

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 analysis and interpretation.

This has been done objective wise in the following captions.

SECTION I

4.1 Analysis of Software Component of the Tech Aided Grade2 Braille (TAG2B)

- i. Testing of Error Free Software Programme
- ii. Testing of Time & Space Complexity Software Programme

SECTION II

4.2 Percentage Analysis was done from the response of Special education Student Teachers and Special Teachers on validity of Tech Aided Grade2 Braille

SECTION III

4.3 'T - test' Analysis was executed on the Acquisition of Grade2 Braille before and after introduction of 'Tech Aided Grade2 Braille' among students with visual impairment

SECTION IV

4.4 Repeated Measures 'ANOVA' was employed to analyze the Performance in the Pretest, Posttest and Progress Monitoring Test administered for Grade2 Braille.

SECTION V

4.5 An Analysis of Covariance (ANCOVA) was employed to examine the effect of Gender, Grade and locality on 'Tech Aided Grade2Braille'

SECTION - I

4.1 Analysis of the Software Component of ‘TAG2B’ Tutoring System

4.1.1 Testing of Error Free Software Programme

‘TAG2B’ tutoring system has been tested for error free and bug free feature. The screenshot of the successfully programmed and uploaded TAG2B presented in Fig.4.1 proved that the programme is bug free and error free.

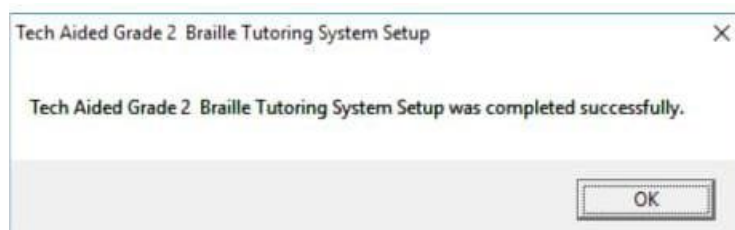


Fig 4.1 Screenshot of the Installation of Software Programme

4.1.2 Testing of Time and Space Complexity of the Software Programme

Time complexity is the amount of time taken by the system to perform its operations. Time complexity is also referred to computational complexity. It is determined by counting the number of operations involved in the program. ‘TAG2B’ software works well for all the three cases viz. Learning, Practice and Evaluation. Figure 4.2 shows the time complexity with respect to O (i.e., .big-o) notation.

Table 4.1 Time Complexity of the Proposed System

S.No	Complexity Case	Time Complexity
1.	Best case	$O(n \log n)$
2.	Average case	$O(n \log n)$
3.	Worst case	$O(n \log n)$

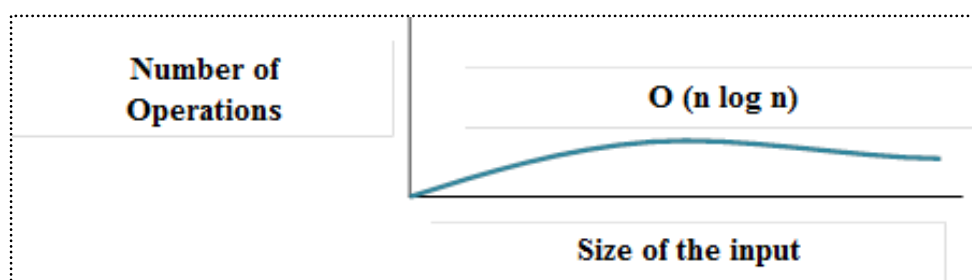


Figure 4.2 Time Complexity of ‘TAG2B’

SECTION II

4.2 Percentage Analysis of the Feedback of ‘TAG2B’ Tutoring System

A four point rating scale with six dimensions such as ‘Existing Knowledge on Grade2 Braille Manual’, ‘Application of Tech aided Grade2 Braille tutoring system’, ‘Tech aided Grade2 Braille tutoring system as a learning tool’, ‘Advantages of Tech aided Grade 2Braille tutoring system’, ‘Usability’ and ‘Challenges’ in using ‘TAG2B’ was used to examine the perception of Special Education Student Teachers (99) and Special Teachers (21) on the usage of the ‘TAG2B’ tutoring system. The responses were analyzed and formulated in the table 4.2 given below with discussion and represented in figs 4.3 to 4.8.

Table 4.2 Percentage Analysis on the ‘Impact of Tech Aided Grade 2 Braille Tutoring System’

Dimensions of the scale	N (State-ments)	Strongly Agree		Agree		Disagree		Strongly Disagree	
		Mean	%	Mean	%	Mean	%	Mean	%
Existing Knowledge on Grade 2Braille Manual	10	3.2	3	15.2	13	67.6	56	34	28
Application of Tech aided Grade 2Braille tutoring system	5	29.4	25	66	55	15.4	13	9.2	8
Tech aided Grade2 Braille tutoring system as a learning tool	5	22	19.1	62	53.9	17.3	15.7	12.7	11.3
Advantages of Tech aided Grade 2Braille tutoring system	5	20.6	17	67.8	57	15.6	13	16	13
Usability	10	27.7	23.0 8	68.9	57.42	15.3	12.75	8.1	6.75
Challenges	5	5.6	4.67	15.4	12.83	70.2	58.50	28.8	24.00

a. Existing Knowledge on 'Grade 2 Braille Manual'

It can be discussed from the above table that about 13% (agree) and 3% (strongly agree) of the respondents reported that their students use manual Braille slate to read and write Grade2 braille. Almost 84% of the respondents expressed (56% (disagree) & 28% (strongly disagree)) that students with visual impairment never use Braille Slate to read and write before introduction of 'Tech Aided Grade2 Braille Tutoring System' (Fig 4.3).

b. Application of 'Tech Aided Grade 2 Braille Tutoring System'

Regarding the 'Application of 'Tech Aided Grade 2 Braille Tutoring System' 66% (agree) and 29% (strongly agree) of the respondents reported that 'Tech Aided Grade2 Braille tutoring system' is helpful to learn Alphabet Word Signs, Group signs, Short forms, word meaning, spelling in Standing Alone contractions since the audio format synchronizes with the video format and the students with visual impairment are able to learn Grade 2 braille as against about 8% (strongly disagree) and 13% (disagree) reported that their students are not able to learn due to lack of individual attention and self motivation when 'TAG2B' is used (Fig 4.4).

c. 'Tech Aided Grade 2 Braille Tutoring System' as a Learning Tool

Around 54% (agree) and 19% (strongly agree) of the respondents proclaimed that 'Tech Aided Grade2 Braille tutoring system' is self instructional, helpful to learn and practise braille individually, and is self evaluative and it saves time as against a few student teachers and special teachers (11% strongly disagree & 16% disagree) deny (Fig 4.5).

d. Advantages of 'Tech Aided Grade 2 Braille Tutoring System'

About 68% (agree) and 21% (strongly agree) of the respondents delineated that 'Tech Aided Grade2 Braille tutoring system' is helpful to their students to learn, practice and self evaluate in Braille since minimum keys are involved and can practise braille at any time, and by everyone who knows braille as against 13% (strongly disagree & disagree) of them repudiate the advantages of the system (Fig 4.6).

e. Usability of ‘Tech Aided Grade 2 Braille Tutoring System’

About 23% (agree) and 57 % (strongly agree) of the respondents reported that ‘Tech Aided Grade2 Braille tutoring system’ is a self learning device, effective for use in online teaching, helpful in peer tutoring, supportive for special teachers , parents and minimizes the task of the special teachers. In addition, even poor learners can also use the tool repeatedly which consequently enhances braille literacy as against 7% and 13% of them contradict the usage of the system (Fig 4.7).

f. Challenges of ‘Tech Aided Grade 2 Braille Tutoring System’

Regarding the Challenges of ‘Tech Aided Grade 2 Braille Tutoring System’ only 5% (agree) and 13% (strongly agree) of the respondents communicated that ‘Tech Aided Grade2 Braille tutoring system’ requires basic computer knowledge, students get distracted to monotonous voice, limits the tactual mode of learning and restricts interaction with peer group and special teachers as against 59% and 24% of them refute the challenges of the system (Fig 4.8).

g. Cent percent of the students with visual impairment were able to respond to Grade1 Braille Alphabet.

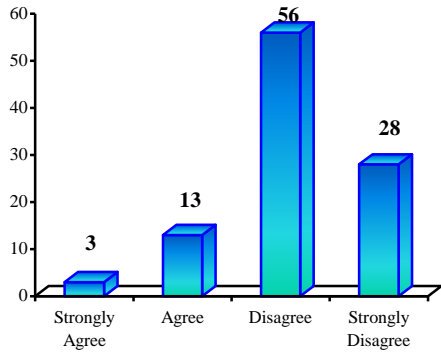


Fig 4.3 Existing Knowledge on Grade 2 Braille Manual

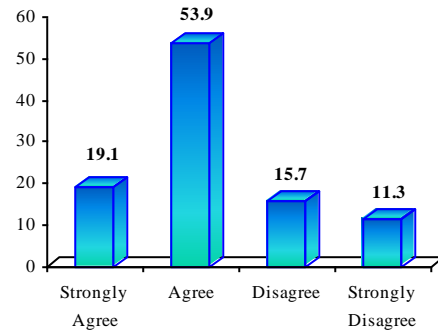


Fig 4.4 Application of 'Tech Aided Grade 2 Braille Tutoring System'

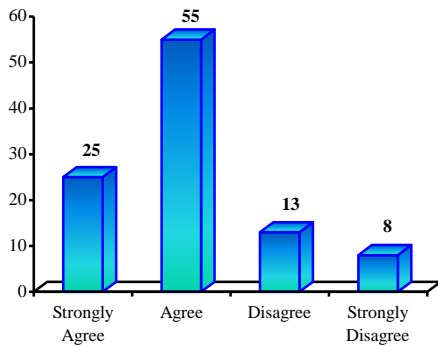


Fig 4.5 'Tech Aided Grade 2 Braille Tutoring System' as a Learning Tool

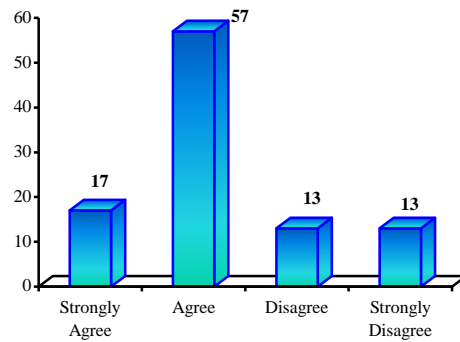


Fig 4.6 Advantages of 'Tech Aided Grade 2 Braille Tutoring System'

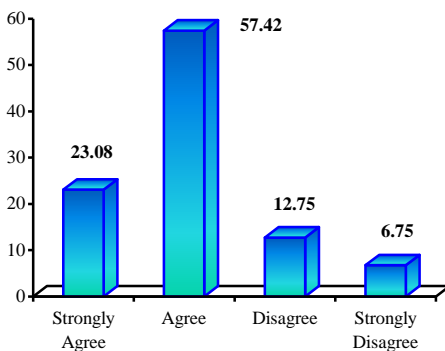
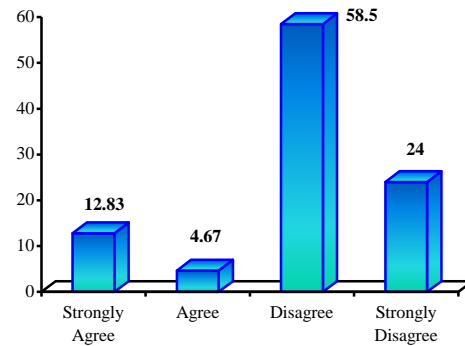


Fig 4.7 Usability of 'Tech Aided Grade 2 Braille Tutoring System'



4.8 Challenges of 'Tech Aided Grade 2 Braille Tutoring System'

SECTION - III

4.3 Analysis of Acquisition of ‘TAG2B’ among Students with Visual Impairment

The following tables 4.3 to 4.10 analyses the performance scores of students with visual impairment in Grade2 Braille before and after introduction of ‘Tech Aided Grade2 Braille tutoring system’.

Table 4.3 Testing Wise Mean, SD, df and t-value for ‘Alphabet Word Sign’

	Test	N	df	Mean	SD	t-Value
Alphabet Word Sign	Pre	42	41	1.50	0.83	55.11**
	Post			17.71	2.20	

** Significant at 0.01 level

From the table 4.3, it is evident that the t-value is 55.11 with df =41 for the ‘Alphabet Word Sign’ which is significant at 0.01 level. It indicates that pre and posttests score of ‘Alphabet Word Sign’ differ significantly. It means that there was a significant impact of ‘Tech Aided Grade 2 Braille Tutoring System’ among students with visual impairment. In the light of this null hypothesis stated that *“there is no significant difference in mean for Alphabet Word Sign among students with visual impairment”* is rejected. It may therefore be said that the ‘Tech Aided Grade 2 Braille Tutoring System’ enhanced the learning of ‘Alphabet Word Sign’ among students with visual impairment.

Table 4.4 Testing Wise Mean, SD, df and t-value for ‘Strong Words’

	Test	N	df	Mean	SD	t-Value
Strong Words	Pre	42	41	0.93	0.51	46.68**
	Post			13.48	1.76	

** Significant at 0.01 level

The above table 4.4, convey that the t-value is 46.68 with df=41 for the ‘Strong Words’ is significant at 0.01 level. It indicates that pre and posttests score of ‘Strong Words’ differ significantly. It means that there was a significant impact of ‘Tech Aided Grade 2 Braille Tutoring System’ among students with visual impairment. In view of the null hypothesis stated that *“there is no significant difference in mean for Strong*

Words among Students with visual impairment” is rejected. It may therefore be said that the ‘Tech Aided Grade 2 Braille Tutoring System’ enhanced the learning of ‘Strong words’ among students with visual impairment.

Table 4.5 Testing Wise Mean, SD, df and t-value for’ Lower Signs’

	Test	N	df	Mean	SD	t-Value
Lower Signs	Pre	42	41	0.29	0.46	59.80**
	Post			7.40	0.73	

**** Significant at 0.01 level**

From the table 4.5, it is apparent that the t-value is 59.80 with df=41 for the ‘Lower Signs’ which is significant at 0.01 level. It indicates that pre and posttests score of ‘Lower Signs’ differ significantly. It means that there was a significant impact of ‘Tech Aided Grade 2 Braille Tutoring System’ among students with visual impairment. Taking into consideration of the null hypothesis enunciated that *“there is no significant difference in mean for Lower Signs among Students with visual impairment”* is rejected. It may therefore be said that the ‘Tech Aided Grade 2 Braille Tutoring System’ enhanced the learning of Lower signs among students with visual impairment.

Table 4.6 Testing Wise Mean, SD, df and t-value for ‘Dot 5 with Initial Letter’

	Test	N	df	Mean	SD	t-Value
Dot 5 Initial Letter	Pre	42	41	0.86	1.14	62.80**
	Post			16.07	1.80	

**** Significant at 0.01 level**

It can be discussed (Table 4.6) that the t-value is 62.80 with df=41 for the ‘Dot 5 with Initial Letter’ which is significant at 0.01 level. It indicates that pre and posttests score of ‘Dot 5 with Initial Letter’ differ significantly. It means that there was a significant impact of ‘Tech Aided Grade 2 Braille Tutoring System’ among students with visual impairment. In the light of the null hypothesis that *“there is no significant difference in mean for Dot 5 with Initial Letter among students with visual impairment”* is rejected. It may therefore be said that the ‘Tech Aided Grade 2 Braille Tutoring System’ enhanced the learning of Dot 5 with Initial Letter among students with visual impairment.

4.7 Testing wise Mean, SD, df and t-value for ‘Dot 4 - 5 with Initial Letter’

Dot 4 and 5 Initial Letter	Test	N	df	Mean	SD	t-Value
	Pre	42	41	0.19	0.40	31.80**
	Post			3.45	0.67	

**** Significant at 0.01 level**

From the above table 4.7, it is perceptible that the t-value is 31.80 with df=41 for the ‘Dot 4 - 5 with Initial Letter’ which is significant at 0.01 level. It specifies that pre and posttests score of ‘Dot 4 and 5 with Initial Letter’ differ significantly. It means that there was a significant impact of ‘Tech Aided Grade 2 Braille Tutoring System’ among students with visual impairment. In the light of the null hypothesis that **“there is no significant difference in mean for Dot 4 - 5 with Initial Letter among students with visual impairment”** is rejected. It may therefore be said that the ‘Tech Aided Grade 2 Braille Tutoring System’ enhanced the learning of ‘Dot 4 -5 with Initial Letter’ among students with visual impairment.

Table 4.8 Testing Wise Mean, SD, df and t-value for ‘Dot 4- 5 -6 with Initial Letter’

Dot 4 5 6 Initial Letter	Test	N	df	Mean	SD	t-Value
	Pre	42	41	0.21	0.47	44.36**
	Post			3.64	0.53	

**** Significant at 0.01 level**

From the table 4.8, it is obvious that the t-value is 44.36 with df=41 for the ‘Dot 4- 5 -6 with Initial Letter’ which is significant at 0.01 level. It shows that pre and posttests score of ‘Dot 4 -5- 6 with Initial Letter’ differ significantly. It implies that there was a significant impact of ‘Tech Aided Grade 2 Braille Tutoring System’ among students with visual impairment. In the view of the null hypothesis that **“there is no significant difference in mean for Dot 4 -5- 6 with Initial Letter among students with visual impairment”** is rejected. It may therefore be said that the ‘Tech Aided Grade 2 Braille Tutoring System’ enhanced the learning of ‘Dot 4 -5 -6 with Initial Letter’ among students with visual impairment.

Table 4.9 Testing Wise Mean, SD, df and t-value for ‘Final Letter’

Final Letter	Test	N	df	Mean	SD	t-Value
	Pre	42	41	0.00	0.00	64.87**
	Post			8.98	0.90	

**** Significant at 0.01 level**

The table 4.9 indicates that the t-value is 64.87 with df=41 for the ‘Final Letter’ is significant at 0.01 level. It implies that pre and posttests score of ‘Final Letter’ differ significantly. It means that there was a significant impact of ‘Tech Aided Grade 2 Braille Tutoring System’ among students with visual impairment. In the light of the null hypothesis that **“there is no significant difference in mean of Final Letter among Students with visual impairment”** is rejected. It may therefore be said that the ‘Tech Aided Grade 2 Braille Tutoring System’ enhanced the learning of ‘Final Letter’ among students with visual impairment.

Table 4.10 Testing Wise Mean, SD, df and t-value for ‘Short Forms’

Short Forms	Test	N	df	Mean	SD	t-Value
	Pre	42	41	2.64	1.90	66.69**
	Post			57.98	6.10	

**** Significant at 0.01 level**

From the table 4.10, it is evident that the t-value is 66.69 with df=41 for the ‘Short Forms’ which is significant at 0.01 level. It reflects that pre and posttests score for ‘Short forms’ differ significantly. It implies that there was a significant impact of ‘Tech Aided Grade 2 Braille Tutoring System’ among students with visual impairment. In the view of the null hypothesis indicated that **“there is no significant difference in mean for Short Forms among students with visual impairment”** is rejected. It may therefore be said that the ‘Tech Aided Grade 2 Braille Tutoring System’ enhanced the learning of Short forms among students with visual impairment.

SECTION IV

4.4 Analysis of Performances in ‘Tech Aided Grade2 Braille’ among students with visual impairment. (Pretest, Progress Monitoring Test1, Progress Monitoring Test2, Progress Monitoring Test3, Progress Monitoring Test 4 and Posttest)

4.4.1 Repeated Measures ANOVA for ‘Alphabet Word Sign’

The Repeated Measures ANOVA was employed to determine whether the Performance Score in ‘Alphabet Word Sign’ differ significantly in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post test’ applying statistical methods such as ‘Sphericity Assumed, Greenhouse-Geisser, Huynh-Feldt and Lower-bound’. The results are given in the following table.

Table 4.11 Summary of Repeated Measures ANOVA for ‘Alphabet Word Sign’

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Alphabet Word Sign	Sphericity Assumed	7488.73	5	1497.75	1.22	.000**	.967
	Greenhouse-Geisser	7488.73	3.24	2313.61	1.22	.000**	.967
	Huynh-Feldt	7488.73	3.55	2111.28	1.22	.000**	.967
	Lower-bound	7488.73	1.00	7488.73	1.22	.000**	.967
Error	Sphericity Assumed	252.43	205	1.23			
	Greenhouse-Geisser	252.43	132.71	1.90			
	Huynh-Feldt	252.43	145.43	1.74			
	Lower-bound	252.43	41.00	6.16			

** Significant at 0.01 level

From the table 4.11 it is evident that the F value for Alphabet Word Sign is (5, 3.24) = 1.22, $p < 0.01$. This shows the Mean of ‘Alphabet Word Sign’ in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test’ differs significantly. The effect size $\eta^2 = .967$ was found to be significant in making changes as the result of the intervention. In the context that the null hypothesis stated as “*there is no significant difference*”

within Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test Scores” is rejected. To investigate as to which Pairs of Means differed significantly, Post-Hoc was further operated. The results of the analysis are given in the following table.

Table 4.12 Sidak Post Hoc Test of Alphabet Word Sign

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	PMT 1	6.74	5.24	0.18	.00**
	PMT 2	10.45	8.95	0.26	.00**
	PMT 3	13.33	11.83	0.25	.00**
	PMT 4	15.38	13.88	0.27	.00**
	Post	17.71	16.21	0.29	.00**
PMT 1	Pre	1.50	5.24	0.18	.00**
	PMT 2	10.45	3.71	0.26	.00**
	PMT 3	13.33	6.60	0.23	.00**
	PMT 4	15.38	8.64	0.25	.00**
	Post	17.71	10.98	0.29	.00**
PMT 2	Pre	1.50	8.95	0.26	.00**
	PMT 1	6.74	3.71	0.26	.00**
	PMT 3	13.33	2.88	0.19	.00**
	PMT 4	15.38	4.93	0.25	.00**
	Post	17.71	7.26	0.29	.00**
PMT 3	Pre	1.50	11.83	0.25	.00**
	PMT 1	6.74	6.60	0.23	.00**
	PMT 2	10.45	2.88	0.19	.00**
	PMT 4	15.38	2.05	0.15	.00**
	Post	17.71	4.38	0.23	.00**
PMT 4	Pre	1.50	13.88	0.27	.00**
	PMT 1	6.74	8.64	0.25	.00**
	PMT 2	10.45	4.93	0.25	.00**
	PMT 3	13.33	2.05	0.15	.00**
	Post	17.71	2.33	0.16	.00**
Post	Pre	1.50	16.21	0.29	.00**
	PMT 1	6.74	10.98	0.29	.00**
	PMT 2	10.45	7.26	0.29	.00**
	PMT 3	13.33	4.38	0.23	.00**
	PMT 4	15.38	2.33	0.16	.00**

**** Significant at 0.01 level**

From the above table 4.11, it is evident that the significant difference resulted between: ‘Pre & PMT 1 (5.24), Pre & PMT 2 (8.95), Pre & PMT 3 (11.83), Pre & PMT 4 (13.88), Pre & Post (16.21), PMT1 & PMT 2 (3.71), PMT 1 & PMT 3 (6.60), PMT 1 & PMT 4 (8.64), PMT 1 & Post (10.98), PMT 2 & PMT 3 (2.88), PMT 2 & PMT 4 (4.93), PMT 2 & Post (7.26), PMT 3 & PMT 4 (2.05), PMT 3 & Post (4.38), PMT 4 & Post (2.33)’. These results indicate that the students with visual impairment have shown improvement and their scores scaled up in each test after introduction of the ‘Tech Aided Grade 2 Braille Tutoring System’.

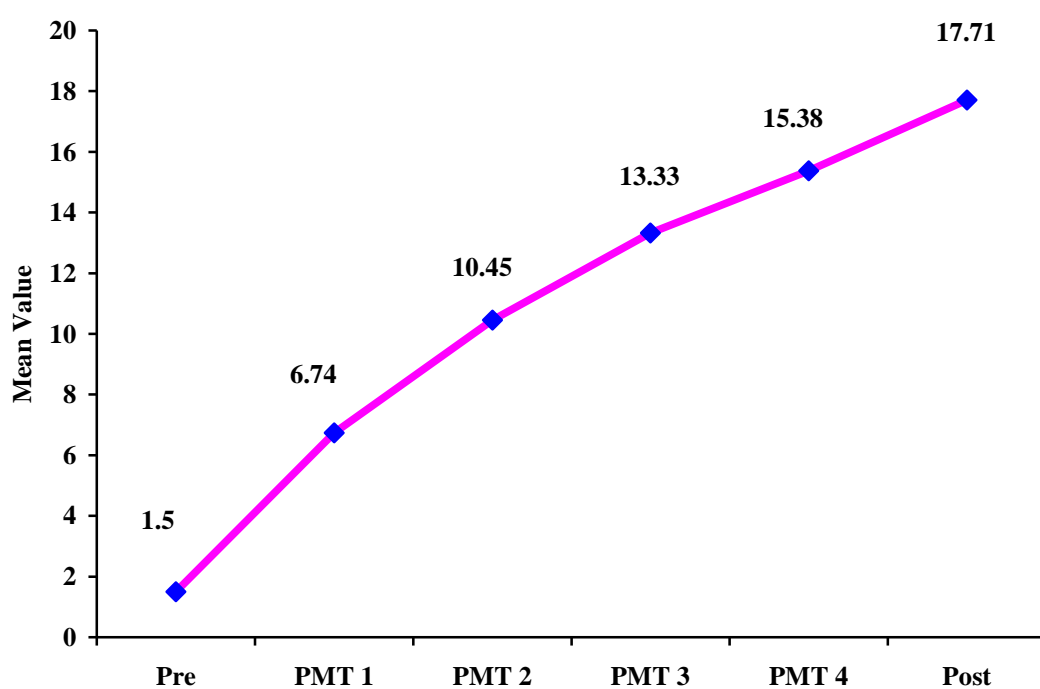


Fig 4.9 Analysis of Performances in ‘Alphabet Word Sign’

4.4.2 Repeated Measures ANOVA for ‘Strong Words/Group Signs’

The Repeated Measures ANOVA was employed to determine whether the Performance Score in ‘Strong Words/Group Signs’ differ significantly in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and PMT 5’ applying statistical methods such as ‘Sphericity Assumed, Greenhouse-Geiser, Huynh-Feldt and Lower-bound’. The results are given in the following table 4.13.

Table 4.13 Summary of Repeated Measures ANOVA for ‘Strong Words/Group Signs’

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Strong Words/Group Signs	Sphericity Assumed	4478.73	5	895.75	537.29	.00**	.929
	Greenhouse-Geisser	4478.73	2.67	1676.02	537.29	.00**	.929
	Huynh-Feldt	4478.73	2.88	1557.23	537.29	.00**	.929
	Lower-bound	4478.73	1.00	4478.73	537.29	.00**	.929
Error	Sphericity Assumed	341.77	205	1.67			
	Greenhouse-Geisser	341.77	109.56	3.12			
	Huynh-Feldt	341.77	117.92	2.90			
	Lower-bound	341.77	41.00	8.34			

From the table 4.13 it is evident that the F value for ‘Alphabet Word Sign’ is (5, 2.67) = 537.29, $p < 0.01$. This shows the Mean of ‘Strong Words/Group Signs’ in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test’ differs significantly. The effect size $\eta^2 = .929$ was found to be significant in making changes as the result of the intervention. In the event of the null hypothesis stated as “*there is no significant difference within Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test Scores*” is rejected. To explore as to which Pairs of Means differed significantly, Post-Hoc was further applied. The results of the analysis are given in the following table 4.14.

Table 4.14 Sidak Post Hoc Test of Strong Words/Group Signs

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	PMT 1	5.38	4.45	0.33	.00**
	PMT 2	7.71	6.79	0.35	.00**
	PMT 3	10.07	9.14	0.39	.00**
	PMT 4	11.98	11.05	0.38	.00**
	Post	13.48	12.55	0.27	.00**
PMT 1	Pre	0.93	4.45	0.33	.00**
	PMT 2	7.71	2.33	0.17	.00**
	PMT 3	10.07	4.69	0.25	.00**
	PMT 4	11.98	6.60	0.27	.00**
	Post	13.48	8.10	0.29	.00**
PMT 2	Pre	0.93	6.79	0.35	.00**
	PMT 1	5.38	2.33	0.17	.00**
	PMT 3	10.07	2.36	0.18	.00**
	PMT 4	11.98	4.26	0.22	.00**
	Post	13.48	5.76	0.30	.00**
PMT 3	Pre	0.93	9.14	0.39	.00**
	PMT 1	5.38	4.69	0.25	.00**
	PMT 2	7.71	2.36	0.18	.00**
	PMT 4	11.98	1.91	0.13	.00**
	Post	13.48	3.41	0.28	.00**
PMT 4	Pre	0.93	11.05	0.38	.00**
	PMT 1	5.38	6.60	0.27	.00**
	PMT 2	7.71	4.26	0.22	.00**
	PMT 3	10.07	1.91	0.13	.00**
	Post	13.48	1.50	0.28	.00**
Post	Pre	0.93	12.55	0.27	.00**
	PMT 1	5.38	8.10	0.29	.00**
	PMT 2	7.71	5.76	0.30	.00**
	PMT 3	10.07	3.41	0.28	.00**
	PMT 4	11.98	1.50	0.28	.00**

** Significant at 0.01 level

From the above table 4.14, it is evident that the significant difference have resulted between: Pre & PMT 1 (4.45), Pre & PMT2 (6.79), Pre & PMT 3 (9.14), Pre & PMT 4 (11.05), Pre & Post (12.55), PMT 1 & PMT 2 (2.33), PMT 1 & PMT 3 (4.69), PMT 1 & PMT 4 (6.60), PMT 1 & Post (8.10), PMT 2 & PMT 3 (2.36), PMT 2 & PMT 4 (4.26), PMT 2 & Post (5.76), PMT 3 & PMT 4 (1.91), PMT 3 & Post (3.41), PMT 4 & Post (1.50). These results indicate that the students have shown improvement and their scores scaled up in each test after introduction of the ‘Tech Aided Grade 2 Braille Tutoring System’.

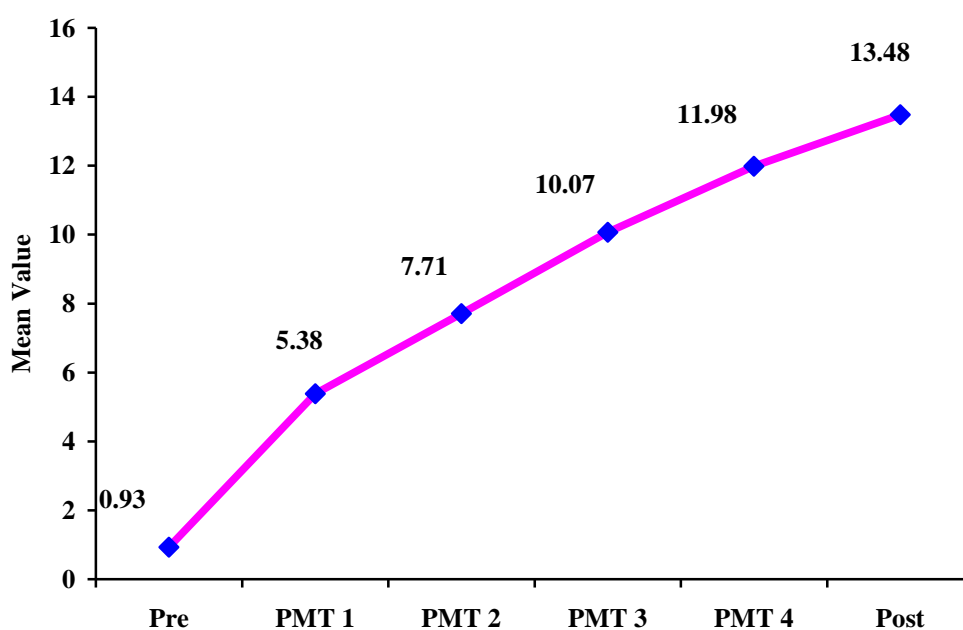


Fig 4.10: Analysis of Performances in Strong Words/Group Signs

4.4.3 Repeated Measures ANOVA for Lower Signs

The Repeated Measures ‘ANOVA’ was employed to determine whether the Performance Score in ‘Lower Signs’ differ significantly in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post’ applying statistical methods such as ‘Sphericity Assumed, Greenhouse-Geisser, Huynh-Feldt and Lower-bound’. The results are given in the following table 4.15.

Table 4.15 Summary of Repeated Measures ANOVA for Lower Signs

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Lower Signs	Sphericity Assumed	1363.18	5	272.64	628.07	.00**	.939
	Greenhouse-Geisser	1363.18	2.75	495.02	628.07	.00**	.939
	Huynh-Feldt	1363.18	2.97	458.71	628.07	.00**	.939
	Lower-bound	1363.18	1.00	1363.18	628.07	.00**	.939
Error	Sphericity Assumed	88.99	205	0.43			
	Greenhouse-Geisser	88.99	112.91	0.79			
	Huynh-Feldt	88.99	121.84	0.73			
	Lower-bound	88.99	41.00	2.17			

** Significant at 0.01 level

From the table 4.15 it is evident that the F value for ‘Lower Sign’ is (5, 2.75) = 628.07, $p < 0.01$. This shows the Mean of ‘Lower Signs’ in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test’ differs significantly. The effect size $\eta^2 = .939$ was found to be significant in making changes as the result of the intervention. In the view of the null hypothesis stated as that *“there is no significant difference within Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test Scores”* is rejected. To probe as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table 4.15.

Table 4.16 Sidak Post Hoc Test of Lower Signs

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	PMT 1	2.57	2.29	0.16	.00**
	PMT 2	3.62	3.33	0.15	.00**
	PMT 3	4.83	4.55	0.13	.00**
	PMT 4	6.07	5.79	0.13	.00**
	Post	7.40	7.12	0.12	.00**
PMT 1	Pre	0.29	2.29	0.16	.00**
	PMT 2	3.62	1.05	0.13	.00**
	PMT 3	4.83	2.26	0.16	.00**
	PMT 4	6.07	3.50	0.18	.00**
	Post	7.40	4.83	0.20	.00**
PMT 2	Pre	0.29	3.33	0.15	.00**
	PMT 1	2.57	1.05	0.13	.00**
	PMT 3	4.83	1.21	0.09	.00**
	PMT 4	6.07	2.45	0.15	.00**
	Post	7.40	3.79	0.17	.00**
PMT 3	Pre	0.29	4.55	0.13	.00**
	PMT 1	2.57	2.26	0.16	.00**
	PMT 2	3.62	1.21	0.09	.00**
	PMT 4	6.07	1.24	0.10	.00**
	Post	7.40	2.57	0.13	.00**
PMT 4	Pre	0.29	5.79	0.13	.00**
	PMT 1	2.57	3.50	0.18	.00**
	PMT 2	3.62	2.45	0.15	.00**
	PMT 3	4.83	1.24	0.10	.00**
	Post	7.40	1.33	0.09	.00**
Post	Pre	0.29	7.12	0.12	.00**
	PMT 1	2.57	4.83	0.20	.00**
	PMT 2	3.62	3.79	0.17	.00**
	PMT 3	4.83	2.57	0.13	.00**
	PMT 4	6.07	1.33	0.09	.00**

** Significant at 0.01 level

From the above table 4.16, it is evident that the significant difference are resulted between: Pre & PMT 1 (2.29), Pre & PMT 2 (3.33), Pre & PMT 3 (4.55), Pre & PMT 4 (5.79), Pre & Post (7.12), PMT 1 & PMT 2 (1.05), PMT 1 & PMT 3 (2.26), PMT 1 & PMT 4 (3.50), PMT 1 & Post (4.83), PMT 2 & PMT 3 (1.21), PMT 2 & PMT 4 (2.45), PMT 2 & Post (3.79), PMT 3 & PMT 4 (1.24), PMT 3 & PMT 5 (2.57), PMT 4 & Post (1.33). These results indicate that the students have shown improvement and their scores scaled up after introducton of the Tech Aided Grade 2 Braille Tutoring System.

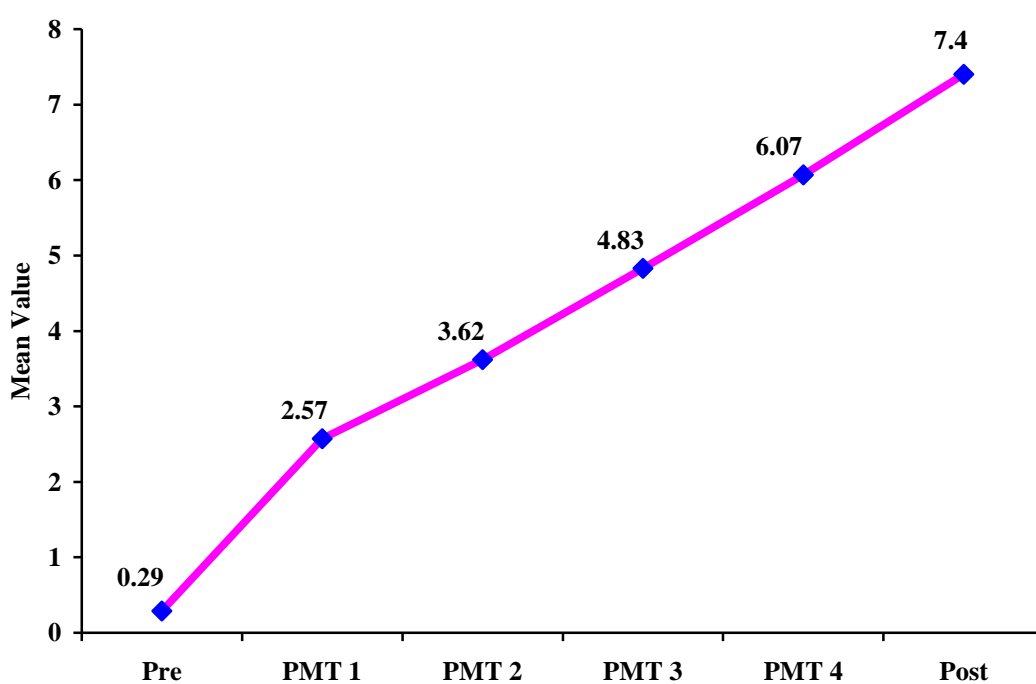


Fig 4.11: Analysis of Performances in Lower Signs

4.4.4 Repeated Measures ANOVA ‘Dot-5 with Initial Letter’

The Repeated Measures ‘ANOVA’ was employed to determine whether the Performance Score in Dot-5 with Initial Letter differ significantly in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post’ applying statistical methods such as ‘Sphericity Assumed, Greenhouse-Geiser, Huynh-Feldt and Lower-bound’. The results are given in the following table 4.17.

Table 4.17 Summary of Repeated Measures ANOVA for Dot-5 with Initial Letter

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Dot-5 Initial Letter	Sphericity Assumed	6335.81	5	1267.16	1.42	.00	.972
	Greenhouse-Geisser	6335.81	3.19	1989.01	1.42	.00	.972
	Huynh-Feldt	6335.81	3.49	1817.98	1.42	.00	.972
	Lower-bound	6335.81	1.00	6335.81	1.42	.00	.972
Error	Sphericity Assumed	182.52	205	0.89			
	Greenhouse-Geisser	182.52	130.60	1.40			
	Huynh-Feldt	182.52	142.89	1.28			
	Lower-bound	182.52	41.00	4.45			

**** Significant at 0.01 level**

From the table 4.17 it is evident that the F value for ‘Dot-5with Initial Letter’ is (5, 3.19) = 1.42, $p < 0.01$. This shows the Mean of Dot-5 with Initial Letter in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test’ differs significantly. The effect size $\eta^2 = .972$ was found to be significant in making changes as the result of the intervention. In the ambience of the null hypothesis stated as **“there is no significant difference within Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test Scores”** is rejected. To explore as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table 4.17.

Table 4.18 Sidak Post Hoc Test of Dot-5 with Initial Letter

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	PMT 1	5.95	5.10	0.21	.00**
	PMT 2	8.67	7.81	0.21	.00**
	PMT 3	11.33	10.48	0.21	.00**
	PMT 4	13.55	12.69	0.23	.00**
	Post	16.07	15.21	0.24	.00**
PMT 1	Pre	0.86	5.10	0.21	.00**
	PMT 2	8.67	2.71	0.18	.00**
	PMT 3	11.33	5.38	0.23	.00**
	PMT 4	13.55	7.60	0.24	.00**
	Post	16.07	10.11	0.28	.00**
PMT 2	Pre	0.86	7.81	0.21	.00**
	PMT 1	5.95	2.71	0.18	.00**
	PMT 3	11.33	2.67	0.15	.00**
	PMT 4	13.55	4.88	0.16	.00**
	Post	16.07	7.41	0.21	.00**
PMT 3	Pre	0.86	10.48	0.21	.00**
	PMT 1	5.95	5.38	0.23	.00**
	PMT 2	8.67	2.67	0.14	.00**
	PMT 4	13.55	2.21	0.13	.00**
	Post	16.07	4.74	0.20	.00**
PMT 4	Pre	0.86	12.69	0.23	.00**
	PMT 1	5.95	7.60	0.24	.00**
	PMT 2	8.67	4.88	0.16	.00**
	PMT 3	11.33	2.21	0.13	.00**
	Post	16.07	2.52	0.13	.00**
Post	Pre	0.86	15.21	0.24	.00**
	PMT 1	5.95	10.12	0.28	.00**
	PMT 2	8.67	7.41	0.21	.00**
	PMT 3	11.33	4.74	0.20	.00**
	PMT 4	13.55	2.52	0.13	.00**

** Significant at 0.01 level

From the above table 4.18, it is evident that the significant difference are resulted between: Pre & PMT 1 (5.10), Pre & PMT 2 (7.81), Pre & PMT 3 (10.48), Pre & PMT 4 (12.69), Pre & Post (15.21), PMT 1 & PMT 2 (2.71), PMT 1 & PMT 3 (5.38), PMT 1 & PMT 4 (7.60), PMT 1 & Post (10.12), PMT 2 & PMT 3 (2.67), PMT 2 & PMT 4 (4.88), PMT 2 & Post (7.41), PMT 3 & PMT 4 (2.21), PMT 3 & Post (4.74), PMT 4 & Post (2.52). These results indicate that the students have shown improvement and their scores scaled up in each test after introduction of the Tech Aided Grade 2 Braille Tutoring System.

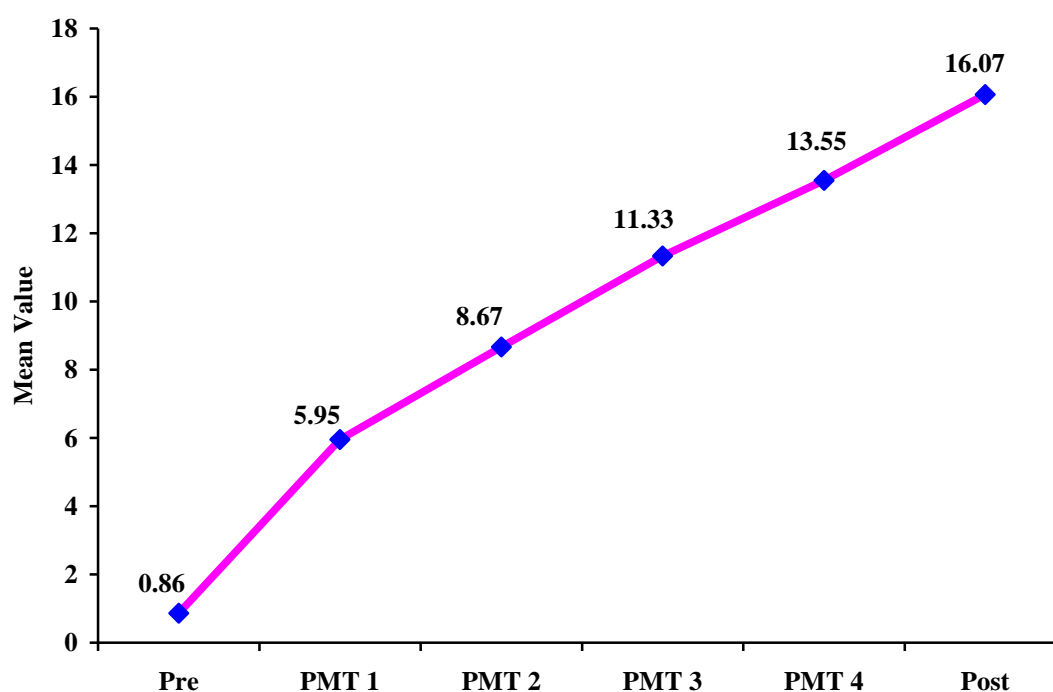


Fig 4.12: Analysis of Performances in Dot-5with Initial Letter

4.4.5 Repeated Measures ANOVA for Dot 4 -5 with Initial Letters

The Repeated Measures ‘ANOVA’ was employed to determine whether the Performance Score in Dot 4- 5with Initial Letters differ significantly in the ‘Pre, PMT 1, PMT 2, PMT3, PMT 4, and Post’ applying statistical methods such as ‘Sphericity Assumed, Greenhouse-Geiser, Huynh-Feldt and Lower-bound’. The results are given in the following table 4.19.

Table 4.19 Summary of Repeated Measures ANOVA for Dot 4-5 with Initial Letters

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Dot 4 and 5 Initial Letters	Sphericity Assumed	300.93	5	60.19	367.47	.00**	.900
	Greenhouse-Geisser	300.93	4.19	71.85	367.47	.00**	.900
	Huynh-Feldt	300.93	4.72	63.70	367.47	.00**	.900
	Lower-bound	300.93	1.00	300.93	367.47	.00**	.900
Error	Sphericity Assumed	33.58	205	0.16			
	Greenhouse-Geisser	33.58	171.72	0.20			
	Huynh-Feldt	33.58	193.69	0.17			
	Lower-bound	33.58	41.00	0.82			

** Significant at 0.01 level

From the table 4.19 it is evident that the F value for ‘Dot 4 – 5 with Initial Letters’ is (5, 4.19) = 367.47, $p < 0.01$. This shows the Mean of ‘Dot 4- 5with Initial Letters’ in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test’ differs significantly.

The effect size $\eta^2 = .900$ was found to be significant in making changes as the result of the intervention. In the context of the null hypothesis stated as that *“there is no significant difference within Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test Scores”* is rejected. To evaluate as to which Pairs of Means differed significantly, Post-Hoc was further employed. The results of the analysis are given in the following table 4.19.

Table 4.20 Sidak Post Hoc Test of Dot 4 - 5 with Initial Letters

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	PMT 1	1.02	0.83	0.08	.00**
	PMT 2	1.48	1.29	0.09	.00**
	PMT 3	2.17	1.98	0.09	.00**
	PMT 4	2.81	2.62	0.10	.00**
	Post	3.45	3.26	0.10	.00**
PMT 1	Pre	0.19	0.83	0.08	.00**
	PMT 2	1.48	0.45	0.08	.00**
	PMT 3	2.17	1.14	0.09	.00**
	PMT 4	2.18	1.79	0.09	.00**
	Post	3.45	2.43	0.09	.00**
PMT 2	Pre	0.19	1.29	0.09	.00**
	PMT 1	1.02	0.45	0.08	.00**
	PMT 3	2.17	0.69	0.07	.00**
	PMT 4	2.81	1.33	0.08	.00**
	Post	3.45	1.98	0.09	.00**
PMT 3	Pre	0.19	1.98	0.09	.00**
	PMT 1	1.02	1.14	0.09	.00**
	PMT 2	1.48	0.69	0.07	.00**
	PMT 4	2.81	0.64	0.08	.00**
	Post	3.45	1.29	0.10	.00**
PMT4	Pre	0.19	2.62	0.10	.00**
	PMT 1	1.02	1.79	0.09	.00**
	PMT 2	1.48	1.33	0.08	.00**
	PMT 3	2.17	0.64	0.08	.00**
	Post	3.45	0.64	0.08	.00**
Post	Pre	0.19	3.26	0.10	.00**
	PMT 1	1.02	2.43	0.09	.00**
	PMT 2	1.48	1.98	0.09	.00**
	PMT 3	2.17	1.29	0.10	.00**
	PMT 4	2.81	0.64	0.08	.00**

** Significant at 0.01 level

From the above table 4.19, it is evident that the significant difference are resulted between: Pre & PMT 1 (0.83), Pre & PMT 2 (1.29), Pre & PMT 3 (1.98), Pre & PMT 4 (2.62), Pre & Post (3.26), PMT 1 & PMT 2 (0.45), PMT 1 & PMT 3 (1.14), PMT 1 & PMT 4 (1.79), PMT 1 & Post (2.43), PMT 2 & PMT 3 (0.69), PMT 2 & PMT 4 (1.33), PMT 2 & Post (1.98), PMT 3 & PMT 4 (0.64), PMT 3 & Post (1.29), PMT 4 & Post (0.64). These results indicate that the students have shown improvement and their scores scaled up in each test after introduction of the Tech Aided Grade 2 Braille Tutoring System.

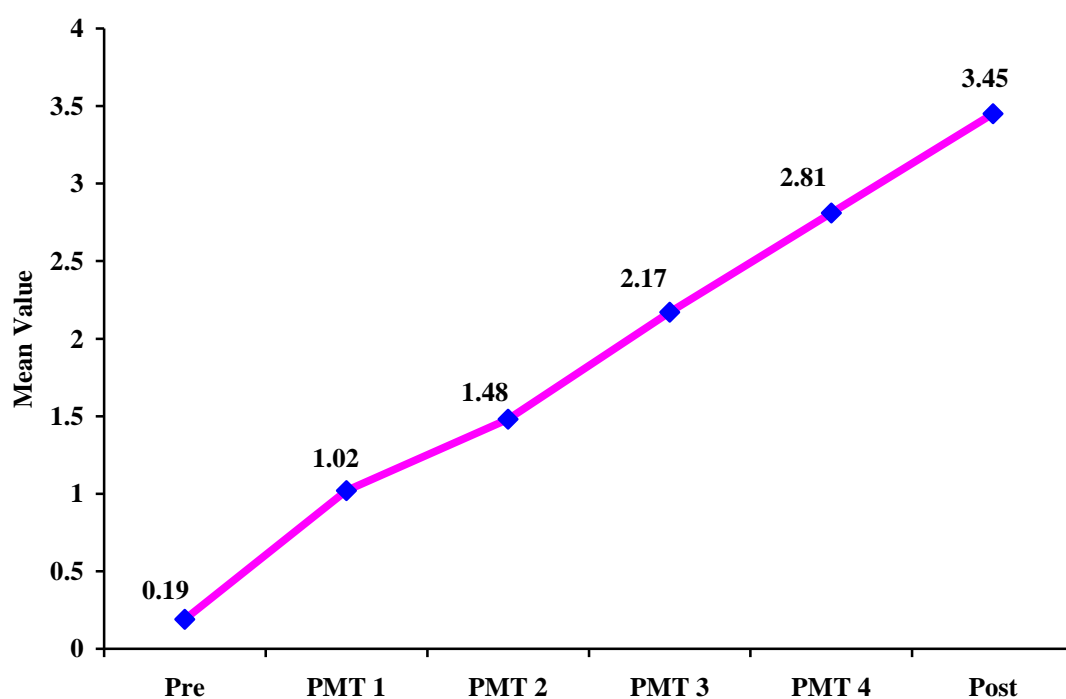


Fig 4.20: Analysis of Performances in Dot4- 5 with Initial Letters

4.4.6 Repeated Measures ANOVA for Dot 4- 5 -6 with Initial Letters

The Repeated Measures ‘ANOVA’ was employed to determine whether the Performance Score in ‘Dot 4- 5 - 6 with Initial Letters’ differ significantly in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post’ applying statistical methods such as ‘Sphericity Assumed, Greenhouse-Geiser, Huynh-Feldt and Lower-bound’. The results are given in the following table 4.21.

Table 4.21 Summary of Repeated Measures ANOVA for Dot 4- 5 - 6 with Initial Letters

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Dot 4, 5 and 6 Initial Letters	Sphericity Assumed	364.50	5	72.90	533.65	.00**	.929
	Greenhouse-Geisser	364.50	3.51	103.96	533.65	.00**	.929
	Huynh-Feldt	364.50	3.87	94.08	533.65	.00**	.929
	Lower-bound	364.50	1.00	364.50	533.65	.00**	.929
Error	Sphericity Assumed	28.00	205	0.14			
	Greenhouse-Geisser	28.00	143.76	0.20			
	Huynh-Feldt	28.00	158.85	0.18			
	Lower-bound	28.00	41.00	0.68			

** Significant at 0.01 level

From the table 4.21 it is evident that the F value for Dot 4- 5 – 6 with Initial Letters is $F(5, 3.51) = 533.65, p < 0.01$. This shows the Mean of ‘Dot 4- 5- 6 with Initial Letters in the Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test’ differs significantly. The effect size $\eta^2 = .929$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as that *“there is no significant difference within Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test Scores”* is rejected. To explore 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 Dot 4- 5 – 6 with Initial Letters

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	PMT 1	0.71	0.50	0.10	.00**
	PMT 2	1.07	0.86	0.10	.00**
	PMT 3	1.93	1.71	0.09	.00**
	PMT 4	2.83	2.62	0.08	.00**
	Post	3.64	3.43	0.08	.00**
PMT 1	Pre	0.21	0.50	0.10	.00**
	PMT 2	1.07	0.36	0.08	.00**
	PMT 3	1.93	1.21	0.06	.00**
	PMT 4	2.83	2.12	0.08	.00**
	Post	3.64	2.93	0.10	.00**
PMT 2	Pre	0.21	0.86	0.10	.00**
	PMT 1	0.71	0.36	0.08	.00**
	PMT 3	1.93	0.86	0.06	.00**
	PMT 4	2.83	1.76	0.08	.00**
	Post	3.64	2.57	0.08	.00**
PMT 3	Pre	0.21	1.71	0.09	.00**
	PMT 1	0.71	1.21	0.06	.00**
	PMT 2	1.07	0.86	0.06	.00**
	PMT 4	2.83	0.91	0.06	.00**
	Post	3.64	1.71	0.08	.00**
PMT 4	Pre	0.21	2.62	0.08	.00**
	PMT 1	0.71	2.12	0.08	.00**
	PMT 2	1.07	1.76	0.08	.00**
	PMT 3	1.93	0.91	0.06	.00**
	Post	3.64	0.81	0.07	.00**
Post	Pre	0.21	3.43	0.08	.00**
	PMT 1	0.71	2.93	0.10	.00**
	PMT 2	1.07	2.572	0.08	.00**
	PMT 3	1.93	1.71	0.08	.00**
	PMT 4	2.83	0.81	0.07	.00**

** Significant at 0.01 level

From the above table 4.22, it is evident that the significant difference are resulted between: Pre & PMT 1 (0.50), Pre & PMT 2 (0.86), Pre & PMT 3 (1.71), Pre & PMT 4 (2.62), Pre & Post (3.43), PMT 1 & PMT 2 (0.36), PMT 1 & PMT 3 (1.21), PMT 1 & PMT 4 (2.12), PMT 1 & Post (2.93), PMT 2 & PMT 3 (0.86), PMT 2 & PMT 4 (1.76), PMT 2 & Post (2.57), PMT 3 & PMT 4 (0.91), PMT 3 & Post (1.71), PMT 4 & Post (0.81). These results indicate that the students have shown improvement and their scores scaled up after introduction of the ‘Tech Aided Grade 2 Braille Tutoring System’.

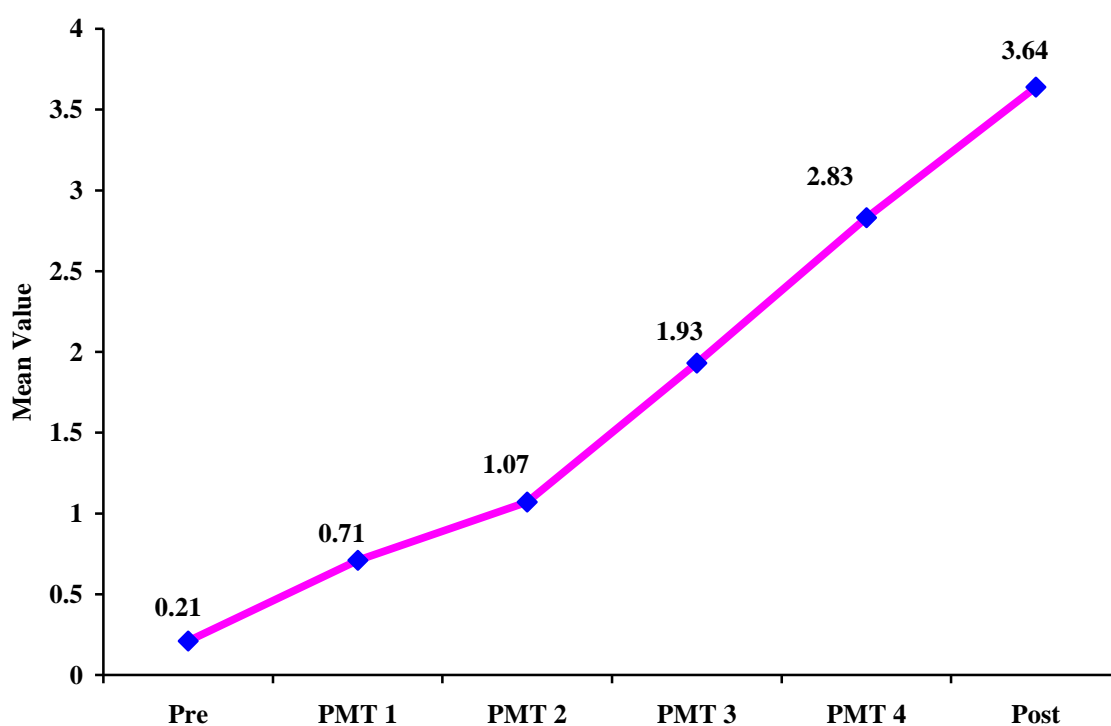


Fig4.14: Analysis of Dot 4- 5- 6 with Initial Letters

4.4.7 Repeated Measures ANOVA for ‘Final Letter’ Contractions

The Repeated Measures ‘ANOVA’ was employed to determine whether the Performance Score in Final Letter Contractions differ significantly in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post’ applying statistical methods such as ‘Sphericity Assumed, Greenhouse-Geiser, Huynh-Feldt and Lower-bound’. The results are given in the following table.

Table 4.23 Summary of Repeated Measures ANOVA for Final Letter Contractions

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Final Letter Contractions	Sphericity Assumed	2229.85	5	445.97	1.26	.00**	.969
	Greenhouse-Geisser	2229.85	3.31	674.59	1.26	.00**	.969
	Huynh-Feldt	2229.85	3.63	614.28	1.26	.00**	.969
	Lower-bound	2229.85	1.00	2229.85	1.26	.00**	.969
Error	Sphericity Assumed	72.32	205	0.35			
	Greenhouse-Geisser	72.32	135.53	0.53			
	Huynh-Feldt	72.32	148.83	0.49			
	Lower-bound	72.32	41.00	1.76			

** Significant at 0.01 level

From the table 4.23 it is evident that the F value for Final Letter Contractions is $F(5, 3.31) = 1.26, p < 0.01$. This shows the Mean of Final Letter Contractions in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test’ differs significantly. The effect size $\eta^2 = .969$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as that *“there is no significant difference within Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test Scores”* is rejected. To examine 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 Final Letter Contractions

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	PMT 1	2.50	2.50	0.09	.00**
	PMT 2	3.90	3.91	0.15	.00**
	PMT 3	5.60	5.60	0.16	.00**
	PMT 4	7.24	7.24	0.16	.00**
	Post	8.98	8.98	0.14	.00**
PMT 1	Pre	0.00	2.50	0.09	.00**
	PMT 2	3.90	1.41	0.11	.00**
	PMT 3	5.60	3.10	0.14	.00**
	PMT 4	7.24	4.74	0.14	.00**
	Post	8.98	6.48	0.13	.00**
PMT 2	Pre	0.00	3.91	0.15	.00**
	PMT 1	2.50	1.41	0.11	.00**
	PMT 3	5.60	1.69	0.09	.00**
	PMT 4	7.24	3.33	0.13	.00**
	Post	8.98	5.07	0.15	.00**
PMT 3	Pre	0.00	5.60	0.16	.00**
	PMT 1	2.50	3.10	0.14	.00**
	PMT 2	3.90	1.69	0.09	.00**
	PMT 4	7.24	1.64	0.11	.00**
	Post	8.98	3.38	0.13	.00**
PMT 4	Pre	0.00	7.24	0.16	.00**
	PMT 1	2.50	4.74	0.14	.00**
	PMT 2	3.90	3.33	0.13	.00**
	PMT 3	5.60	1.64	0.11	.00**
	Post	8.98	1.74	0.11	.00**
Post	Pre	0.00	8.98	0.14	.00**
	PMT 1	2.50	6.48	0.13	.00**
	PMT 2	3.90	5.07	0.15	.00**
	PMT 3	5.60	3.38	0.13	.00**
	PMT 4	7.24	1.74	0.11	.00**

** Significant at 0.01 level

From the above table 4.24, it is evident that the significant difference are resulted between: Pre & PMT 1 (2.50), Pre & PMT 2 (3.91), Pre & PMT 3 (5.60), Pre & PMT 4 (7.24), Pre & Post (8.98), PMT 1 & PMT 2 (1.41), PMT 1 & PMT 3 (3.10), PMT 1 & PMT 4 (4.74), PMT 1 & Post (6.48), PMT 2 & PMT 3 (1.69), PMT 2 & PMT 4 (3.33), PMT 2 & Post (5.07), PMT 3 & PMT 4 (1.64), PMT 3 & Post (3.38), PMT 4 & Post (1.74). These results indicate that the students have shown improvement and their scores scaled up in each test after inroducton of the ‘Tech Aided Grade 2 Braille Tutoring System’.

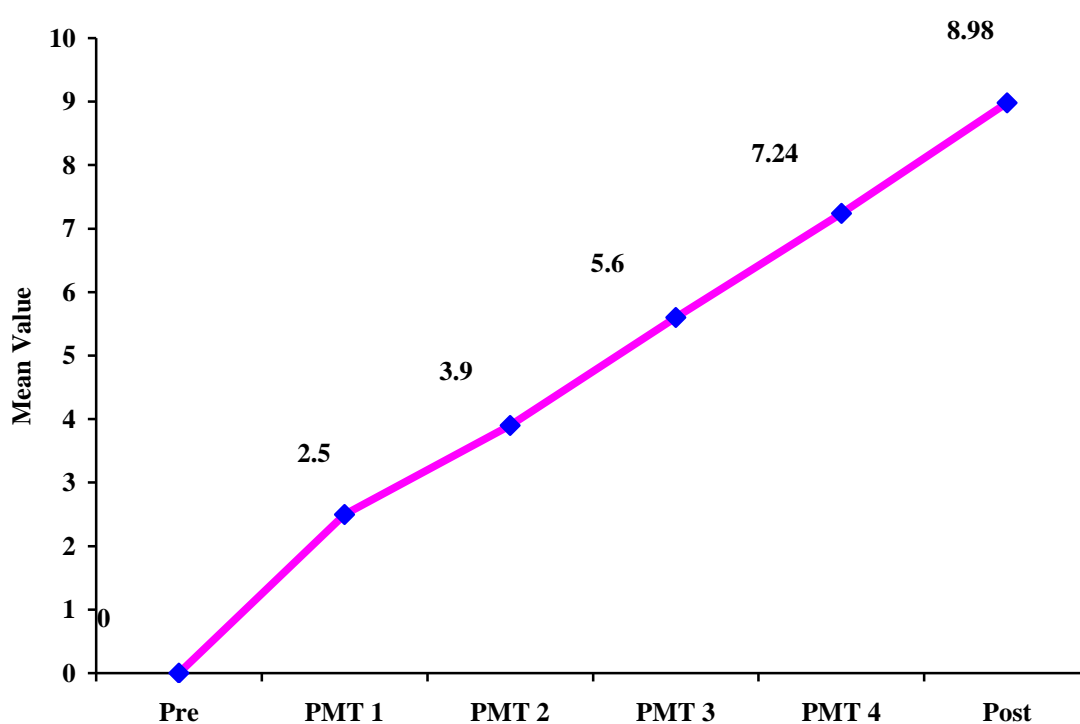


Fig 4.15: Analysis of Performances in Final Letter Contractions

4.4.8 The Repeated Measures ANOVA for ‘Short Forms’

The Repeated Measures ‘ANOVA’ was employed to determine whether the Performance Score in Short Forms differ significantly in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post ‘ applying statistical methods such as ‘Sphericity Assumed, Greenhouse-Geisser, Huynh-Feldt and Lower-bound’. The results are given in the following table 4.25.

Table 4.25 Summary of Repeated Measures ANOVA for Short Forms

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Short Forms	Sphericity Assumed	88010.75	5	17602.15	1.81	.00**	.978
	Greenhouse-Geisser	88010.75	3.09	28502.52	1.81	.00**	.978
	Huynh-Feldt	88010.75	3.37	26131.38	1.81	.00**	.978
	Lower-bound	88010.75	1.00	88010.75	1.81	.00**	.978
Error	Sphericity Assumed	1990.25	205	9.71			
	Greenhouse-Geisser	1990.25	126.60	15.72			
	Huynh-Feldt	1990.25	138.09	14.41			
	Lower-bound	1990.25	41.00	48.54			

** Significant at 0.01 level

From the table 4.24 it is evident that the F value for Short Forms is $F(5, 3.09) = 1.81, p < 0.01$. This shows the Mean of ‘Short Forms’ in the ‘Pre, PMT 1, PMT 2, PMT 3, PMT 4, and Post Test’ differs significantly. The effect size $\eta^2 = .978$ was found to be significant in making changes as the result of the intervention. In the context the null hypothesis stated as that *“there is no significant difference within Pre, PMT 1, PMT 2, PMT 3, PMT 4, and 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 Short Forms

Testing		Mean	Mean Difference	Std. Error	Sig.
Pre	PMT 1	16.83	14.19	0.46	.00**
	PMT 2	27.71	25.07	0.68	.00**
	PMT 3	39.33	36.69	0.63	.00**
	PMT 4	48.02	45.38	0.79	.00**
	Post	57.98	55.33	0.83	.00**
PMT 1	Pre	2.64	14.19	0.46	.00**
	PMT 2	27.71	10.88	0.62	.00**
	PMT 3	39.33	22.50	0.59	.00**
	PMT 4	48.02	31.19	0.71	.00**
	Post	57.98	41.14	0.86	.00**
PMT 2	Pre	2.64	25.07	0.68	.00**
	PMT 1	16.83	10.88	0.62	.00**
	PMT 3	39.33	11.62	0.47	.00**
	PMT 4	48.02	20.31	0.61	.00**
	Post	57.98	30.26	0.93	.00**
PMT 3	Pre	2.64	36.69	0.63	.00**
	PMT 1	16.83	22.50	0.59	.00**
	PMT 2	27.71	11.62	0.47	.00**
	PMT 4	48.02	8.69	0.46	.00**
	Post	57.98	18.64	0.70	.00**
PMT 4	Pre	2.64	45.38	0.79	.00**
	PMT 1	16.83	31.19	0.71	.00**
	PMT 2	27.71	20.31	0.61	.00**
	PMT 3	39.33	8.69	0.46	.00**
	Post	57.98	9.95	0.64	.00**
Post	Pre	2.64	55.33	0.83	.00**
	PMT 1	16.83	41.14	0.86	.00**
	PMT 2	27.71	30.26	0.93	.00**
	PMT 3	39.33	18.64	0.70	.00**
	PMT 4	48.02	9.95	0.64	.00**

** Significant at 0.01 level

From the above table 4.26, it is evident that the significant difference have resulted between: Pre & PMT 1 (14.19), Pre & PMT 2 (25.07), Pre & PMT 3 (36.69), Pre & PMT 4 (45.38), Pre & Post (55.33), PMT 1 & PMT 2 (10.88), PMT 1 & PMT 3 (22.50), PMT 1 & PMT 4 (31.19), PMT 1 & Post (41.14), PMT 2 & PMT 3 (11.62), PMT 2 & PMT 4 (20.31), PMT 2 & Post (30.26), PMT 3 & PMT 4 (8.69), PMT 3 & Post (18.64), PMT 4 & Post (9.95). These results indicate that the students have shown improvement and their scores scaled up in each test after introduction of the ‘Tech Aided Grade 2 Braille Tutoring System’.

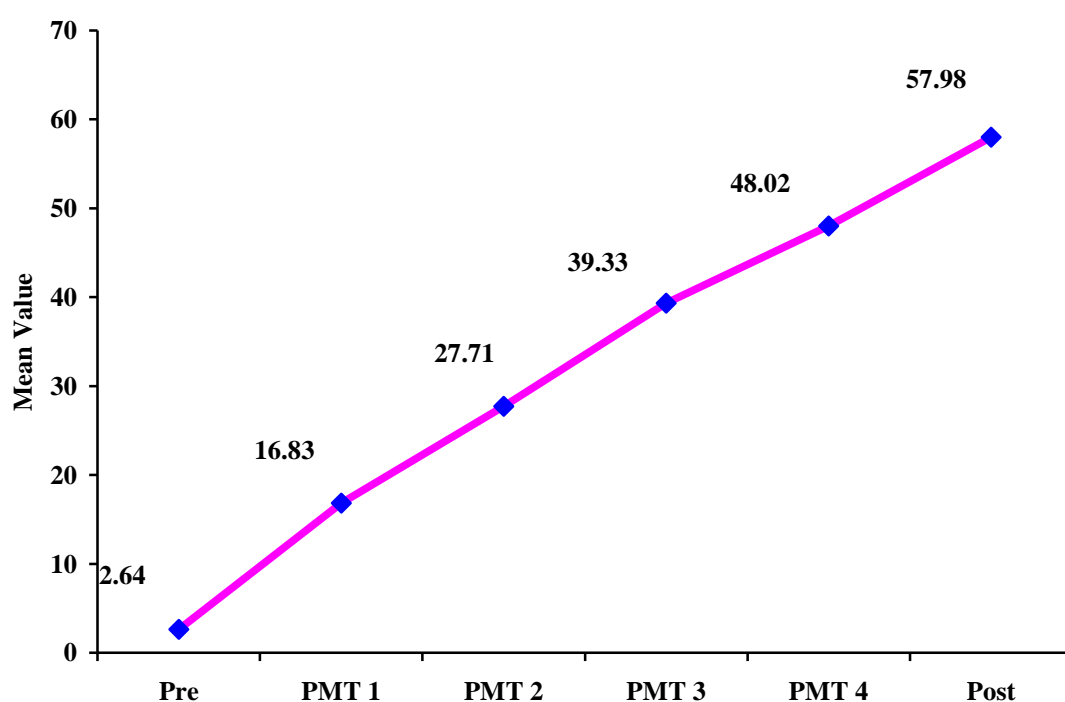


Fig 4.16: Analysis of Performances in Short forms

SECTION V

4.5 Analysis of Covariance (ANCOVA) for ‘Tech Aided Grade2 Braille Contractions

An ‘ANCOVA’ test was conducted to examine the effect of Gender, Grade and Locality on the ‘Tech Aided Grade2 Braille Contractions’ and presented in the following tables 4.27 to 4.34

Table 4.27 Summary of 2 x 2 x 2 Factorial Design ANCOVA for Alphabet Word Sign by Considering Pre score as Covariate

Source of Variance	df	SS _{y,x}	MS _{y,x}	F
Grade	1	6.181	6.181	1.98NS
Gender	1	1.696	1.696	.54NS
Locality	1	.859	.859	.28NS
Grade * Gender * Locality	1	31.487	31.487	10.08NS
Error	33	103.072	3.123	
Total	42	13378.000		

NS - Not Significant

From the above table 4.27, it is evident that the adjusted F value for the Grade is 1.98 with df= 41, which is not significant. It indicates that the mean scores of the Alphabet Word Sign of Students in Grade VIII, IX, X and XI &XII do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Grade on Alphabet Word Sign by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that students of different Grades were found to have secured the score to the same extent and Grade is found to be independent of its interaction.

Similarly, it is evident that the adjusted F value for the Gender is 0.54 with df= 41, which is not significant. It indicates that the mean scores of the Alphabet Word Sign of Boys and girls do not differ significantly when Pre-score was taken as the covariate. In this Context, the null hypothesis that *“there is no significant influence of Gender on Alphabet Word Sign by taking Pre-score as covariate”* is not rejected.

It may therefore be concluded that Gender were found to have secured the score to the same extent and Gender is independent of its interaction.

It was also found that the adjusted F value for the Locality (Urban, Rural) is 0.28 with $df= 41$, which is not significant. It indicates that the mean scores of the Alphabet Word Sign of Rural and Urban Students do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Locality on Alphabet Word Sign by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that Locality were found to have secured the score to the same extent and Locality is independent of its interaction.

The adjusted F value for interaction among Gender, Grade and locality is 10.08 which is not significant. It indicates that there was no significant influence of resultant of interaction among Gender, Grade and locality when Pre score was taken as covariate. In this context, the null hypothesis that *“there is no significant influence of interaction among Gender, Grade and locality on Alphabet Word Sign by considering the Pre score as covariate”* is not rejected. It may therefore be concluded that Alphabet Word Sign was found to be independent of the interaction among Gender, Grade and locality when Pre score was taken as covariate.

Table 4.28 Summary of 2 x 2 x 2 Factorial Design ANCOVA for Strong Words by Considering Pre score as Covariate

Source of Variance	df	SS _{y, x}	MS _{y, x}	F
Grade	1	0.486	0.169	0.684NS
Gender	1	4.765	4.765	1.65NS
Locality	1	2.327	2.327	0.81NS
Grade * Gender * Locality	1	14.057	14.057	4.88NS
Error	33	95.158	2.884	
Total	42	7754.000		

NS - Not Significant

From the above table 4.28, it is evident that the adjusted F value for the Grade is 0.68 with $df= 41$, which is not significant. It indicates that the mean scores of the Strong Words of Students in Grade VIII, IX, X and XI & XII do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there*

is no significant influence of Grade on Strong Words by taking Pre- score as covariate” is not rejected. It may therefore be concluded that students of different Grades were found to have secured the score to the same extent and Grade is found to be independent of its interaction.

Similarly, it is evident that the adjusted F value for the Gender is 1.65 with $df= 41$, which is not significant. It indicates that the mean scores of the Strong Words of Boys and Girls do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Gender on Strong Words by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that Gender were found to have secured the score to the same extent and Gender is independent of its interaction.

It was also found that the adjusted F value for the Locality (Urban, Rural) is 0.80 with $df= 41$, which is not significant. It indicates that the mean scores of the Strong Words Sign of Rural and Urban Students do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Locality on Strong Words by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that Locality were found to have secured the score to the same extent and locality is independent of its interaction.

The adjusted F value for interaction among Gender, Grade and locality is 4.88 which is not significant. It indicates that there was no significant influence of resultant of interaction among Gender, Grade and locality when Pre score was taken as covariate. In this context, the null hypothesis that *“there is no significant influence of interaction among Gender, Grade and locality on Strong Words by considering the Pre score as covariate”* is not rejected. It may therefore be concluded that Strong Words was found to be independent of the interaction among Gender, Grade and locality when Pre score was taken as covariate.

Table 4.29 Summary of 2 x 2 x 2 Factorial Design ANCOVA for Lower Signs by Considering Pre score as Covariate

Source of Variance	df	SS _{y, x}	MS _{y, x}	F
Grade	1	0.074	0.074	0.15NS
Gender	1	0.473	0.473	0.98NS
Locality	1	1.892	1.892	3.90NS
Grade * Gender * Locality	1	2.358	2.358	4.86NS
Error	33	16.002	0.485	
Total	42	2325.000		

NS - Not Significant

From the above table 4.29, it is evident that the adjusted F value for the Grade is 0.15 with df= 41, which is not significant. It indicates that the mean scores of the Lower Signs of Students in Grade VIII, IX, X and XI &XII do not differ significantly when Pre-scores was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Standard on Lower Signs by taking Pre-scores as covariate”* is not rejected. It may therefore be concluded that students of different Grades were found to have secured the score to the same extent and Grade is found to be independent of its interaction.

Similarly, it is evident that the adjusted F value for the Gender is 0.97 with df= 41, which is not significant. It indicates that the mean scores of the Lower Signs of Boys and Girls do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Gender on Lower Signs by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that Gender were found to have secured the score to the same extent and Gender is independent of its interaction.

It was also found that the adjusted F value for the Locality (Urban, Rural) is 3.90 with df= 41, which is not significant. It indicates that the mean scores of the Lower Signs of Rural and Urban Students do not differ significantly when Pre-score was taken as the covariate. In this Context, the null hypothesis that *“there is no significant influence of Locality on Lower Signs by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that Locality were found to have secured the score to the same extent and locality is independent of its interaction.

The adjusted F value for interaction among Gender, Grade and locality is 4.86 which is not significant. It indicates that there was no significant influence of resultant of interaction among Gender, Grade and locality when Pre score was taken as covariate. In this context, the null hypothesis that *“there is no significant influence of interaction among Gender, Grade and locality on Lower Signs by considering the Pre score as covariate”* is not rejected. It may therefore be concluded that Lower Signs was found to be independent of the interaction among Gender, Grade and locality when Pre score was taken as covariate

Table 4.30 Summary of 2 x 2 x 2 Factorial Design ANCOVA for Dot 5 with Initial Letter by Considering Pre score as Covariate

Source of Variance	df	SS _{y, x}	MS _{y, x}	F
Grade	1	2.728	2.728	1.38NS
Gender	1	0.056	0.056	0.03NS
Locality	1	0.720	0.720	0.37NS
Grade * Gender * Locality	1	14.002	14.002	7.096**
Error	33	65.118	1.973	
Total	42	10981.000		

NS - Not Significant

From the above table 4.30, it is evident that the adjusted F value for the Grade is 1.38 with df= 41, which is not significant. It indicates that the mean scores of the ‘Dot 5 with Initial Letter’ of Students in Grade VIII, IX, X and XI &XII do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Grade on Dot 5 with Initial Letter by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that students of different Grades were found to have secured the score to the same extent and Grade is found to be independent of its interaction.

Similarly, it is evident that the adjusted F value for the Gender is 0.02 with df= 41, which is not significant. It indicates that the mean scores of the ‘Dot 5with Initial Letter’ of Boys and Girls do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Gender on Dot 5 Initial Letter by taking Pre-score as covariate”* is not rejected.

It may therefore be concluded that Gender were found to have secured the score to the same extent and Gender is independent of its interaction.

It was also found that the adjusted F value for the Locality (Urban, Rural) is 0.36 with $df= 41$, which is not significant. It indicates that the mean scores of the ‘Dot 5 with Initial Letter’ of Rural and Urban Students do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Locality on Dot 5 Initial Letter by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that Locality were found to have secured the score to the same extent and Locality is independent of its interaction.

The adjusted F value for interaction among Gender, Grade and locality is 7.096 which is significant. It indicates that there was no significant influence of resultant of interaction among Gender, Grade and locality when Pre score was taken as covariate. In this context, the null hypothesis that *“there is no significant influence of interaction among Gender, Grade and locality on Dot 5 with Initial Letter by considering the Pre score as covariate”* is rejected. It may therefore be concluded that Dot 5 with Initial Letter was found to be independent of the interaction among Gender, Grade and locality when Pre score was taken as covariate.

Table 4.31 Summary of 2 x 2 x 2 Factorial Design ANCOVA for Dot 4 - 5 with Initial Letter by Considering Pre score as Covariate

Source of Variance	df	SS _{y, x}	MS _{y, x}	F
Grade	1	0.442	0.442	1.010NS
Gender	1	0.034	0.034	0.078NS
Locality	1	0.018	0.018	0.042NS
Grade * Gender * Locality	1	0.001	0.001	0.003NS
Error	33	14.459	0.438	
Total	42	519.000		

NS - Not Significant

From the above table 4.31, it is evident that the adjusted F value for the Grade is 1.01 with $df= 41$, which is not significant. It indicates that the mean scores of the ‘Dot 4 - 5 with Initial Letter’ of Students in Grade VIII, IX, X and XI & XII do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis

that *“there is no significant influence of Grade on Dot 4-5 with Initial Letter by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that students of different Grades were found to have secured the score to the same extent and Grade is found to be independent of its interaction.

Similarly, it is evident that the adjusted F value for the Gender is 0.07 with $df=41$, which is not significant. It indicates that the mean scores of the ‘Dot 4 - 5 Initial Letter’ of Boys and Girls do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Gender on Dot 4 - 5 Initial Letter by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that Gender were found to have secured the score to the same extent and Gender is independent of its interaction.

It was also found that the adjusted F value for the Locality (Urban, Rural) is 0.42 with $df=41$, which is not significant. It indicates that the mean scores of the ‘Dot 4 - 5 Initial Letter’ of Rural and Urban Students do not differ significantly when Pre-score was taken as the covariate. In this Context, the null hypothesis that *“there is no significant influence of Locality on Dot 4-5 Initial Letter by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that Locality were found to have secured the score to the same extent and locality is independent of its interaction.

The adjusted F value for interaction among Gender, Grade and locality is 0.003 which is not significant. It indicates that there was no significant influence of resultant of interaction among Gender, Grade and locality when Pre score was taken as covariate. In this context, the null hypothesis that *“there is no significant influence of interaction among Gender, Grade and locality on Dot 4-5 Initial Letter by considering the Pre score as covariate”* is not rejected. It may therefore be concluded that Dot 4- 5 Initial Letter was found to be independent of the interaction among Gender, Grade and locality when Pre score was taken as covariate.

Table 4.31 Summary of 2 x 2 x 2 Factorial Design ANCOVA for Dot 4- 5- 6 Initial Letter by Considering Pre score as Covariate

Source of Variance	df	SS _{y, x}	MS _{y, x}	F
Grade	1	0.163	0.163	0.83NS
Gender	1	0.494	0.494	2.52NS
Locality	1	0.126	0.126	0.64NS
Grade * Gender * Locality	1	0.033	0.033	0.17NS
Error	33	6.466	0.196	
Total	42	569.000		

NS - Not Significant

From the above table 4.32, it is evident that the adjusted F value for the Grade is 1.01 with df= 41, which is not significant. It indicates that the mean scores of the ‘Dot 4-5-6 Initial Letter’ of Students in Grade VIII, IX, X and XI &XII do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that **“there is no significant influence of Grade on Dot 4- 5- 6 Initial Letter by taking Pre-score as covariate”** is not rejected. It may therefore be concluded that students of Grade were found to have secured the score to the same extent and Grade is independent of its interaction.

Similarly, it is evident that the adjusted F value for the Gender is 2.51 with df= 41, which is not significant. It indicates that the mean scores of the ‘Dot 4- 5- 6 Initial Letter’ of Boys and Girls do not differ significantly when Pre-score was taken as the covariate. In this Context, the null hypothesis that **“there is no significant influence of Gender on Dot 4- 5- 6 Initial Letter by taking Pre-score as covariate”** is not rejected. It may therefore be concluded that Gender were found to have secured the score to the same extent and Gender is independent of its interaction.

It was also found that the adjusted F value for the Locality (Urban, Rural) is 0.64 with df= 41, which is not significant. It indicates that the mean scores of the ‘Dot 4-5-6 Initial Letter’ of Rural and Urban Students do not differ significantly when Pre-score was taken as the covariate. In this Context, the null hypothesis that **“there is no significant influence of Locality on Dot 4- 5- 6 Initial Letter by taking Pre-score as covariate”** is not rejected. It may therefore be concluded that Locality were found to have secured the score to the same extent and Locality is independent of its interaction.

The adjusted F value for interaction among Gender, Grade and locality is 0.17 which is not significant. It indicates that there was no significant influence of resultant of interaction among Gender, Grade and locality when Pre score was taken as covariate. In this context, the null hypothesis that *“there is no significant influence of interaction among Gender, Grade and locality on Dot 4-5-6 Initial Letter by considering the Pre score as covariate”* is not rejected. It may therefore be concluded that Dot 4-5- 6 Initial Letter was found to be independent of the interaction among Gender, Grade and locality when Pre score was taken as covariate.

Table 4.33 Summary of 2 x 2 x 2 Factorial Design ANCOVA for Final Letter Contraction by Considering Pre Score as Covariate

Source of Variance	df	SS _{y, x}	MS _{y, x}	F
Grade	1	0.340	0.340	0.42NS
Gender	1	0.546	0.546	0.67NS
Locality	1	1.358	1.358	1.67NS
Grade * Gender * Locality	1	0.907	0.907	1.11NS
Error	34	27.689	0.814	
Total	42	3417.000		

NS - Not Significant

From the above table 4.33, it is evident that the adjusted F value for the Grade is 0.41 with df= 41, which is not significant. It indicates that the mean scores of the ‘Final Letter Contraction’ of Students in Grade VIII, IX, X and XI &XII do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Standard on Final Letter Contraction by taking Pre-score as covariate”* is not rejected. It may therefore be concluded that students of different Grades were found to have secured the score to the same extent and Grade is found to be independent of its interaction.

Similarly, it is evident that the adjusted F value for the Gender is 0.67 with df= 41, which is not significant. It indicates that the mean scores of the ‘Final Letter Contraction’ of Boys and Girls do not differ significantly when Pre- Final Letter Contraction was taken as covariate. In this Context, the null hypothesis that *“there is no significant influence of Gender on Final Letter Contraction by taking Pre- score as covariate”* is not rejected. It may therefore be concluded that Gender

were found to have secured the score to the same extent and Gender is independent of its interaction.

It was also found that the adjusted F value for the Locality (Urban, Rural) is 1.66 with $df= 41$, which is not significant. It indicates that the mean scores of the Final Letter Contraction of Rural and Urban Students do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that ***“there is no significant influence of Locality on Final Letter Contraction by taking Pre-score as covariate”*** is not rejected. It may therefore be concluded that Locality were found to have secured the score to the same extent and Locality is independent of its interaction.

The adjusted F value for interaction among Gender, Grade and locality is 1.11 which is not significant. It indicates that there was no significant influence of resultant of interaction among Gender, Grade and locality when Pre score was taken as covariate. In this context, the null hypothesis that ***“there is no significant influence of interaction among Gender, Grade and locality on Final letter contractions by considering the Pre score as covariate”*** is not rejected. It may therefore be concluded that Final letter contractions was found to be independent of the interaction among Gender, Grade and locality when Pre score was taken as covariate.

Table 4.34 Summary of 2 x 2 x 2 Factorial Design ANCOVA for Short Form Words by Considering Pre Score as Covariate

Source of Variance	df	SS _{y, x}	MS _{y, x}	F
Grade	1	5.370	5.370	0.19NS
Gender	1	34.360	34.360	1.23NS
Locality	1	29.811	29.811	1.07NS
Grade * Gender * Locality	1	112.553	112.553	4.04NS
Error	33	919.815	27.873	
Total	42	142699.000		

NS - Not Significant

From the above table 4.34, it is evident that the adjusted F value for the Grade is 0.19 with $df= 41$, which is not significant. It indicates that the mean scores of the ‘Short Form Words’ of Students in Grade VIII, IX, X and XI & XII 8, 9, 10, 11 and 12 do not differ significantly when Pre-score was taken as covariate. In this Context, the null

hypothesis that ***“there is no significant influence of Grade on Short Form Words by taking Pre score as covariate”*** is not rejected. It may therefore be concluded that students of different Grades were found to have secured the score to the same extent and Grade is found to be independent of its interaction.

Similarly, it is evident that the adjusted F value for the Gender is 1.23 with $df=41$, which is not significant. It indicates that the mean scores of the ‘Short Form Words’ of Boys and Girls do not differ significantly when Pre-score was taken as covariate. In this Context, the null hypothesis that ***“there is no significant influence of Gender on Short Form Words by taking Pre score as covariate”*** is not rejected. It may therefore be concluded that Gender were found to have secured the score to the same extent and Gender is independent of its interaction.

It was also found that the adjusted F value for the Locality (Urban, Rural) is 1.07 with $df=41$, which is not significant. It indicates that the mean scores of the ‘Short Form Words’ of Rural and Urban Students do not differ significantly when Pre-score was taken as the covariate. In this Context, the null hypothesis that ***“there is no significant influence of Locality on Short Form Words by taking Pre score as covariate”*** is not rejected. It may therefore be concluded that Locality were found to have secured the score to the same extent and locality is independent of its interaction.

The adjusted F value for interaction among Gender, Grade and locality is 4.04 which is not significant. It indicates that there was no significant influence of resultant of interaction among Gender, Grade and locality when Pre score was taken as covariate. In this context, the null hypothesis that ***“there is no significant influence of interaction among Gender, Grade and locality on Short Form Words by considering the Pre score as covariate”*** is not rejected. It may therefore be concluded that Short Form Words was found to be independent of the interaction among Gender, Grade and locality when Pre score was taken as covariate.