

CHAPTER - IV
DATA ANALYSIS, INTERPRETATION AND
DISCUSSION

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DATA ANALYSIS, INTERPRETATION AND DISCUSSION

4.0.0 INTRODUCTION

Data was collected through Google Forms. stored in EXCEL sheets and statistically analyzed in IBM SPSS statistics software, and inferences were made. The population was divided into two groups namely control and experimental, of which experimental groups received e-content mediated timely interventions with classroom teaching-learning and control groups received normal instructor based teaching and learning.

4.0.1 CONTROL GROUP

- 80 respondents in the control group were learners from KV NO 1, Angul. These individuals received normal content and course material delivery from their respective instructors.
- Attitude and achievement pre & post tests were delivered in the form of google form mediated structured questionnaires and minimal intervention was given to prevent unnatural and forced responses although the links were shared by the researcher, principals and subject teachers were directed to reinform the participants once about the essentiality of this survey for an educational research.

4.0.2 EXPERIMENTAL GROUP

- 80 respondents in the experimental group were learners from KV No2, Angul. These individuals received normal content and course material delivery from their respective biological science subject teachers and experimentally focussed high yielding supplementary learning materials were delivered by the researcher, these were specially designed e-contents containing targeted information on scientific aspects of material world and relevant subject matter specific classroom transactions, delivered in a timely manner for the period of the study.
- Attitude and achievement pre & post tests were delivered in the form of google form mediated structured questionnaires and minimal intervention was given to prevent unnatural and forced responses although the links were shared by the researcher, principals and subject teachers were directed to reinform the participants once about the essentiality of this survey for an educational research.
- E-contents for high yielding educational experiences were created by the researcher validated by experts and subject teachers, heads, principals & the supervisor.
- E-contents were timely delivered to learners after the day's school work is complete, as an after school but official supplementary course material for study.

4.1.0 ANALYSIS OF DATA

4.1.1.0 GENDER DISTRIBUTION IN THE SAMPLE

4.1.1.1 CONTROL GROUP

		GenderG1			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	49	49.0	61.3	61.3
	Male	31	31.0	38.8	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 1 - Gender Group 1 - Control Group)

The control group consists of 49 Females and 31 Males leading to a total of 80 respondents from Kendriya Vidyalaya Number 1, Angul district.

4.1.1.2 EXPERIMENTAL GROUP

		GenderG2			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	54	54.0	67.5	67.5
	Male	26	26.0	32.5	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 2 - Gender Group 2 - Experimental Group)

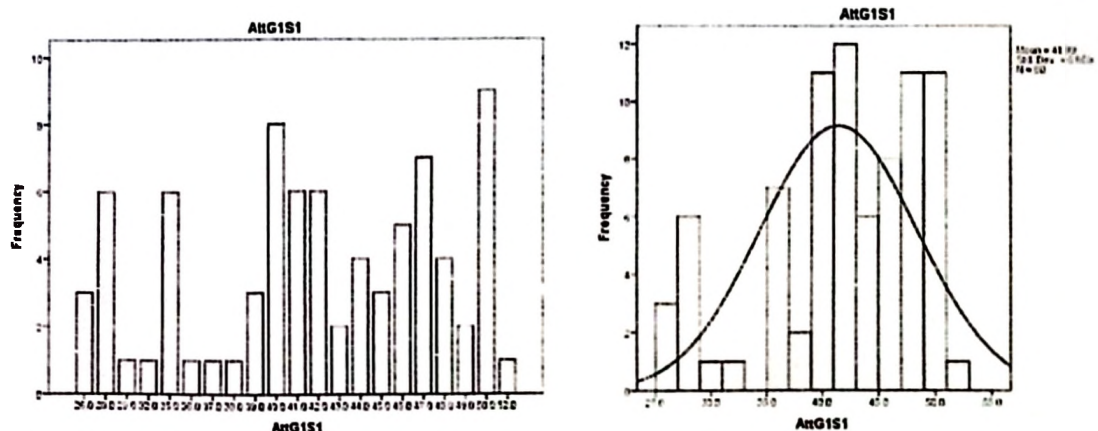
The experimental group consists of 54 Females and 26 Males leading to a total of 80 respondents from Kendriya Vidyalaya Number 2, Angul district.

4.1.2.0 PRE ATTITUDE TEST OF GROUP 1 (CONTROL GROUP)

ARG1S1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	28.0	3	3.0	3.8	3.8
	29.0	6	6.0	7.5	11.3
	30.0	1	1.0	1.3	12.5
	32.0	1	1.0	1.3	13.8
	35.0	6	6.0	7.5	21.3
	36.0	1	1.0	1.3	22.5
	37.0	1	1.0	1.3	23.8
	38.0	1	1.0	1.3	25.0
	39.0	3	3.0	3.8	28.8
	40.0	8	8.0	10.0	38.8
	41.0	6	6.0	7.5	46.3
	42.0	6	6.0	7.5	53.8
	43.0	2	2.0	2.5	56.3
	44.0	4	4.0	5.0	61.3
	45.0	3	3.0	3.8	65.0
	46.0	5	5.0	6.3	71.3
	47.0	7	7.0	8.8	80.0
	48.0	4	4.0	5.0	85.0
	49.0	2	2.0	2.5	87.5
	50.0	9	9.0	11.3	98.8
	52.0	1	1.0	1.3	100.0
Total		80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 3 - Frequency distribution of Pre Attitude test of Group 1 - Control Group)

The pre attitude scores are shown in the above given table. This suggests that out of a total score of 52, 6 individuals have scored 28, 6 individuals have scored 35, 8 individuals have scored 40, 6 have scored 41, 6 have scored 42, 7 have scored 47 and 9 individuals scored 50. With mean scores being 41.39 and standard deviation 6.969.



(Figure 2 - frequency distribution of group 1 in their pre attitude tests)

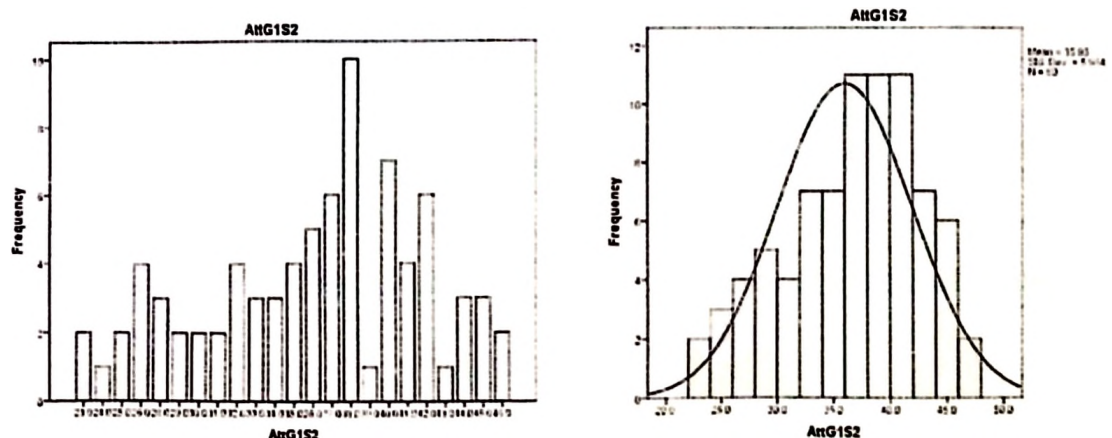
MEAN - 41.39

4.1.3.0 POST ATTITUDE TEST OF GROUP 1 (CONTROL GROUP)

ANG1S2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	23.0	2	2.0	2.5	2.5
	24.0	1	1.0	1.3	3.8
	25.0	2	2.0	2.5	6.3
	26.0	4	4.0	5.0	11.3
	28.0	3	3.0	3.8	15.0
	29.0	2	2.0	2.5	17.5
	30.0	2	2.0	2.5	20.0
	31.0	2	2.0	2.5	22.5
	32.0	4	4.0	5.0	27.5
	33.0	3	3.0	3.8	31.3
	34.0	3	3.0	3.8	35.0
	35.0	4	4.0	5.0	40.0
	36.0	5	5.0	6.3	46.3
	37.0	6	6.0	7.5	53.8
	38.0	10	10.0	12.5	66.3
	39.0	1	1.0	1.3	67.5
	40.0	7	7.0	8.8	76.3
	41.0	4	4.0	5.0	81.3
	42.0	6	6.0	7.5	88.8
	43.0	1	1.0	1.3	90.0
	44.0	3	3.0	3.8	93.8
	45.0	3	3.0	3.8	97.5
	46.0	2	2.0	2.5	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
	Total	100	100.0		

(Table 4 - Frequency distribution of post attitude test Group 1)

Out of 52 marks of attitude tests, the scores 25, 32, 35 & 41 came 4 times each, 5 respondents scored 36, 6 respondents scored 37. 10 respondents scored 38, 7 respondents scored 40 and 6 respondents scored 42. The mean score was calculated to be 35.95 with standard deviation of 5.964.



(Figure 3 - Frequency distribution of group I in post attitude survey)

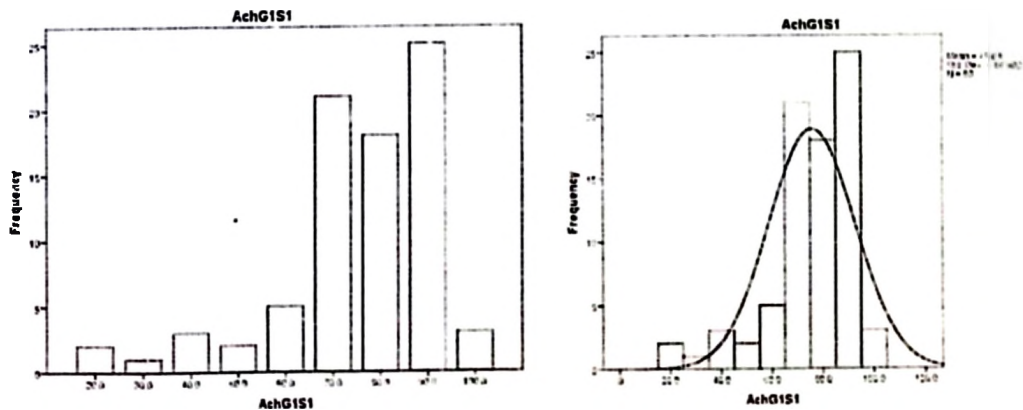
MEAN - 35.95

4.1.4.0 PRE ACHIEVEMENT TEST OF GROUP 1 (CONTROL GROUP)

AchG1S1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20.0	2	2.0	2.5	2.5
	30.0	1	1.0	1.3	3.8
	40.0	3	3.0	3.8	7.5
	50.0	2	2.0	2.5	10.0
	60.0	5	5.0	6.3	16.3
	70.0	21	21.0	26.3	42.5
	80.0	18	18.0	22.5	65.0
	90.0	25	25.0	31.3	96.3
	100.0	3	3.0	3.8	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 5 - Frequency of pre Achievement test - Group 1)

Out of 100 marks achievement test. 5 respondents scored 60, 21 scored 70, 18 scored 80, and 25 scored 90 marks. Making their mean scores as 75.63 and standard deviation as 16.902.



(Figure 4 - Frequency distribution of pre - achievement scores of control group)

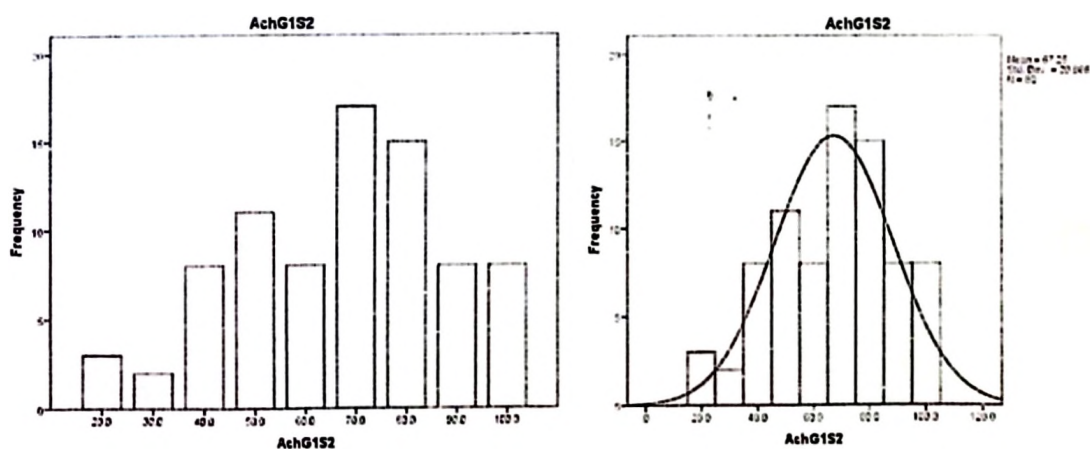
MEAN - 75.63

4.1.5.0 POST ACHIEVEMENT TEST OF GROUP 1 (CONTROL GROUP)

AchG1S2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20.0	3	3.0	3.8	3.8
	30.0	2	2.0	2.5	6.3
	40.0	8	8.0	10.0	16.3
	50.0	11	11.0	13.8	30.0
	60.0	8	8.0	10.0	40.0
	70.0	17	17.0	21.3	61.3
	80.0	15	15.0	18.8	80.0
	90.0	8	8.0	10.0	90.0
	100.0	8	8.0	10.0	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 6 - Frequency table of post achievement test - control group)

The frequency table describes marks out of a 100 mark achievement test in biological science subject, here 11 respondents scored 50, 17 respondents scored 70, 15 respondents scored 80 and 8 respondents scored 40, 60, 90 and 100 respectively. With mean score being 67.25 and standard deviation as 20.866.



(Figure 5 - Frequency distribution of post achievement scores of control group)

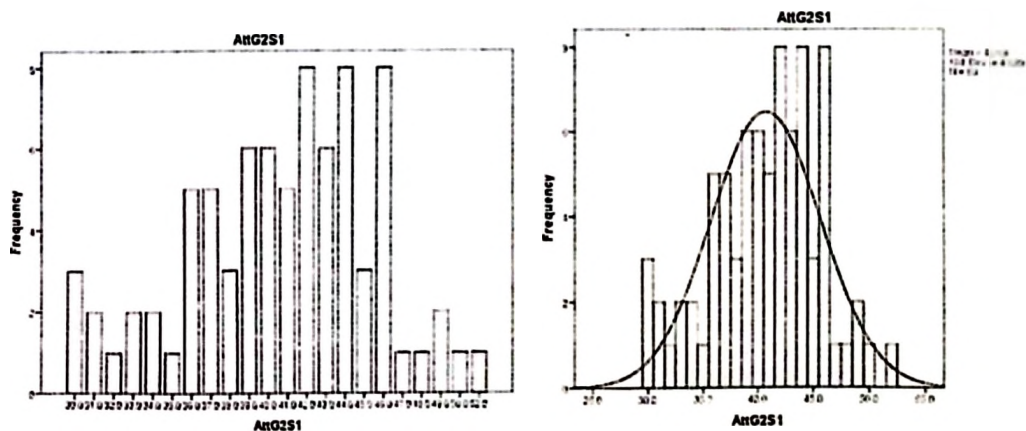
MEAN - 67.25

4.1.6.0 PRE ATTITUDE TEST OF GROUP 2 (EXPERIMENTAL GROUP)

ARG2S1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30.0	3	3.0	3.8	3.8
	31.0	2	2.0	2.5	6.3
	32.0	1	1.0	1.3	7.5
	33.0	2	2.0	2.5	10.0
	34.0	2	2.0	2.5	12.5
	35.0	1	1.0	1.3	13.8
	36.0	5	5.0	6.3	20.0
	37.0	5	5.0	6.3	26.3
	38.0	3	3.0	3.8	30.0
	39.0	6	6.0	7.5	37.5
	40.0	6	6.0	7.5	45.0
	41.0	5	5.0	6.3	51.3
	42.0	8	8.0	10.0	61.3
	43.0	6	6.0	7.5	68.8
	44.0	8	8.0	10.0	78.8
	45.0	3	3.0	3.8	82.5
	46.0	8	8.0	10.0	92.5
	47.0	1	1.0	1.3	93.8
	48.0	1	1.0	1.3	95.0
	49.0	2	2.0	2.5	97.5
	50.0	1	1.0	1.3	98.8
	52.0	1	1.0	1.3	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 7 - frequency of experimental group - pre attitude test)

Out of 80 respondents 5 scored 36, 5 scored 37, 6 scored 39, 6 scored 40, 5 scored 41, 8 scored 42, 6 scored 43, 8 scored 44 and 8 scored 46. Mean score stays 40.69 with standard deviation of 4.939.



(Figure 6 - frequency distribution of pre attitude scores - experimental group)

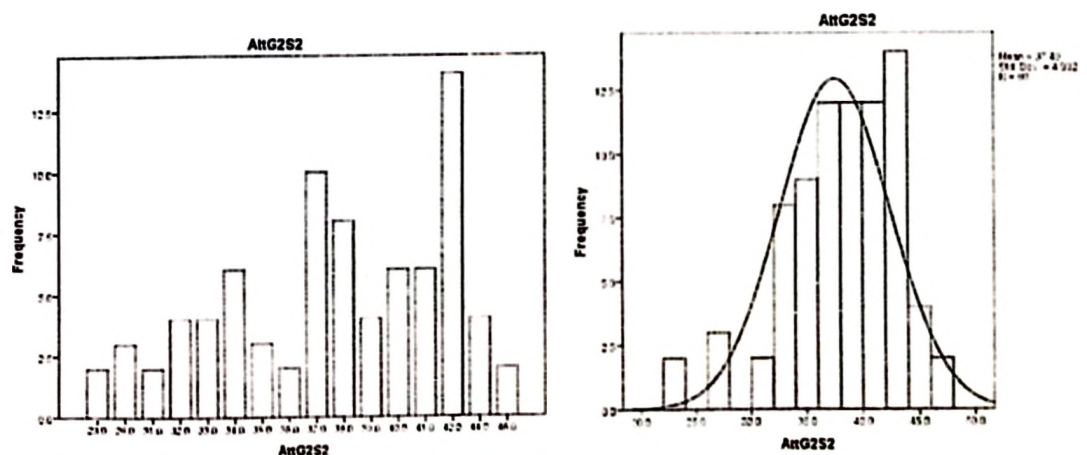
MEAN - 40.69

4.1.7.0 POST ATTITUDE TEST OF GROUP 2 (EXPERIMENTAL GROUP)

AttG2S2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	23.0	2	2.0	2.5	2.5
	26.0	3	3.0	3.8	6.3
	31.0	2	2.0	2.5	8.8
	32.0	4	4.0	5.0	13.8
	33.0	4	4.0	5.0	18.8
	34.0	6	6.0	7.5	26.3
	35.0	3	3.0	3.8	30.0
	36.0	2	2.0	2.5	32.5
	37.0	10	10.0	12.5	45.0
	38.0	8	8.0	10.0	55.0
	39.0	4	4.0	5.0	60.0
	40.0	6	6.0	7.5	67.5
	41.0	6	6.0	7.5	75.0
	42.0	14	14.0	17.5	92.5
	44.0	4	4.0	5.0	97.5
	46.0	2	2.0	2.5	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 8 - Frequency of post attitude scores - experimental group)

Here attitude scores are reported, 6 respondents scored 34, 10 respondents scored 37, 8 respondents scored 38, 6 respondents scored 40, 6 scored 41 and 14 respondents scored 42 out of 52 marks making its mean value as 37.49, with standard deviation of 4.932.



(Figure 7 - Frequency distribution of post attitude scores - experimental group)

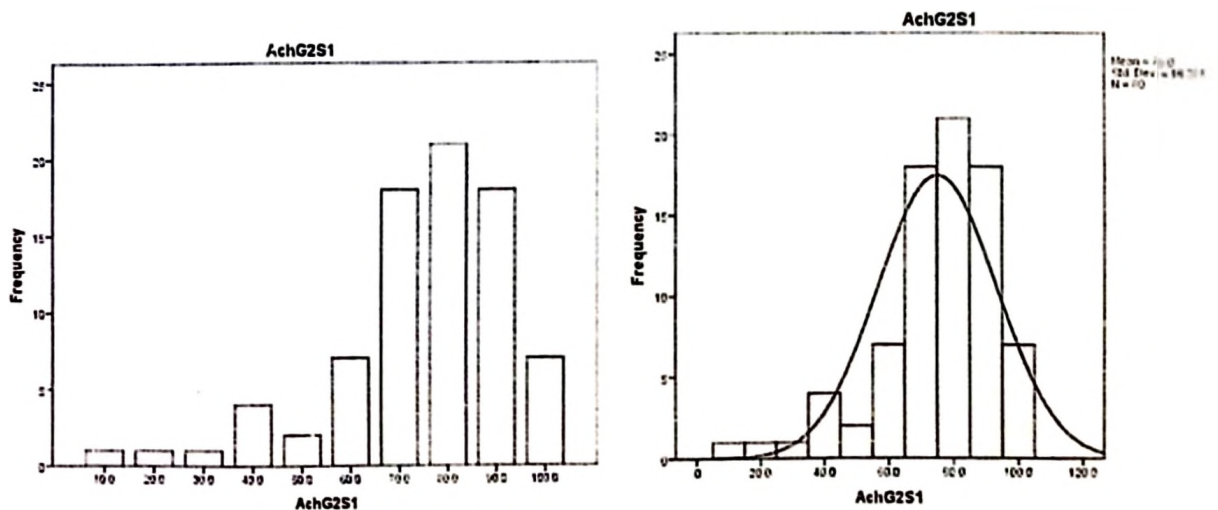
MEAN - 37.49

4.1.8.0 PRE ACHIEVEMENT TEST OF GROUP 2 (EXPERIMENTAL GROUP)

AchG2S1					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10.0	1	1.0	1.3	1.3
	20.0	1	1.0	1.3	2.5
	30.0	1	1.0	1.3	3.8
	40.0	4	4.0	5.0	8.8
	50.0	2	2.0	2.5	11.3
	60.0	7	7.0	8.8	20.0
	70.0	18	18.0	22.5	42.5
	80.0	21	21.0	26.3	68.8
	90.0	18	18.0	22.5	91.3
	100.0	7	7.0	8.8	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 9 - Frequency of pre - achievement scores of experimental group)

The achievement scores were calculated out of 100 marks where 4 respondents scored 40 marks, 7 respondents scored 70 marks, 18 respondents scored 70, 21 respondents scored 80, and 18 respondents scored 90 marks making the mean score 75 with standard deviation 18.281.



(Figure 8 - Pre-achievement score distribution of experimental group)

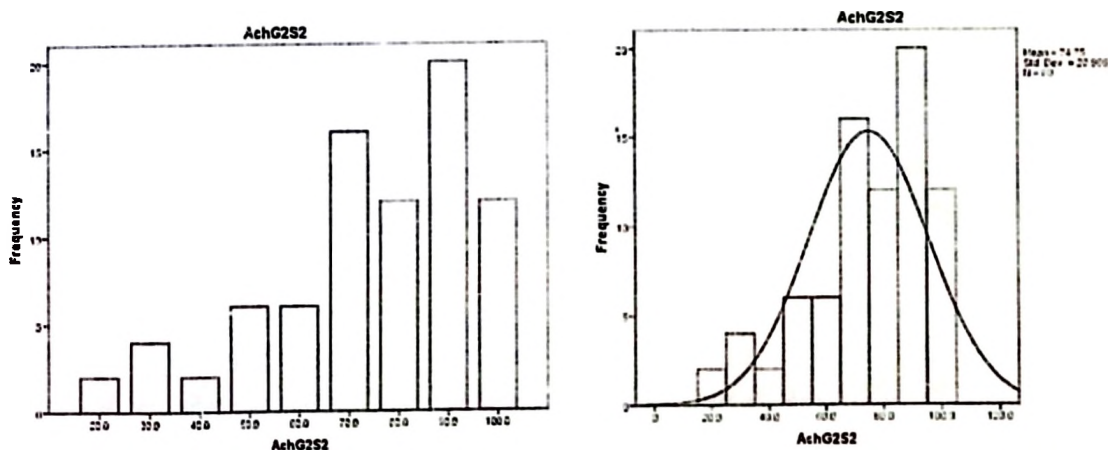
MEAN - 75.00

4.1.9.0 POST ACHIEVEMENT TEST OF GROUP 2 (EXPERIMENTAL GROUP)

AchG2S2					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20.0	2	2.0	2.5	2.5
	30.0	4	4.0	5.0	7.5
	40.0	2	2.0	2.5	10.0
	50.0	6	6.0	7.5	17.5
	60.0	6	6.0	7.5	25.0
	70.0	16	16.0	20.0	45.0
	80.0	12	12.0	15.0	60.0
	90.0	20	20.0	25.0	85.0
	100.0	12	12.0	15.0	100.0
	Total	80	80.0	100.0	
Missing	System	20	20.0		
Total		100	100.0		

(Table 10 - frequency of post achievement scores of experimental group)

Out of a total mark of 100, 16 respondents scored 70 marks, 12 scored 80 marks, 20 scored 90 marks and 12 respondents scored 100 marks making the mean score 74.75 with standard deviation 20.866.



(Figure 9 - frequency distribution of Post Achievement scores of experimental group)

MEAN - 74.75

4.1.10.0 DESCRIPTIVE STATISTICS MEDIATED ANALYSIS OF CONTROL & EXPERIMENTAL GROUP SCORES

Descriptive Statistics													
	II	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
AttG1S1	80	26.0	26.0	52.0	3311.0	41.388	.7792	6.9892	48.569	-.730	.269	-.280	.532
AttG1S2	80	23.0	23.0	46.0	2875.0	35.950	.6668	5.9638	35.567	-.441	.269	-.585	.532
AchG1S1	80	80.0	20.0	100.0	6050.0	75.625	1.8897	16.9021	285.660	-1.377	.269	2.175	.532
AchG1S2	80	80.0	20.0	100.0	5380.0	67.250	2.3329	20.8658	435.360	-.335	.269	-.527	.532
AttG2S1	80	22.0	30.0	52.0	3255.0	40.688	.5522	4.9391	24.395	-.303	.269	-.260	.532
AttG2S2	80	23.0	23.0	46.0	2939.0	37.488	.5515	4.9324	24.329	-.921	.269	.917	.532
AchG2S1	80	90.0	10.0	100.0	6000.0	75.000	2.0438	18.2805	334.177	-1.250	.269	2.008	.532
AchG2S2	80	80.0	20.0	100.0	5980.0	74.750	2.3329	20.8658	435.360	-.891	.269	1.57	.532
Valid II (listwise)	80												

(Table 11 - descriptive statistics of 8 attitude & achievement surveys & tests)

- 8 Tests were conducted, 4 on experimental group and 4 on control group, the tests were divided into pre & post tests of achievements in science and pre & post scores of attitudes towards science.
- After careful analysis it was found that control groups and experimental groups differed significantly in their post test scores of attitudes and achievements.
- The mean scores of attitudes in post tests for control and experimental groups were 35.950 & 37.488 respectively. Thus there is visible change in the scores, with mean score as 37.488 experimental group learners have comparatively better attitudes towards sciences in comparison to control group with a mean score of 35.950.
- Similarly mean scores of achievements in post test scores of control and experimental groups were 67.250 & 74.750 respectively. The visible changes in mean scores indicate a better achievement in experimental (74.750) group learners than control (67.250) group learners.
- The mean scores in achievement in control groups were 75.625 in pre tests which further were reduced to 67.250 in post tests without interventions. Similarly mean attitude scores in pre tests was 41.388 which was reduced to 35.950 in post tests.

- The mean score in achievement in the experimental group was 75.000 in pre test which was reduced to 74.750 in post test. Similarly the mean score of attitudes in pretest were 40.688 which further were reduced to 37.488 in post test.

Statistics

	ANG1S1	ANG1S2	AchG1S1	AchG1S2	ANG2S1	ANG2S2	AchG2S1	AchG2S2
N	Valid 80	80	80	80	80	80	80	80
	Missing 20	20	20	20	20	20	20	20
Mean	41.388	35.950	75.625	67.250	40.688	37.488	75.000	74.750
Std. Error of Mean	.7792	.6668	1.8897	2.3329	.5522	.5515	2.0438	2.3329
Median	42.000	37.000	80.000	70.000	41.000	38.000	80.000	80.000
Mode	50.0	38.0	90.0	70.0	42.0 ^a	42.0	80.0	90.0
Std. Deviation	6.9692	5.9638	16.9021	20.8658	4.9391	4.9324	18.2805	20.8658
Variance	48.569	35.567	285.680	435.380	24.395	24.329	334.177	435.380
Skewness	-.730	-.441	-1.377	-.335	-.303	-.921	-1.250	-.881
Std. Error of Skewness	.269	.269	.269	.269	.269	.269	.269	.269
Kurtosis	-.280	-.585	2.175	-.527	-.260	.917	2.008	.157
Std. Error of Kurtosis	.532	.532	.532	.532	.532	.532	.532	.532
Range	26.0	23.0	80.0	80.0	22.0	23.0	90.0	80.0
Minimum	26.0	23.0	20.0	20.0	30.0	23.0	10.0	20.0
Maximum	52.0	46.0	100.0	100.0	52.0	46.0	100.0	100.0
Sum	3311.0	2876.0	6050.0	5380.0	3255.0	2999.0	6000.0	5980.0

a. Multiple modes exist. The smallest value is shown.

(Table 12 - descriptive statistics of 8 attitude & achievement surveys & tests)

- The maximum scores in the pre attitude survey were 52 for the control group and 52 for the experimental group. Similarly the maximum scores of pre achievement tests were 100 for control and 100 for experimental group.
- The minimum scores in pre attitude surveys were 26 in the control group and 30 in the experimental group respondents. Similarly the minimum scores in pre achievement tests were 20 for control group and 10 for experimental group.
- The maximum score in post attitude surveys were 46 in the control group and 46 in the experimental group. Similarly the maximum scores of post achievement scores were 100 in the control group and 100 in the experimental group.
- The minimum scores in post attitude surveys were 23 in the control group and 23 in the experimental group. Similarly the minimum scores of post achievement scores were 20 in the control group and 20 in the experimental group.

4.1.11.0 ANALYSIS OF TWO TAILED T-TEST RESULTS

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	ANG1S1	41.39	80	6.969	.779
	ANG1S2	35.95	80	5.964	.667
Pair 2	AchG1S1	75.63	80	16.902	1.890
	AchG1S2	67.25	80	20.866	2.333
Pair 3	ANG2S1	40.69	80	4.939	.552
	ANG2S2	37.49	80	4.932	.551
Pair 4	AchG2S1	75.00	80	18.281	2.044
	AchG2S2	74.75	80	20.866	2.333

(Table 13 - Paired Samples Statistics)

Out of the 80 respondents in control and 80 respondents in experimental groups the two tailed t-test analyzed their mean scores in pairs. Pair 1 contains attitude pre & post test scores of the control group. Pair 2 contains pre & post achievement scores of the control group. Pair 3 contains pre & post attitude scores of the experimental group. Pair 4 contains pre & post achievement test scores of the experimental group.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	ANG1S1 & ANG1S2	80	-.081	.473
Pair 2	AchG1S1 & AchG1S2	80	.077	.499
Pair 3	ANG2S1 & ANG2S2	80	.038	.741
Pair 4	AchG2S1 & AchG2S2	80	-.090	.429

(Table 14 - Paired Samples Correlation)

Correlations were -0.081 for pair 1 with significance of 0.473, 0.77 for pair 2 with significance of 0.499, 0.038 for pair 3 with significance of 0.741, -0.090 for pair 4 with significance of 0.429.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ANG1S1 - ANG1S2	5.438	9.535	1.066	3.316	7.559	5.101	79	.000
Pair 2	AchG1S1 - AchG1S2	8.375	25.825	2.887	2.628	14.122	2.901	79	.005
Pair 3	ANG2S1 - ANG2S2	3.200	6.848	.766	1.676	4.724	4.180	79	.000
Pair 4	AchG2S1 - AchG2S2	.250	28.947	3.236	-6.192	6.692	.077	79	.939

(Table 15 - Paired Samples Test)

With a degree of freedom of 79, t values were 5.101, 2.901, 4.180 & 0.077 for pairs 1, 2, 3 & 4, having two tailed significance about 0.000, 0.005, 0.000 & 0.939 respectively.

4.2.0 INTERPRETATION OF RESULTS

1. The mean scores show that the experimental group students are differentiated significantly from control group students in their post-test scores, where experimental group respondents retained better attitudes and achievements. This might be due to the effect of e-content mediated timely interventions, which might have promoted the efficiency of learning by improving the quality of resources and quality of teaching learning.
2. The steady decline in attitudes and achievements in both control and experimental groups studied from the pre and post test results, points out the pandemic induced online education has a negative effect on learner's attitudes and achievements towards learning sciences.

4.3.0 DISCUSSIONS

Experimental group gained better scores in achievement in and attitudes towards science than did control groups in post-tests though there were no statistical differences between the two groups in pre- test. This is due to the biological science e-content mediated program which met the experimental group's needs and interests. On the contrary, the control group was left to be taught in a traditional way. This goes in line with our adopted perspective which indicates that traditional methods used in our schools do not direct learners toward tasks and materials , and do not challenge their abilities. This may lead learners to hate all subjects and the school in general. On the contrary, when teachers adopt differentiated instruction that suits learners diverse interests and challenge their abilities with its various modalities, attitudes and achievements change. This indicates that as we learn more about the scope and complexity of individual differences and how they affect academic progress, we become increasingly convinced that many individuals who do not do well at school due to the instructional methods used to teach them does not complement preferred styles to learn, thus, we should seek strategies that help these students and match their strengths.