Improving Phonological Awareness, Phonological Memory and Rapid Naming in Children with Dyslexia: The Efficacy of Cognitive Remediation Programs

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Abstract

The present study was an attempt to improve reading skills in dyslexic children by using cognitive remediation programs. This study had utilized quantitative technique for data collection. The present study had adopted one-group pre-test post-test research design. 147 children were purposively selected from three schools of Cuttack district in Odisha. Out of 147 children 14 children were identified as children having dyslexia. Children identified with dyslexia belong to class-V and were within the age bracket of 10-11 years. Subtests of 'Test of Word Reading Efficiency', 'Comprehensive Test of Phonological Processing' tests were used to identify children having dyslexia. The results of the study revealed that the difference between pre-test and post-test reading skills scores of phonological awareness, phonological memory and rapid naming found to be statistically significant. The dyslexic children performed better in the post-test measures of these tests after receiving cognitive remediation programs.

Keywords: *Phonological Awareness, Phonological Memory, Rapid Naming, Dyslexia, Cognitive Remediation Programs.*

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Introduction

Reading skill can be operationally defined as "a cognitive ability which a person is able to use when interacting with texts" (Urquhart & Weir, 1998). Reading is one of the most valued scholastic skills. Development of reading skills in dyslexic children is currently a matter of considerable concern, because these children tend to lag behind their same-age peers in general population (Development of Indian Affairs and Northern Development, 2005). The Government of India, since 2001, has launched the "Sarva Shiksha Abhiyan" ("Education for All" movement), which is a comprehensive and integrated flagship program to attain universal education in the country to all children, including the children with disabilities ("Inclusive Education"). But till today, proper teacher guidance with an enriched curriculum specifically meant for reading disabled children has not yet been developed. Therefore, this research will focus on improving reading skills through the application of cognitive-based training programs. Such programs are designed to improve the underlying cognitive skills necessary to become a successful reader—that is, the processes through which children learn to interpret, remember, manipulate, and make use of information (Das, Parrila & Papadopoulos, 2000). Cognitive training is based on learning through inductive rather than deductive inferences. Accordingly, remediation is structured in such a way as to facilitate inductive inference and internalization of principles and strategies rather than deductive rule learning (Brown & Campione, 1996; Das, Mishra, & Pool, 1995) and, as such, is an alternative to the direct training of reading skills. One program, the *PASS Reading Enhancement Program* (PREP) has been successfully used in both research and educational settings (Das, Naglieri, & Kirby, 1994; Papadopoulos, Das, Parrila, & Kirby, 2003). Another, relatively new program for primary school children, *Cognition Enhancement Training* (COGENT), has been used with a small group of reading disabled children (Das, Hayward, Samantaray, & Panda, 2006). In the present study, the researchers have also taken these two cognitive remediation programs (COGENT & PREP) to explore its effectiveness in improving reading skills in dyslexic children. Motivation for the study came from the challenge of improving the reading skills of dyslexic children who have experienced reading failures in academic life. After all, one of the biggest challenges of 21st

century is how to function properly, not only in academic life, but also in psychological, and social life. In India, statistics reveals that the chronic school dropout rates of reading and learning disabled children are increasing day by day. While the reasons for such statistics are necessarily complex, one contributing factor to school is early reading failure and our education system's inability to properly identify and assist those with persistent reading disabilities. Therefore, this study is an attempt to focus on the reading skills of dyslexic children and bringing them back into the mainstream through cognitive remediation programs.

Objectives

1. To explore the efficacy of Cognitive Remediation Programs (Cognition Enhancement Training-COGENT & PASS Reading Enhancement Program-PREP) for improving the reading skills of dyslexic children.
2. To study the difference between pre-test and post-test scores of dyslexic children in phonetic decoding efficiency test.
3. To study the difference between pre-test and post-test scores of dyslexic children in phonological awareness test.
4. To study the difference between pre-test and post-test scores of dyslexic children in phonological memory test.
5. To study the difference between pre-test and post-test scores of dyslexic children in rapid naming test.

Research Design

This study utilized a quantitative technique for data collection. The present study included one independent variable and one dependent variable. The independent variable in this study was the cognitive remediation programs. The dependent variable of this study was reading skill. The present study had adopted one-group pre-test post-test research design.

Participants

147 children were purposively selected from three schools (Buckley Girls' High School, Christ Collegiate School, and Reserve Police Line Upper Primary School) of Cuttack district. Out of 147 children 14 children were identified as children having dyslexia. All 14 children identified with dyslexia belong to class-V and were within the age bracket of 10-11 years.

Tools

The following tests were used in this study to identify children having dyslexia. All children were administered the following tests individually by the researchers who were trained in the administration of all protocols. Testing was completed before and after remediation period. The specific testing protocols are described below.

1. Test of Word Reading Efficiency (TOWRE)-

The Test of Word Reading Efficiency (TOWRE) was developed by Joseph K. Torgesen, Richard Wagner and Carl Rashotte in 1999. This test measures a participant's word reading accuracy and fluency to provide an efficient means of monitoring word reading skills that are critical in the development of overall reading ability. Word decoding is a key component of dyslexia. This test consists of two subtests, viz. Sight Word Reading (SWR) and Phonetic Decoding Efficiency (PDE). The Phonetic Decoding Efficiency (PDE) subtest of TOWRE was used in this research. This test measured the number of pronounceable printed non-words that can be accurately decoded within 45 seconds. The TOWRE test–retest reliability for 10-18 years olds ranges from .83 to .92.

2. Comprehensive Test of Phonological Processing (CTOPP)-

The Comprehensive Test of Phonological Processing (CTOPP) was developed by Joseph K. Torgesen, Richard Wagner and Carl Rashotte in 1999. This test assesses phonological awareness, phonological memory and rapid naming. Individuals with deficits in one or more of these kinds of phonological processing abilities may have more difficulty in learning to read than those who do not.

Procedure

The above mentioned tests were used for identifying children with dyslexia from three schools of Cuttack district in Odisha. 147 participants were given Test of Word Reading Efficiency or TOWRE [Phonetic Decoding Efficiency (PDF) subtest]; Comprehensive Test of

Phonological Processing or CTOPP. 14 children of class-V were identified as having dyslexia. All children were administered phonological awareness, phonological memory and rapid naming tests individually by the researchers. Then, the participants were provided with two cognitive remediation programs namely Cognition Enhancement Training (COGENT) having 5 modules named 'Squeeze and Say', 'Clap and Listen', 'Funny Relatives', 'Name Games', and 'Shapes, Colours, and Letters' in 20 sessions and PASS Reading Enhancement Program (PREP) 4 successive processing modules named 'Joining Shapes', 'Connecting Letters', 'Related Memory', and 'Window Sequencing' in 20 sessions. The total time taken for these remediation programs were 1 hours time limit per day with a gap of two days time according to the children's grasping ability. In each session, there were a group of (5 children from 1st school, 5 children from 2nd school and 4 children from 3rd school) dyslexic children. Likewise, 3 groups of children were selected for giving intervention programs to 14 identified dyslexic children in this study. The researchers were trained with these two cognitive remediation programs for three months.

After the test had been administered to the entire sample, the scoring procedure was undertaken. All the tests were scored as per the guidelines provided in the test manual. The scores of the participants were then neatly noted on the data sheets and data were analyzed by using SPSS 20.

Results

In order to test the significance of mean differences between pre-test (before intervention-BI) and post-test (after intervention-AI) measures of reading skills for dyslexic children, t-test was calculated.

Table-I: **Means, Standard Deviations and t-Values Showing Differences in Pre-test and Post-test Measures.**

Measures		Pre-test		Post-test		t
		Mean	SD	Mean	SD	
Phonological Awareness	Phonetic Decoding Efficiency (TOWRE subtest)	64.35	4.12	72.64	7.43	5.72*
	Phonemic Elision (CTOPP subtest)	5.92	4.61	21.07	2.67	13.42*
	Blending Words (CTOPP subtest)	4.85	5.44	19.00	2.03	9.71*
Phonological Memory	Memory for Digits (CTOPP subtest)	9.57	4.60	16.07	2.20	7.27*
	Non-word Repetition (CTOPP subtest)	4.28	4.61	13.57	1.45	9.11*
Rapid Naming	Rapid Digit Naming (CTOPP subtest)	5.71	3.31	15.57	2.50	13.88*
	Rapid Letter Naming (CTOPP subtest)	7.00	4.62	16.42	5.03	14.64*

Note: * t value is significant at .01 level of significance (P<.01).

From the analysis of the above result table, it was found that there exist significant differences in the pre-test (before intervention) and post-test (after intervention) measures. The dyslexic students showed improvement in reading skills of post test (after intervention) measures after receiving cognitive remediation programs. This is indicating the efficacy of cognitive remediation programs (COGENT & PREP) in the present study.

DISCUSSION

The present study was designed to explore the efficacy of Cognition Enhancement Training (COGENT) and PASS Reading Enhancement Program (PREP) for improving the reading skills of dyslexic children. The hypotheses taken for this study stated that there will be a significant difference between pre-test (before intervention) and post-test (after intervention) measures indicating improvement in the reading skills of dyslexic children; and the role of cognitive remediation programs will be found to be effective for improving the reading skills of dyslexic children. The one-group pre-test post-test research design was adopted for this study. 147 participants were participated in the screening process for identifying poor readers. Among them 14 students from class-V were found as having dyslexia. The purposive sampling technique was used in this study. The major findings of this study revealed that the

dyslexic children had shown improvement in their reading skills after receiving COGENT and PREP cognitive remediation programs. They had shown improvement in their post-test (after intervention) measures which clearly indicated their positive response to these programs. This provides an insight into the efficacy of these remediation measures for improving reading skills of dyslexic children. There are several research studies conducted in this area which also provide information regarding similar results with this study (Das, 2009; Mahapatra, Das, Stack-Cutler, & Parrila, 2010; Hayward, Das, & Janzen, 2007).

Phonological Awareness and Reading

It is widely accepted that most children with reading difficulties have a core phonological deficit that interferes with their ability to develop phonological awareness, that is, the ability to perceive and manipulate the sounds of spoken words. Children who are learning to read differ widely in phonological awareness; some are very good at it by their second year in elementary school, while others at that age still find these simple things very difficult (Das, 2009). Phonological awareness has been repeatedly shown to be a strong predictor of reading ability, in both alphabetic and non-alphabetic writing systems. Studies have also shown that a child's level of phonological awareness, measured when reading instruction begins, accurately predicts his/her reading performance in later years (Das, 2009).

Rapid Automatic Naming (RAN) and Reading

Rapid Automatic Naming (RAN) has been acknowledged as a second core deficit in reading disabilities (Wolf & Bowers, 1999). RAN is described as the ability to name, as fast as possible, visually presented familiar symbols, such as colours, shapes, objects, and letters. It is the foundation for the skills of letter recognition, learning the sounds of words, and translating spelling to speech. As with phonological awareness, RAN performance has been shown to distinguish average from poor readers during childhood and into adulthood. Similarly, even after statistically equating IQ, reading experience, attention deficit disorder, socioeconomic status, articulation rate, and most importantly, phonological awareness, RAN remains a reliable predictor of reading.

Remediation of Reading Disabilities

Remediation differs from instruction. Instruction is what happens in the school in a classroom. The teachers instruct or formally teach children. The teacher has the knowledge and the problem in instruction is how to transfer this knowledge to the child. This is not a very simple affair. Remediation is not instruction. Only when instruction has failed does remediation take over. Instruction is typically given to a large number of children in a classroom. The instructor in the classroom cannot take into account only an individual child's learning style, maturation, and case history. Instruction does not aim at removing the deficit or difficulty the child may be experiencing for some very specific reasons. It treats children as a community of learners in a classroom. The purpose of remediation is, of course, to help the child compensate for difficulties that he/she has. As the word suggests, it is aimed at correcting the problem (Das, 2009). Generally speaking, remediation is aimed at ameliorating the difficulties, reducing the deficits, and correcting maladaptive strategies that a learner may have. Remediation, therefore, goes beyond the surface difficulties. If a child does not know how to swim, the remedy is not to throw him into the water and let him sink or swim. Similarly, if a child is poor in spelling, remediation would not recommend more and more spelling exercises.

Role of Cognitive Enhancement Training in Improving Reading Skills

The COGENT (Cognitive Enhancement Training) program aims at building the cognitive, language, and phonemic awareness skills that support reading, especially for those children who are at risk for developing reading difficulties (Das, 2004). COGENT is an attempt to create a program for reading readiness by first ensuring that children are engaged in PASS (Planning, Attention, Simultaneous, and Successive processing) processes, a prerequisite for reading. It is based on knowledge borrowed from several reliable studies (Luria, 1981). COGENT benefits cognitive growth, typically of developing children as well as children with special needs such as

those with limited exposure to literacy, mild developmental delay, language impairment, and those at risk for developing dyslexia and other reading disabilities. The program is suitable for classroom instruction as well as for one-on-one and small group training in clinical and educational settings.

Role of PASS Reading Enhancement Program in improving Reading Skills

PREP assumes that children's difficulties in learning can be modified, reduced, and improved through appropriate cognitive stimulation, that is, the child has an enormous potential for learning, only some of which is exploited in regular classroom instruction. It also assumes that if the child is appropriately treated from the beginning, these unused potentials can be developed and the possibility of a learning deficit can be avoided.

Role of Cognitive Remediation Programs in Improving Phonological Awareness, and Phonological Memory in Dyslexic Children

In the current study, the results evidenced that the COGENT and PREP had put positive impact on improving phonological awareness, and phonological memory of dyslexic children. Here, we can evaluate the pre-test (before intervention) and post-test (after intervention) results of TOWRE-PDE (Test of Word Reading Efficiency-Phonetic Decoding Efficiency), CTOPP Phonological Awareness (subtests of "Elision" and "Blending Words") and CTOPP Phonological Memory (subtests of "Memory for Digits" and "Non-word Repetition"). In all these above mentioned aspects of reading skills, the dyslexic children showed better performance in post-test (after intervention) measures after receiving the cognitive remediation programs. The findings of the present research are supported by the previous research findings (Das, 2009; Hayward, Das, & Janzen, 2007).

The Module-2 (Clap and Listen) of COGENT focused on improving the phonological awareness and working memory (phonological discrimination, phonological memory, rhyming, and analysis of sounds in words and syllables). This module provided opportunity to these children to respond to and discriminate smaller units of speech (i.e., words and syllables) presented in progressively longer and faster sequences. The children's task was to respond, or say, a series of words and when they hear a word that is different from the rest of the sequence, they clap their hands. The level of difficulty was increased by (a) making the word series longer, (b) presenting the series at a faster rate, (c) discriminating sounds, and (d) holding information in working memory while simultaneously processing the information. This study was also made a clear sense for the effectiveness of PREP in remediating deficient reading skills related to during the elementary school years. The hypotheses taken for this study was supported by the previous studies which indicated that word decoding improved after completion of PREP. These results suggested that PREP is effective with elementary school students who have reading and decoding problems that are related to successive processing difficulties (Das, 2009; Hayward, Das, & Janzen, 2007; Keat, & Ismail, 2011).

Effect of Cognitive Remediation Programs in Improving Rapid Naming Reading Skill in Dyslexic Children

In the current study, the results evidenced that the COGENT had put positive impact on improving rapid naming reading skills of dyslexic children. Here, we can evaluate the pre-test (before intervention) and post-test (after intervention) results of CTOPP Rapid Naming (subtests of "Rapid Digit Naming", and "Rapid Letter Naming"). In all these above mentioned aspects of rapid naming reading skills, the dyslexic children showed better performance in post-test (after intervention) measures after receiving the cognitive remediation programs. These findings of this research were similar with the findings of previous researches (Das, 2009; Hayward, Das, & Janzen, 2007). The Module-5 (Shapes, Colours, and Letters) of COGENT focused on the rapid naming of shapes, colours, and letters. The children's task was to identify and name a series of shapes, colours, and letters. They completed a range of tasks with shapes first, followed by colours, coloured shapes, and finally with letters. This program enhanced the child's ability of rapid naming for their reading skill improvement. Naming speed is the foundation skill that is linked to learning of sound of words

and to translating spelling to speech (Kirby, Georgiou, Martinussen, & Parrila, 2010; Wolf & Bowers, 1999). In terms of PASS theory, this module enhanced the successive processing of dyslexic children. Window Sequencing of PREP focused on the successive processing. In the global part, the student is asked to represent a series of chips that vary in colour and shape, in the same order in which they are presented by the instructor. In the bridging part, he/she has to reproduce a series of letters in the same order in which they are presented to him and spell the word. Here, the student gets the chance for developing rapid naming of colours, and shapes.

Conclusion

Development of reading skills is dependent upon the language development of the child and proficiency in the skill is determined by the level of cognitive development attained by the child. Therefore, suitable cognitive remediation programs were implemented in the present study. As the reading disability imposes incalculable social and economic consequences upon the individual and the society for that amelioration of reading difficulties of children is considered imperative. After all, the ultimate goal of reading is to understand, enjoy, and learn from written text and this research study was an attempt in this direction which has both theoretical and practical implications.

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