CHAPTER – 4

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

The present chapter focuses mainly on the analysis and interpretation of the data that was collected for the study. Data analysis is the process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making.

4.2 Analysis of the Data

Data is a collected form of facts for extracting factual information from the set of raw data. Analysis of data in a structured and systematic procedure of categorizing, arranging, ordering, and summarizing the data to discover facts and for getting answers related to the research purpose. The basic purpose of data analysis is to reduce data into a simple and interpretable form so that inferences may be drawn from it (Kothari, 2004). Analysis and interpretation of data are helpful in knowing the relationship between the variables and drawing appropriate conclusions. Data analysis is the process of breaking the data into smaller parts to extract useful information for forecasting the outcomes. Careful analysis with the help of appropriate statistical techniques leads to better prediction and accurate assessment. Therefore, data analysis is an important step that involves a whole composite procedure for assessing data utilizing appropriate descriptive and inferential statistics.

4.3 Objective-wise Analysis, Interpretation and Discussion of Result

To facilitate and bring clarity, the entire analysis is presented and the result based on it is discussed under the following sections.

4.3.1 OBJECTIVE-1: To assess and compare the academic performance of children with and without learning disabilities in reading, writing, speaking and numeracy.

Analysis of Pre-Test Scores: Normal vs. LD Students:- To investigate the initial academic gap between students with and without learning disabilities, an independent samples t-test was conducted using the pre-test total scores of both groups. The test compared the means of normal students (Group 1) and students with learning disabilities (Group 2) to determine if there was a statistically significant difference at the beginning of the study.

Table 4.1 Pre-Test Total Scores of Students With and Without Learning Disability

Total scores of students without learning disability(pre-test)	44	44	43	44	43	42	43	43	44	44
Total scores of students with learning disability(pre-test)	12	12	12	12	12	14	14	14	14	14

Table 4.2 T-Test Analysis of Pre-Test Scores of both the Groups

	Normal Students	**LD Students**
Mean	43.33333	13.11111
Variance	0.5	1.111111
Observations	10	10
Hypothesized Mean Difference	0	
df	14	
t Stat	71.4307	
P(T<=t) one-tail	1.2E-19	
t Critical one-tail	1.76131	
P(T<=t) two-tail	2.41E-19	
t Critical two-tail	2.144787	

Interpretation

- The mean pre-test score of normal students (M = 43.33) was substantially higher than that of students with learning disabilities (M = 13.11).
- The t-statistic value of 71.43 far exceeds the critical value of 2.14, indicating a highly significant difference between the two groups.
- The p-value (two-tailed) = 2.41×10^{-19} is far below 0.05, confirming that the difference in means is statistically significant.

These results clearly show that before the AI-based intervention, there was a significant academic performance gap between students with learning disabilities and their typically developing peers.

Table 4.3 Mean Score of both the Groups

group	Mean score
Normal students	43.33
LD students	13.11

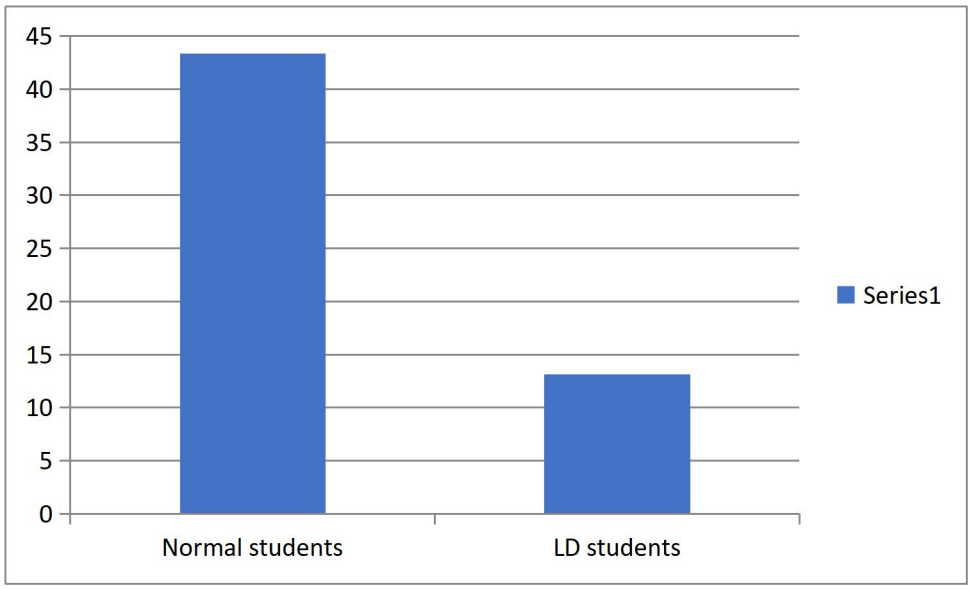

Figure 4.1: Mean Comparison of Pre-Test Scores of Normal Students and LD Students

Findings;-

The statistical analysis confirms the presence of a substantial and statistically significant academic performance gap between students with and without learning disabilities at the pre-test level. This validates the need for targeted interventions, such as AI-integrated teaching, to help bridge this gap and promote educational equity.

4.3.2 OBJECTIVE-2: To evaluate the effectiveness of AI tools in improving the post-test academic performance of students with learning disabilities compared to their pre-test academic performance

Analysis of LD Students (Pre-Test) vs. LD Students (Post-Test);-

To assess the improvement in academic performance among students with learning disabilities (LD) following the AI-based intervention, an independent samples t-test was conducted between their pre-test and post-test scores**.**

Table 4.4 Pre-Test and post-test total scores of students with learning disability

Total scores of students with learning disability(pre-test)	12	12	12	12	12	14	14	14	14	14
Total scores of students with learning disability(post-test)	28	28	28	28	28	30	30	30	30	30

Table 4.5 t-test analysis of pre-test and post-test scores of LD students

	Pre-test (LD)	*Post-test(LD)*
Mean	13.11111	29.11111
Variance	1.111111	1.111111
Observations	10	10
Pooled Variance	1.111111	
Hypothesized Mean Difference	0	
df	16	
t Stat	-32.1994	
P(T<=t) one-tail	2.81E-16	
t Critical one-tail	1.745884	
P(T<=t) two-tail	5.63E-16	
t Critical two-tail	2.119905	

Interpretation

- The post-test mean score of LD students increased significantly to 29.11, compared to a pre-test mean of 13.11. This 16-point gain reflects a marked improvement in academic performance after the implementation of the AI-based teaching strategy.
- The calculated t-statistic is -32.20, which far exceeds the critical t-value of ±2.12, indicating a highly significant difference.
- Additionally, the two-tailed p-value is 5.63×10^{-16}, well below the conventional alpha level of 0.05, confirming that this improvement is statistically significant and unlikely due to chance.

Table 4.6 Means Score of the LD Students

	Mean score
Pre-test	13.11
Post- test	29.1

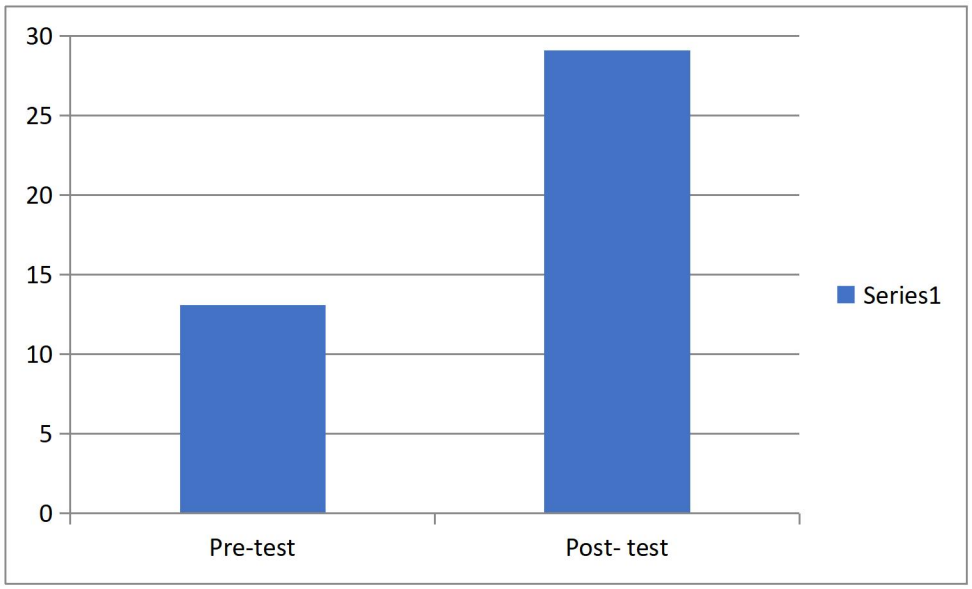

Figure 4.2: Mean Comparison of Pre-Test and Post-Test Scores of LD Students

Findings:-

The results show a statistically and educationally significant improvement in the academic performance of students with learning disabilities after the AI-based intervention. The mean score nearly doubled, rising from 13.11 to 29.11. This finding strongly suggests that the AI-supported learning strategy was effective in enhancing academic outcomes for LD students and holds promise as a supportive tool in inclusive education settings.

4.3.3 OBJECTIVE-3: To determine whether AI-based instruction reduces the learning gap between students with learning disabilities and their typically developing peers.

Analysis of Normal Students (Pre-Test) vs. LD Students (Post-Test):-

To evaluate the effectiveness of the AI-based intervention in reducing the academic performance gap, an independent samples t-test was conducted between the pre-test scores of normal students and the post-test scores of students with learning disabilities.

Table 4.7 Pre-Test total Scores of Students Without Learning Disability and Post-Test Score of Students With Learning Disability

Total scores of students without learning disability(pre-test)	44	44	43	44	43	42	43	43	44	44
Total scores of students with learning disability(post-test)	28	28	28	28	28	30	30	30	30	30

Table 4.8 T-Test Analysis of Pre-Test Scores of Normal Students and Post-Test Scores of Students With Learning Disability

	44	*28*
Mean	43.33333	29.11111
Variance	0.5	1.111111
Observations	10	10
Hypothesized Mean Difference	0	
df	14	
t Stat	33.61445	
P(T<=t) one-tail	4.33E-15	
t Critical one-tail	1.76131	
P(T<=t) two-tail	8.66E-15	
t Critical two-tail	2.144787	

Interpretation

- The mean score of LD students after AI intervention increased to 29.11, up from 13.11 in the earlier pre-test.
- The performance gap between LD and normal students narrowed from a 30-point difference to a 14-point difference**.**
- However, the t-statistic (33.61) is still much larger than the critical value (2.14)**.**
- The p-value = 8.66×10^{-15} is far below 0.05, indicating the difference between the groups is still statistically significant**.**

Table 4.9 Mean Score of Normal Students (Pre-Test) Vs. LD Students (Post-Test)

group	Mean score
Normal students	43.33
LD students	29.11

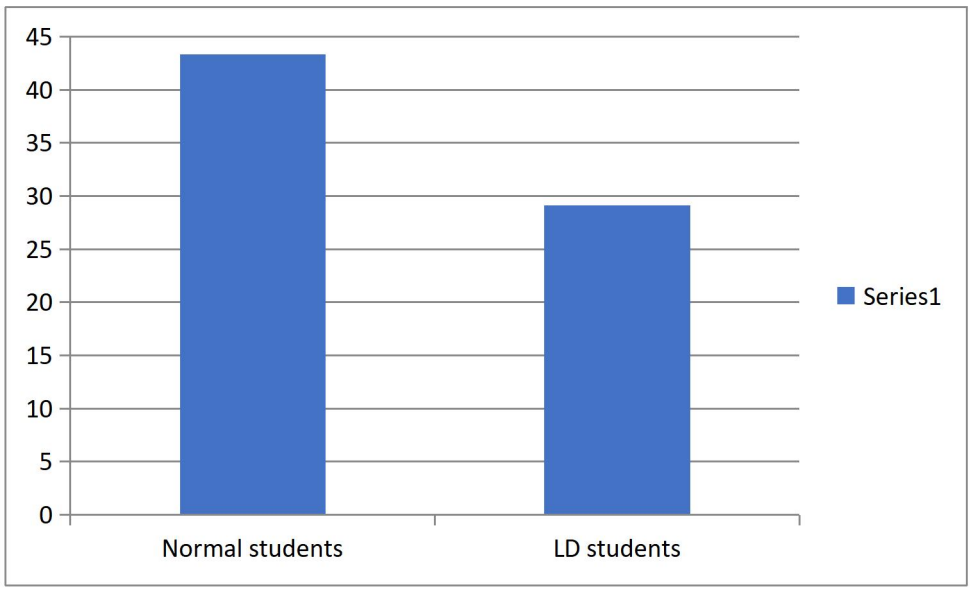

Figure 4.3: Mean Comparison of Pre-Test Scores of normal students and post-test scores of LD students

Findings:-

Although the difference between the two groups remains statistically significant, the results indicate a substantial improvement in the academic performance of students with learning disabilities following the AI intervention. The mean post-test score of LD students rose from 13.11 to 29.11, suggesting that the AI-based teaching strategy was effective in partially closing the learning gap. These findings support the potential of AI as a beneficial tool in inclusive education.

4.3.2 OBJECTIVE- 4: To examine the effect of AI-based instructional tools on the behavioral, cognitive, and emotional engagement of children with learning disabilities in comparison to traditional teaching methods.

A) Behavioral Engagement

QUESTION NO. 1: The student shows consistent interest in interacting with AI tools.

Table 4.10 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
50%	40%	10%	0%	0%

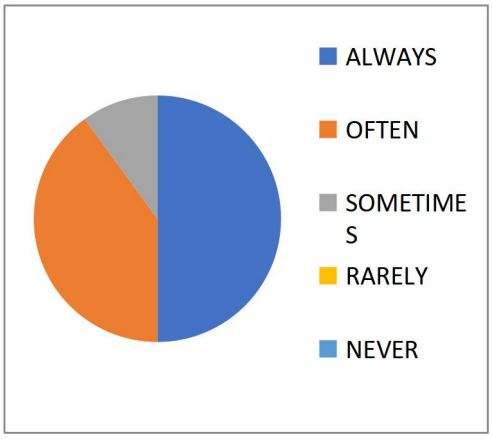

Figure 4

QUESTION NO. 2 : The student actively participates in AI-based learning activities.

Table 4.11observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
40%	30%	30%	0%	0%

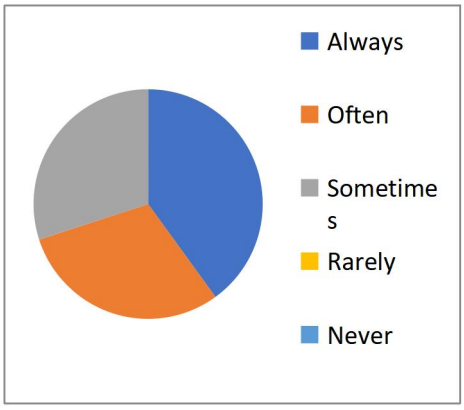

Figure 5

QUESTION NO. 3: The student seeks help or clarification when facing difficulties with AI tools.

Table 4.12 observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
40%	40%	20%	0%	0%

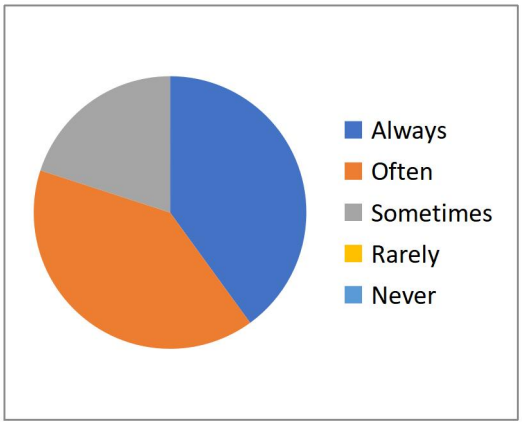

Figure 6

QUESTION NO. 4: The student maintains focus and concentration during AI-assisted sessions.

Table 4.13 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
20%	70%	10%	0%	0%

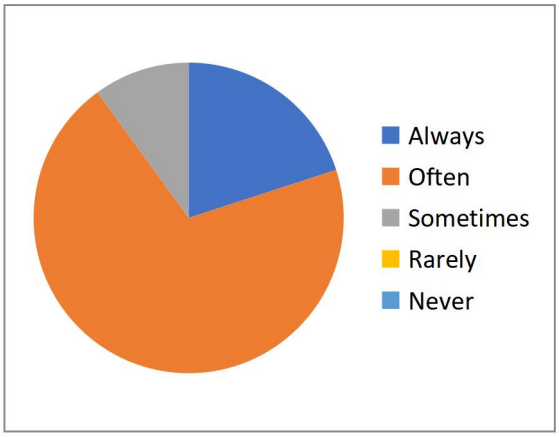

Figure 7

B) Cognitive Engagement

QUESTION NO. 5: The student demonstrates understanding of concepts introduced through AI tools.

Table 4.14 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
20%	80%	0%	0%	0%

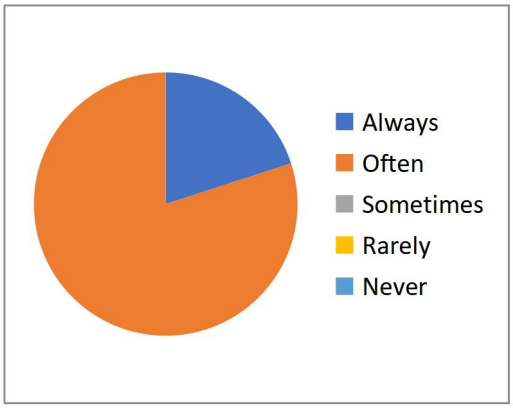

Figure 8

QUESTION NO. 6: The student applies learned skills and knowledge to other tasks effectively.

Table 4.15 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
0%	0%	50%	50%	0%

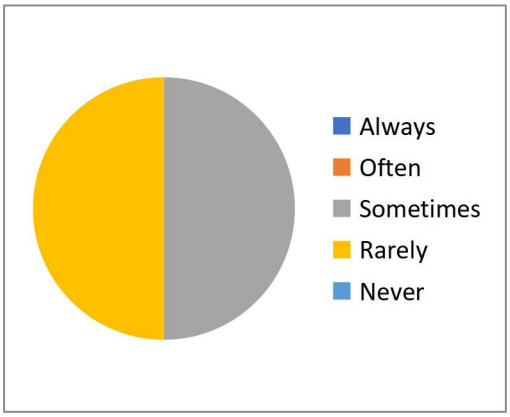

Figure 9

QUESTION NO. 7: The student accurately responds to AI-generated questions and exercises.

Table 4.16 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
10%	40%	30%	20%	0%

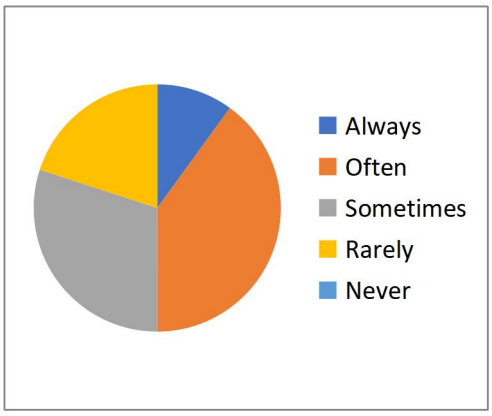

Figure 10

QUESTION NO. 8: The student completes tasks independently with minimal guidance.

Table 4.17 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
0%	50%	50%	0%	0%

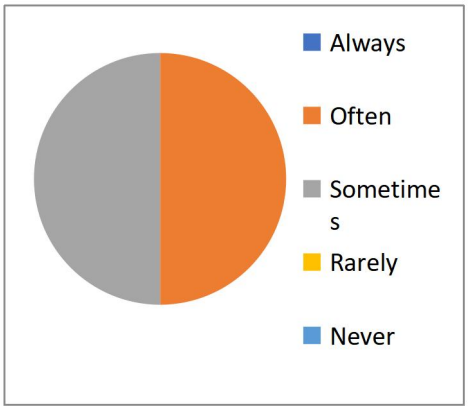

Figure 11

C) Emotional Engagement

QUESTION NO. 9: The student shows enthusiasm and enjoyment while using AI tools.

Table 4.18 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
50%	50%	0%	0%	0%

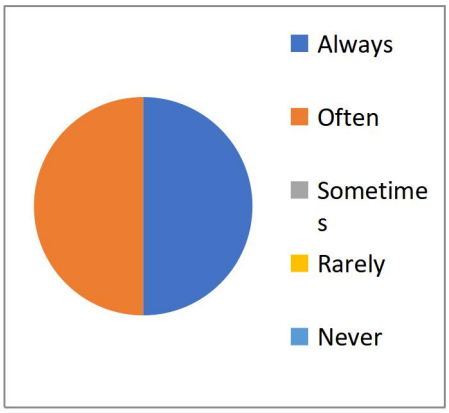

Figure 12

QUESTION NO. 10: The student expresses satisfaction or pride upon successfully completing activities.

Table 4.19 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
10%	70%	20%	0%	0%

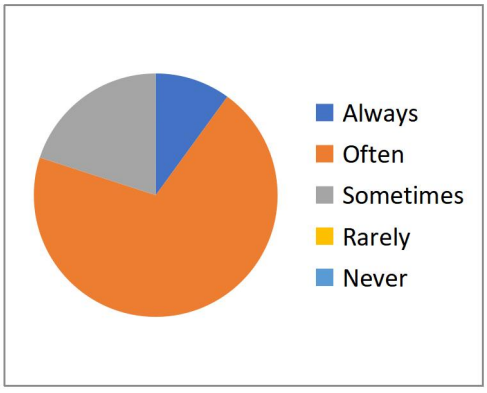

Figure 13

QUESTION NO. 11: The student displays reduced frustration and anxiety during AI-assisted learning.

Table 4.20 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
0%	50%	50%	0%	0%

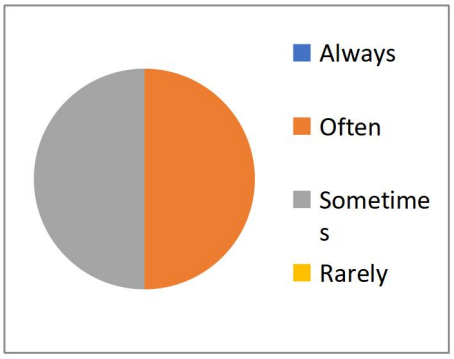

Figure 14

QUESTION NO.12: The student maintains a positive attitude towards AI-based learning activities.

Table 4.21 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
100%	0%	0%	0%	0%

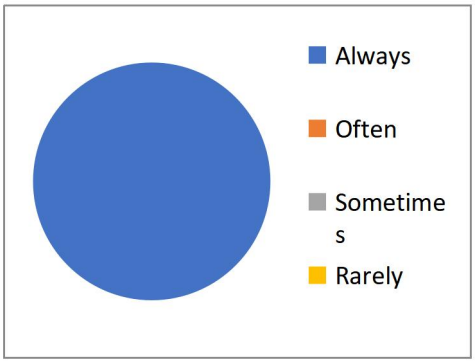

Figure 15

D) Overall Improvement

QUESTION NO. 13: The student shows noticeable improvement in overall language skills across all languages and in numeracy.

Table 4.22 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
0%	100%	0%	0%	0%

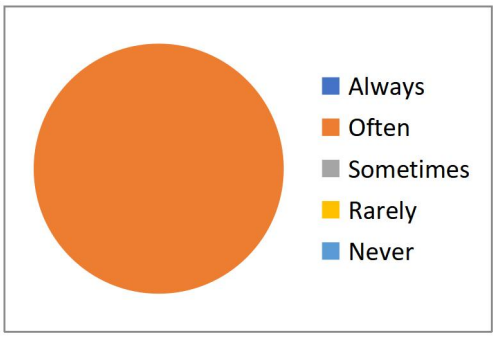

Figure 16

QUESTION NO. 14: The student demonstrates a consistent improvement in engagement and participation.

Table 4.23 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
20%	50%	30%	0%	0%

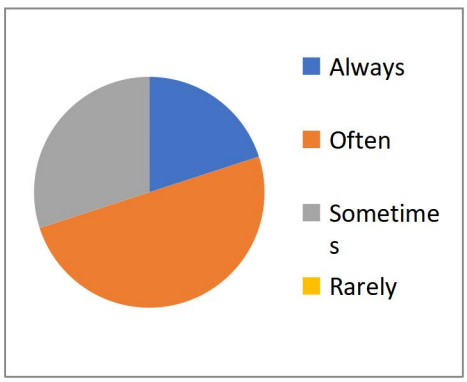

Figure 17

QUESTION NO. 15: The student's achievement level has increased as a result of AI-integrated teaching.

Table 4.24 Observations

Marks in percentage				
Always	Often	Sometimes	Rarely	Never
100%	0%	0%	0%	0%

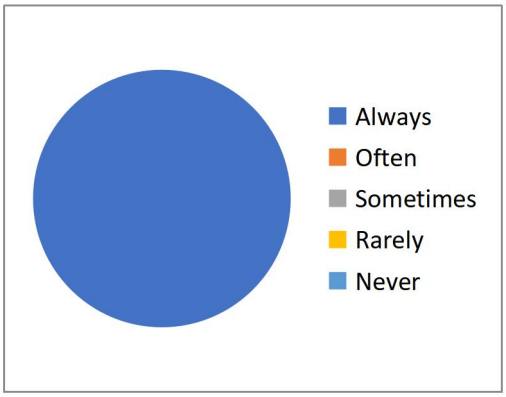

Figure 18

Findings:-

The analysis of the observation checklist revealed positive outcomes across behavioral, cognitive, emotional, and overall improvement domains among students with learning disabilities following AI-integrated instruction. In the **behavioral engagement** domain, students showed consistent interest and active participation, with most scoring "always" or "often" in maintaining focus and seeking help when needed. This reflects high attentiveness and involvement during AI sessions.

Cognitive engagement showed mixed responses. While most students understood the concepts presented by the AI tools, fewer were able to independently apply this knowledge or respond accurately to AI-generated tasks. This suggests that while comprehension was achieved, the ability to transfer learning still requires reinforcement.

In contrast, **emotional engagement** was remarkably strong. All students expressed enthusiasm, enjoyment, and satisfaction during learning, and none showed signs of

anxiety or frustration. A positive attitude was consistently observed, highlighting the emotionally supportive nature of AI-based learning.

In terms of **overall improvement**, all students demonstrated visible academic growth, with increased engagement and performance in literacy and numeracy. The AI tools evidently played a significant role in bridging learning gaps, not only academically but also by enhancing student motivation, confidence, and participation.