

Original Articles

## The efficacy of occupational therapy intervention in visual-spatial and visual Analysis skills development among children with learning disorders.

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**Objectives:** The visual-motor skill is one of the major factors in the learning process. Visual-spatial and visual analysis skills are components of the visual motor skill. Any deficiency in Visual - Motor skills and their components often causes problem in writing and learning processes in children. The aim of this study was to investigate the effect of occupational therapy (O.T.) intervention on visual-spatial and visual analysis skills in children with L.D.

**Method:** Fifty-eight children with learning disorder (L.D.) from “Learning Disorders Centers “in Tehran were assessed in this study. Out of them, 23 children were selected. They were in second, third and fourth standard classes. They had normal I.Q and no visual or auditory problem .All of the children took the “Test of Visual Motor Skills- Revised “(TVMS-R). They were divided into two groups: 11 in experimental group and 12 in control group. O.T interventions were performed for 16 sessions in the experimental group and finally all of the children were assessed with TVMS-R again. TVMS-R includes 8 categories and is designed based on copying some geometric figures. This test was standardized in Exceptional Children Institute, Tehran in 2002.

**Results:** There was no significant difference of means between the pretest and the post test in the control group ( $P=0.10$ ), but there was a significant difference of means in the experimental group based on paired t-test ( $P=0.000$ )

**Conclusion:** Results showed that the O.T. intervention had a statistically meaningful effect on visual-spatial and visual analysis skills in children with L.D.

**Key words:** O.T intervention, Visual-Spatial skill, Visual analysis skill, Children with learning disorder.

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### Introduction:

Although children with learning disability have normal I.Q, they face learning problems. They are diagnosed as L.D while they are below in the expected level based on standard tests in reading, mathematics and writing. The children have lots of problems in reading and writing and they are usually diagnosed too late. Emotional conditions

in adults and youth are related to study problems at school .The level of escaping from the school in L.D children is 1.5 times the average level (1). The visual motor skill is an important subset of visual perception and help the child to copy a figure or rebuild some symbols. Weil and Cunningham Amundson (2) stated that there is a meaningful relationship between visual motor

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skill and hand writing. They maintain that along with increasing the ability of copying a figure, the child will be able to copy the words. Visual motor skills are made up of components as follows:

Visual-spatial skills.

Visual analysis skills.

Visual fixation

Visual-motor integration

Visual-spatial skills and visual analysis skills are emphasized in this study. It allows the child to have a good relationship with the environment and causes appropriate judgment about objects and body positions.

The visual-spatial skill is important due to a closed relationship between this skill and motor coordination development, balance and directionality during reading and writing. The visual – spatial skill can improve the child's ability in mathematics and geometry (3).

Visual analysis consists of identification of whole and main factor of everything. It does not give any attention to details. This skill starts from six month of age. Word identification is based on the visual analysis skill. This skill is important for the development of mathematical concepts in childhood. Obigut JE., Hansen (4) stated that visual identification is part of visual perception and it is related to the initial stage of reading (5 & 6). Weil & Amundson (2) mentioned that any deficiency in visual analysis skill can cause deficiency in word writing. Corbin (7) described any problem in directionality and other specific points related to word spatial situation can be due to deficiency in visual spatial skills. A child with deficiency in the visual –spatial skill has problem reading maps, tables, and figures (5). Birch stated that Children with reading disabilities have some problem in their visual – perception skills. (8).

Identification of the visual-motor disorder and its components in children with L.D. and O.T.

intervention to increase the level of this skill, can improve reading and writing skills in this group of children. Some of the problems are as follows:

-The child faces problem while copying from blackboard.

- The child performs writing and drawing skills messy and fitfully.

-The child is weak in spatial skills and is not able to keep a line in reading and writing.

-The child is usually successful in oral exams but has problem in objective exam.

- As the child cannot write numbers vertically, S/he face, problem in mathematics.

Visual-motor skills and its components are assessed by drawing and eye-hand coordination. The Test of Visual-Motor Skill-Revised (TVMS-R) is a test for the assessment of this skill (9).

This test evaluates visual-motor skills and its components by copying some geometric figures. The visual-motor skill is not emphasized by therapists and clinical psychologists but the focus is mostly on visual perception in children with L.D. There was no investigation in the area of visual – motor skill and its components. The aim of this study was to investigate the effect of occupational therapy intervention on visual – spatial and visual analysis skills in children with LD in the primary school level.

#### **Method:**

The study was an interventional investigation and the subjects were from the L.D center, Tehran. In the first stage, 58 students who were referred to the center within the last two weeks were assessed. Twenty - three children from second, third and fourth standard classes were selected. The children did not receive any rehabilitation intervention and had only the educational program. There were no problems in their visual and auditory systems. They were normal in IQ, based on Wechsler Intelligence Scale. The children from the first standard class were omitted because a normal child may show some characteristics similar to L.D children such as mirror writing or palingraphia and problems in directionality. Hence, diagnosis of L.D in the first standard might not be correct but from the second standard is usually correct.

All children were assessed by the Test of Visual – Motor Skill-Revised (TVMS -R). The children,

who got 7 or less than 7 marks from each of eight classifications of the test, were included for the study. All of them divided in two groups through Randomization Block Method, 11 in experimental and 12 in the control group.

**Tools:** TVMS-R was used as the pretest and the posttest. This test was revised by Morisson F. Gardner (9) and standardized at Research Institute of Exceptional Children 'Tehran by Farahbod and Minaei in 2002. The test included 23 designs. Each design is on a separate page and the child should copy them in the correct order. There were eight classifications and each classification has special characteristics. The classification numbers 1, 3, 4, 6 and 8 evaluate the visual analysis skill and the classification numbers 2, 5 and 7 evaluate the visual-spatial skill. Mark is given based on mistake in copying of 23 designs on characteristics of eight classifications as follows:

1. Closure,
2. Angles,
3. Intersecting or overlapping individual lines,
4. Size of design,
5. Rotation or reversal (design or part of design),
6. Line length,
7. Overpenetration, underpenetration,
8. Modification of design,

The Experimental group received occupational therapy intervention for eight weeks, two sessions in a week and one hour per session. Both groups had educational intervention in L.D center. Visual-spatial intervention took half an hour and visual analysis program took half an hour as well. Occupational therapy interventions related to visual-spatial skills were as follows:

- Directionality education, at first on own body and then in environment.
- Understanding the relationship between objects in space.
- Drawing lines on a paper or a board. The child follows the lines and directions as streets with the help of fingers.
- To understand a position in space, hread the beads in a special order for example yellow, blue, red or circle, quadrangle, ellipse...
- The child made a shape from a sample with help

of cubes. Sound a frosting sample from different shapes, reading the words in different orders; right to left, left to right, up to down, down to up. Occupational therapy intervention related to visual analysis included:

- Figure fixation: The child must find a figure the same as the sample figure if we rotate or change the size of it.
- Figure-ground discrimination: The Child discriminates overlapping figures.
- Finding differences between the same pictures.
- Visual closure.

### Results:

In the study, sex, standard class, hand dominancy and period of educational intervention received by subjects acted as demographic variables. 33% of children were girls and 67% of them were boys, mean age in the experimental group was 110 month and in the control group, 110.5 months. Statistical analysis of Findings showed that there were no significant differences of means in demographic variables between the two groups. As table 1 shows, there was no significant difference of means in visual-spatial skills between two groups at pretest but there was a significant difference of means between the two groups on the post-test. Paired t-test showed that there was no significant difference of means in the control group between the pretest and the posttest ( $P= 0/475$ ). But there was a significant difference of means in the experimental group between the pretest and the post test ( $p=0.000$ )

**Table 1 :** comparison of means in visual-spatial skills between two groups at pretest and posttest

Group	Number	Pre Test		Post Test		P-Value
		-SD	×	-SD	×	
Experimental	11	13.84	282.27	16.50	314.54	P=0.000
control	12	16.65	270.00	16.71	275.41	P=0.475
P-Value	23	P=0.06		P=0.000		

Table 2 shows that there was no significant difference of means in visual analysis between two groups on the pretest but there was a significant difference of means between the two groups on the posttest. Paired t-test showed that there was no significant difference of means in

the control group between the pretest and the posttest ( $P=0.331$ ), but there was a significant difference of means in the experimental group between the pretest and the posttest ( $P=0.005$ ).

**Table 2:** Comparison of means in visual analysis skills between two groups at pretest and posttest

Group	Number	Pre Test		Post Test		P-Value
		-SD	-X	-SD	-X	
Experimental	11	38.73	28.32	504.55	458.63	$P=0.005$
control	12	24.66	36.33	447.08	434.16	$P=0.331$
P-Value	23	$P=0.082$		$P=0.000$		

Table 3 shows that there was no significant difference of means in the total score between the experimental and the control groups on the pretest, but the difference was significant in the posttest. Paired t-test shows that there was no significant difference of means in the control group between the pretest and the posttest ( $P=0.4$ ), but there was significant difference of means in the experimental group between the pretest and the posttest ( $P=0.000$ ). Hence, occupational therapy intervention improves visual – motor skills and their items (visual analysis and visual - spatial skills).

**Table 3:** Comparison of means of the total score in TVMS-R

Group	Number	Pre Test		Post Test		P-Value
		-SD	-X	-SD	-X	
Experimental	11	10.55	86.45	6.90	105.09	$P=0.000$
control	12	4.99	80.00	9.94	82.33	$P=0.4$
P-Value	23	$P=0.07$		$P=0.000$		

### Discussion:

The following investigations have been performed in the area of visual motor skills: Morency & Wepman (1973) stated that the child's ability in the information processing of visual motor skills is one of the main factors for the estimation of reading to enter the primary school. (Case Smith, 2001)

Myklebust (10) mentioned that inability in writing is associated with a problem in visual motor skills.

Weil & Amundson (2), in their investigations, emphasized the importance of visual analysis and visual discrimination in different aspects of the learning process. Levin (7) Brown (11) also discussed the importance of visual-spatial skills in the learning process especially mathematics learning(12).

It is found in this study that occupational therapy intervention has a positive effect on visual motor skills and their components in children with L.D. Parietal cortex located between tactile and visual cortex is an important part of spatial perception (13). It seems occupational therapy intervention influences this part of C.N.S.

Danker (14) performed a study on children in the first and second standard classes and concluded that children showed considerable promotion in visual-spatial skills after an educational program. we know that signals from primary visual cortex (17 Brodman area) make a synapsis in secondary visual cortex ( 18, 19 , Brodman area)and then pass the mid - temporal area, and finally through ascending pathway, to the post parietal area (13; 15). It seems occupational therapy intervention influences these pathways. Studies performed by Brown and Alford (11) showed that visual analysis progressed in children with L.D.

In the study performed by Dankert, Davis and Gavin (14) observed that O.T intervention could promote visual-motor skills in preschool children with a developmental delay. Heat , Hansen and Solan (16) in a study on Spanish children at preschool, the first and second standard classes showed that vision Therapy causes progression in visual-motor skills. Siner and Solan(16) found that visual exercise causes promotion in reading and skills in mentally retarded children at first and second standard classes.

### Conclusion:

Standard marks of level 2,5,7 and total scores showed that occupational therapy intervention had a significant effect on visual-spatial skills in

this study and standard marks of 1st,3rd,4th,6th and 8th, and total scores also showed that there was a progression on visual analysis skills after occupational therapy intervention.

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