	9.10	9.00	0.24	0.00**
Post	Pre	0.10	2.57	0.29	0.00**
	Delayed Post	9.10	6.43	0.27	0.00**
Delayed Post	Pre	0.10	9.00	0.24	0.00**
	Post	2.67	6.43	0.27	0.00**



***** Significant at 0.01 level.***

From the above Table 4.24, it is evident that the significant difference are resulted between: Pre & Post (2.6), Pre &Delayed Post (9) and Post & Delayed Post (6.4). These results indicate that the students have shown improvement in Performing Experiment after inroducton of the SLTD.

4.5.3 Electricity Light Detection Experiment: Group I

Table 4.25 Repeated Measures ANOVA for Current Light Detection Experiment of Group I

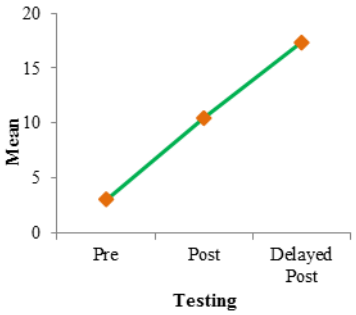
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Current Light Detection Experiment	Sphericity Assumed	3040.07	2	1520.03	439.49	0.00**	.938
	Greenhouse-Geisser	**3040.07**	**1.57**	**1933.09**	**439.49**	**0.00****	**.938**
	Huynh-Feldt	3040.07	1.64	1845.55	439.49	0.00**	.938
	Lower-bound	3040.07	1.00	3040.07	439.49	0.00**	.938
Error	Sphericity Assumed	200.60	58	3.46			
	Greenhouse-Geisser	200.60	45.61	4.40			
	Huynh-Feldt	200.60	47.77	4.20			
	Lower-bound	200.60	29.00	6.92			

***** Significant at 0.01 level.***

From the Table 4.25, it is evident that the F value for Materials Required component in Current Light Detection Experiment is (2, 1.6) = 439.49, $p<0.01$. This shows the mean scores of Current Light Detection Experiment of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = 0.938$was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.26 Sidak Post Hoc Test of Light Detection Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	10.47	7.67	0.46	0.00**
	Delayed post	17.33	14.33	0.59	0.00**
Post	Pre	3.10	7.67	0.46	0.00**
	Delayed Post	17.33	6.87	0.37	0.00**
Delayed Post	Pre	3.10	14.33	0.59	0.00**
	Post	10.47	6.87	0.37	0.00**



***** Significant at 0.01 level***

From the above Table 4.26, it is evident that the significant difference are resulted between: Pre & Post (7.67), Pre &Delayed Post (14.33), and Post& Delayed Post (6.87). These results indicate that the students have showen improvement in Light Detection Current Experiment after inroducton of the SLTD.

Table 4.27 Repeated Measures ANOVA for Listing of Materials Light Detection Experiment of Group I

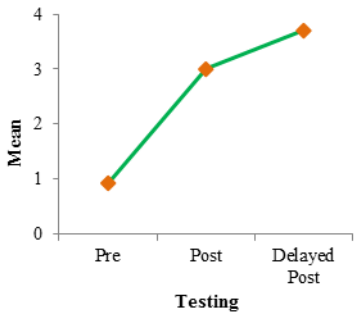
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Listing of Materials	Sphericity Assumed	124.16	2	62.08	181.44	0.00**	.862
	Greenhouse-Geisser	**124.16**	**1.72**	**72.27**	**181.44**	**0.00****	**.862**
	Huynh-Feldt	124.16	1.82	68.37	181.44	0.00**	.862
	Lower-bound	124.16	1.00	124.16	181.44	0.00**	.862
Error	Sphericity Assumed	19.84	58	0.34			
	Greenhouse-Geisser	19.84	49.82	0.40			
	Huynh-Feldt	19.84	52.66	0.38			
	Lower-bound	19.84	29.00	0.68			

***** Significant at 0.01 level.***

From the Table 4.27, it is evident that the F value for Listing of Materials in Current Light Detection Experiment is (2, 1.7) = 181.44, p<0.01. This shows the mean scores of Listing of Materials of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 = .862 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.28 Sidak Post Hoc Test for Listing of Materials Light Detection Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3	2.07	0.18	0.00**
	Delayed post	3.7	2.77	0.13	0.00**
Post	Pre	0.93	2.07	0.18	0.00**
	Delayed Post	3.7	0.70	0.14	0.00**
Delayed Post	Pre	0.93	2.77	0.13	0.00**
	Post	3	0.70	0.14	0.00**



***** Significant at 0.01 level***

From the above Table 4.28, it is evident that the significant difference are resulted between: Pre & Post (2), Pre &Delayed Post (2.8) and Post& Delayed Post (0.7). These results indicate that the students have showen improvement in Listing of Materials after inroducton of the SLTD.

Table 4.29 Repeated Measures ANOVA for Materials Identification Light Detection Experiment of Group I

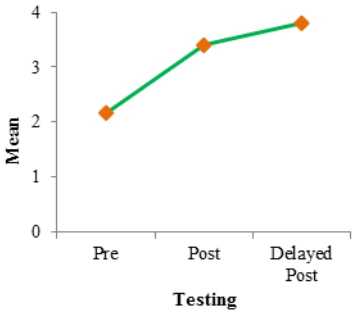
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Materials Identification	Sphericity Assumed	43.49	2	21.74	65.76	0.00**	.694
	Greenhouse-Geisser	**43.49**	**1.54**	**28.16**	**65.76**	**0.00****	**.694**
	Huynh-Feldt	43.49	1.62	26.93	65.76	0.00**	.694
	Lower-bound	43.49	1.00	43.49	65.76	0.00**	.694
Error	Sphericity Assumed	19.18	58	0.33			
	Greenhouse-Geisser	19.18	44.79	0.43			
	Huynh-Feldt	19.18	46.83	0.41			
	Lower-bound	19.18	29.00	0.66			

***** Significant at 0.01 level***

From the Table 4.29, it is evident that the F value for Materials Identification in Current Light Detection is (2, 1.54) = 65.76, $p<0.01$. This shows the mean scores of Material Identification of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = .694$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.30 Sidak Post Hoc Test of Material Identification Light Detection Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.40	1.23	0.14	0.00**
	Delayed post	3.80	1.63	0.18	0.00**
Post	Pre	2.17	1.23	0.14	0.00**
	Delayed Post	3.80	0.40	0.11	0.004
Delayed Post	Pre	2.17	1.63	0.18	0.00**
	Post	3.40	0.40	0.11	0.004



***** Significant at 0.01 level***

From the above Table 4.30, it is evident that the significant difference are resulted between: Pre & Post (1.2), Pre & Dealyed Post (1.6). These results indicate that the students have showen improvement in Material Identification after inroducton of the SLTD. The scores between post & delayed post found to be at same level.

Table 4.31 Repeated Measures ANOVA for Setting the Apparatus Light Detection Experiment of Group I

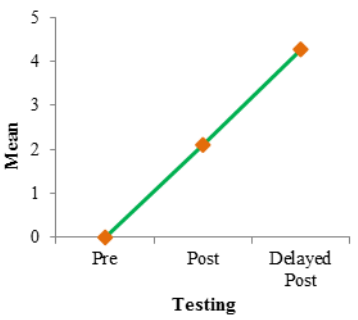
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Setting the Apparatus	Sphericity Assumed	273.09	2	136.54	273.93	0.00**	.904
	Greenhouse-Geisser	**273.09**	**1.82**	**150.49**	**273.93**	**0.00****	**.904**
	Huynh-Feldt	273.09	1.93	141.57	273.93	0.00**	.904
	Lower-bound	273.09	1.00	273.09	273.93	0.00**	.904
Error	Sphericity Assumed	28.91	58	0.50			
	Greenhouse-Geisser	28.91	52.63	0.55			
	Huynh-Feldt	28.91	55.94	0.52			
	Lower-bound	28.91	29.00	1			

***** Significant at 0.01 level***

From the Table 4.31, it is evident that the F value for Setting the Apparatus in Current Light Detection is (2, 1.82) = 273.93, p<0.01. This shows the mean scores of Setting the Apparatus of Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =.904 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.32 Sidak Post Hoc Test of Setting the Apparatus Light Detection Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	2.10	2.10	0.188	0.00**
	Delayed post	4.27	4.27	0.203	0.00**
Post	Pre	0.00	2.10	0.188	0.00**
	Delayed Post	4.27	2.17	0.152	0.00**
Delayed Post	Pre	0.00	4.27	0.203	0.00**
	Post	2.10	2.17	0.152	0.00**



***** Significant at 0.01 level***

From the above Table 4.32, it is evident that the significant difference are resulted between: Pre & Post (2.10), Pre & Delayed Post (4.27), and Post&Delayed Post (2.17). These results indicate that the students have showen improvement in Setting the Apparatus after inroducton of the SLTD.

Table 4.33 Repeated Measures ANOVA for Performing Experiment Light Detection Experiment of Group I

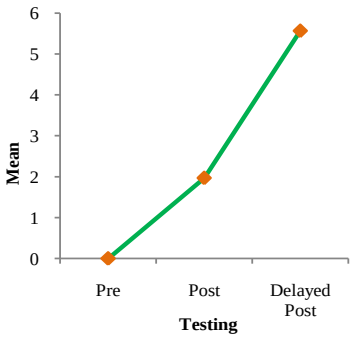
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Performing Experiment	Sphericity Assumed	478.16	2	239.08	155.49	0.00**	.843
	Greenhouse-Geisser	**478.16**	**1.32**	**362.24**	**155.49**	**0.00****	**.843**
	Huynh-Feldt	478.16	1.36	352.01	155.49	0.00**	.843
	Lower-bound	478.16	1.00	478.16	155.49	0.00**	.843
Error	Sphericity Assumed	89.18	58	1.54			
	Greenhouse-Geisser	89.18	38.28	2.33			
	Huynh-Feldt	89.18	39.39	2.26			
	Lower-bound	89.18	29.00	3.08			

***** Significant at 0.01 level***

From the Table 4.33, it is evident that the F value for Performing Experiment is (2, 1.3) = 155.49, $p<0.01$. This shows the mean scores of Performing Experimentof Group I students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2$ =.843 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.34 Sidak Post Hoc Test of Performing Experiment Light Detection Experiment of Group I

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	1.97	1.97	.227	0.00**
	Delayed post	5.57	5.57	.417	0.00**
Post	Pre	0.00	1.97	.227	0.00**
	Delayed Post	5.57	3.60	.286	0.00**
Delayed Post	Pre	0.00	5.57	.417	0.00**
	Post	1.97	3.60	.286	0.00**



***** Significant at 0.01 level***

From the above Table 4.34, it is evident that the significant difference are resulted between: Pre & Post (1.97), Pre & Delayed Post (5.57), and Post&Delayed Post (3.60). These results indicate that the students have showen improvement in Setting the Apparatus after inroducton of the SLTD.

4.6 Analysis of Performance of Group II Students in Experiments

Table 4.35 and 4.73 present the analysis of performance in the experiments among Group II students. The results of the performance of Group II students in Temperature Melting Point of Wax Experiment are given in the following table.

4.6.1 Temperature Melting Point Experiment: Group II

Table 4.35 Repeated Measures ANOVA for Temperature for Melting Point of Wax Experiment of Group II

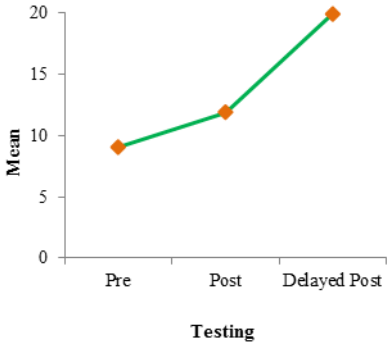
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Temperature Melting Point of Wax Experiment	Sphericity Assumed	3314.45	2	1657.23	699.64	0.00**	0.960
	Greenhouse-Geisser	**3314.45**	**1.47**	**2252.94**	**699.64**	**0.00****	**0.960**
	Huynh-Feldt	3314.45	1.53	2165.49	699.64	0.00**	0.960
	Lower-bound	3314.45	1.00	3314.45	699.64	0.00**	0.960
Error	Sphericity Assumed	137.38	58	2.37			
	Greenhouse-Geisser	137.38	42.66	3.22			
	Huynh-Feldt	137.38	44.38	3.10			
	Lower-bound	137.38	29.00	4.74			

***** Significant at 0.01 level***

From the Table 4.35, it is evident that the F value for Materials Required component in Temperature Melting Point of Wax Experiment is (2, 1.47) = 699.64, $p<0.01$. This shows the mean scores of Temperature Melting Point of Wax Experiment of Group 2 students in the Pre, Post and Delayed Post Test differs significantly. The effect size $\eta 2 = 0.960$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as *"there is no significant difference within Pre, Post and Delayed Post Test Scores"* is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.36 Sidak Post Hoc Test of Temperature for Melting Point of Wax Experiment of Group II

Testing		Mean	Mean Diff	Std. Error	Sig.
Pre	Post	11.90	2.85	0.466	0.00**
	Delayed post	19.90	10.85	0.438	0.00**
Post	Pre	9.05	2.85	0.466	0.00**
	Delayed Post	19.90	8.00	0.254	0.00**
Delayed Post	Pre	9.05	10.85	0.438	0.00**
	Post	11.90	8.00	0.254	0.00**



***** Significant at 0.01 level***

From the above Table 4.36, it is evident that the significant difference are resulted between: Pre & Post (2.85), Pre & Delayed Post (10.85), and Post& Delayed Post (8.00). These results indicate that the students have showen improvement in Temperature Melting Point of Wax Experiment after inroducton of the SLTD.

4.6.1.1 Analysis of Performance of Group II Students in Experiments

Table 4.37 to 4.44, 4.47 to 4.54, 4.57 to 4.64 and 4.67 to4.74 analyze the four aspects of experiments namely listing of Materials requiring for the experiment, Identification of Materials by naming, Setting the Apparatus for experiment and Performing the experiment before introduction, during introduction and after introduction of the SLTD. The scores are noted as pre mean score, post mean score and delayed post mean score. These tables describe the scores of Group II students in four experiments namely Temperature Melting Point of Wax Experiment, Acid & Base Experiment, Current Ammeter Experiment and Current Voltmeter Experiment.

Table 4.37 Repeated Measures ANOVA for Listing of Materials in Melting Point Wax of Group II

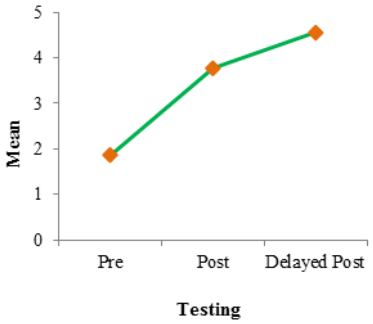
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Listing of Materials	Sphericity Assumed	114.24	2	57.12	143.45	0.00**	0.832
	Greenhouse-Geisser	**114.24**	**1.53**	**74.77**	**143.45**	**0.00****	**0.832**
	Huynh-Feldt	114.24	1.60	71.59	143.45	0.00**	0.832
	Lower-bound	114.24	1.00	114.24	143.45	0.00**	0.832
Error	Sphericity Assumed	23.09	58	0.40			
	Greenhouse-Geisser	23.09	44.31	0.52			
	Huynh-Feldt	23.09	46.28	0.50			
	Lower-bound	23.09	29.00	0.80			

***** Significant at 0.01 level***

From the Table 4.37, it is evident that the F value for Listing of Materials in Temperature Melting Point of Wax Experiment is (2, 1.5) = 143.45, $p<0.01$. This shows the mean scores of Listing of Materials of Group II students in the Pre, Post and Delayed Post Test differs significantly. The effect size $\eta 2 = 0.832$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.38 Sidak Post Hoc Test for Listing of Materials in Melting Point Wax of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.77	1.90	0.18	0.00**
	Delayed post	4.55	2.68	0.19	0.00**
Post	Pre	1.87	1.90	0.18	0.00**
	Delayed Post	4.55	0.78	0.11	0.00**
Delayed Post	Pre	1.87	2.68	0.19	0.00**
	Post	3.77	0.78	0.11	0.00**



***** Significant at 0.01 level***

From the above Table 4.38, it is evident that the significant difference are resulted between:Pre & Post (1.9), Pre &Delayed Post (2.7) and Post & Delayed Post (0.8).These results indicate that the students have showen improvementin Listing of Materialsafter inroducton of the SLTD.

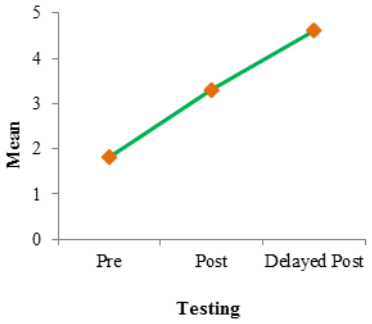
Table 4.39 Repeated Measures ANOVA for Material Identification in Melting Point Wax of Group II

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Materials Identi-fication	Sphericity Assumed	117.74	2	58.87	144.71	0.00**	0.833
	Greenhouse-Geisser	**117.74**	**1.54**	**76.35**	**144.71**	**0.00****	**0.833**
	Huynh-Feldt	117.74	1.61	73.04	144.71	0.00**	0.833
	Lower-bound	117.74	1.00	117.74	144.71	0.00**	0.833
Error	Sphericity Assumed	23.59	58	0.41			
	Greenhouse-Geisser	23.59	44.72	0.53			
	Huynh-Feldt	23.59	46.75	0.51			
	Lower-bound	23.59	29.00	0.81			

***** Significant at 0.01 level***

From the Table 4.3, it is evident that the F value for Material Identification in Temperature Melting Point of Wax Experiment is (2, 1.54) = 144.71, p<0.01. This shows the mean scores of Material Identification of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =0.833 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.40 Sidak Post Hoc Test of Material Identification in Melting Point Wax of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.	
Pre	Post	3.30	1.48	0.19	0.00**	
	Delayed post	4.62	2.80	0.19	0.00**	
Post	Pre	1.82	1.48	0.19	0.00**	
	Delayed Post	4.62	1.32	0.11	0.00**	
Delayed Post	Pre	1.82	2.80	0.19	0.00**	
	Post	3.30	1.32	0.11	0.00**	

***** Significant at 0.01 level***

From the above Table 4.40, it is evident that the significant difference are resulted between:Pre & Post (1.5), Pre & Delayed Post (2.8) and Post & Delayed Post (1.3). These results indicate that the students have showen improvementin Material Identification after inroducton of the SLTD.

Table 4.41 Repeated Measures ANOVA for Setting Apparatus in Melting Point Wax of Group II

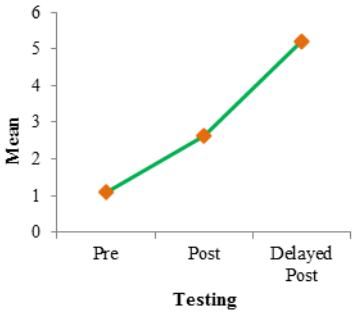
Source		Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Setting the Apparatus	Sphericity Assumed	257.49	2	128.74	434.70	0.00**	0.937
	Greenhouse-Geisser	**257.49**	**1.78**	**144.59**	**434.70**	**0.00****	**0.937**
	Huynh-Feldt	257.49	1.89	136.29	434.70	.00**	0.937
	Lower-bound	257.49	1.00	257.49	434.70	.00**	0.937
Error	Sphericity Assumed	17.18	58	0.30			
	Greenhouse-Geisser	17.18	51.64	0.33			
	Huynh-Feldt	17.18	54.79	0.31			
	Lower-bound	17.18	29.00	0.59			

***** Significant at 0.01 level***

From the Table 4.41, it is evident that the F value for Setting the Apparatus in Temperature Melting Point of Wax Experiment is (2, 1.78) = 434.70, $p<0.01$. This shows the mean scores of Setting the Apparatus of Group II students in the Pre, Post and Delayed Post Test differs significantly. The effect size $\eta 2 = 0.937$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.42 Sidak Post Hoc Test of Setting Apparatus in Melting Point Wax of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	2.63	1.53	0.16	.00**
	Delayed post	5.20	4.10	0.15	.00**
Post	Pre	1.10	1.53	0.16	.00**
	Delayed Post	5.20	2.57	0.11	.00**
Delayed Post	Pre	1.10	4.10	0.15	.00**
	Post	2.63	2.57	0.11	.00**



***** Significant at 0.01 level***

From the above Table 4.42, it is evident that the significant difference are resulted between:Pre & Post (1.5), Pre & Delayed Post (4.1) and Post & Delayed Post (2.6).These results indicate that the students have showen improvementin Setting the Apparatus after inroducton of the SLTD.

Table 4.43 Repeated Measures ANOVA for Performing Experiment in Melting Point Wax of Group II

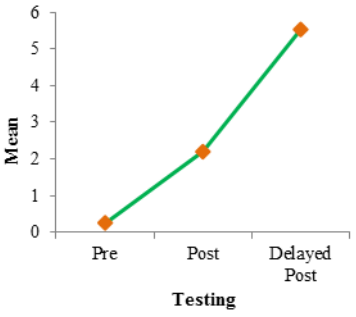
Source		Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Performing Experiment	Sphericity Assumed	425.87	2	212.93	511.75	.00**	0.946
	Greenhouse-Geisser	**425.87**	**1.51**	**282.06**	**511.75**	**.00****	**0.946**
	Huynh-Feldt	425.87	1.58	270.41	511.75	.00**	0.946
	Lower-bound	425.87	1.00	425.87	511.75	.00**	0.946
Error	Sphericity Assumed	24.13	58	0.42			
	Greenhouse-Geisser	24.13	43.79	0.55			
	Huynh-Feldt	24.13	45.67	0.53			
	Lower-bound	24.13	29.00	0.83			

**** Significant at 0.01 level***

From the Table 4.43, it is evident that the F value for Performing Experimentin Temperature Melting Point of Wax Experiment is(2, 1.51) = 511.75, p<0.01. This shows the mean scores of Performing Experimentin the Pre, Post and Delayed Post Test differs significantly. The effect size η2 =0.946 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.44 Sidak Post Hoc Test of Performing Experiment in Melting Point Wax of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	2.20	1.93	0.14	.00**
	Delayed post	5.53	5.27	0.21	.00**
Post	Pre	0.26	1.93	0.14	.00**
	Delayed Post	5.53	3.33	0.14	.00**
Delayed Post	Pre	0.26	5.27	0.21	.00**
	Post	2.20	3.33	0.14	.00**



***** Significant at 0.01 level***

From the above Table 4.44, it is evident that the significant difference are resulted between:Pre & Post (1.9), Pre &Delayed Post (5.3) and Post&Delayed Post (3.3). These results indicate that the students have showen improvement in Performing Experiment after inroducton of the SLTD.

4.6.2 Acid & Base Experiment: Group II

Table 4.45 Repeated Measures ANOVA for Acid & Base Experiment of Group II

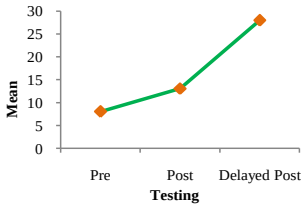
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Acid & Base Experiment	Sphericity Assumed	5909.40	2	2954.70	734.66	.00**	0.962
	Greenhouse-Geisser	**5909.40**	**1.45**	**4083.03**	**734.66**	**.00****	**0.962**
	Huynh-Feldt	5909.40	1.50	3931.02	734.66	.00**	0.962
	Lower-bound	5909.40	1.00	5909.40	734.66	.00**	0.962
Error	Sphericity Assumed	233.27	58	4.02			
	Greenhouse-Geisser	233.27	41.97	5.56			
	Huynh-Feldt	233.27	43.60	5.35			
	Lower-bound	233.27	29.00	8.04			

***** Significant at 0.01 level***

From the Table 4.45, it is evident that the F value for Acid & Base Experiment is (2, 1.45) = 734.66, $p<0.01$. This shows the mean scores of Acid & Base Experiment of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = 0.962$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.46 Sidak Post Hoc Test of Temperature Acid & Base Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	13.07	8.70	0.64	.00**
	Delayed post	28.00	19.95	0.52	.00**
Post	Pre	8.05	8.70	0.64	.00**
	Delayed Post	28.00	14.93	0.35	.00**
Delayed Post	Pre	8.05	19.95	0.52	.00**
	Post	13.07	14.93	0.35	.00**



***** Significant at 0.01 level***

From the above Table 4.46, it is evident that the significant difference are resulted between: Pre & Post (8.70), Pre &Delayed Post (19.95), and Post&Delayed Post (14.93). These results indicate that the students have showen improvement in Acid & Base Experiment after inroducton of the SLTD.

Table 4.47 Repeated Measures ANOVA for Listing of Materials in Acid & base Experiment of Group II

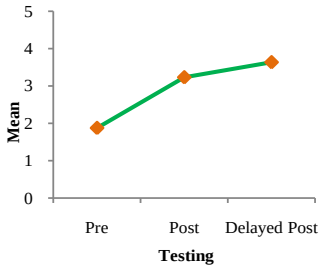
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Listing of Materials	Sphericity Assumed	51.49	2	25.74	86.93	.00**	0.750
	Greenhouse-Geisser	**51.49**	**1.73**	**29.77**	**86.93**	**.00****	**0.750**
	Huynh-Feldt	51.49	1.83	28.15	86.93	.00**	0.750
	Lower-bound	51.49	1.00	51.49	86.93	.00**	0.750
Error	Sphericity Assumed	17.18	58	0.30			
	Greenhouse-Geisser	17.18	50.15	0.34			
	Huynh-Feldt	17.18	53.04	0.32			
	Lower-bound	17.18	29.00	0.59			

***** Significant at 0.01 level***

From the Table 4.47, it is evident that the F value for Listing of Materials in Acid & Base Experiment is (2, 1.73) = 86.93, p<0.01. This shows the mean scores of Listing of Materials of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =0.750 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.48 Sidak Post Hoc Test for Listing of Materials in Acid & base Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.23	1.37	0.16	.00**
	Delayed post	3.63	1.77	0.14	.00**
Post	Pre	1.87	1.37	0.16	.00**
	Delayed Post	3.63	0.40	0.11	0.004
Delayed Post	Pre	1.87	1.77	0.14	.00**
	Post	3.23	0.40	0.11	0.004



***** Significant at 0.01 level***

From the above Table 4.48, it is evident that the significant difference are resulted between:Pre & Post (1.4), Pre & Delayed Post (1.8). These results indicate that the students have showen improvementin Listing of Materials after inroducton of the SLTD. The scores between post and delayed post found to be at same level.

Table 4.49 Repeated Measures ANOVA for Materials Identification in Acid & base Experiment of Group I

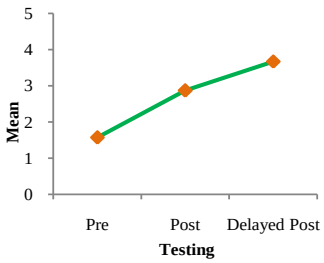
Source		Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Material Identification	Sphericity Assumed	67.40	2	33.70	163.79	.00**	0.850
	Greenhouse-Geisser	**67.40**	**1.98**	**34.08**	**163.79**	**.00****	**0.850**
	Huynh-Feldt	67.40	2.00	33.70	163.79	.00**	0.850
	Lower-bound	67.40	1.00	67.40	163.79	.00**	0.850
Error	Sphericity Assumed	11.93	58	0.21			
	Greenhouse-Geisser	11.93	57.35	0.21			
	Huynh-Feldt	11.93	58.00	0.21			
	Lower-bound	11.93	29.00	0.41			

***** Significant at 0.01 level***

From the Table 4.49, it is evident that the F value for Materials Identification in Acid & Base Experiment is(2, 1.98) = 163.79, $p<0.01$. This shows the mean scores of Material Identification of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = 0.850$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.50 Sidak Post Hoc Test of Material Identification in Acid & base Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	2.87	1.30	0.12	.00**
	Delayed post	3.67	2.10	0.11	.00**
Post	Pre	1.57	1.30	0.12	.00**
	Delayed Post	3.67	0.80	0.12	.00**
Delayed Post	Pre	1.57	2.10	0.11	.00**
	Post	2.87	0.80	0.12	.00**



***** Significant at 0.01 level***

From the above Table 4.50, it is evident that the significant difference are resulted between:Pre & Post (1.3), Pre &Delayed Post (2.1) and Post&Delayed Post (0.8). These results indicate that the students have showen improvementin Material Identification after inroducton of the SLTD.

Table 4.51 Repeated Measures ANOVA for Setting the Apparatus in Acid & base Experiment of Group II

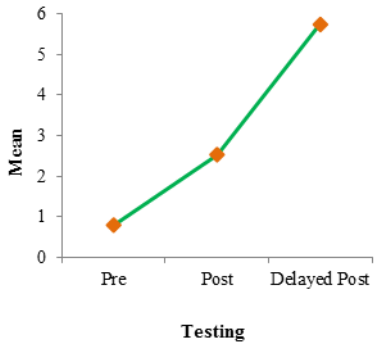
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Setting the Apparatus	Sphericity Assumed	375.82	2	187.91	450.78	.00**	0.940
	Greenhouse-Geisser	**375.82**	**1.89**	**198.44**	**450.78**	**.00****	**0.940**
	Huynh-Feldt	375.82	2.00	187.91	450.78	.00**	0.940
	Lower-bound	375.82	1.00	375.82	450.78	.00**	0.940
Error	Sphericity Assumed	24.18	58	0.42			
	Greenhouse-Geisser	24.18	54.92	0.44			
	Huynh-Feldt	24.18	58.00	0.42			
	Lower-bound	24.18	29.00	0.83			

***** Significant at 0.01 level***

From the Table 4.51, it is evident that the F value for Setting the Apparatus in Acid & Base Experiments (2, 1.89) = 450.78, p<0.01. This shows the mean scores of Setting the Apparatus in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =0.940 was found to be significant in making changes as the result of the intervention.In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.52 Sidak Post Hoc Test of Setting the Apparatus in Acid & base Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	2.53	1.73	0.19	.00**
	Delayed post	5.73	4.93	0.16	.00**
Post	Pre	0.80	1.73	0.19	.00**
	Delayed Post	5.73	3.20	0.16	.00
Delayed Post	Pre	0.80	4.93	0.16	.00**
	Post	2.53	3.20	0.16	.00**



***** Significant at 0.01 level***

From the above Table 4.52, it is evident that the significant difference are resulted between:Pre & Post (1.7), Pre &Delayed Post (4.9) and Post&Delayed Post (3.2). These results indicate that the students have showen improvementin Setting the Apparatus after inroducton of the SLTD.

Table 4.53 Repeated Measures ANOVA for Performing Experiment in Acid & base Experiment of Group II

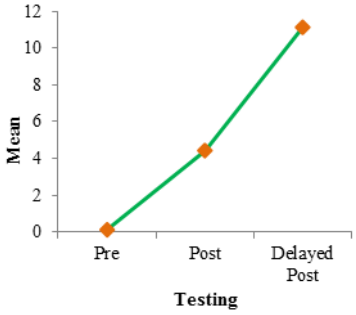
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Performing Experiment	Sphericity Assumed	1843.80	2	921.90	298.94	.00**	0.912
	Greenhouse-Geisser	**1843.80**	**1.46**	**1259.16**	**298.94**	**.00****	**0.912**
	Huynh-Feldt	1843.80	1.52	1210.86	298.94	.00**	0.912
	Lower-bound	1843.80	1.00	1843.80	298.94	.00**	0.912
Error	Sphericity Assumed	178.87	58	3.08			
	Greenhouse-Geisser	178.87	42.47	4.21			
	Huynh-Feldt	178.87	44.16	4.05			
	Lower-bound	178.87	29.00	6.17			

***** Significant at 0.01 level***

From the Table 4.53, it is evident that the F value for Performing Experimentin Acid & Base Experiment is (2, 1.46) = 298.94, $p<0.01$. This shows the mean scores of Performing Experimentof Group II students in the Pre, Post and Delayed Post Test differs significantly. The effect size $\eta 2 = 0.912$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.54 Sidak Post Hoc Test of Performing Experiment in Acid & base Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	4.43	4.30	0.53	.00**
	Delayed post	11.13	11.00	0.50	.00**
Post	Pre	0.13	4.30	0.53	.00**
	Delayed Post	11.13	6.70	0.29	.00**
Delayed Post	Pre	0.13	11.00	0.50	.00**
	Post	4.43	6.70	0.29	.00**



***** Significant at 0.01 level***

From the above Table 4.54, it is evident that the significant difference are resulted between: Pre & Post (4.3), Pre &Delayed Post (11) and Post&Delayed Post (6.7). These results indicate that the students have showen improvementin Performing Experiment after inroducton of the SLTD.

4.6.3 Electricity Ammeter Experiment: Group II

Table 4.55 Repeated Measures ANOVA for Electricity Ammeter Experiment of Group II

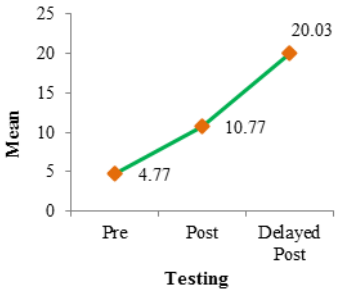
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Current Ammeter Experiment	Sphericity Assumed	3663.38	2	1831.69	432.76	.00**	0.935
	Greenhouse-Geisser	**3663.38**	**1.68**	**2175.11**	**432.76**	**.00****	**0.935**
	Huynh-Feldt	3663.38	1.77	2065.91	432.76	.00**	0.935
	Lower-bound	3663.38	1.00	3663.376	432.76	.00**	0.935
Error (factor1)	Sphericity Assumed	253.96	60	4.233			
	Greenhouse-Geisser	253.96	50.53	5.026			
	Huynh-Feldt	253.96	53.20	4.774			
	Lower-bound	253.96	30.00	8.465			

***** Significant at 0.01 level***

From the Table 4.55, it is evident that the F value for Current Ammeter Experiment is (2, 1.68) = 432.76, p<0.01. This shows the mean scores of Current Ammeter Experiment of Group II students in the Pre, Post and Delayed Post Test differs significantly. The effect size η2 =0.935 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.56 Sidak Post Hoc Test of Electricity Ammeter Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	10.77	6.00	0.39	.00**
	Delayed post	20.03	15.26	0.57	.00**
Post	Pre	4.77	6.00	0.39	.00**
	Delayed Post	20.03	9.26	0.58	.00**
Delayed Post	Pre	4.77	15.26	0.58	.00**
	Post	10.77	9.26	0.58	.00**



***** Significant at 0.01 level***

From the above Table 4.56, it is evident that the significant difference are resulted between: Pre & Post (6.00), Pre & Delayed Post (15.26), and Post&Delayed Post (9.26). These results indicate that the students have showen improvement in Current Ammeter Experiment after inroducton of the SLTD.

Table 4.57 Repeated Measures ANOVA for Listing of Materials in Electricity Ammeter Experiment of Group II

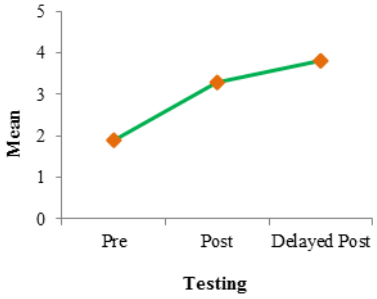
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Listing of Materials	Sphericity Assumed	60.07	2	30.03	142.99	.00**	0.827
	Greenhouse-Geisser	**60.07**	**1.90**	**31.70**	**142.99**	**.00****	**0.827**
	Huynh-Feldt	60.07	2.00	30.03	142.99	.00**	0.827
	Lower-bound	60.07	1.00	60.07	142.99	.00**	0.827
Error	Sphericity Assumed	12.60	60	0.21			
	Greenhouse-Geisser	12.60	56.85	0.22			
	Huynh-Feldt	12.60	60.00	0.21			
	Lower-bound	12.60	30.00	0.42			

***** Significant at 0.01 level***

From the Table 4.57, it is evident that the F value for Listing of Materials in Measuring Current Ammeter is (2, 1.90) = 142.99, $p<0.01$. This shows the mean scores of Listing of Materials of Group II students in the Pre, Post and Delayed Post Test differs significantly. The effect size $\eta 2$ =0.827 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4. 58 Sidak Post Hoc Test for Listing of Materials in Electricity Ammeter Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.29	1.39	0.12	.00**
	Delayed post	3.81	1.90	0.13	.00**
Post	Pre	1.90	1.39	0.12	.00**
	Delayed Post	3.81	0.52	0.10	.00**
Delayed Post	Pre	1.90	1.90	0.13	.00**
	Post	3.29	0.52	0.10	.00**



***** Significant at 0.01 level***

From the above Table 4.58, it is evident that the significant difference are resulted between: Pre & Post (1.4), Pre &Delayed Post (1.9) and Post&Delayed Post (0.5). These results indicate that the students have showen improvementin Listing of Materials after inroducton of the SLTD.

Table 4.59 Repeated Measures ANOVA for Materials Identification in Electricity Ammeter Experiment of Group II

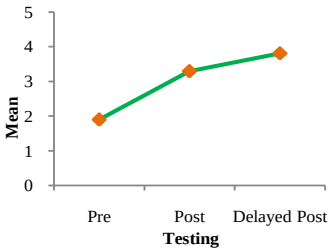
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Material Identification	Sphericity Assumed	21.10	2	10.55	32.34	.00**	0.519
	Greenhouse-Geisser	**21.10**	**1.76**	**11.99**	**32.34**	**.00****	**0.519**
	Huynh-Feldt	21.10	1.86	11.34	32.34	.00**	0.519
	Lower-bound	21.10	1.00	21.10	32.34	.00**	0.519
Error	Sphericity Assumed	19.57	60	0.33			
	Greenhouse-Geisser	19.57	52.79	0.37			
	Huynh-Feldt	19.57	55.82	0.35			
	Lower-bound	19.57	30.00	0.65			

***** Significant at 0.01 level***

From the Table 4.59, it is evident that the F value for Materials Identification in Measuring Current Ammeter is (2, 1.76) = 32.34, $p<0.01$. This shows the Mean of Material Identification of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = 0.519$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.60 Sidak Post Hoc Test of Material Identification in Electricity Ammeter Experiment of Group II

Testing		Mean	Mean Diff	Std. Error	Sig.
Pre	Post	3.39	0.68	0.14	.00**
	Delayed post	3.87	1.16	0.17	.00**
Post	Pre	2.71	0.68	0.14	.00**
	Delayed Post	3.87	0.48	0.12	.001
Delayed Post	Pre	2.71	1.16	0.17	.00**
	Post	3.39	0.48	0.12	.001



***** Significant at 0.01 level***

From the above Table 4.60, it is evident that the significant difference are resulted between:Pre & Post (0.7), Pre &Delayed Post (1.2). These results indicate that the students have showen improvement in Material Identification after inroducton of the SLTD. The scores between Post test & Delayed Post Test found to be as at same level.

Table 4.61 Repeated Measures ANOVA for Setting the Apparatus in Electricity Ammeter Experiment of Group II

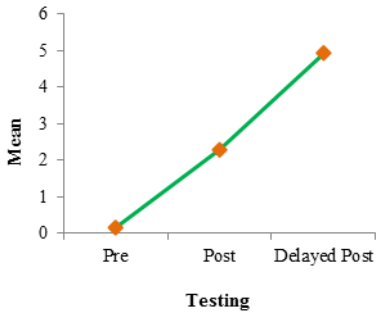
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Setting the Apparatus	Sphericity Assumed	354.67	2	177.33	245.54	.00**	0.891
	Greenhouse-Geisser	**354.67**	**1.84**	**192.38**	**245.54**	**.00****	**0.891**
	Huynh-Feldt	354.67	1.96	181.07	245.54	.00**	0.891
	Lower-bound	354.67	1.00	354.67	245.54	.00**	0.891
Error	Sphericity Assumed	43.33	60	0.72			
	Greenhouse-Geisser	43.33	55.31	0.78			
	Huynh-Feldt	43.33	58.76	0.74			
	Lower-bound	43.33	30.00	1.44			

***** Significant at 0.01 level***

From the Table 4.61, it is evident that the F value for Setting the Apparatus in Measuring Current Ammeter is (2, 1.84) = 245.54, p<0.01. This shows the mean scores of Setting the Apparatus of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =0.891 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.62 Sidak Post Hoc Test of Setting the Apparatus in Electricity Ammeter Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	2.29	2.13	0.19	.00**
	Delayed post	4.94	4.77	0.21	.00**
Post	Pre	0.16	2.13	0.19	.00**
	Delayed Post	4.94	2.65	0.24	.00**
Delayed Post	Pre	0.16	4.77	0.21	.00**
	Post	2.29	2.65	0.24	.00**



***** Significant at 0.01 level***

From the above Table 4.62, it is evident that the significant difference are resulted between:Pre & Post (2.1), Pre &Delayed Post (4.8) and Post&Delayed Post (2.7). These results indicate that the students have showen improvement in Setting the Apparatus component after inroducton of the SLTD.

Table 4.63 Repeated Measures ANOVA for Performing Experiment

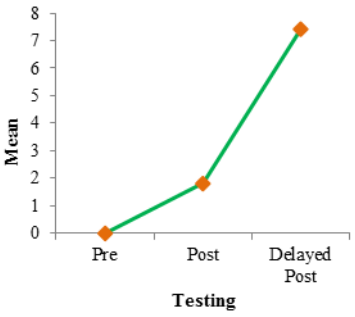
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Performing Experiment	Sphericity Assumed	928.09	2	464.04	164.51	.00**	0.846
	Greenhouse-Geisser	**928.09**	**1.38**	**671.13**	**164.51**	**.00****	**0.846**
	Huynh-Feldt	928.09	1.43	649.86	164.51	.00**	0.846
	Lower-bound	928.09	1.00	928.09	164.51	.00**	0.846
Error	Sphericity Assumed	169.25	60	2.82			
	Greenhouse-Geisser	169.25	41.49	4.08			
	Huynh-Feldt	169.25	42.84	3.95			
	Lower-bound	169.25	30.00	5.64			

***** Significant at 0.01 level***

From the Table 4.63, it is evident that the F value for Performing Experiment in Measuring Current Ammeter is (2, 1.38) = 164.51, $p<0.01$. This shows the mean scores of Performing Experiment in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = 0.846$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.64 Sidak Post Hoc Test for Performing Experiment in Electricity Ammeter Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	1.81	1.82	0.260	.00**
	Delayed post	7.42	7.42	0.524	.00**
Post	Pre	0.00	1.81	0.260	.00**
	Delayed Post	7.42	5.61	0.451	.00**
Delayed Post	Pre	0.00	7.42	0.524	.00**
	Post	1.81	5.61	0.451	.00**



***** Significant at 0.01 level***

From the above Table 4.64, it is evident that the significant difference are resulted between:Pre & Post (1.8), Pre & Delayed Post (7.4) and Post & Delayed Post (5.6). These results indicate that the students have showen improvementin Performing Experimentafter inroducton of the SLTD.

4.6.4 Electricity Voltmeter Experiment: Group II

Table 4.65 Repeated Measures ANOVA for Electricity Voltmeter Experiment of Group II

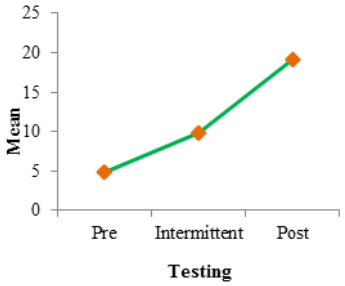
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Current Voltmeter Experiment	Sphericity Assumed	3247.57	2	1623.79	576.16	.00**	0.951
	Greenhouse-Geisser	**3247.57**	**1.76**	**1849.81**	**576.16**	**.00****	**0.951**
	Huynh-Feldt	3247.57	1.86	1749.68	576.16	.00**	0.951
	Lower-bound	3247.57	1.00	3247.57	576.16	.00**	0.951
Error	Sphericity Assumed	169.10	60	2.82			
	Greenhouse-Geisser	169.10	52.669	3.21			
	Huynh-Feldt	169.10	55.683	3.04			
	Lower-bound	169.10	30.000	5.64			

***** Significant at 0.01 level***

From the Table 4.65, it is evident that the F value for Current Voltmeter Experiment is F (2, 1.76) = 576.16, p<0.01. This shows the mean scores of Current Voltmeter Experiment of Group II students in the Pre, Post and Delayed Post Test differs significantly. The effect size η2 =0.951 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.66 Sidak Post Hoc Test of Electricity Voltmeter Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	9.839	4.99	0.35	.00**
	Delayed post	19.13	14.29	0.49	.00**
Post	Pre	4.87	4.99	0.36	.00**
	Delayed Post	19.13	9.29	0.42	.00**
Delayed Post	Pre	4.87	14.29	0.49	.00**
	Post	9.84	9.29	0.42	.00**



***** Significant at 0.01 level***

From the above Table 4.66, it is evident that the significant difference are resulted between: Pre & Post (4.99), Pre &Delayed Post (14.29), and Post&Delayed Post (9.29). These results indicate that the students have showen improvement in Electricity Voltmeter Experiment after inroducton of the SLTD.

Table 4.67 Repeated Measures ANOVA for Listing of Materials Electricity Voltmeter Experiment of Group II

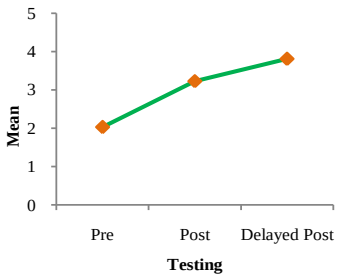
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Listing of Materials	Sphericity Assumed	50.73	2	25.37	114.70	.00**	0.793
	Greenhouse-Geisser	50.73	1.79	28.37	114.70	.00**	0.793
	Huynh-Feldt	50.73	1.89	26.78	114.70	.00**	0.793
	Lower-bound	50.73	1.00	50.73	114.70	.00**	0.793
Error	Sphericity Assumed	13.27	60	0.22			
	Greenhouse-Geisser	13.27	53.65	0.25			
	Huynh-Feldt	13.27	56.83	0.23			
	Lower-bound	13.27	30.00	0.44			

***** Significant at 0.01 level***

From the Table 4.67, it is evident that the F value for Listing of Materials in Current Voltmeter Experiment is (2, 1.79) = 114.70, $p<0.01$. This shows the mean scores of Listing of Materials of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = 0.793$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.68 Sidak Post Hoc Test for Listing of Materials Electricity Voltmeter Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.23	1.19	0.12	.00**
	Delayed post	3.81	1.77	0.14	.00**
Post	Pre	2.03	1.19	0.12	.00**
	Delayed Post	3.81	0.58	0.10	.00**
Delayed Post	Pre	2.03	1.77	0.12	.00**
	Post	3.23	0.58	0.10	.00**



***** Significant at 0.01 level***

From the above Table 4.68 it is evident that the significant difference are resulted between:Pre &Post (1.2), Pre &Delayed Post (1.8) and Post&Delayed Post (0.6).These results indicate that the students have showen improvementin Listing of Materialsafter inroducton of the SLTD.

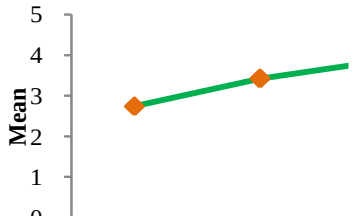
Table 4.69 Repeated Measures ANOVA for Material Identification Electricity Voltmeter Experiment of Group II

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Material Identification	Sphericity Assumed	20.02	2	10.01	37.59	0.000	0.556
	Greenhouse-Geisser	20.02	1.69	11.86	37.59	0.000	0.556
	Huynh-Feldt	20.02	1.78	11.26	37.59	0.000	0.556
	Lower-bound	20.02	1.00	20.02	37.59	0.000	0.556
Error	Sphericity Assumed	15.98	60	0.27			
	Greenhouse-Geisser	15.98	50.66	0.31			
	Huynh-Feldt	15.98	53.35	0.30			
	Lower-bound	15.98	30.00	0.53			

From the Table 4.69, it is evident that the F value for Materials Identification in Current Voltmeter Experiment is (2, 1.69) = 37.59, p<0.01. This shows the mean scores of Material Identification of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =0.556 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.70 Sidak Post Hoc Test for Material Identification Electricity Voltmeter Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	3.42	0.68	0.13	.00**
	Delayed post	3.87	1.13	0.15	.00**
Post	Pre	2.74	0.68	0.13	.00**
	Delayed Post	3.87	0.45	0.10	.00**
Delayed Post	Pre	2.74	1.13	0.15	.00**
	Post	3.42	0.45	0.10	.00**



**** Significant at 0.01 level***

From the above Table 4.70, it is evident that the significant difference are resulted between:Pre &Post (0.7), Pre & Delayed Post (1.1) and Post & Delayed Post (0.5). These results indicate that the students have showen improvementin Material Identification after inroducton of the SLTD.

Table 4.71 Repeated Measures ANOVA for Setting the Apparatus Electricity Voltmeter Experiment of Group II

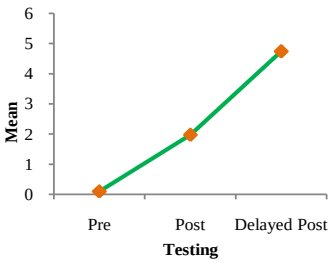
Source		Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Setting the Apparatus	Sphericity Assumed	338.67	2	169.33	371.71	.00**	0.925
	Greenhouse-Geisser	**338.67**	**1.77**	**191.53**	**371.71**	**.00****	**0.925**
	Huynh-Feldt	338.67	1.87	181.04	371.71	.00**	0.925
	Lower-bound	338.67	1.00	338.67	371.71	.00**	0.925
Error	Sphericity Assumed	27.33	60	0.46			
	Greenhouse-Geisser	27.33	53.05	0.52			
	Huynh-Feldt	27.33	56.12	0.49			
	Lower-bound	27.33	30.00	0.91			

***** Significant at 0.01 level***

From the Table 4.71, it is evident that the F value for Setting the Apparatus in Current Voltmeter Experiment is (2, 1.77) = 371.71, $p<0.01$. This shows the mean scores of Setting the Apparatus of Group II students in the Pre, Post and Delayed Post Test differ significantly. The effect size $\eta 2 = 0.925$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.72 Sidak Post Hoc Test for Setting the Apparatus Electricity Voltmeter Experiment of Group II

Testing		Mean	Mean Diff	Std. Error	Sig.
Pre	Post	1.97	1.87	0.14	.00**
	Delayed post	4.74	4.65	0.19	.00**
Post	Pre	0.10	1.87	0.14	.00**
	Delayed Post	4.74	2.77	0.18	.00**
Delayed Post	Pre	0.10	4.65	0.19	.00**
	Post	1.97	2.77	0.18	.00**



***** Significant at 0.01 level***

From the above Table 4.72, it is evident that the significant difference are resulted between:Pre & Post (1.9), Pre &Delayed Post (4.7) and Post &Delayed Post (2.8). These results indicate that the students have showen improvementin Setting the Apparatus component after inroducton of the SLTD.

Table 4.73 Repeated Measures ANOVA for Performing Experiment Electricity Voltmeter Experiment of Group II

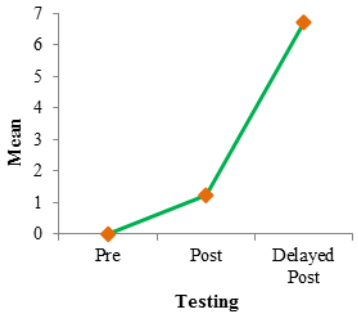
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Performing Experiment	Sphericity Assumed	791.48	2	395.74	218.81	.00**	0.879
	Greenhouse-Geisser	**791.48**	**1.37**	**576.68**	**218.81**	**.00****	**0.879**
	Huynh-Feldt	791.48	1.42	558.81	218.81	.00**	0.879
	Lower-bound	791.48	1.00	791.48	218.81	.00**	0.879
Error	Sphericity Assumed	108.52	60	1.81			
	Greenhouse-Geisser	108.52	41.18	2.64			
	Huynh-Feldt	108.52	42.49	2.55			
	Lower-bound	108.52	30.00	3.62			

***** Significant at 0.01 level***

From the Table 4.73, it is evident that the F value for Performing Experiment in Current Voltmeter Experiment is (2, 1.37) = 218.81, p<0.01. This shows the mean scores of Performing Experiment in the Pre, Post and Delayed Post Test differ significantly. The effect size η2 =0.879 was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as ***"there is no significant difference within Pre, Post and Delayed Post Test Scores"*** is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table.

Table 4.74 Sidak Post Hoc Test for Performing Experiment Electricity Voltmeter Experiment of Group II

Testing		Mean	Mean Diff.	Std. Error	Sig.
Pre	Post	1.23	1.23	0.22	.00**
	Delayed post	6.71	6.71	0.43	.00**
Post	Pre	0	1.23	0.22	.00**
	Delayed Post	6.71	5.48	0.35	.00**
Delayed Post	Pre	0	6.71	0.43	.00**
	Post	1.23	5.48	0.35	.00**



***** Significant at 0.01 level***

From the above Table 4.74, it is evident that the significant difference are resulted between:Pre &Post (1.2), Pre &Delayed Post (6.7) and Post &Delayed Post (5.5). These results indicate that the students have showen improvementin Pperforming Experiment after inroducton of the SLTD.

108,109,111,112,114-
116,118,121,124,128,131,134,137,139,141,144,147,150,153,157,160,163,166

110,113,117,119,120,122,123,125-
127,129,130,132,133,135,136,138,140,142,143,145,146,148,149,151,152,154,155,156,
158,159,161,162,164,165,167,168