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THE EFFECT OF AUDITORY AND MEMORY STIMULATING ACTIVITIES TO IMPROVE ACADEMIC PERFORMANCE IN CHILDREN WITH LEARNING DISABILITY

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Abstract
Aim of the study is to determine the effect of auditory and memory stimulating activitiesin children with learning disability. Objectives of the study were to identify the academic performance in children with learning disability, to administer the Academic Performance Rating Scale to assist with the academic performance level in children with learning disability and to evaluate the effect of auditory and memory stimulating activities to improve the academic performance in children with learning disability. The study is a quasi-experimental design and a convenient sampling technique was adapted. The study was done among the children with learning disability between the age group of 6 to 10 years. Totally thirty (30) subjects were selected, 15 subjects in control group and 15 subjects in experimental group. The control group went under observation only. The experimental group received the auditory and memory stimulating activities intervention. The pre and post-test is assessed by the Academic Performance Rating Scale. The Mann Whitney and Wilcoxon test gives us the process results. Statistical analysis showed significant changes in experimental group after receiving the auditory and memory stimulating activities.The result suggests that the auditory and memory stimulating activities can be used as an effective intervention to improve the academic performance in children with learning disability.
KeyWords: Academic Performance Rating Scale, Learning Disability, Auditory and Memory Stimulating activities, Low academic performance.

Introduction

Pediatric Occupational therapy practitioners provide support to the infants, toddlers, children and youths and family members in various settings. They help the children to instill skills that will allow them to grow self-sufficient successful adults. A child who doesn't master the skills required for success and independence will have more complications when they grow. Some of the general developmental areas are fine motor skills, gross motor skills, cognitive skills, self-care tasks and social skills. Occupational therapists develop intervention based on analysis of the child's behavior and performance, the occupation in which they engage. While evaluating a child's performance, the therapist determines how performance is influenced by impairment and how the environment support or constraints the performance. In 1980's National Joint Committee on Learning

Disabilities (NJCLD) defined LD as "A heterogeneous group of disorders manifested by significant difficulties in the acquisition and the use of listening, speaking, reading, writing, reasoning or mathematical abilities. (Neuro Rehabilitation A Multidisciplinary Approach 2nd edition).LD is common among children 12. 97% rural primary school children having IQ < 90 were found to have poor academic achievement. The lifetime prevalence of LD was 9.7% in children of USA. A study conducted in India reported that prevalence rate ranging from 3-10% among students. A study conducted in government schools of northern city of India, 33.6% of children were identified by teachers as at- risk students. 3.08% were confirmed as having Learning Disability. Academic performance is important because it is strongly linked to the positive outcome that we value. It is important for future because higher level of education can tackle the technologically demanding occupations. Children who have good academic performance have higher self-esteem, low anxiety and are socially inclined. Children who master basic reading, writing and mathematical skills are more likely to have a good academic performance. Auditory perception is the process that allows the brain to interpret what is being heard. Auditory memory is being able to remember what is heard and recall it later. Auditory discrimination is being able to notice the similarity and differences in sounds. Auditory sequential memory is being able to remember what sound or word is heard first. Auditory analysis is splitting up words depending on the sound (syllables). Auditory synthesis is forming a word using sounds (phonics). Auditory foreground - background discrimination involves focusing on one sound while eliminating other sounds in the background. Learning is defined as the acquisition of information and skills and subsequent retention of the information it's known as memory. Problems in working memory can lead to difficulties in learning. This affects the child's ability to follow directions, organising the thoughts for speaking and writing and learning multi- step Procedure or processing the information quickly. Long – term memory is recalling the information, time taken to recall, remembering the date time place or sequence of the information. Long term memory is subdivided into declarative and non declarative memory Declarative memory is further divided into 2 types they are semantic memory (general knowledge is stored) and episodic memory (personal experience / information). Non declarative memory is further divided into 2 types they are procedural memory (carrying out practical activities), perceptual memory (sensory experience ex: how a strawberry taste). Short term memory is storing the information for a short period of time. These are some activities that stimulate auditory and memory for learning: Bingo, picture bingo, Recorded sounds, Treasure hunt, Sing a song, Sequence memory, Drawing, Chain games, Remember what you heard game, Simon says.

Need For TheStudy

Significant researches have been conducted in this same condition and on the same technique that I have used (auditory and memory stimulating activities). But this particular study has not been proven that this technique is an evidence-based practice. This study is done to determine the effect of auditory and memory stimulating activities. I have taken auditory and memory stimulating

activities to improve the academic performance in children with learning disability. Hence it is important to find the effect of auditory and memory stimulating activities for LD children.

Objectives Of The Study

Themainobjectivesofthestudyarediscussedbelow:

- To identify the academic performance in children with learning disability
- To administer the Academic Performance Rating Scale to assist with the academic performance level in children with learning disability.
- To evaluate the effect of auditory and memory stimulating activities to improve the academic performance in children with learning disability.

Literature Review

Ruth Olmstead, PhD, 2005 conducted a study on the use of auditory and visual stimulation to improve cognitive abilities in Learning Disabled children. This study examined the effect of auditory and visual stimulation in four specific cognitive abilities which includes working memory, encoding, visuomotor coordination, planning and processing information. Children diagnosed with LD and who scored low and below average score on Wechsler Intelligence Scale for children (WISC-III), Symbol search, Coding, Arithmetic and Digit span (SCAN) were taken for the intervention. AVS intervention was done for 35 minutes. Thus the study demonstrates that AVS intervention produced significant difference in all the four specific cognitive abilities as measured with the WISC- III & SCAD. Thus concluded and suggested AVS benefits children with LD.

Ingo Roden et al, 2019 conducted a study on Auditory stimulation training with technically manipulated musical material in preschool children with specific language impairment. A total lf 101 preschool children were separated into two group. Experimental group has deficit in speech comprehension, poor working memory were allocated for the AST. While the comparison group received pedagogical activities. Session took 3 days per week for about 30 minutes over 12 weeks. Children who received AST showed significantly greater working memory capacity, speech perception and phoneme discrimination after the session. Thus the study concluded that AST enhance auditory cognitive performance.

Alireza Sangani et al, 2019 conducted the study investigating the difference of working memory in boys and girls with writing – learning Disorders. The Dunn profile was obtained from the parents. Daneman and Carpenter working memory, questions were directly asked. Results show that significant difference in working memory, multisensory processing, auditory processing ($p < 0.002$), sensory processing styles varies in boys and girls. Thus the study concluded that boys have difficulties in working memory and sensory processing.

Hongxia Zhang et al, 2018 conducted a study on Working memory training improves mathematical performance in middle school students with LD. This study was done to investigate the whether working memory update improves academic performance and mathematical performance. They separated children in two groups they are training a group and a control group. The training group had running memory task lasting approximately 40 minutes per day for 28 days. Thus the study concluded that working memory training showed significant improvement in academic performance and mathematical performance.

Erin A Hayes et al 2003, conducted this study examining the plasticity of the central auditory pathway and accompanied cognitive changes in children with LD. Children diagnosed with LD, ADD had commercial auditory processing training software for 8 weeks. Academic achievement and cognitive abilities were assessed with standardized measures. Results compared to the control group, trained group improved on measures of auditory processing exhibited changes in cortical response in quiet and noise. Thus the study demonstrated that learning impaired children working with auditory processing training program had a effect on both the perception and the cortical representation of the sound.

Melahat Amani, 2017 a study was conducted on the effect of strengthening the executive functions on the academic achievement of the children with nonverbal LD. The statistical population consisted of nonverbal LD children. The research instrument was Loft Aabadi' reading test, the researcher made writing test and Mathematical Standard Learning Ability Recognition. They were separated in two groups, the control group carried out the school routine while the experimental group had coding, trial making, verbal and visual memory to strengthen the executive functioning of the children. The result showed significant difference in academic achievement by strengthening executive functions in children with nonverbal LD.

Theajakuriakose et al, 2015, conducted a study on Auditory memory training in children with learning disability: . The study investigates the effectiveness of the auditory memory training for LD children. Two groups were separated in age range of 6 to 8 years. Group 1 has normal children and group 2 has children from 1st to 3rd grade who are diagnosed with LD. The study took 3 phases a pre therapy auditory memory testing (phase 1) Auditory memory training (phase 2), and post therapy auditory memory training test (phase 3). Thus their results were compared and the study concluded that intensive training improves the auditory memory in children with LD.

Sharman Jeffries 2004, this paper reports a study of working memory its role in Dyslexic children and children with special educational needs. Here the children are separated in two groups a group with special educational needs and group varied from SENs. Their abilities were compared on phonological processing, visuospatial/ motor coordination and executive/ inhibitory functioning based on working memory theories. Primary and secondary school children are taken. 21 Dyslexic children, 26 dyspraxia, emotional/ behavioural problems, ADD are taken in experimental group.

40 children were in control group. The study concluded that both the groups didn't performed good in the working memory task. The performance of the SEN children was comparatively measured low than the control group. Thus concluded that working memory has a role on the child's ability inphonological processing, visual-spatial/ motor coordination.

Yehia A Abo-Ras et al, 2018, The purpose of this study is to adapt and apply the 'no glamour memory' training program to suit the Egyptian LD children and to determine the effectiveness of this program. The study was conducted on 20 school age children who are LD and had a complain of memory problems. The children were assessed using the protocol of assessment of Learning difficulties and memory deficits. The training period is 3 to 6 months. After the training they were assessed with different tests they are Stanford Binet Intelligence Scale, Childhood attention and adjustment survey, Arabic dyslexia assessment test and test of memory and learning, 2nd edition. , Thus the study concluded that the training benefited in general cognitive mechanisms (multiple areas of cognition and learning).

David R Moore et al, 2003, karmarkar and Buonomao (2003) did a work on auditory perceptual learning. In the mid 1990s neuroscientists found that children with Language based learning impairments such as Dyslexia, poor visual and auditory processing abilities. These difficulties typically involve multiple sensory, cognitive and motor system. So training based on the principle of perceptual learning can effectively treat these problems.

H. Lee Swanson et al, 2001, Mathematical Problem solving and Working memory in children with LD: both Executive and phonological processes are important. The purpose of this investigation was to explore the relationship between Working memory and mathematical problem solving. Children with LD in the age range of 11 were compared to the same age group and younger comprehension/computation achievement-matched children in the age group of 8-9 years on measures of verbal and Visual-spatial WM, phonological processing, components of problem solving and word problem solving accuracy. The measures of verbal and Visual-spatial WM contributed significant variances to solution accuracy independent of phonological processing. The influence of WM on solution accuracy was mediated by Long term memory (LTM) process related to algorithm. Thus the result support the notion that information activated from LTM rather than phonological process mediates the relationship between executive processing and solution accuracy in children with LD.

Bart Boets et al, 2008,Modelling relations between sensory processing and phonological ability and literacy achievement. This study states that Dyslexia is a multimodal deficit in the process of dynamic and transient stimuli. In this study auditory and visual processing, speech in noise perception, phonological ability and orthographic ability in 5 year old children. Pre school measurements were done for the children. Phonological test, productive letter knowledge, dynamic auditory and visual processing, speech perception, literacy measures were done using standardized

tools. SEM analysis was done since the test was done for larger population. This study concluded that dynamic visual processing is related to orthographic ability, phonological awareness, orthographic ability and verbal short term memory was related to reading and spelling development.

David R Moore et al, 2008, this paper reviews the use of auditory learning to manage listening problems in children. Recent studies were reviewed and say that using adaptive auditory training to adapt communication problem. Auditory learning contributes to listening and language problems. Two groups were examined by auditory and non auditory contributions for learning. Significant auditory learning can occur relatively in brief periods of training. APD children produced measurable improvements in both trained task and general listening and 1language skills.

Lesley Bretherton et al, 2003, The relationship between auditory temporal processing, phonemic awareness and reading disability. This study investigates the relationship between Auditory Temporal Processing of non speech sounds and phonological sound ability in Dyslexic children in the age group of 8-12 years using Tallal's tone-order judgment task. 42 children were subdivided by average and poor performance in the task. And they were compared, and concluded that the presence of tone-order deficit does not relate to the performance or reading difficulties.

Lucy M. Perriello et al, 1991, this study was done to investigate about the psychometric Properties of the Academic Performance Rating Scale (APRS) in a urban elementary school. Children from 6-12 years of age range in a large population were taken. 50 children, 22 girls and 28 boys were randomly selected for the validity of APRS. They were observed in their regular classroom. The grade and the gender differences of APRS were noted. Girls showed greater component than boys in the Academic Productivity Subscale. The result was expected as gender differences favouring girls have been found for most similar teacher questionnaires.

Research Methodology

Material and Methods

The samples were selected from the center I went. Total 30 samples were selected according to the inclusion criteria. Pre-test was done for thirty (30) samples. Their Academic Performance is measured using Academic Performance Rating Scale (Reliability – 0.95, Validity – 0.72). And according to the levels they were divided into control and experimental group. The therapy went for 3 months, 24 sessions, 2 sessions per week for about 45 minutes. The experimental group children had auditory and memory stimulating activities after the baseline data is obtained from using the APRS. The control group children did not have any sessions but they had their conventional OT. Before starting the session, received consent form from the parents and Centre. After the completion of 24 sessions, post-test was done using APRS, then the data collected from both the groups before and after therapy was analyzed to determine the effect of auditory and memory stimulating activities to improve the academic performance in children with learning disability.

Research Design

The duration of the study was 3 months and 2 sessions/week. The study has a total of 26 sessions including the pre-test and post-test sessions. Monthly two group session was conducted on the 2nd and 4th week. The duration of the session was 45 minutes with a 60sec break every 10 minutes. Weekly 2 sessions was conducted.

Every session will start with a warm up activity like singing song/ poems. The sessions ended after 45 minutes. The children will receive a material reward depending upon the performance by the 2nd session of every week.

SESSION 1: Self introduction by the researcher and building rapport with the children.

SESSION 2: Rapport building, pre-test was done using the APRS questionnaire

SESSION 3: Asking each child about which subjects was their favourite and in which subject do they find difficulty.

SESSION 4: Alphabet sounds were taught for the children.

In this session the child will learn how a alphabet sounds and how it is formed.

SESSION 5: Learning to listen sound and form the word.

In this session the child hears the sound and should write them correctly. This improves the child auditory processing and working memory.

SESSION 6: It was group session. Where the children sits in a circle form. A child is made to stand in the centre, rest of the children in the circle are asked to sing a song or poem together. After that a child is chosen and he/she is asked to sing a song/poem. The child in the centre is blindfolded and he/she should recognise the direction of the sound.

SESSION 7: Word pairs

In this session words that sounds similar or rhyming are taught.

SESSION 8: Finding the odd sound.

A set of rhyming words will be given along with a odd sound word. The child should listen those and should say or write the odd sound word. (Ex: coat/goat)

SESSION 9: Learning a New poem / song.

Repetitions is made and making the child to memorize the poem/song.

SESSION 10: Story narrations.

Narrating a story and asking questions from the story.

SESSION 11: Reading a paragraph loud and answering the questions asked.

SESSION 12: Cross out 6, Simple word problems are done in the group session.

Crossing out the 6 in the worksheet to improve working memory. In the group session a simple word problem is narrated and the children should answer them. (Ram had 4 chocolates and Ragu had 3 chocolates, together how many apples did Ram and Ragu had.)

SESSION 13: Simon says.

Ex: Simon says touch your right knee with your left hand. Here the child should listen keenly to follow what was said.

SESSION 14: What will happen next.

Telling the child a familiar story and asking them to continue. This improves the child's working memory, share their thoughts and feelings.

SESSION 15: Simple word problems are asked solve.

Asking the child to solve simple word problems of addition and subtraction. Teaching the child how to calculate mentally and teaching which words represent addition and subtraction.

SESSION 16: Clapping syllables

Asking the child to listen a word and they should clap for how many syllables heard.

SESSION 17: Asking simple General Knowledge questions.

Ex: Capital of the state, National flower etc. ,

SESSION 18: Hearing different sounds.

In this group session, Mixing different sounds and they are played. Familiar sounds are chosen (Ex: horn, plane sound, train, birds chirping, slamming a book, tearing paper, tapping the table, coughing, bell) now asking the child to name the sounds heard, how many times and in what order.

SESSION 19: Engaging the children in active reading.

Making the child to remember the highlighted information and asking questions. This helps in long term memory reading strategies.

SESSION 20: Mnemonics

Teaching the child Mnemonics (Ex: To teach planets, teach them “My Very Educated Mother Just Served Us Noodles”.)

SESSION 21: Finding the word heard

Here the child hears a set of words that are almost similar when pronounced. They differ only frequency and acoustic properties. (Ex: sigh, shy, hi, thigh.)

SESSION 22: Finding what sound is played.

Record the sounds of a dog barking, water dribbling sound, clock sound, hair dryer sound. Now play them and ask the child to name them.

SESSION 23: Chunking

In this session a tasks steps are orally given typically the child has to break the instructions into small steps, to complete the task. (Ex: memorizing a phone number 95 12 13 05 89 rather than 9512130589.)

SESSION 24: Drawing

Ex: a circle on the top of a line and left to a square. For this the child need active listening and working memory.

SESSION 25: Active listening. Here the child is given an instruction to do activity. Basically 2 or 3 sounds are mixed along with the speech.

Now the child has to omit or block the noise to hear the instruction. (auditory discrimination).

SESSION 26: The academic performance of the child was evaluated and post-test was done.

Data Analysis and Interpretation

Statistical Method:

A quantitative study was carried out by the analysis of inferential statistics in this study.

Mean and Standard deviation (minimum–maximum) were used as a measurement criterion on repeated basis for the result.

The descriptive statistics examined record distribution to summarize the data. The results were measured and categorized in number (%)

Significant figures

** strongly significant (P value; $p< p < 0.05$)

*Moderately significant (P value; $0.01 < p< 0.05$)

+Suggestive significance (P value; $0.05 <p <0.10$).

Since the samples belonged to the sample size (30), non- parametric method was used to test the statistical differences between pre-test and post-test scores of control group and experimental group.

Mann Whitney U rank test was used to test the statistical differences between the pre-test and post-test scores, and in finding the hypothesis being tested were analysed whether there exist a statistical significant difference in consideration of the treatment given.

An alpha level of P =0. 05 were measured to be statistically significant.

The statistical analysis was done with the help of IBM SPSS version 23.0.

Results

Table no. 4.1 statistical analysis for pre and post-test control group

Wilcoxon signed rank test was performed to find the significant difference between Pre test and post test scores. 5% level of significance was observed.

Control Group (30)	N	Mean	Std. Dev.	Z value	p value
Pre- test	15	50	6.1062		
Post-test	15	50.4	5.93777	-2.449	0.014

*Significant at 5% alpha level

Since the p value of 0.014 is less than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference in pre test and post test scores control group of the APRS scale. This suggests that conventional OT intervention received by the control group was effective.

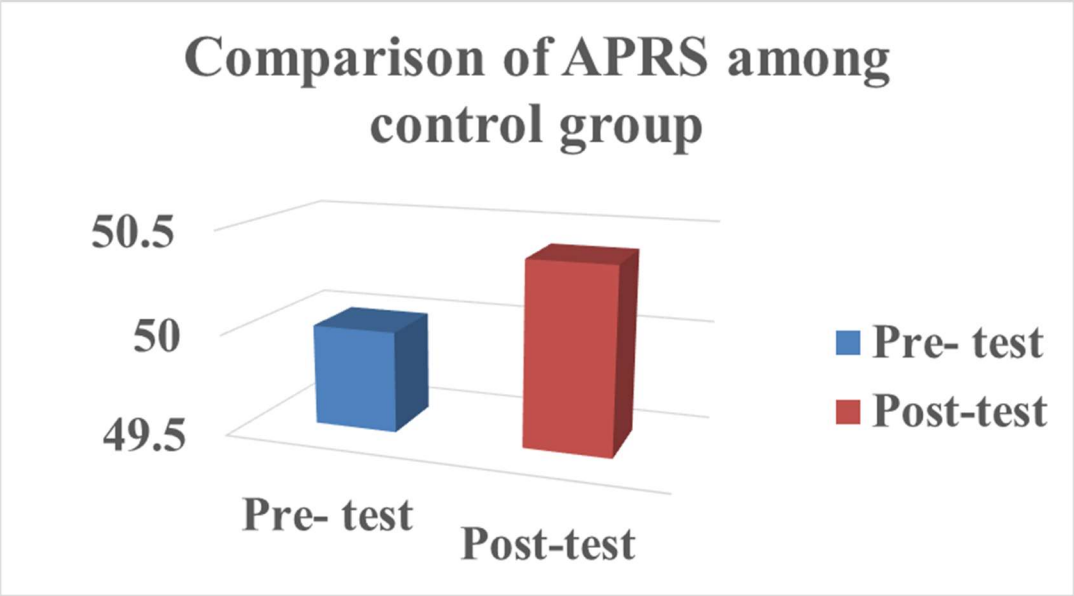


Figure no. 4.1 comparison of pre and post-test of the control group

Table no. 4.2 statistical analysis for pre and post-test of experimental group

Experimental Group (30)	N	Mean	Std. Dev.	Z value	p value
Pre- test	15	46.6667	3.10913	-3.432	0.001
Post-test	15	54.7333	3.41147		

*Significant at 5% alpha level

In the Experimental group, since the p value of 0.001 is less than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference in Experimental Group between pre-test and post test scores of APRS scale. This suggests that the intervention (auditory and memory stimulation activities) along with conventional OT received by the experimental group was effective.

Figure no. 4.2 comparison of pre and post-test of the experimental group

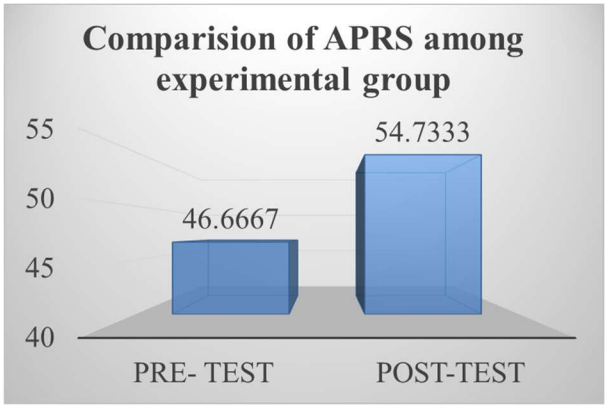


Table no. 4.3 statistical analysis of post-test scores of control and experimental group

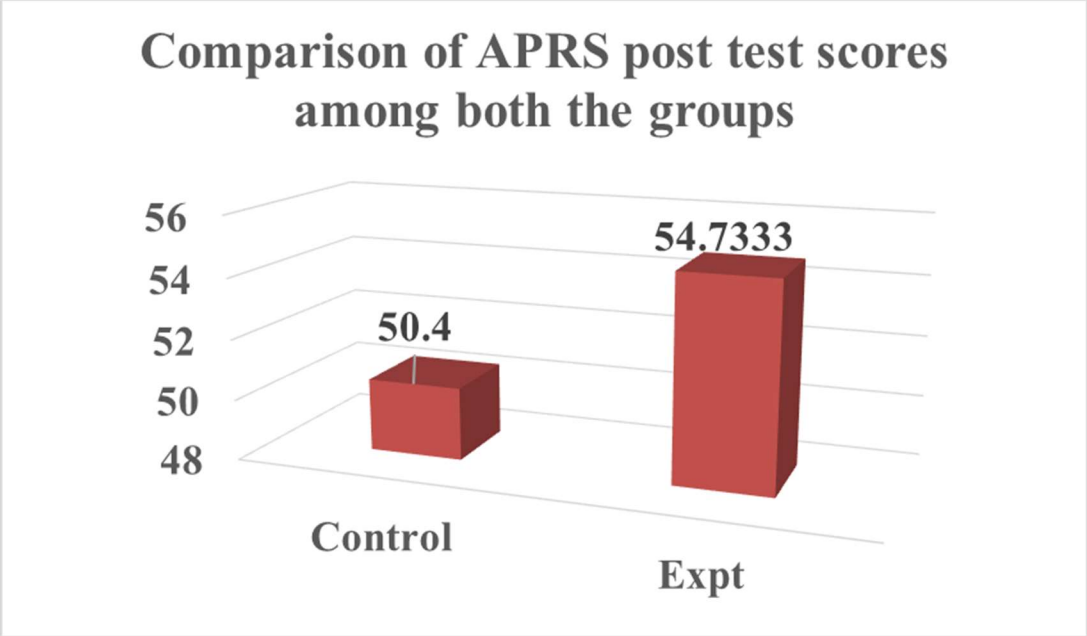
Mann Whitney U test was performed to find the significant difference between Experimental and Control Group. 5% level of significance was observed.

Post test APRS (30)	N	Mean	Std. Dev.	Z value	p value
Control	15	50.4	5.93777		
Experimental	15	54.7333	3.41147	-2.0324	0.0424

*Significant at 5% alpha level

Since the p value of 0.0424 is lesser than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference in post test scores between Experimental and Control Group of the APRS scale. The results suggest that the intervention received by the experimental group was more effective than control group.

Figure no. 4.3 comparision of post-test scores of control and experimental group.



Recommendations

Study can be done on a larger population, for a longer period of time and for different age group and conditions.

Findings And Implications

Learning disability are disorders that affect the ability to understand or use spoken or written language, do mathematical calculations, coordinate movements or direct attention.The purpose of the study is to determine the effect of auditory and memory stimulating activities to improve the academic performance in children with learning disability. The study was conducted in Sherin's Rainbow Occupational Therapy and Rehab Centre. A total of 30 children were selected under the selection criteria described in the methodology and they were allocated according to the APRS level into control and experimental group. The age group of 6 to 10 year includes both girls and boys. Pre-test was done on the academic performance using the APRS for both the groups, then the experimental group alone went for auditory and memory stimulating activities while the control group had no specific therapy except the conventional OT. The intervention period is 3 months, 3 sessions per week with duration of 45 minutes. After the intervention of three months post-test was done for both the groups and the scores were calculated and statistically the result was analysed. Effects of auditory and memory stimulating activities was analysed by comparing the pre and post- test scores of the experimental groups. And by comparing both the post-test scores of both groups. In table 4.1 and figure 4.1 that is the comparison of pre and post-test scores of the control group using APRS, the mean scores of pre and post-test are 50 and 50. 4, 'z' value is -2. 449 and the 'p' value is 0.014 which is less than 0.05, it indicates that there is a slight significant increase in the levels of the group because of conventional OT. In table 4.2 and figure 4.2 that is the comparison of pre and post-test scores of the experimental group using APRS, the mean scores of pre and post-test are 46.6667 and 54.7333, 'z' value is -3.432 and the 'p' value is 0.001 which is less than 0.05, it indicates there is a highly significant difference in the levels since the experimental group had the auditory and memory stimulating activity intervention. Thus the present study correlates with the result of Theajakuriakose et al 2015, conducted a study on Auditory memory training in children with learning disability. The study investigates the effectiveness of the auditory memory training for LD children. Two groups were separated in age range of 6 to 8 years. Group 1 has normal children and group 2 has children from 1st to 3rd grade who are diagnosed with LD. The study took 3 phases a pre therapy auditory memory testing (phase 1), Auditory memory training (phase 2), and post therapy auditory memory training test (phase 3). Thus their result was compared and the study concluded that intensive training improves the auditory memory in children with LD. In table 4.3 and figure 4.3 that is the comparison of post-test scores of control and experimental group using APRS, the mean scores are 50.4 and 54.7333, 'z' value is -2.0324 and the 'p' value is 0.0424 which is lesser than 0.05. Thus there is a statistically significant difference the result suggests that the intervention received by the experimental group was more effective than control group.Ingo Roden et al (2019) conducted a study on auditory stimulation training for specific language impairment in school children. Where the children were divided into two groups control group was having their pedagogical activities, experimental group had AST training. Thus the study concluded that children who had AST training has enhanced auditory cognitive performance.Hongxia Zhang et al (2018), conducted a study on working memory training improves the mathematical performance in children with LD. The children were

separated in two groups. One group didn't receive any training while the other group had running memory task for 40 minutes over 28 days. Thus the study concluded that working memory training improves the academic performance of the children with LD.

Conclusion

The study was conducted over a 3 months intervention period with 30 samples, 15 samples were in control group and 15 samples were in experimental group. Pre and post-test were conducted in both the groups using Academic Performance Rating Scale. The experimental group underwent auditory and memory stimulating activities while the control group had their conventional Occupational therapy. The results show that there was a significant increase in the levels of experimental group than the control group after receiving the auditory and memory stimulating activities. Thus this study proves the effect of auditory and memory stimulating activities improved the academic performance in children with learning disability. Thus the result of the present study suggests that the effectiveness of auditory and memory stimulating activities can be a useful skill for children who have poor academic performance. Other studies also showed that this is an effective therapy to treat LD children.

Limitations Of This Research

Study was done on a small sample size and for a short period of time.

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