Relationship between visual- motor perception and cognitive abilities of children with learning disorders

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Abstract

This study determined the relationship between visual- motor perception and cognitive abilities of children with learning disorders in Ahvaz. The study population consists of a group of elementary school students with learning disorders who were receiving educational services from exceptional children learning centers in Ahvaz. Using random sampling, overall 58 students studying in grades 1 to 5 were selected as the study sample. Wechsler intelligence scale for children- revised version (WISC-R) was used to gather the data on the children’s cognitive abilities and the Bender Gestalt test, with Koppitz scoring method, was used to measure their visual-movement abilities. Descriptive statistical methods, i.e. pearson correlations and Regression, were used to analyze and interpret the data. Findings revealed that: There is a negative significant relationship between visual-Motor perception errors and function in Arithmetic, Picture completion, Picture arrangement, Block design, Object assembly, Mazes and Wisc-r subscales. There is a positive significant relationship between visual- motor perception Quotient and WISC-R non-verbal IQ.

Keywords: learning disorders, visual- motor perception, cognitive abilities

Introduction

Rapid increasing of number of individuals with learning disorders has placed this disorder among most prevalent known disorders. Prevalence of this disorder is more than 10 percent in general population (Namersi, 2001) and about 23 percent in school-age children (McColin, 2010). It seems that this disorder has lifelong effects for person that is beyond reading, writing and mathematical problems and includes domains such as mental health, inter-individual contacts (Shahim, 2003), social and individual success (Mister et al, 2001), further educational (Kartlone and Wakenshaw, 1991), employment and job seeking, etc. given to importance of diagnosis of learning disorders in preventing negative consequences of this disorder and following consideration of different types of learning disorder symptoms, one of the most diagnosis indicators of this disorder is fluctuations of cognitive abilities (Anjiuli and sigel, 2003). Researches has indicated that function of individual with learning disorder in subtests of revised Wexler intelligence scale for kids (WISK-R) doesn't have consistency but there is significant difference between individual function in various subtests of WIKS-R (Grasmarnat, 1997, Anjiuli and sigel, 2003).

Some experts outline deficiency in development of basic psychological processes such as memory, language, thinking, cognition and visuomotor coordination as main cause of learning disorders (Kakavand, 2006). Visuomotor perception is one of basic psychological processes which have an important role in other mental functions of person.

Barnhardet et al (2005) found through comparing two groups of children with deficiencies in visuomotor combination and normal children that children with deficiencies in visuomotor deficiencies have poor function in order of numbers, organizing mathematical problems and spatial imagination of letters and words and totally they concluded that visuomotor skills is effective in mathematical and writing function of children. Also Kalp et al (2004) outlined visual perception skills including visual recognition and visual memory as a significant predictor...
for mathematical skills. Kupitz (1969) in a research on children with learning disorders found out that Bender scores obtained in second grade of primary school is correlated with success in mathematics and reading and this correlation was -0.75 that has a good consistency with findings of previous studies in context of relation between mathematical subtest in WISK scale (quoted by Baradari, 2011).

Also Kupitz research (1969) indicated that among 30 individual items of Bender test, 22 items have high correlation with reading and mathematical skills. Also it was shown that total score of Bender test compared to individual scores have highest relation with success in mathematics and readings, particularly mathematics. More recent studies with qualitative assessment of Bender errors approve this relation (Chan, 2000). Research of Ozkab et al (2009) indicated through evaluating visuomotor perception of children with developed phonological disorders and mathematics that children with this disorder compared to children without this disorder had significantly more errors in Gestalt test. This research indicated that whenever one of cognitive processes such as language in children has a problem there is probably more perceptual errors. On the other hand existence of determined relation between visual perception and success in lessons such as mathematics and reading and writing indicates relation between visual perception skill and basic cognitive abilities that are necessary for learning educational skills. So if a child has deficiency in visual perception, because of its relation with cognitive skills, he may be a candidate for deficiency in learning abovementioned lessons.

In a research by Diblasi (2007), high correlation between cognitive skills and child function in practical subscales of Wechsler scale with spatial subtests of visual perception test. Deker, Alen and Choca (2006) indicated that copy score in Gestalt test is predictor for visuospatial perception and perceptual organization in WISK-R.

**Materials and Methods**

**Research objective**

Given to importance of finding effective factors in cognitive functions, in order for diagnosis and rehabilitation of children with learning disorders, main objective of research is determining relation between visuomotor perception as a basic psychological processes and cognitive function of children with learning disorders. Specific objective of this research is determining relation between error in visuomotor perception subscales of Gestalt test and cognitive function of testees with learning disorder in WISK-R scale.

**Research hypothesis**

1. There is significant relation between having visuomotor perception error and performance in WISK-R subtests.
2. There is significant relation between visuomotor perception skills and intelligence quotient of children with learning disorders in WISK-R.

**Research method**: present research is a correlation research.

A) Statistical universe and sampling method:

Statistical universe of this research includes all children of primary school with learning disorder that receive services in educational and rehabilitation centers of learning deficiencies in Ahvaz. Among all this individuals, 58 male and female students in fifth grade of primary school were chosen through simple random sampling.

B) Research tools:

1. Revised Wechsler intelligence scale for kids (WISK-R). Wechsler intelligence scale for kids (1049) was revised 25 years after design by Wechsler and after standardization was named revised Wechsler intelligence scale for kids (WISK-R) (shahim, 1992). This scale was translated and adapted by Shahim in 1984 for evaluating intelligence of 6- to 13-year-old children and was standardized using a 1400 individual sample. Retest validity of test was 0.44 to 0.9d (median 0.73) and descriptive terminal was 0.42 to 0.98 (median 0.69). Concurrent reliability of that through using correlation of scores with scores of practical section of Wechsler scale for preschool children was 0.74. Correlation coefficients of vocal, practical and total intelligence quotient were 0.84, 0.76 and 0.80, respectively (Shahim 2006 quoted by Shahim and Haroon Rashidi, 2006). This test is used for evaluating cognitive skills of children.

2. Gestalt visuomotor perception test: this test that includes 9 distinct patterns was designed by Lurta Bender in 1938 for evaluating development of motor perception level of kids. In present research for evaluating development of children in visuomotor skills, Gestalt test with Kupitz scoring was used. In Kupitz
scoring each error is given one score. Number of errors that receive score is 30 that is categorized based on quality in 4 types of errors including deviation, incorrect combination of details, continuity and rotation. Based on total number of errors, visuomotor perception of child is determined. Validity coefficient of this test with retest method ranges from 0.81 to 0.96 based on age level (Baraheni et al, 1992).

**Method of data gathering:**
Among all children that received services in learning disorder centers of Ahvaz, 58 male and female students with learning disorder were chosen randomly as sample and WISK-R and gestalt visuomotor perception test was executed individually. For executing test, four examiners were used. Executing and scoring of test for each testee last 2 45-minute meeting.

**Statistical analysis method:** for analyzing data Pearson correlation coefficient method and linear regression was used.

### Results

For considering first hypothesis, correlation coefficient and regression of predictive variables were calculated. According to findings provided in table 1, there is significant negative relation between making visuomotor perception errors and function of children with learning disorder in subtests including information, mathematics, vocabulary, perception, number memory, picture completion, picture order, cubes design and mazes in 0.01 significance level and similarities in 0.05 significance level but there isn't significant relation between making perception errors and function of children with learning disorder in decoding subtest.

Results about degree of predictability of making perception errors for function in WISK-R scale subtest through regression test indicated that highest level of predictability of cognitive performance in WISK-R scale is in mathematical subtest with predictability about 39% of variance. According to determined variance and based on obtained beta, predictability of cognitive performance in WISK-R scale is significant in subscales including picture completion, picture order, number memory, cube design, information, vocabulary, mazes, perception and similarities by committing sum of errors. The only subtest that doesn't have significant predictability capacity by committing various perception errors is decoding subtest.

### Table 1. correlation coefficient and regression analysis of making perception mistake and cognitive function of testees

<table>
<thead>
<tr>
<th>T</th>
<th>Beta</th>
<th>F</th>
<th>Determinant coefficient</th>
<th>Significance level</th>
<th>Correlation coefficient</th>
<th>variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.741</td>
<td>-0.447</td>
<td>13.997</td>
<td>0.200</td>
<td>0</td>
<td>-0.447**</td>
<td>information</td>
</tr>
<tr>
<td>-2.612</td>
<td>0.330</td>
<td>6.823</td>
<td>0.109</td>
<td>0.012</td>
<td>-0.330*</td>
<td>similarities</td>
</tr>
<tr>
<td>5.931</td>
<td>0.621</td>
<td>35.176</td>
<td>0.386</td>
<td>0</td>
<td>-0.621**</td>
<td>mathematics</td>
</tr>
<tr>
<td>3.656</td>
<td>0.439</td>
<td>13.367</td>
<td>0.193</td>
<td>0.001</td>
<td>-0.439**</td>
<td>vocabularies</td>
</tr>
<tr>
<td>2.751</td>
<td>0.345</td>
<td>7.569</td>
<td>0.119</td>
<td>0.008</td>
<td>-0.345**</td>
<td>perception</td>
</tr>
<tr>
<td>4.103</td>
<td>0.481</td>
<td>16.836</td>
<td>0.231</td>
<td>0</td>
<td>-0.481**</td>
<td>memory</td>
</tr>
<tr>
<td>4.329</td>
<td>0.501</td>
<td>18.741</td>
<td>0.251</td>
<td>0</td>
<td>-0.501**</td>
<td>Picture completion</td>
</tr>
<tr>
<td>4.180</td>
<td>0.488</td>
<td>17.473</td>
<td>0.238</td>
<td>0</td>
<td>-0.488**</td>
<td>Picture order</td>
</tr>
<tr>
<td>3.993</td>
<td>0.471</td>
<td>15.942</td>
<td>0.222</td>
<td>0</td>
<td>-0.471**</td>
<td>Cube design</td>
</tr>
<tr>
<td>2.819</td>
<td>0.352</td>
<td>7.946</td>
<td>0.124</td>
<td>0.007</td>
<td>-0.352**</td>
<td>Item adjustment</td>
</tr>
<tr>
<td>1.878</td>
<td>0.243</td>
<td>3.527</td>
<td>0.059</td>
<td>0.066</td>
<td>-0.243</td>
<td>decoding</td>
</tr>
<tr>
<td>3.048</td>
<td>0.377</td>
<td>9.292</td>
<td>0.142</td>
<td>0.004</td>
<td>-0.377**</td>
<td>maze</td>
</tr>
</tbody>
</table>

Considering second hypothesis indicates significant relation between visuomotor perception skill and intelligence quotient of children with learning disorder in WISK-R scale. There is positive significant relation between this two in 0.05 significance level. Also according to results indicated in table 2, there isn’t significant relation between visuomotor perception skill and vocal intelligence quotient and total intelligence quotient of children with learning disorder.

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Table 2. correlation coefficient between visuomotor perception skill and WISK-R intelligence quotient

<table>
<thead>
<tr>
<th>Significance level</th>
<th>Correlation coefficient</th>
<th>WISK-R intelligence quotient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0.265</td>
<td>Verbal quotient</td>
</tr>
<tr>
<td>0.049</td>
<td>0.378</td>
<td>Non-verbal quotient</td>
</tr>
<tr>
<td>0.30</td>
<td>0.182</td>
<td>Total quotient</td>
</tr>
</tbody>
</table>

Discussion

Present research was executed for determining relation between visuomotor perception and cognitive skills of children with learning disorders. Data analysis indicated that some perceptual errors have higher qualitative and quantitative correlation with cognitive function of children with learning disorder in Wechsler subtests. Negative significant correlation between sum of visuomotor error commitment and subtests including information, mathematics, vocabulary, number memory, picture completion, picture order, cube design and mazes in 0.01 significance level and similarity subtest in 0.05 significance level indicates that performance quality in Gastalt test is correlated with performance skill in abovementioned subtests. As individuals commit more perception errors, they will have poorer function in abovementioned subtests. According to Wechsler definition, subtests including picture completion, picture order, and cube design are factor of perceptual organization in WISK-R scale and based on Banatine definition, subtests including block adjustment, cubes, and picture completion are spatial factor of this scale (quoted by Kartini and Marly, 2004, Monte et al, 1997, Nately 1984). Since factor approach is base on this finding that each factor, compared to total subtests, provides purer indicator of abovementioned abilities and given to correlation significance and predictability level (regression), children function in WISK-R above-mentioned subtest through committing visuomotor perception errors, can consider visuomotor perception as an important role player in development of cognitive objectives related to subtests. Because perception skills that are evaluated practically have correlation not only with nonverbal subtests of WISK-R scale but also with all subtests that measure cognitive functions verbally. So it seems that consistent to findings of Decker, Allen and Choka (2006), domains including motor perception, visual perception and integration of this two domain are important in development of mental structures of children. Other finding of present research that consistent with motor perception theories of Copart, Gotman and Berch approves motor learning as learning offspring is existence of highest significance correlation level between visuomotor perception and mathemathic subtest. This relation is important because in present research, based on instruction, in mathematic subtest, child should hear problems and solve them mentally and verbally and response verbally and so existence of high correlation in this task that is executed without using motor and visual skills can approve that advanced mental processes are created after appropriate development of motor system and perception system as well as relations between perceptual and motor learning (Richmond, 2010) according to this finding, consistent with Kupitz researches (as quoted by Baradari 2011), Barnhardt et al (2005) and Kalp et al (2004) motor learning and visuomotor perception can have an important role in development of mathematical concepts. This finding is useful in preventing, treating and rehabilitating of mathematical learning disorders.

Also lack of significant relation between sums of visuomotor perception errors with decoding subtest, given to objectives of this subtest, can indicate type of cognitive task of decoding subtest. Because decoding needs visuomotor perception that includes visual association, visual perception, visuomotor coordination and visuomotor integration (mahmood aliloo, 1993) as well as dexterity and mental flexibility in changing symbols. On the other hand, significant relation between visuomotor perception function and maze subtest as a timer test needs dexterity, eye-hand coordination and writing skills, requires lack of significant relation in decoding subtest for mental flexibility for performing this task.

It means that although in quick consideration of maze and decoding subtests it seems that this two subtest in terms of motor and perception integration follow similar cognitive task and have high correlation with motor conceptual skills but decoding subtest because of having higher level cognitive task, mental flexibility and probably higher predictability of this task, don’t show significant relation with motor perceptual skills.

Significant relation between visuomotor perceptual function and WISK-R scale subtest indicate perceptual skills importance in other cognitive functions and as a result educational functions, institutional non-institutional learning. Relation of these two variables may indicate importance of perceptual skills in learning process. Based on present research findings perceptual errors such as simplifying pictures, changing of model, lack of form recognition and its details, over shrinking or magnifying sizes and lack of size proportion, changing angle, omitting and adding components, using line instead of point and or circle instead of point, mistake in number of units and picture replication, missing pictures, conflicting pictures, problem in closing patterns may lead to deficiencies in recognition and learning in individuals. So it seems that by rehabilitating visuomotor
perception problems, we can prevent cognitive deficiencies and as a result learning disorders and educational problems.

Significant positive correlation coefficient between visuomotor perception skill and nonverbal intelligence quotient of children in WISK-R scale is consistent with Bender and Kupitz (1969, quoted by Baradari, 2011). Therefore as visuomotor perception quotient of individuals increases, their nonverbal intelligence quotient improves.

It is suggested that for preventing learning and educational problems, students practice visuomotor perception skills in preschool grades because it is an important period in development. Also for treating learning disorders particularly mathematics, improving visuomotor perception skills should be emphasized.

Also given to simple, quick and no expensive execution of Gestalt test and its significant relation with WISK-R scale subtests in children with learning disorders it is recommended that in future researches, this test be used for screening of learning disorders.

References


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