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Effect of Visual-Perceptual Exercises Based on Frostig Model on Reading Improvement in Dyslexic Students

MINA GHAFARIAN SHAYESTEGI
MSc Psychology of Exceptional Children
University of Allameh Taba Tabaei, Tehran
Iran
Dr. HAMID ALIZADEH
Professor
University of Allameh Taba Tabaei, Tehran
Iran

Abstract:

In the present study, effect of visual-perceptual exercises based on Frostig model on reading improvement in dyslexic students was taken into account. Statistical population of this study involves dyslexic primary students in Tehran in 2011. According to population under consideration, available sampling method was used. A sample with size of 12 people from dyslexic students referred to Yousef Abad Special Learning Center who had highest standards in dyslexia and weakness in field of visual perception were selected based on visage test and Andre Rey's complex figures test. The findings of research suggests that visual-perceptual exercises based on the Frostig model have had maximum impact on reading words, words chain and minimum impact on calling image, letter sign, category mark and voices removal and no impact on comprehension of text

Key words: *visual-perceptual exercises, dyslexic students, Frostig Model*

Introduction

Reading disorder or dyslexia is an expression used to refer to those group of kids who are not able to read in spite of possessing normal intelligence and this group of kids may know most of words and be able to apply them easily but may not be able to understand and identify written or printed signs. Some kids can even read most of the words but do not understand their meanings [4]. According to a research, dyslexic kids exhibit disorders in the field of calling familiarity signs which are visually shown quickly such as objects, colors, numbers and letters [8]. In Gerd Shuttle's study (2010), it has stated that defects in visual perceptions because recognition rate of letters and numbers to visually become less so the speed of reading would reduce. In addition, most of dyslexic ones show binocular focus fixation instability especially on the left hemisphere; therefore, they have poor visual concentration and this causes them to see the letters they try to read indistinctly [10]. Researches have demonstrated that specific problems such as binocular focus convergence, impairment in the ability to follow and object path from left to right visually and poor fixity of eye sight in visual stabilization may lead to difficulties in the process of learning reading. Most of the studies carried out on kids suffering from dyslexia have identified a vast range of problems with visual attention in these people [5].

What causes the dyslexic readers to distinguish from ordinary readers is in the function of coarse cell path in V5 area. This region's activity is less in both of hemisphere in dyslexic people and this causes them to act worse in the assignments that need faster processing [22].

According to neuropsychological studies, dyslexic people exhibit symmetry in planum temporal and posterior regions of the brain more than ordinary readers. In addition, these people exhibit a kind of inverse asymmetry in the parietal - occipital region of the brain. There is the possibility that these findings

would imply a kind of reduction in normal left hemisphere superiority for processing verbal information in dyslexic people [12]. In some of the dyslexia cases that their origin is not probably phonological, vast visual impairments consisting of visual attention, visual memory and visual processing are effective [3]. For considering the listener more, a set of visual exercises were trained to primary students on the third grade and thus, what obtained from the results of this research suggested the effectiveness of training visual perception skills on dyslexic students' performance [1].

In addition, according to the cognitive support theory, the main cause of dyslexic kids' difficulty is that these kids are weak to shape the cognitive support in the assignments relying on a small series of successive stimuli. With regard to these findings, researches express that the direct training of visual perception skills, is a reassuring method in the improvement and progress of dyslexic students in reading function [8]. Some researchers believe that people's ability in the field of visual system would help the correct reading skill of dyslexic students [21]. Most of dyslexic people exhibit stabilized binocular focus especially on the left hemisphere, therefore, they possess a poor visual concentration. The dyslexic person's binocular focus instability and visual perception unsustainability cause them to see the words they want to read indistinctly [17]. Researches also indicate this point that reading correctly and fluently require a quick visual recognition and letters semantic interpretation and new words in consecutively fixing the eyes [3]. Researchers have proved that in response to the three visual, non-verbal (figures) stimuli, the dyslexic people's impairment begins from the last succession. In general, there is a correlation between the start and end of ordinary students' reaction to visual assignments. According to conducted researches, it can be said that the direct training of visual perception would probably lead to the improvement and progress in learning reading [12]. Since regarding several

theories suggesting that dyslexic kids have weakness in visual attention and visual processing, then we have to try to improve these kids' visual perception in order to make their reading progress better. Modern researches have indicated that dyslexic people who have performed remedial reading exercises along with emphasis on eye and hand corresponding exercises, their difficulty has been noticeably resolved [4]. Therefore, regarding previous researches, it seems necessary to study the visual perception skills in dyslexic kids along with a series of activities affecting the increase of visual perception abilities positively and if productive, these activities would be included in a restorative and modifying program [31].

One of the restorative visual perception program which have to be studied and if effective, it has to be provided to these students' teachers is Frostig visual-perceptual exercises, because in these exercises, Motor and ocular coordination abilities, image and background recognition, understanding the stability of figure, differentiation of the situation in space and understanding the spatial relationships would be improved and restored. And since these abilities are necessary to succeed at school and in performing them, organism activity is more complete and should be basically grown during the kid's first years of living, for this, so education and strengthening of these contexts are successful [2].

Therefore, provided that the education is effective in this context and the dyslexic students' performance can be increased by improving visual perception, dyslexic students could be substantially helped; because the reading disorder can affect other students' educational and social contexts. In this article, the main question is that whether Frostig's visual-perceptual exercises would affect these kid's reading function.

Method

This research is to implement quasi-experimental project with pretest-posttest without any group control. In this research, the subject was tested by visage test and Andre Rey test and also in the last session, these two tests were used again. The statistical population involves the dyslexic primary students in Tehran in 2012. The participants were referred to Yousef Abad Special Learning Center and were diagnosed as dyslexic by this center. Regarding the population under consideration, the available sampling method was used. A sample with the size of 12 people from dyslexic kids referred to the clinic were selected so that they possessed the most dyslexia standard and weakness in the field of visual perception based on visage test and Andre Rey's complex figures test.

Measures

In the present research, in order to study the visual perceptual problems, Andre Rey's complex figures test [13]was used. Andre Rey's test consists of 2 cards (A, B) that each card is selected separately and according to the occasion, then will be executed. In this research, card A was used; this card includes 18 perceptual components and is applied to individuals at age upper than 4. The effective efficiency of this card is for individuals at age upper than 7. “Visual perception is not a simple vector effect taken from an external phenomenon (Bahrami, 2003)”Andre Ray writes. The implementation of the test will be carried out after selecting each card on two occasions. On the first occasion, card A is put in a suitable direction in front of the subject and he/she is said to draw the same thing on a white paper without lines. On the second occasion and as the card has been taken away from him/her and three minutes passed, he/she is asked to draw the previous picture again carefully and by heart. The judgment on the

subject is made according to the comparison of his/her performance on each stage. Usually the first stage of drawing is counted as the subject's drawing growth potential and perceptual structuring and the second stage will indicate his/her performance level of visual memory with regard to the first stage's drawing quality and quantity. The implementation method of this test was conducted individually and using Andre Ray and Streat's instruction. Andre Ray arranged the figures on cards A and B in a way that would possibly lack emotional impacts and stimulate cognitive areas of the subject. The features of the figures are: their components being large or small, the position of the components in proportion to each other, the number of angles and their degrees, the fact of their being field or their distances from each other and the amount of their interference. Andre Ray's test (card A) used in this research has been brought up on the appendix. In this research, in order to consider the difficulties related to reading, visage test (Ahmad Panah, 2007) was used. Regarding the linguistic diversity in Iran [1], attempts in this research made to consider Farsi-speaking students as well as Azeri-speaking and Kurd-speaking students in this study, so that in addition to comparing the differences of the impact of different languages on learning Farsi-speaking (Persian-speaking), the reading and dyslexia test would also be prepared and standardized in the Azeri-speaking and Kurd-speaking regions. Different stages of edition and standardization were conducted over 5 years. The validity of this test is in a way that initial study were conducted on 300 people (100 Farsi-speaking people from Tehran, 100 Kurd-speaking students from Sanandaj and 100 Azeri-speaking students from Tabriz). The main execution of the test was conducted on 1614 people (770 male students and 844 female ones) in 5 grades and in Tehran, Sanandaj and Tabriz. After gathering data, raw scores and standard scores were measures for each grade in each city.

Training Package

1. **Reading words**: This consists of 3 listings containing 40 words. The subject should read these words with a correct pronunciation and quickly during 2 minutes.
2. **Words chain**: There are 3 or 4 meaningful words in each chain. The subject's assignment is to separate meaningful words by drawing a line. 2 minutes is the duration.
3. **Rhyme**: this subtest includes 20 words. There are 3 choices each with a rhyme for each word suggested that only one of them is true; and the examiner should choose the correct answer. The duration is 2 minutes.
4. **Calling the figures**: this subtest includes 2 paralleled cards containing figures so that each card has 20 figures and the subject should say their names loudly. The duration is 1 minute for each card.
5. **Text comprehension**: in the text comprehension subtest, a story is read so that the subject's assignment is to listen to it carefully and answer to the questions made by the examiner.
6. **Words comprehension**: this test includes 30 words in which there is a multiple-choice question suggested for each concept, definition or the use of each word. The duration of the subtest is also recorded.
7. **Voices removal**: this test includes 30 words which is read one by one by the examiner. Then the subject is asked to read each word loudly after the examiner and immediately with removing the desired voice.
8. **Reading unfamiliar words**: in this subtest, the subject should read 40 words (meaningless) correctly, carefully and quickly. The duration of this test is 2 minutes.
9. **Letters signs**: this subtest includes three letters from Persian alphabets (M, A, N); they are shown to the subject and while they are being read loudly, the subject is asked to

remember as many words as they can starting with these letters. The total duration of this subtest is 3 minutes.

10. **Category signs**: this test includes 6 categories (girls' names, boys' names, organs names, fruits, colors, kitchen utensils). The manner of conducting this test is similar to letters signs. The test is separately offered to the subject and the given time is 1 minute for each category and he/she is asked to remember as many words connected with the category as they can and say them. The duration of this test is one minute for each category and 6 minutes altogether.

After conducting these subtests, the answer sheets are checked and correct answers in each subtest are specified and his/her raw score is measured. Raw scores are written down in the answer sheet as well as the subject's summarized reading status sheet in front of each subtest. The balanced scores are measured by referring to the related table of each subtest in each grade and the subject's profile in reading test is drawn and finally results are interpreted and its scores recorded.

Procedure

10 sessions of boosting visual perception programme is conducted based on Marian Frostig's theory extracted from Tabrizi's book so that it is practiced for one 30-minute session every week.

Findings

Table 1: Descriptive statistics related to the reading components scores

Statistical indicator		number	Mean	SD	Average standard error
Reading words	Pre-test	12	48.33	27.75	8.01
	Post-test	12	73.92	27.05	7.81
Words chain	Pre-test	12	18.92	12.69	3.66
	Post-test	12	34.58	12.27	3.54

Rhyme	Pre-test	12	5.83	1.11	0.32
	Post-test	12	10.17	1.95	0.56
Calling the figures	Pre-test	12	34.33	4.21	1.21
	Post-test	12	38.00	1.13	0.33
Text comprehension	Pre-test	12	12.00	3.62	1.04
	Post-test	12	14.25	3.89	1.12
Words	Pre-test	12	12.50	4.81	1.39
comprehension	Post-test	12	21.33	4.96	1.43
Voices removal	Pre-test	12	7.75	4.07	1.18
	Post-test	12	12.75	3.19	0.92
Reading unfamiliar	Pre-test	12	16.08	10.54	3.04
words	Post-test	12	23.42	9.70	2.80
Letters signs	Pre-test	12	11.92	4.48	1.29
	Post-test	12	18.25	5.41	1.56
Category signs	Pre-test	12	48.92	11.44	3.30
	Post-test	12	61.75	13.47	3.89

As it is deduced from table-2, the average of scores of the post-test is more than the average of the pre-test in terms of reading words, Words chain, rhyme, calling the figure, text comprehension, words comprehension, voices removal, reading unfamiliar words, letters signs and category signs components. Now, we continue to consider the significance of this difference.

Table 2. Results of the correlated t-test, average scores of the reading components

Variable	Mean discrepancy	SD	T	df	Sig.
Reading words	-25.58	9.00	-9.84	11	0.0001
Words chain	-15.66	5.25	-10.34	11	0.0001
Rhyme	-4.33	2.06	-7.28	11	0.0001
Calling the figures	-3.66	3.70	-3.43	11	0.006
Text comprehension	-2.25	3.84	-2.02	11	0.067
Words comprehension	-8.83	3.95	-7.74	11	0.0001
Voices removal	-5.00	2.92	-5.92	11	0.0001
Reading unfamiliar words	-7.33	3.37	-7.54	11	0.0001
Letters signs	-6.33	4.70	-4.67	11	0.0001
Category signs	-12.83	9.64	-4.70	11	0.0001

As the results of correlated t-test demonstrates, since the obtained absolute value of t in the reading words, Words chain, rhyme, calling the figure, text comprehension, words comprehension, voices removal, reading unfamiliar words, letters signs and category signs components with the degree of

freedom 11 is greater than the critical value of t and also because their obtained significance level is less than criterion significance level (0.01), therefore, with 99% of certainty, it could be said that the observed difference between pre-test scores and post-test scores is significant. Thus, the research hypothesis concerning the impact of visual-perceptual exercises based on Frostig's model on reading words, Words chain, rhyme, calling the figure, text comprehension, words comprehension, voices removal, reading unfamiliar words, letters signs and category signs components and null assumption is rejected. It is also needed to mention that the obtained value of t in the text comprehension component is smaller than the critical amount of t and according to the obtained significance level (0.067) which is smaller than the criterion significance level (0.05), it could be concluded that there is no significant difference between pre-test scores and post-test scores of the text comprehension component.

Table 3. Descriptive statistics and results of the correlated t-test, average scores on perception and memory

Variable / Statistical indicator		Number	Mean	SD	Average error	standard	T	Sig.
Perception	Pre-test	12	17.50	8.61	2.48		-3.84	0.0001
	Post-test	12	22.58	7.75	2.24			
Memory	Pre-test	12	5.33	2.39	0.69		-6.41	0.0001
	Post-test	12	9.50	3.15	0.91			

As it is deduced from table-2, average of scores of post-test in perception and memory variables is greater than their average scores of pre-test. Now, we continue to consider the significance of this difference. As the results of correlated t-test demonstrates, since obtained absolute value of t in perception and memory variables and with the degree of freedom 11 is

greater than the critical value of t and also because their obtained significance level is less than criterion significance level (0.01), therefore, with 99% of certainty, it could be said that observed difference between pre-test scores and post-test scores is significant.

Discussion and conclusion

Hypothesis: training of Frostig's visual-perceptual exercises has an influence on reading component improvement in dyslexic kids. For this purpose, with regard to results of correlated t-test and its significance value which is less than 0.05, it could be said that visual-perceptual exercises based on Frostig's model has an influence on reading components. In addition, results of this research is consistent with researches stating that visual-perceptual exercises increase visual perception quickly and changes in speed of perception cause reading ability to increase [12]. The results of this hypothesis is different from studies carried out by [12,10,9] and its reason is that children with learning disorder possess severe fluctuations in their abilities profile and their perceptual abilities cannot only represent their total ability indicator. The results of researches by Karlo and showed that dyslexic people who suffer from more sever visual impairments are not able to distinguish among letters, words or figures or transcribe words or find out differences between figures. Amiti and colleagues (2002) proved that those two groups who had difficulty in reading gained lower scores on the scales of recalling memory and suffered more from memory difficulties[3]. Denkla and Radol (2008) concluded that motion-visual combinative tests in most cases would provide us with a little information about etiology of reading inabilities [8]. In brief, in conducted studies in which weak and ordinary readers were compared with each other, when impact of verbal coding had been controlled, differences were found in assessment of visual processing abilities among

these groups. Zigler (2005) discovered that even so visual processing has a unique variance in predicting reading skills in weak readers [31], value of this variance is relatively low in comparison with variance that phonological skills measurements present. In English, special linguistic and cognitive abilities including phonological awareness, naming quickly, visual processing and phonological memory have been associated with words recognition and comprehension skills. Denkla and Radol (2008) have reported that dynamic visual processing is connected with dictation abilities [8]. Similarly, Hawkla and colleagues (2006) found out that individuals with a good visual time processing were weaker in comparison with their peer colleagues and better in terms of spelling, but it was not same in terms of decoding words [12]. Prado argued that only auditory shortages bring upon reading impairments; visual deficit is only as another reflection of a total ordinal processing without having a direct influence on reading function. Owing to visual sensory and general auditory deficits which affect reading skill through verbal comprehension impairment and phonological awareness deficit impairment, visual and auditory deficits happen to people suffering from dyslexia who also possess phonological comprehension impairments. Therefore, these visual ordinal processing impairment can specifically clarify a subset of dyslexic kids who have connected phonological comprehension difficulty. Karlo and colleagues proved that ordinal processing impairment can be evident providing that intervals would reach from 10 milliseconds to 100 milliseconds; that this interval is longer than interval is ordinarily used in fast time processing studies. In absence of chain processing difficulties, deficits have hardly ever been reported. Despite this fact, Amiti (2002) reported that dyslexic kids who had difficulties in matching skill when 2 digits were shown simultaneously for 200 milliseconds[3]; however, when two digits were shown consecutively and in an ordinal way, performance of these people were as good as witness group

peers in terms of age. Denkla and Radol (2008), along with previous findings [8], proved that selective ordinal processing disorder exists in dyslexic people who suffer from phonological comprehension problems. According to research conducted by Boss and colleagues (2007), multi-element processing disorder indicates a deficit in allocating attention to a range of symbols or letters, so that number of elements which can be processed in a parallel form while reading would be limited. In accordance with multi-way model, reading memory of link-oriented ones in this disorder would be interpreted as reduction of scope of visual attention range. Range of visual attention for number of visual elements are separated that they can be processed simultaneously in a multi-element combination. In addition, results of this research is similar to studies carried out by [12, 9, 22, 31, and 8]. because in this method, student can provide him/herself with effective framework for learning more through making connection between perceptual information and motion ones and extending them to their surrounding environment. These exercises would facilitate kid's mental growth through boosting visual-perceptual learnings and perceptual-motion link and prepare him/her for greater mental activities; they would also result in growth of learning skills and success at school and creation of abstract thought. On other hand, impact of visual-perceptual exercises based on Frostig model on reading words, Words chain, rhyme, calling figure, text comprehension, words comprehension, voices removal, reading unfamiliar words, letters signs and category signs components were taken into account. Consideration of results indicates that visual-perceptual exercises based on Frostig model has had maximum impact on reading words, Words chain, rhyme, reading unfamiliar words and minimum impact on calling figure, voices removal, letters signs, category signs and rhyme and has no impact on text comprehension, and since impacts of visual perception exercises on reading words, words chain have been equal in all of kids, then it could be concluded that

improvement of these components have been directly under influence of these exercises, but it has observed in a few kids in cases related to calling figure, category sign, letter sign and voices removal. Therefore, it could be said that underlying factors such as motivation, anxiety and concentration may be influential. In this research, Frostig's visual-perceptual exercises had no impact on text comprehension because Frostig's exercises are in form of visual ones so they can improve mostly reading mechanism which is controlled by left hemisphere. Thus, it is certain that it would have no impact on text comprehension which is controlled by right hemisphere. Therefore, it is better to use other exercises that would increase comprehension in order to increase reading comprehension and use Frostig's visual-perceptual exercises to improve reading as well as writing, dictation and handwriting. The results of this study are similar to ones carried out by Meg [31,3,8,13,7]. Neurophysiological studies demonstrate that there is a relationship between developmental dyslexia and delay of left hemisphere in language processing [20]. Dyslexic people would probably exhibit symmetry more than ordinary readers on plenum temporal [31,20] and on posterior regions of brain, across posterior tip [8]. In addition, it is probable that these people would exhibit a kind of inverse asymmetry in parietal occipital region [17]. In addition, it is possible that these findings imply a kind reduction in normal superiority of left hemisphere in verbal information processing in dyslexic people. In noted researches, since in this study, we are faced with an increase in dyslexic students' scores with regard to table 4 and 5 in Andre Ray's visual perception test, then it could be concluded that visual perception as well as visual processing have been improved in these kids through visual-perceptual exercises based on Frostig model; and since big regions of cell and temporal region are involved in visual processing according to previous researches and also noted regions play a role in dyslexia, then we are faced with an increase in visual

processing and dyslexic students boosting their reading through stimulation and growth of big regions of cell and temporal regions using visual-perceptual exercises based on Frostig model. According to findings of this research it could be stated that Frostig's exercises can be recommended to therapists in an extended level as new methods so as to have developmental dyslexic students' reading performance increased.

RESOURCES

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