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Pre–Post Evaluation of an AI-Driven Learning Intervention for Children with Dyslexia

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Abstract

The study aims to carry out a pre and post evaluation of an AI driven learning intervention for children with dyslexia. “Dyslexia is among one of the three learning disabilities or in other words a language processing disorder, in which people have difficulty in learning to read and write, although it is not associated with a low level of intelligence” (*Madeira J et.al, 2015*). Dyslexia is disorder with a neurological basis that causes lack of ability in reading and writing despite normal (or above) intelligence and sensory abilities. The current paper is sub-part of the main study and focuses on children with dyslexia studying in class IV- VIII in government schools in Delhi. Children diagnosed as dyslexic by psychological assessment by special educator at Government schools of North-West Delhi were selected for the study. The children with dyslexia were screened using Dyslexia Screening Test (2014) by Harp Learning Institute on individual basis. The study covers 30 children with dyslexia. Based on the result of the screening / pre-test, an AI based intervention was carried out for 3 months. The study reflects on the pre and post analysis to understand the effectiveness of the AI based reading intervention for children with dyslexia.

Keywords: *Children with Dyslexia, Technology, Artificial Intelligence and Sensory Abilities.*

1. INTRODUCTION

Dyslexia is one of the types of specific learning disorder with a neurological origin that causes lack of proficiency in reading and writing despite normal (or above) intelligence and sensory abilities. “Dyslexia among children is a specific and significant impairment in reading abilities who otherwise possess adequate intelligence and motivation” (Suvarna R et.al, 2013). It can also be called as a language processing disorder, in which people have difficulty in learning to read and write, although it is not associated with a low level of intelligence” (Madeira J et.al, 2015). Dyslexia is disorder with a neurological origin that causes lack of proficiency in reading and writing despite normal (or above) intelligence and sensory abilities.

It is the most common learning disability, and nearly 70%-80% of students diagnosed with Learning Disability have deficits in reading. It has a worldwide incidence of 5-20%. Dyslexia is found among 15% of the Indian population i.e. nearly 228,994,454 students in recognized schools. (PIB, 2015)

“Diagnosing dyslexia at an early stage is important to mitigate the child having to go through a stressful childhood. Early detection helps to direct the child with dyslexia to targeted assistance, which has shown promising results” (Heim, 2004). “Although dyslexia has been known for the last ten decades and is spread among a significant population, unfortunately it often goes undiagnosed” (Oglethorpe, 2002).

According to a ruling of the Delhi High Court (September 2012) all government, private and public schools are mandated to equip themselves to handle children with various

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disabilities including learning disability. As a positive measure, it was observed that Specific Learning Disability (SLD) has been recently included in the Person with Disabilities Act and Diagnostic and Statistical Manual of Mental Disorders (DSM V).

"Being a learning disability, dyslexia is a lifelong condition. It is not a disease and it has no cure so far, but it is possible to minimize its effects through age-appropriate dyslexic re-education programs" *(Suvarna R et.al, 2013).*

Use of technology for children with SLD

According to a study conducted in 2012, it was found that 'computer-based games and musical training can really benefit children with developmental learning disorders as they can engage action to sound. Such training also assists the child in visual perception, auditory ability, language, reasoning, time and space orientation, and motor coordination'. (*Hornickel J et.al, 2012).*

In the above context, it can be concluded that computer-based games are considered to be a useful tool to enhance the knowledge of young people and consequently improve their self-esteem, if used with pre-defined objectives (Suvarna R et.al, 2013). Similar findings were concluded by Ball & McCormack (2013) in which they emphasized that developments in computers and assistive technology provide significant essential help to students with dyslexia.

Prevalence of AI based interventions in the area of education

Artificial intelligence can be defined as the study of intelligence agents which have the ability to understand / examine the environment and act accordingly (*Russell, 2003*). Lot of researches has been carried out and provides evidence of use of AI tools in the area of education (*Lanzilotti, 2007*). AI is also defined as the simulation of human intelligence on a machine, so as to make the machine efficient to identify and use the right piece of knowledge at a given step of solving problem. Moving further, AI has the ability to think and act rationally. In other words, it can plan and take action at the right time and in the right direction.

In a study carried out in the year 2020, it was emphasized that AI has the potential to make the studying experience for each student more personalized. It is also very helpful for the teachers as it helps to reach many students through the content they create. The study emphasized on an AI-powered tool called Immersive Learning that helps pupils gain confidence in reading for students with dyslexia. Another similar study reflects that the software makes it possible for the teacher to design their learners' content which is vital because then the teacher can guide the learning direction of the students. Teachers can use AI to design and prepare lessons, prepare tests, and monitor the progress, concentration, interests, and performance of their students (*Kabahizi, 2020*).

Reflecting on the achievements of artificial intelligence in the education sector, the current study aims to explore the benefits of artificial intelligence for dyslexic children (type of learning disorder) in the age group of 8-12 years. By leveraging technologies such as natural language processing, speech recognition, and machine learning, the proposed tool seeks to provide interactive, tailored support to improve literacy skills and learning outcomes.

About the AI based Intervention used by the Study

The intervention tool aimed at supporting children with dyslexia in the area of language use, vocabulary, phonetics and so on. The prepared tool was reviewed by a set of experts from different fields such as psychology, special education and revision were be made accordingly.

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Based on the review of studies the following simple recommendations were considered to make intervention as dyslexia friendly such as focus on font style, formatting, writing style and layout for making it suitable for children with dyslexia. The font size was kept big and clear to maximize the readability for the child along with at least 1.5-line spacing.

The sentences and paragraphs are kept short and simple while explaining concepts to children. The use of pictures, tables and graphics were made to make the text interesting and presentable for children.

The tool includes concept explanation and activities related to words' structure to know child's understanding regarding beginning of words; rhyming words, letter sequencing in words and structure of syllable in words. Each of the exercises consists of a question and a number of answers (words), out of which one is considered to be a correct response. From here, the game will progress from simple to complex depending on the performance of the child. The exposure to failure was kept minimal taking into consideration the possibility of low self-esteem among children with dyslexia. So, all children will always have the opportunity to move into the next level.

The proposed tool includes set of 10 activities for the child. The 10 activities per day will include exercises to be taken up by the child with regard to story reading, rhyme recitation, grammar exercise, act for physical domain and one fun activity like maze, drawing, joining dots and so on.

Characteristics of the proposed tool are as follows:

- It is self-explanatory with very minimal parent / teacher engagement.
- It includes audio sound for asking questions from children. An option to select the audio sound is provided to the child along with default option.
- The children are given an option to get the question repeated, if it was not clear in the first attempt.
- The audio sound is in Indian context and will be slow in speed to make it comfortable for the child to understand.
- Two characters will be introduced to make the reading experience interesting for children
- For every positive response, the child is reinforced with clap sound to enhance child's level of confidence
- After every question, correct responses for the errors made is indicated for child's improvement.
- After every 5 questions, feedback is provided to the child based on his/her performance. A list of new words learned in a day's session is provided for the child to make efforts to read again. If there are errors, support is provided.
- An opportunity to engage in physical activity is provided once in every session to break the boredom and fatigue faced by the child.
- One fun activity like maze, drawing, joining dots and so on is also added to strengthen child's interest in the given set of activities.

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- A writing pad is provided to attempt questions which involves the child to form letters or draw or join the dots.

2. REVIEW OF LITERATURE

According to Rello et.al. (2019), "People with dyslexia have, despite their general intelligence, difficulties for reading and writing through their whole life. Therefore, web technologies can help people with dyslexia to improve their reading and writing experience on the web. The study introduces the main technologies and many examples of tools that support a person with dyslexia in processing information on the web, either in assistive applications for reading and writing as well as using web applications/games for dyslexia screening and intervention".

Alobaedy et.al. (2018) studied "assistive applications designed for children with dyslexia and found two categories of virtual assistants used in the analyzed assistive applications, which are girl-like and animal-like objects. The girl-like object is used by 83.3% of the analyzed works. Further the study proceeded with the on-site experiment to collect dyslexic children's preferences. The result showed that boy-like objects are much more preferable, depending on their gender, which contradicts with previous works that present girl-like objects as avatar most of the time".

Perera et.al (2016) revealed that "modern computational technologies play a significant role in enhancing the conventional dyslexia detection techniques as well as in discovering novel approaches for dyslexia detection. The study covers the modern technologies that are being used and examines the existing gaps in the dyslexia detection procedures in order to benefit future research".

Hamid et.al (2015) presented a study of "computer-based learning model to support students with dyslexia interesting, user-friendly, attractive and supportive. The work is crucial to provide a basis for developing a computer-based learning model that addresses dyslexia language-based learning difficulties that considers both students cognitive and emotion. In addition, the study also explores the uses of machine learning (ML) approach to improve effectiveness of the learning process".

Jenny et.al (2012) offered a "new concept called in education called Artificial Education. Though the term artificial education might disturb many educators, parents and students, it is important to understand what it is and the potential it has for the educational success of all learners. This is a short introductory article on what artificial education refers to, and how intelligent or expert systems can assist students and teachers at the elementary level".

3. METHODOLOGY

The study was carried out in North-West part of Delhi. As the sample of the study, 30 school going children with disability in the age group of 9-12 years were selected for the study. Already diagnosed children with dyslexia by psychological assessment by a special educator were selected.

The study was carried out using three parameters to measure the reading skills among children:

- "Reading Speed is measured as the number of error-free words divided by reading time, where error-free words are the number of read words minus errors made in reading them;

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reading duration is measured as overall time taken for reading, which is the time lapse between the first-word utterance attempt and the completion of the last-word utterance.

- Reading Errors Number of erroneous word-utterances during reading (not mispronunciations but incorrect word choices)
- Reading Comprehension aggregate score in word recollection and word remembrance tests" (*Suvarna R et.al, 2013*).

The screening of 30 children with dyslexia was carried out using Dyslexia Screening Test (2014) by Harp Learning Institute. The screening tool includes areas such as alphabet recognition, differentiation between letter 'b' and 'd', letter reversal, matching figures, matching words, copying figures, word recognition, memorization, reversed words, rhyming words, understanding instructions, word and sentence repetition and reading. After screening / pre-test, 15 children out of sample of 30 children were randomly selected for the intervention. The selected 15 children with dyslexia were provided with AI based intervention for a period of over 3 months. At the completion of the intervention, the post test was carried out with those children.

For the purpose of pilot testing, the tool was be given to 6 children to get feedback on the prepared tool. The prepared tool was be revised based on the review from experts and pilot testing results. After necessary revisions, the final intervention tool was introduced to 15 sample children in repeated intervals. On the basis of the analysis, a comparison was drawn between the experimental and control sample results.

4. DATA ANALYSIS

The students were assessed using 'Dyslexia screening test' and the scores for each item were assessed by counting the number of correct responses given by the child. It was done based on the answer key given as part of the tool. At the end of the tool, a cumulative score is calculated based on the items missed by the child or in other words by counting the number of correct responses given by the child. As per the answer key, it is acceptable for the child to make 5-7 mistakes between 2nd to 8th grade in the entire tool. If any child makes more mistakes than the given norms, the child can be considered as Dyslexic.

For the purpose of analysis for the current paper, 18 items covered under the dyslexia screening test are sub-divided into 4 major sub-heads. The sections are as follows:

1) Phonological awareness and reversal: This section covers child's awareness regarding alphabets, understanding letter reversal, identification of required words, decoding the words and rhyming words.
2) Matching games: This section covers identification of matching figures and matching words.
3) Copying figures / memorization: This section covers copying the figures, memorizations of letters and observing & drawing figures.
4) Reading ability: This section covers reading 3 letter words, repeating the given words in a sequence and repeating sentences.

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5. RESULT

The result section has been divided into various sections covering the demographic profile of the children selected for the study along with children's competencies in terms of phonological awareness, performance while conducting cognitive activities such as matching exercises, reversal games, memorization activities and so on. The result section compares pre and post-performance of children with dyslexia.

5.1 Demographic profile of children

The data covers the background information regarding children covered under the study. It includes the age and sex of children studying in government schools of Delhi.

Table 1: Age and Sex of children with Dyslexia

Age group and Sex of the child		
	Female	**Male**
9-year-olds		4
10-year-old	5	2
11-year-old	3	4
12-year-old	10	2
Grand Total	18	12

The sample children fall in the age bracket of 9 to 12 years i.e. class IVth to class VIIIth. The above data reveals that majority of the sampled children were females i.e. 60% (18 girls). Whereas the remaining 40% of sampled children were boys. In addition, it can also be reported that the majority of the girls (33.33%) fall in the age bracket of 12-year-old. Whereas, in case of boy's majority are of 9 and 11-year-old respectively.

5.2 Phonological Awareness

Phonological awareness refers to phonetics/ sound of each letter which helps the child to form words and later form sentences. It is one of the school readiness skills which prepares the child for reading readiness and generally emphasized in the age group of 5 and above. With regard to children with dyslexia this skill can be delayed as they find it challenging to identify and memorize letters and its phonetics.

5.2.1 Alphabet recognition

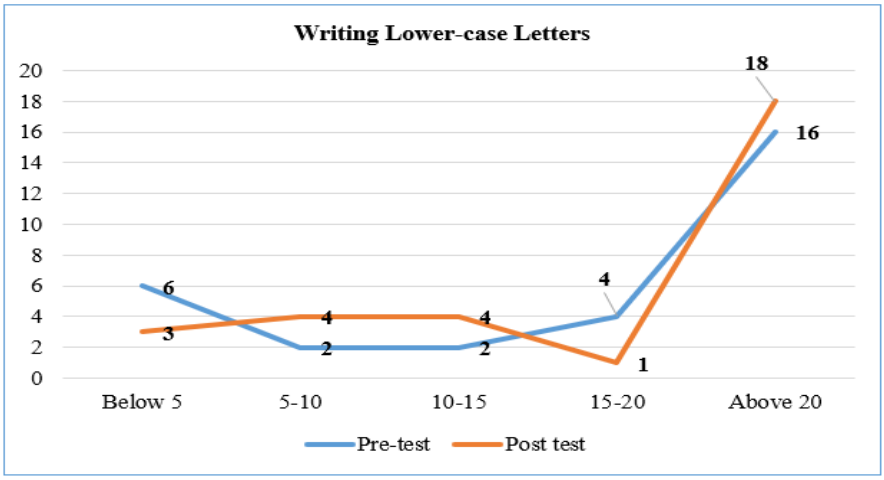

Figure 1: Awareness regarding lower case letters

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With regard to writing of lower-case letters, it was found that with support from intervention 60% of children with dyslexia were able to write lower case letters as compared to 53.3% as reported by the pre-test. In addition, children in the below 5 categories reduced from 20% to 10%, showing a clear decline in very low performance. There is a slight increase in the 5–15 range, suggesting that some children moved up from the lowest category but have not yet reached mastery. Overall, the post-test reflects positive impact especially at the above 20 level.

5.2.2 Identification of lower case 'b'

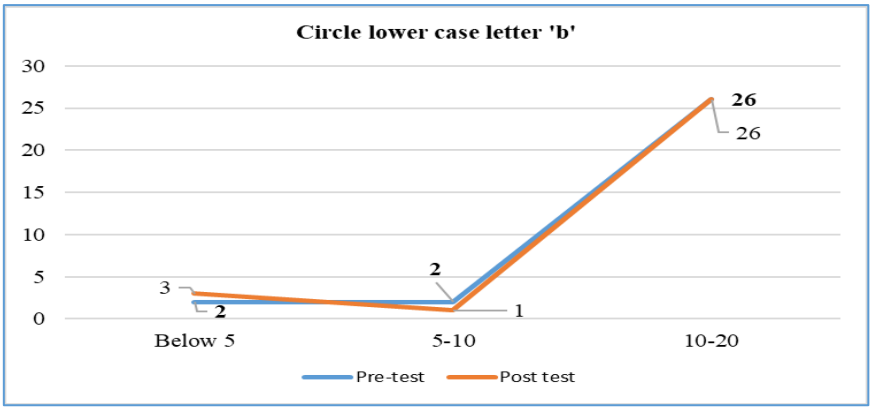

Figure 2: Recognition regarding lower case letter 'b'

With regard to circling of lower-case letter 'b' from a text box of letters such as letter b, d, p and q, no significant change was observed between the pre and post-test result. It was found that, above 80% of children were able to give correct responses in the range of 10–20 in both pre and post-tests analysis.

5.3 Letter and word reversals

Understanding reversals among words and letters is one of the crucial skills which children with dyslexia finds challenging and need to master with practise. In this section, children were given various opportunities to practice these skills such as identifying letter reversals and words with reversed letters. The questions moved from simple to complex tasks for children.

5.3.1 Letter Reversals

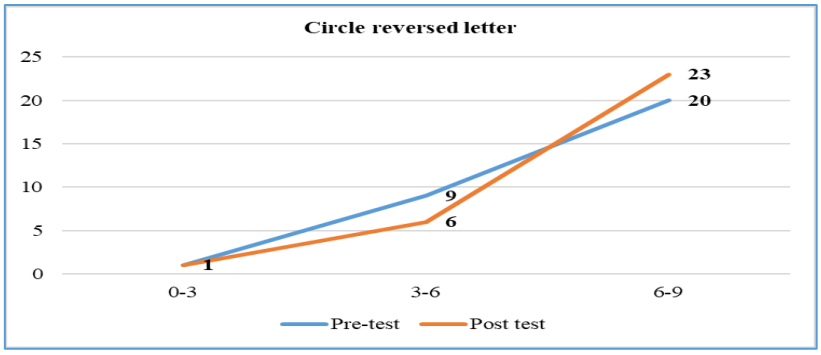

Figure 3: Identification of Reversed Letters

With regard to circling the reversed letters, it was found that after the intervention the children with dyslexia showed improvement where 76.7% (23) children were able to mark

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correctly as compared to 66.7% in the pre-test. In addition, the middle range (3–6) decreased from 30% to 20%, indicating upward movement in performance. Hence, there is clear improvement in identifying reversed letters after intervention.

5.3.2 Identifying reversed letters within words

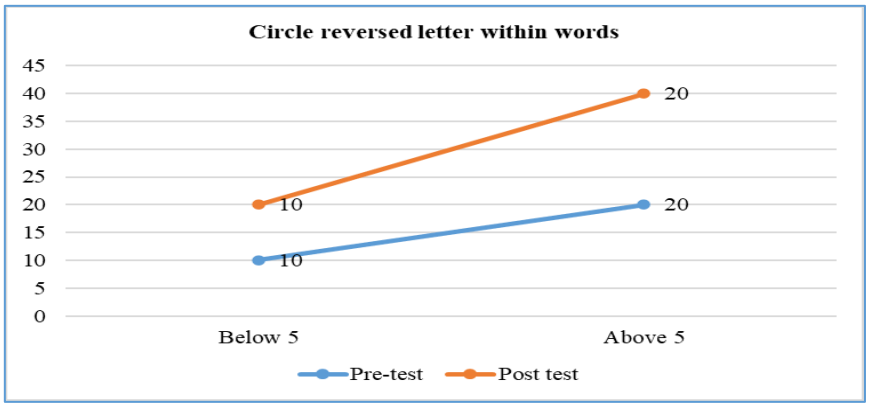

Figure 4: Identification of Reversed Letters within words

With regard to circling reversed letters within words, it was observed that there is no change in the pre and post-test performance of children with Dyslexia. It can be concluded that task appears to be simple than identifying isolated letters, requiring greater visual attention and word-level processing.

5.3.3 Identifying reversed words

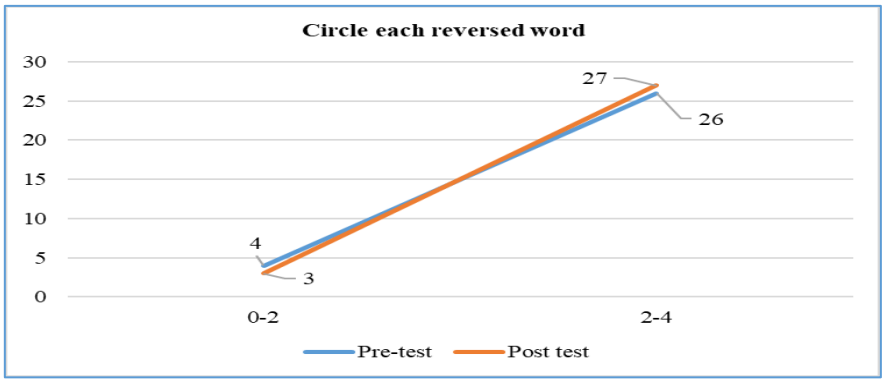

Figure 5: Identification of Reversed words

With regard to circling the entire word with reversed letters, it was found that there is slight improvement in pre and post test results. The proportion of children in the higher score range (2–4) increased slightly from 86.7% to 90%. Children with 0-2 correct responses decreased from 13.3% to 10%, indicating marginal improvement. This reveals better recognition of reversed words at the whole-word level in the post-test. It can be concluded that explicit instruction and practice helped children with dyslexia to improve simpler reversal tasks, while more complex visual–linguistic tasks require continued intervention.

5.4 Matching Exercises

In this section, children with dyslexia were asked to do perform on various matching exercises again moving from simple to complex activities, which includes matching figures, matching words and so on.

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5.4.1 Matching figures

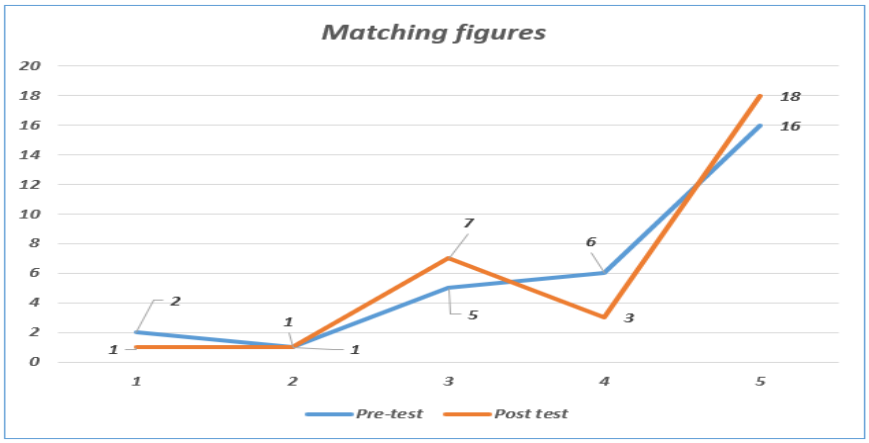

Figure 6: Matching the given figures

When children were asked to match figures, it was positively found that after the intervention 60% of children were able to do the given task correctly as compared to 53.33% (16) in the pre-test reflecting better accuracy. Overall, the post-test results demonstrate enhanced visual discrimination and matching ability.

5.4.2 Matching words

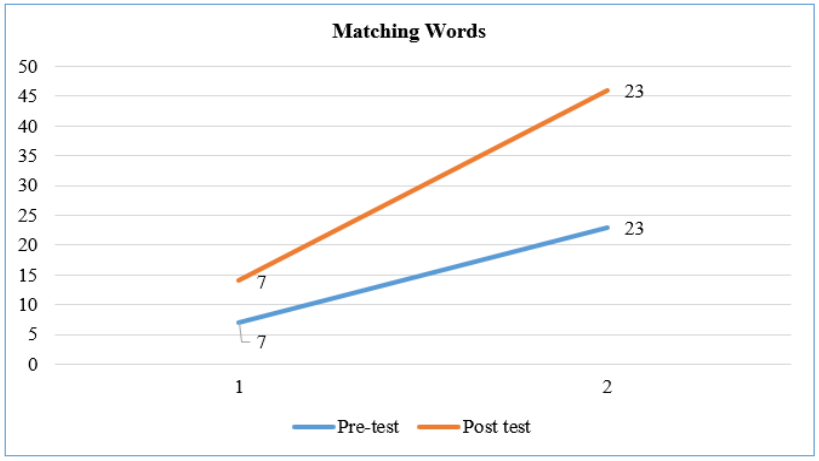

Figure 7: Matching words

In matching words, there is no change in pre-test and post-test results. In this, children were asked to match the word given on the left from the set of three words given on the right. Positively, during the pre-test many children were not able to read the given words but in the post test, children were able to read and do the matching effectively. This reflects that children are able to do visual discrimination along with phonological awareness to read three letter words and do matching.

5.4.3 Matching left and right figures

With regard to matching figures given on the left to the right ones, it was found children with dyslexia has shown significant improvement with regard to pre and post test results. It was observed that 80 % (24) children were able to do the task effectively as compared to 60% (18) children during the pre-test.

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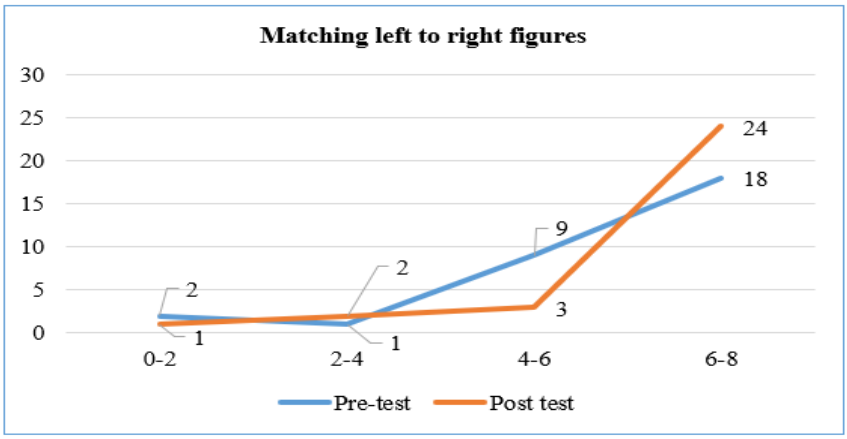

Figure 8: Matching left and right figures

The results highlight significant impact of the intervention on child's ability to do visual sequencing and directional orientation skills. The comparative analysis of pre-test and post-test scores reveals notable improvement in figure matching and left-to-right matching skills, suggesting that the intervention was effective in enhancing visual perception and directional matching abilities. However, matching words showed no change but there was improvement in child's reading ability to do matching activity effectively.

5.5 Memorization Exercises

In this section, children were asked to do various memorization activities which includes joining dots in a particular sequence, remembering letters and writing it once it is hidden and re-creating the figures shown earlier.

5.5.1 Copying figures by Joining dots

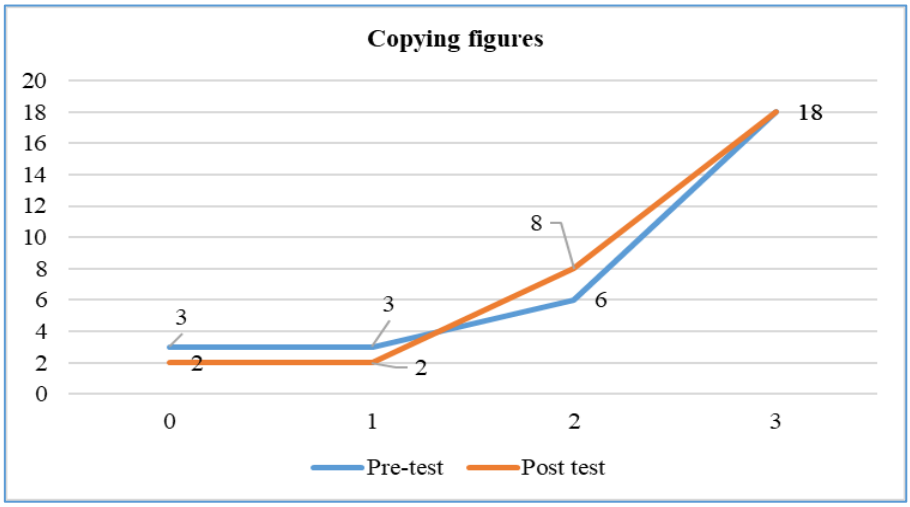

Figure 9: Copying figures

In this question, the child is required to copy the figures from the bottom to the dots on top. With regard to copying figures, there is a slight improvement as after the intervention 26.7% of children were able to give correct responses as compared to 20% children in the pre-test. In the pre-test, few children were not able to understand the instruction and perform the given task but in post-test the performance was considered to be slightly better.

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5.5.2 Letter Memorization

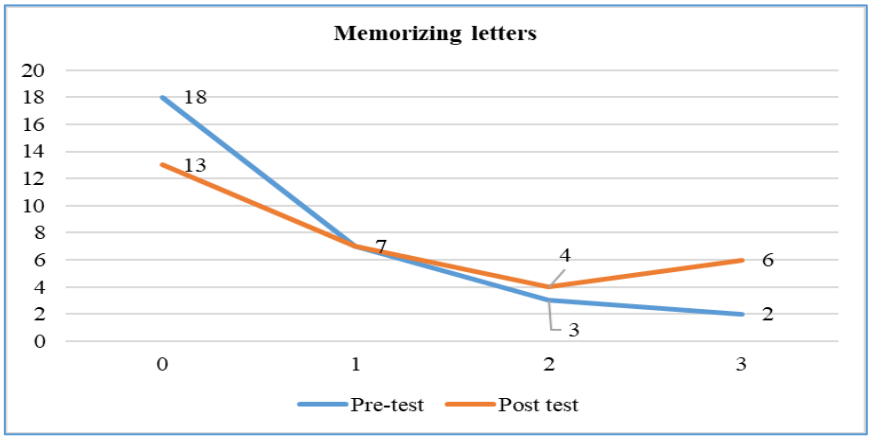

Figure 10: Letter memorization

In this question, children were expected to look at the letters at the left and cover them up and copy them from memory on the line. With regard to memorization of letters, a marked improvement was observed as percentage of children with no correct responses decreased from 60% (18) to 43.3% (13), while those achieving the highest score increased substantially from 6.7% to 20%. This shift indicates that several students moved from poor memorization ability to higher levels after the intervention, reflecting significant gains in letter memory skills.

5.5.3 Memorizing figures

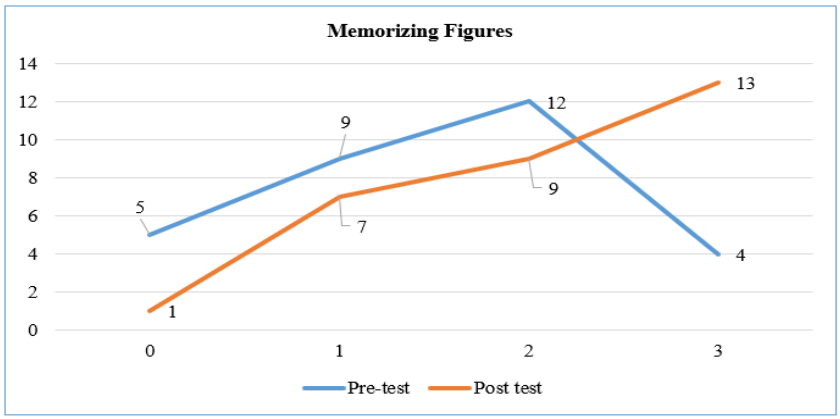

Figure 11: Figures memorization

In this question, the researcher was required to hold card #1 for 5 seconds and take it away and have the student reproduce it on one of the blank cards. Same instruction to be repeated for figure 2 and 3 with increase in time as 10 seconds and 15 seconds respectively. With regard to memorization of figures, substantial improvement was observed in the post-test. The highest score category increased dramatically from 13.3% in the pre-test to 43.3% in the post-test, while the lowest score category declined from 16.7% to 3.3%. This clearly indicates enhanced visual memory and recall ability following the intervention.

The analysis reveals that while ability to copy figures remained largely consistent with slight improvement, on the other hand, both memorizing letters and memorizing figures showed notable positive changes from pre-test to post-test. The increase in high scores in the

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post-test suggest that the intervention was particularly effective in strengthening memory-related cognitive skills, especially visual and symbolic memorization.

5.6 Reading levels

This section covers most crucial task of reading for children with dyslexia. These skills require a child to master phonetic awareness along with binding it together to form words and later form sentences. In this part, various activities were provided to children to perform such as reading three letter words, identification of a particular three-letter word from a pool of words, guessing blinking words, identifying rhyming words and so on.

5.6.1 Reading words

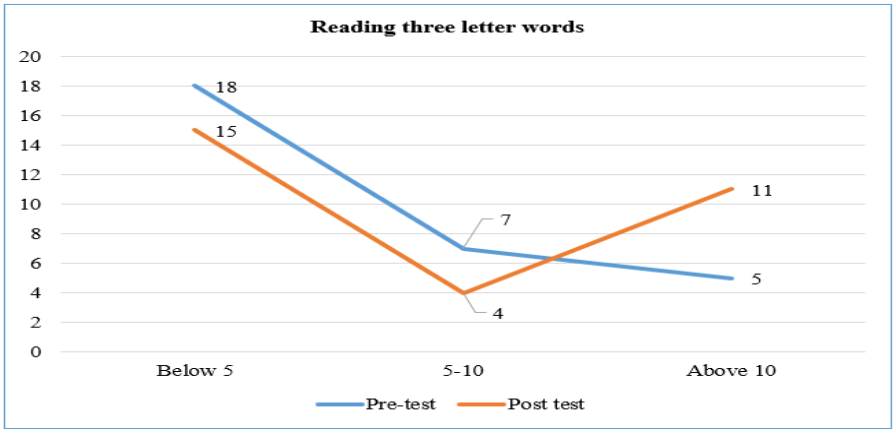

Figure 12: Reading words

In this question, the children were expected to read the words out loud and the researcher was required to mark mistakes. With regard to reading levels of children with dyslexia, it was found that 36.7% children were able to give above 10 correct responses after the intervention as compared to 16.7% in the pre-test. This reflects a substantial improvement in reading proficiency after intervention. The percentage of students scoring 'below 5' decreased from 60% to 50%, showing improvement in basic reading skills. Hence, it can be concluded that intervention was very effective with regard to developing reading skills among young children.

5.6.2 Reading and repeating

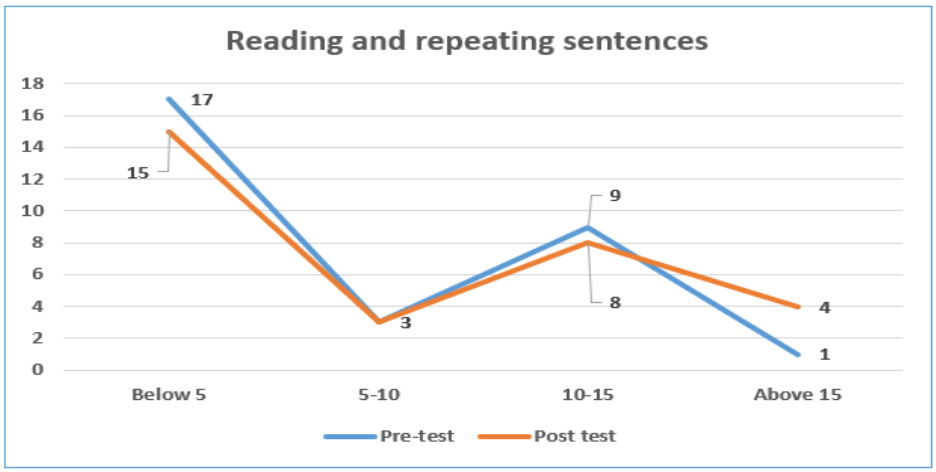

Figure 13: Reading and repeating

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In this question, the researcher was required to read the words out loud and the child was expected to repeat those words back. With regard to reading and repeating words by children with dyslexia, it was found that there was slight improvement in performing this task. It was observed that 13% children in the post test were able to do this task as compared to 3.3% in the pre-test period, this reflects enhanced phonological processing. The 'below 5' category decreased slightly, indicating gradual improvement among children.

Overall, it can be concluded that both reading 3-letter words and reading & repeating sounds show positive post-test improvement, especially at higher score ranges. The shift from lower to higher performance categories indicates that the intervention was effective in improving early reading and phonetic skills, though continued support is needed for students still in the lower ranges.

5.6.3 Word recognition

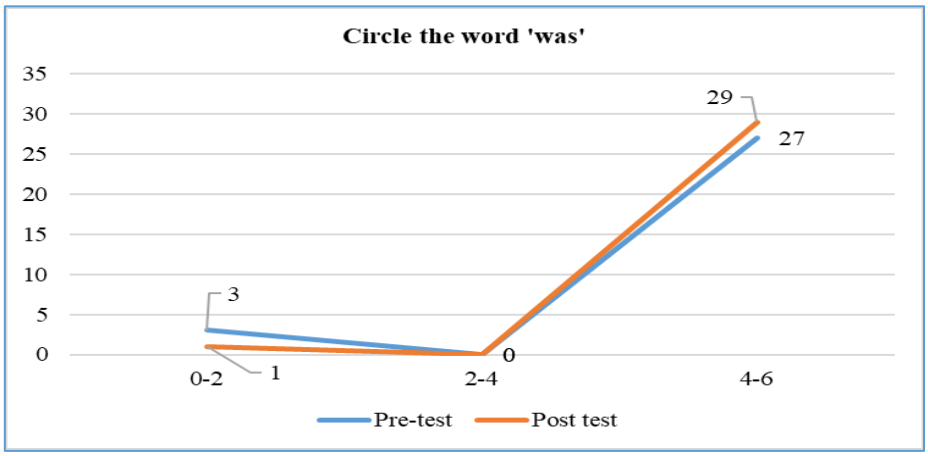

Figure 14: Word recognition

With respect to circling the word 'was' from the given set of words, it was observed that 96.7% children were able to do it in the post test as compared to 90% in the pre-test. So, it can be concluded that there is slight improvement in the performance of children in the given task.

5.6.4 Figure out words

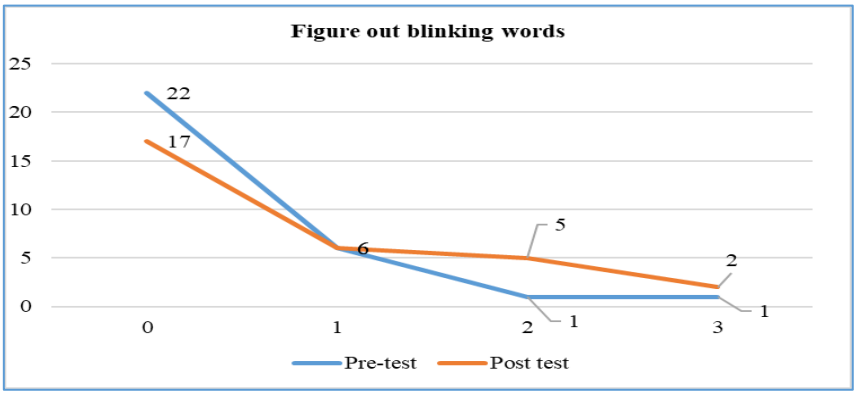

Figure 15: Blinking Text words identification

In this question, the child was expected to look at each of the three words and figure out what it is and write the word on the line. This task measures how quickly and accurately a child can process written words. When children were asked to figure out the blinking words, it was

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considered to be a very challenging activity. But notable improvement as observed as children giving no correct responses reduced from 73.3% to 56.7%, indicating fewer students unable to decode. Higher scores (2–3) increased from 6.6% to 23.4%, reflecting improved visual word processing and decoding ability.

5.6.5 Rhyming Words

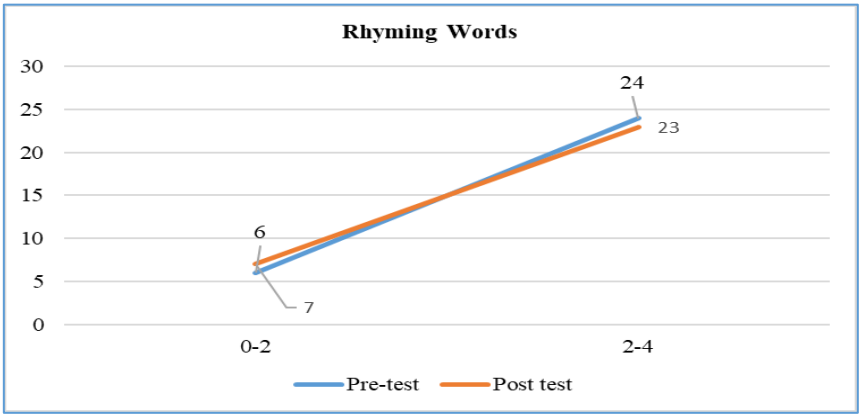

Figure 16: Identification of rhyming words

In the given question, the researcher is expected to read each word out loud and have the child circle the words that rhyme with the word 'gut'. With regard to rhyming words, it was observed that the performance of children remained largely stable across pre and post-tests. A slight shift toward the lower score range suggests that phonological awareness through rhyming showed minimal change.

It can be concluded that word recognition of familiar words (e.g., '*Was'*) showed strong mastery and further improvement. Blinking words demonstrated the most significant gain, indicating enhanced decoding and visual processing skills. Whereas, rhyming skills remained relatively unchanged, highlighting the need for continued phonological awareness activities.

5.6.6 Sentence repetition

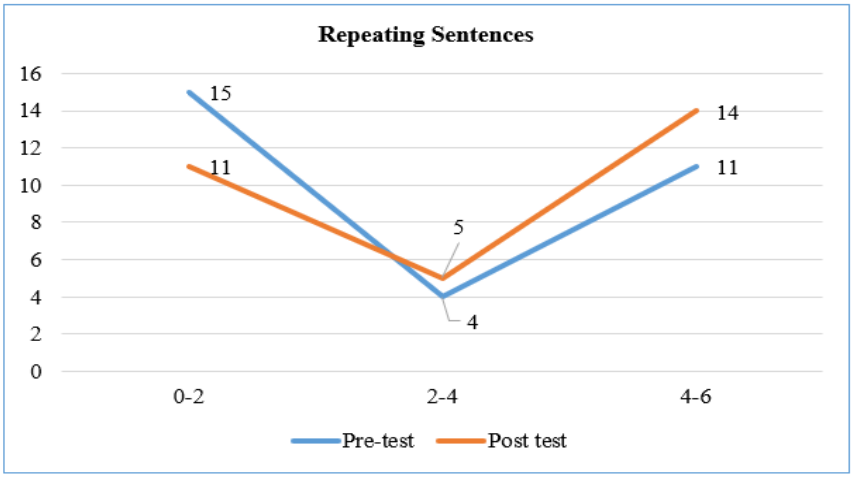

Figure 17: Sentence repetition

In this question, the researcher is required to read sentences to the child and the child is required to repeat these words exactly back. When children were asked to repeat the sentences

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after the researcher, it was considered to be very challenging task by the children. While comparing the pre and post results, it was found that 46.6% of children with dyslexia were able to repeat the sentences during the post-test as compared to 36.7% children in the pre-test, showing better retention and reproduction of sentence structure. The proportion of children in the lowest score range (0–2) decreased from 50% to 36.7%, indicating improved sentence memory and auditory processing.

5.6.7 Repeating Words

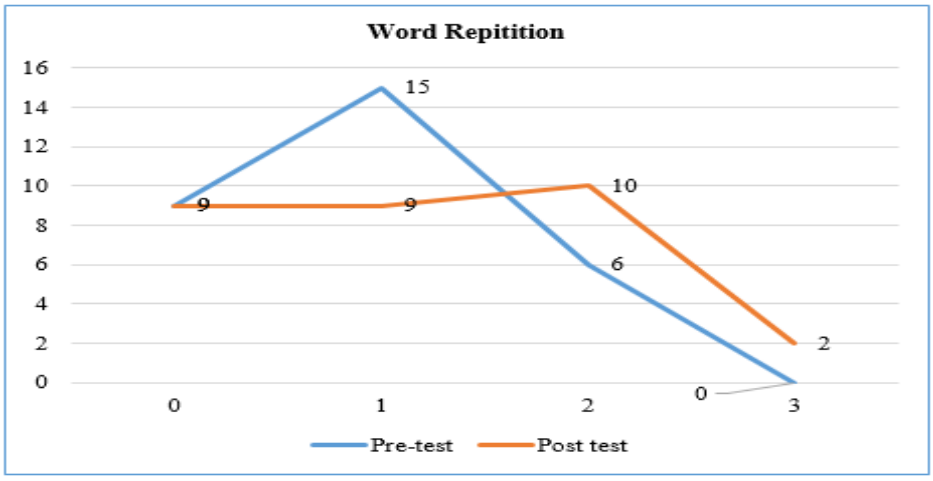

Figure 18: Word repetition

In this question, the researcher is required to read each word out loud and the child is required repeat them back. With regard to word repetition activity, it was found that intervention was found to be quite significant as 33.33% of children with dyslexia were able to give two correct responses out of three as compared to 20% in the pre-test. This indicates improved short-term auditory memory and verbal repetition accuracy. Over all, it can be concluded both sentence repetition and word repetition skills improved from pre to post-test results. Better improvement was observed in sentence repetition activity, suggesting better development of auditory sequencing and syntactic memory.

5.7 Understanding Verbal Instruction

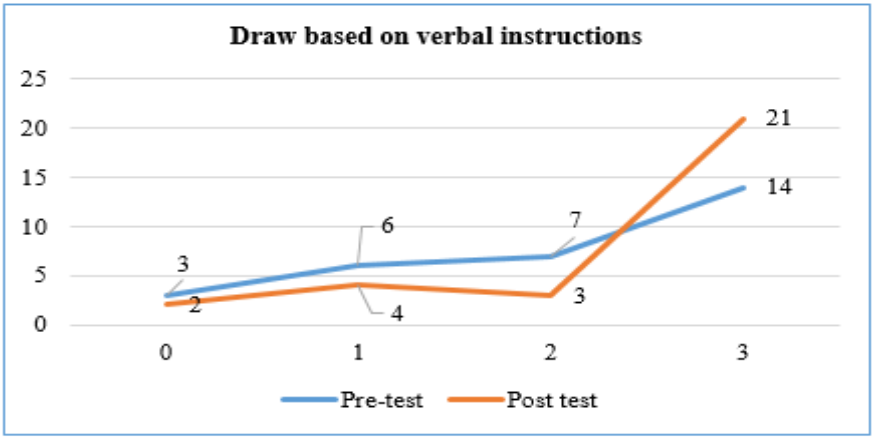

Figure 19: Following verbal instructions

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In this section, children were given various set of instructions to draw complete the drawing. This activity is very useful in understanding language processing ability among young children.

In this question, the child is required to draw vertical or horizontal or diagonal line based on following verbal instruction. There is a marked improvement in students' ability to understand and follow verbal instructions. The highest score category (Score 3) increased substantially from 46.7% in the pre-test to 70.0% in the post-test, indicating stronger listening comprehension and sequential processing. Lower score categories (0–2) showed reductions, suggesting that many students progressed to higher performance levels. Overall, the results demonstrate that the intervention was highly effective in improving comprehension and execution of instructions. The post-test outcomes reflect enhanced auditory comprehension, attention, and motor planning skills, essential for classroom learning tasks.

5.2 Statistical Analysis of Data

For each of the 19 items covered in the Dyslexia Screening Test, each child's competencies were assessed using pre and post comparison. In order to compare the performance of pre and post-test students, t-Test was used as it's a statistics method to determine significant changes between 'means of two groups.

5.2.1 Pre-Control and experimental group

Table 2: Analysis table of Pre-Control and Post experimental group (In-between group analysis)

AI based Intervention for children with Dyslexia	**Pre-control**	**Pre-experiment**	**t- value**	**P- value**
	M+SD	**M+SD**		
	82.53+26.16	84.33+26.86	-0.186	0.85

Table 2 presents the in-between group comparison for participants with dyslexia in the control and experimental group. The data revealed a mean difference between the pre-control and post-experimental scores of participants (82.53+26.16 and 84.33+26.86, respectively), but the difference was not statistically significant (P= 0.85). The data indicate that the children with dyslexia in the control group did not show any statistically significant improvement in their performance as both the groups have same attributes.

Since the p-value is much greater than the 0.05 level of significance, this indicates that there was no significant difference between the control and experimental groups at the pre-test level.

5.2.2 Post Control and Experimental Group

Table 3: Analysis table of Post -test Control and experimental group (In-between group analysis)

AI based Intervention for children with Dyslexia	**Post -Control**	**Post-Experimental**	**t- TEST**	**P-Value**
	M+SD	**M+SD**		
	79.86+23.86	100.6+30.45	-2.075	0.047

Table 3 presents the in-between group comparison for participants with dyslexia in the post control and post experimental group. The data revealed a mean difference between the pre- and post-scores of participants (79.86+23.86 and 100.6+30.45, respectively), the difference was found to be statistically significant ($p < 0.05$). The data indicate that the children

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with dyslexia in the post test category showed statistically significant improvement in their performance.

Positively, this indicates that children with dyslexia who received the AI-based intervention performed significantly better than those in the control group. The results suggest that the intervention had a positive and measurable impact on learning outcomes of children with Dyslexia.

5.2.3 Pre and post Experimental Group analysis

Table 4: Comparative Analysis of participants with Dyslexia in Experimental Group (Within-group analysis)

AI based Intervention for children with Dyslexia	Pre Test Experimental	Post Test Experimental	Paired t test	P-Value
	M+SD	M+SD	-3.08	0.008
	84.33+26.86	100.60+30.45		

Table 4 presents the within-group comparison for participants with dyslexia in the experimental group. The data revealed a mean difference between the pre- and post-scores of participants (84.33+26.86 and 100.60+30.45, respectively), the difference was statistically significant ($p < 0.05$). The data indicate that the children with dyslexia in the experimental group showed significant improvement in their performance with the help of the intervention.

For the purpose of the study, the experimental group includes 15 school going children in the age group of 9 to 12 years. As a part of the intervention, children were given an opportunity to understand phonological awareness, letter reversal, memorization, improve the reading levels and comprehension. The result demonstrates that the AI-based intervention had a significant positive effect on the performance of children with Dyslexia. The improvement is unlikely due to chance and suggests that the intervention was effective in enhancing learning outcomes.

5.2.4 Pre and Post Control Group Analysis

Table 5: Comparative Analysis of participants with Dyslexia in Control group (Within-group analysis)

AI based Intervention for children with Dyslexia	Pre Test Control	Post Test Control	Paired t test	P-Value
	M+SD	M+SD	-.607	0.55
	82.53+26.16	83.33+25.68		

Table 5 presents the within-group comparison for participants with dyslexia in the control group. The data revealed a mean difference between the pre- and post-scores of participants (82.53+26.16 and 83.33+25.68, respectively), but the difference was not statistically significant ($P = 0.55$). The data indicate that the children with dyslexia in the control group did not show any statistically significant improvement in their performance.

The control group refers to the group of children who were not exposed to any form of intervention. The control group includes 15 children out of the total sample of 30 children.

This indicates that without the AI-based intervention, the children with dyslexia in the control group did not show significant improvement in their performance. The small increase in mean score (0.80 points) appears to be due to chance rather than a meaningful effect.

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6. DISCUSSION AND CONCLUSION

It can be concluded that children with dyslexia are very different in terms of their reading and writing capabilities. It can be reflected that though many children were able to perform well on task given to them but still there were many who require support. As observed by the researcher, majority children were not able to read the question and attempt the test independently, though they were able to do the task once it was explained by the researcher. Looking at the challenges faced by the sampled children, the study employed a technology-based AI based tool for children with dyslexia. Based on the identified key areas such as recognition of letters, phonetics, letter memorization, rhyming words, matching exercises, sequencing etc. for which intervention was planned for school going children with dyslexia in the age group of 9-12 years.

With regard to writing of lower-case letters, it was found that with support from intervention 60% of children with dyslexia were able to write lower case letters as compared to 53.3% as reported by the pre-test. With regard to circling of lower-case letter 'b' from a text box of letters such as letter b, d, p and q, no significant change was observed between the pre and post-test result. With respect to identification of reversed words, it can be concluded that explicit instruction and practice helped children with dyslexia to improve simpler reversal tasks, while more complex visual–linguistic tasks require continued intervention.

Further, the comparative analysis of pre-test and post-test scores reveals notable improvement in figure matching and left-to-right matching skills, suggesting that the intervention was effective in enhancing visual perception and directional matching abilities. However, matching words showed no change but there was improvement in child's reading ability to do matching activity effectively. With regard to memorization skills, the analysis reveals that while ability to copy figures remained largely consistent with slight improvement but skills like memorizing letters and memorizing figures showed notable positive changes from pre-test to post-test. The increase in high scores in the post-test suggest that the intervention was particularly effective in strengthening memory-related cognitive skills, especially visual and symbolic memorization. Moving on, it can also be concluded that intervention was very effective with regard to developing reading skills among young children. It can be determined that skills like reading 3-letter words and reading & repeating sounds, show positive post-test improvement, especially at higher score ranges. The shift from lower to higher performance categories indicates that the intervention was effective in improving early reading and phonetic skills, though continued support is needed for students still in the lower ranges. Further, with regard to word recognition of familiar words (e.g., '*Was'*), it can be observed that there was strong mastery and further improvement after the intervention. Blinking words demonstrated the most significant gain, indicating enhanced decoding and visual processing skills. Whereas, rhyming skills remained relatively unchanged, highlighting the need for continued phonological awareness activities. Over all, it can be concluded both sentence repetition and word repetition skills improved from pre to post-test results. Better improvement was observed in sentence repetition activity, suggesting better development of auditory sequencing and syntactic memory.

Overall, the results demonstrate that the intervention was highly effective in improving comprehension and execution of instructions. The post-test outcomes reflect enhanced auditory comprehension, attention, and motor planning skills, essential for classroom learning tasks.

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