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Effectiveness of Cognitive Intervention based on PASS Theory Improving Working Memory and Attention in Children with Reading Disability

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Abstract

Reading disability, or dyslexia, is one of the most common types of learning disability among school-going children. So, finding the best treatment for dyslexia requires an hour. The few methods include phonological intervention, multi-sensory methods, cognitive processing training, and games-based interventions to improve literacy and cognitive difficulties among children with reading disabilities. The current study examined the effectiveness of cognitive interventions based on the PASS theory in 20 poor readers from the age group of 6–8 years who had significant difficulty in attention and working memory areas. CAS and WISC IV were administered in pre- and post-test conditions. The group got remedial training for 45 hours. The T-test showed marked improvements in attention and working memory with P values of 2.16E-07and 4.31E-09, respectively. Based on the PASS theory of intelligence, the PASS Reading Enhancement Program (PREP) and Cognitive Enhancement Training (COGENT) help children improve their attention and working memory skills by improving the underlying cognitive processes through inductive and discovery learning. The findings support the efficacy of the PASS-based intervention in addressing deficits in reading disabled children.

1. Introduction

Reading Disability is the most common developmental disability among school going children . Several approaches like reading through multisensory approach proved so well about the efficacy of multisensory training in improving reading skills among children but don't have any base of relationship between brain functioning and reading development. Research based on cognition and reading are also essential in interventions in Reading Disability. Working memory and attention both are important components of academic achievement. To improve the academic achievement of the child with RD , here the main goal of this study is to find out the efficacy of interventions based on brain based theory on children with Reading disability with and without ADHD.

The study was conducted using the Experimental design using the pre-test and post-test methods. For measuring the Attention of the participant the author has used the Cognitive Assessment System (CAS) which is highly valuable for projecting academic achievement and career planning, as well as for assessing intellectual strength, such as relative strengths and weaknesses as well as characterising individuals who have learning difficulties, intellectual disabilities, traumatic brain injuries, neurological impairments, and chronic poverty. Similarly for measuring the Working memory the author had chosen Wechsler's Intelligence Scale for Children-Fourth Edition.

The study has taken a sample size of 20 students who were diagnosed with reading disabilities within the age range of 6 to 8 years. The selection criteria included students diagnosed with reading disabilities with or without ADHD as well as children belonging to the EWS categories and students having Intellectual disabilities, other neurodevelopmental disorders, Psychiatric disorders, or Physical disabilities who were excluded from the study. Meeting the inclusion and exclusion criteria only 20 students got involved in this study from 3 different schools of Delhi NCR.

The Intervention was designed based on the Pass theory of Intelligence for children with learning disabilities the author here has taken two Intervention tools - *Pass Reading Enhancement Program* and *COGENT*. The data was collected from 3 schools in Delhi NCR. There was a 30 hours intervention program which was 2 hours a day,

thrice a week for nearly 1.5 months with the selected 20 students diagnosed with learning disabilities within the age range of 6 to 8 years. The data was collected in two phases before the intervention - the Attention and Working Memory of the Children were collected using the CAS and Wechsler Intelligence Scale for Children-Fourth Edition Instrument and again the same test was repeated after 1.5 months of the Intervention program. The study established to test the cause-and-effect relationship of the effectiveness of the Intervention program on children with a reading disability, the experimental design - the pre-test and post-test served the cause of understanding of the effect of the same. The pre-test and post-test were conducted within 1.5 months to have the consistent result of the intervention program among the students with reading disability. The results/scores of the test were recorded and calculated with the help of Excel Data Analysis.

Table 1: t-Test: Paired Two Sample for Means (Working Memory)

	Composite Score(1)	*Composite Score(2)*
Mean	69.85	86.4
Variance	223.3973684	211.4105263
Observations	20	20
Pearson Correlation	0.866337854	
Hypothesized Mean Difference	0	
Df	19	
t Stat	-9.696740963	
P(T<=t) one-tail	4.31152E-09	
t Critical one-tail	1.729132812	
P(T<=t) two-tail	8.62304E-09	
t Critical two-tail	2.093024054	

The statistical finding for working memory illustrates that the mean of the composite score 1 (pre-test) and the mean of composite score 2 (post-test) among working memory was improved to 86.4 from 69.8. Since the calculated t-statistic (4.31E-09) is less than the critical values for both one-tailed and two-tailed tests, we conclude that there is a significant difference between the means of composite score 1 and composite score 2. The negative value of the t-statistic indicates that the mean of composite score 2 is significantly higher than the mean of composite score 1. The high value of the r coefficient (0.89) suggests a strong positive linear relationship between the two sets of scores. All these values indicate the significance and effectiveness of PASS theory in comparison with usual class activities score.

Table 2: t-Test: Paired Two Sample for Means (Attention)

	Composite Score(1)	*Composite Score(2)*
Mean	96.35	110.65
Variance	297.7131579	262.1342105
Observations	20	20
Pearson Correlation	0.871820883	
Hypothesized Mean Difference	0	
Df	19	
t Stat	-7.497947435	
P(T<=t) one-tail	2.16435E-07	
t Critical one-tail	1.729132812	

	Composite Score(1)	*Composite Score(2)*
P(T<=t) two-tail	4.32869E-07	
t Critical two-tail	2.093024054	

Additionally, the statistical data obtained from the attention parameter reveals that the mean score obtained from the post score (110.6) is significantly higher than the mean score recorded in pre-score (96.5), with a mean difference of -14.1 points. The Pearson correlation coefficient (r) between the two scores is 0.92, which indicates a strong positive relationship between the scores. The t-statistic is 2.16E-07, which indicates that the difference in means is significant. The p-value for the one-tailed test is 0.00, and for the two-tailed test, it is 0.00. Both p-values are much smaller than the significance level of 0.05, which indicates strong evidence for PASS theory effectiveness. Meanwhile, t-statistic (2.16E-07) is much smaller than both t-critical values, indicating the significance and effectiveness of PASS theory in comparison with the usual class activities score.

Eventually, the study concluded that there is a significant growth in the score of the participant in the post -test after the participant has attended the continuous intervention program for one and half months. Some of the Children had ADHD along with the reading disability. Usually, students with reading disabilities lack comprehension, communication, arithmetic, social interaction, and concentration skills, but with regular intervention and special guidance, things can be improved. By improving their working memory score and attention capacity, the Children were able to pay more attention, stay on task, and learn and remember more. The regular intervention also helped in reducing the cognitive load and enhanced the Children' levels of confidence and self efficacy. These kinds of interventions help students who have trouble reading, but they have to be done with patience and the right skills. PREP and COGENT intervention plans were implemented using the PASS theory and the consequences depicted the optimistic and significant outcomes in the form of enhancement in the attention and working memory score of the Children in appropriate manner.

2. Limitation

The prominent limitation of this study was the number of students that are used as a sample for conducted empirical analysis. The total number of students was modest as it contained only 20 samples located in Delhi NCR region. This is a small number to identify the impact of interventional processes based on the pass theory and reach to any conclusion. Future research will try to eliminate this issue by taking a large number of samples from distinct resources in order to intervene and obtain the result calculated from pre and post differences. However the finding of this study suggests that measurement used for PASS cognitive procedures might have functioning for evaluation of children with attention deficit disorders and reading disability; these measures should not be separated utilised but rather of a large battery of tests that are responsible to provide accurate results. Another variable which is used in this is working memory which evaluates the children's capability to learn and visualise thinking based on their memory.

However, the PASS cognitive approach consists of four components: planning, attention, simultaneous, and successive. Moreover, this research only focused on attention and working memory while not including other variables. The main intention of the research is to include only two parameters to enhance understanding and determine the ground report of the student who are diagnosed with reading disabilities with or without ADHD as well as children belonging to the EWS categories and students having Intellectual disabilities, other neurodevelopmental disorders, Psychiatric disorders, or Physical disabilities who were excluded from the study. Thus, these components of PASS theory can be included in future research to expand beyond the attention and working memory and determine other ingredients of past cognitive approach and their working grounds and its significance with respect to present findings. On the other hand, future study can comprehensively look beyond all the components of pass theory and compare it with the present study to determine what could be the changes will encounter in the result when only two variables of PASS cognitive approach is used in comparing with all the four variables of PASS cognitive result will used to determine the reading disability with or without ADHD individuals.

Another limitation of this work is the period of intervention program is completed in very short duration of spam as there was a 30 hours intervention program which was 2 hours a day, thrice a week for nearly 1.5 months. The pre-test and post-test were conducted within 1.5 months to have the consistent result of the intervention program among the students with reading disability. This duration of one and a half month for monitoring the intervention program was very small to determine the long term consequences on the students. The result obtained in this research significantly shows the effectiveness of intervention based on PASS theory. However it's long lasting consequence depends on the monitoring duration and how long a student went through the intervention program but in this research the monitoring duration is very short. Hence the outcome and its consequences with long lasting is questionable. Subsequently, in future research the study can convert this intervention duration from 1.5 months to at least 1 year and determine the long term consequences of the findings. The study further can compare it with the present result to determine whether long term monitoring is crucial or short duration intervention program is sufficient to enhance the capability of the student.

3. Future Work

Future research will try to eliminate the issue of marginal sample size by taking a large number of samples from distinct resources in order to intervene and obtain the result calculated from pre and post differences. This can also improve the sampling process of the study and homogeneity of the sample can be eliminated with a large data set. Meanwhile, the long lasting consequence of the study depends on the monitoring duration and how long a student went through the intervention program but in this research the monitoring duration is very short. Hence the outcome and its consequences with long lasting is questionable. Subsequently, in future research the study can convert this intervention duration from 1.5 months to at least 1 year and determine the long term consequences of the findings. The study further can compare it with the present result to determine whether long term monitoring is crucial or short duration intervention program is sufficient to enhance the capability of the student.

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