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# The Effect of Selected Perceptual-motor Activities on Eye-hand Coordination of 6-7 years old children

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## ABSTRACT

It can be said that almost each movement is a kind of perceptual-motor skill. The main objective of this research is to investigate the effect of selected perceptual-motor activities on eye-hand coordination of 6-7 years old children. The research is a field research and is conducted in a quasi-experimental manner. Statistical population of this research consist of 1368 boys of 6-7 ages who were studying in pre-elementary and first grade of elementary schools in Torbat-e Heydarieh in academic year of 2012-2013. The statistical method of the research is quasi-experimental. As a result, descriptive statistics is used for determining the mean, standard deviation and drawing tables and diagrams. In inference section, the hypotheses of the research are tested by independent sample t test and dependent sample t test. There is a meaningful difference between the results of posttests which was given to our two groups of 6 years old and 7 years old children. This difference is more significant in the group of 6 years old children compared to the other group of 7 year old children. However, there was no meaningful difference in the pretests of the two groups.

**KEY WORDS:** perceptual-motor activities, perceptual-motor growth, perception, skill

## INTRODUCTION

Theories and researches about child growth show that children pass through different growth stages from early ages to maturity. During infancy and childhood, sensor motor stage is passed. In this stage, the child experiences his surrounding environment through sensation and movement in motor areas.

By touching, grabbing, getting and releasing objects, balancing, crawling and walking, children gradually reach the conceptual stage. Although senses of hearing, muscle and touch play an important role in perceptual stage, visual perception is usually the main factor of learning. Both mentioned stages are bases of a child's progress and upgrade in cognitive level. In this stage, the ability of comprehension and achieving skills such as notating, abstraction, verbal expression, reading, etc. emerge in the child, all of which are related to school homework. Therefore, achieving perceptual-motor experiences is significantly considered as a basis of school learning.

Considering the growth stages, it has been proved that developing perceptual-motor skills lead to growth and concept development in children. If a child is successful in doing an activity, he would be more motivated to make efforts to do other activities. As a result, self-confidence would appear in the child and he would try to do more difficult tasks and activities while he reaches to level of cognitive learning. If a child fails to do a task, he cannot respond to conditions and he would face difficulties in learning (Aminian, et al, 2013).

Followers of perceptual-motor method believe that motor-learning is the origin of learning. They believe that higher mental processes are created by appropriate growth of motor and perceptual systems and relations between motor and perceptual learning.

Newell C. Kephart, one of the most famous pioneers of perceptual-motor method, believes motor learning is effective on intelligence and education. In his theory, he has recognized activities and measures for repairing and improving insufficiencies (Seyf Naraghi, 2002). He concludes that one of the evident insufficiencies in elementary school-age children is development coordination disorder (DCD) referred to as developmental dyspraxia. This is a development disorder which affects motor abilities in healthy and normal children. In other words, the problem is with the function in a way that the abilities of movement will be damaged. DCD is used to explain the problems in the field of motor skills growth. This problem appears in early ages of childhood and it affects the child's learning and skills which require movement coordination (Dyspraxia, 2003). The children affected by DCD show unskilled movements. It is important to diagnose this disorder as soon as possible. In this case, we would be more successful to resolve this problem and teachers also can treat these children in an appropriate manner. Since programs of first grades in elementary schools are based on skills development in children, the early diagnosis of this disorder helps the children significantly to overcome their motor difficulties (Amanda Bowens Iain smith, 2012).

It has been reported that 5-6 % of children are affected with DCD (USA medical association, 2000). In this disorder, motor problems such as a delay in growth, balance disorder, perceptual disorder, physical inexperience, weakness in motor coordination and neurological disorder have been reported (Geuze, 2005). Research conducted in the field of executive functions in children affected with DCD; show that these children face problems in some functions such as organizing, decision-making and planning (Alizadeh&Zahedipour, 2005).

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Mental representation and visualization (Maruff, Wilson, Trebilock & Currie, 1999; Wilson, Maruff, Lves & Currie, 2001; Wilson & et al, 2004), purposeful movements, controlling the speed of movement (Ameratunga, Johnston & Burns, 2004), new movements (Geuze, 2003), are components of executive functions which are affected in children with DCD. As mentioned, executive functions have different components. Although their function is related to frontal cortex, not all of these functions are necessarily related to a specific area. Therefore, it is possible that some children with DCD have problems in some components such as planning and organizing, but they have no problem in the component of inhibition (Alizadeh&Zahedipour, 2005). In other hand, they may be good in working memory, but they face problems in inhibition. This issue is related to location of injury in frontal cortex (Alizadeh, 2007).

The other possibility is that the insufficiency of time perception which is related to cerebellum (Pinel, 1993) affects other executive functions (Barkly, 1997). The research conducted in this field is mostly related to elementary schools with children of 6 to 11 years old. In research of Henderson & Sugden (1992), MABC test was used which included hand and ball skills. There was no significant difference between girls and boys or in total scores. The results of this research indicate that Greek students have mobility problems. It seems their ages have an effect on creating mobility problems (Henderson, 2010). The research results of Kuiper & et al show that children with movement difficulties play with a less change in total movement behaviors during recess time in schools, compared with children who have not any movement difficulties (Kuiper, 1999). The research results of Marina & et al and Anderson & Smith (2000) on children with DCD show that these children have problems with tactile and visual conceptions and therefore they don't participate in physical team games.

These children are withdrawn and isolated in school playgrounds (Marina & et al, 2009). The researchers believe that children's abilities are developed by different tasks and their experience will significantly affect the growth process (Gelman, 2000; Overton, 1998).

The main objective of this research is to investigate the effect of selected perceptual-motor activities on eye-hand coordination of 6-7 years old children

MABC test is used for systematic assessment of children's movement difficulties and it has a checklist for identifying children. Practical skills include static and dynamic balance, hand skills (catching and throwing balls), physical knowledge, movement coordination and identification of different ways.

This research is considered as a quasi-experimental research because the subjects were not completely controlled by the researcher and there are 2 experimented and control groups (Naderi, 1996).

**Variables:**

Independent variables or criterion: Independent variable is 8-week perceptual-motor activities which is determined and conducted by the researcher.

Moderating variable: Sex (girl and boy) which are determined by two-way ANOVA (analysis of variance).

Dependent variable: in this research the dependent variable is eye-hand coordination of boys.

**Statistical population and sampling:**

Statistical population of this research consist of all 6 and 7 years old boys who were studying in pre-elementary and first grade of elementary schools in Torbat-e Heydarieh (academic year 2012-2013). There were 243 six years old boys and 1125 seven years old boys. After coordinating with Education Organization of RazaviKhorasan province and Education Organization of Torbat-e Heydarieh, it was determined that there are near 140 elementary schools and 8 pre-elementary schools in Torbat-e Heydarieh. Since this city has only one center for education organization, we had to divide the map of the city into four parts: north, south, east and west. Then, random and cluster samplings were used. Four pre-elementary classes and four first grade elementary classes were selected from each of these four regions.

Thirty 6years old boys and thirty 7years old boys were randomly selected and they were divided into two experimented and control groups. For 6years old group, 15 boys were selected to experimental group and 15 boys were selected to control group. Likewise, the same happened for 7years old groups.

**Research tools**

Denver developmental screening test (DDST)

This test was developed by Frankenburg and Dobbs in 1969. In 1990, the test was implemented and validated by Frankenburg, Dobbs and Archer. This test is used in researches related to psychology of perception. It is also used for diagnosis and therapeutic purposes. This test which is available for two norms, one for children of 5 to 9 years old and the other for children of 9 to 15 years old, measures eye-hand coordination. In this research, the first norm is used (for 5 to 9 years old boys). In this test, 6 years old and 7 years old boys should throw tennis balls into a basket from a distance of 183 centimeters. The number of throws is 24 which include 3 experimental throws and 21 principle throws. Then, according to the average and standard deviation, the status of the children is assessed due to their ages (Gardner2, 1979).

1- A plastic basket with 50 centimeters height and 34 centimeters diameter.
2- 24 tennis balls, normal sizes
3- A few bins for collecting the balls and putting them in
4- Measure tape for measuring the distance between basket and throwing spot and for measuring children's heights

## METHODS

This test was done individually in the playground of schools. This test was started by May 2007 and was lasted for 2.5 months. Each participant threw 24 tennis balls into the basket. The instructions of the test and throwing the ball were explained to the participants by the tester. For the pretest, each participant was given 24 balls to throw. The first 3 balls were for practicing and the rest 21 balls were for getting points.

During the test, a heavy object was put in the basket in order to avoid its movement. It is obvious that the distance between the basket and throwing spot was kept the same in order to achieve a meaningful result. The basket (with a heavy object in it) was placed in a way that it was not close to any walls. This was to avoid balls dropping into the basket after they hit walls. With all these precautions, if a ball was dropped into the basket after hitting a wall, the point was not given to this throw. In addition, we drew a circle by a chalk around the basket in order to watch its position. Since the subjects were all under 9 years old, the distance between basket and throwing spot was 183 centimeters. For subjects of above 9 years old, this distance is 274 centimeters.

Determining this distance was easy by using measure tape. Also, we drew a line by a chalk to determine the throwing spot. We were careful to watch the children consider this line as their throwing spot. The bin full of 24 balls was located near the children. In the end, the number of successful throws was written for each individual (pretest).

Then, conceptual-motor activities were done with experimental groups of 6 and 7 years old boys separately for 8 weeks and 3 days per week. These activities were done in 45 minutes and the minimum time of exercises was 30 minutes. 15 minutes were used for practicing and necessary explanation about the activities. One reason for separating the time of activities for 6 years old and 7 years old boys was to determine the effect of perceptual-motor activities more accurately. Another reason was to avoid 6 years old boys being affected by 7 years old boys. The purpose of perceptual-motor exercises was using arms and shoulder girdle muscles.

These are some examples of perceptual-motor exercises used in the test:

Throwing sandbags into hula hoops, golfing, throwing ball upward and getting when it falls, shooting a ball in the ground, throwing a ball above a rope, throwing a ball into a circle ring like a hula hoop, throwing a ball into goals with different distances, throwing a ball to a wall, giving a ball to other children in a line, throwing a ball by tester and asking the children to get it, passing a ball between legs, throwing a hula hoop in a straight object like a long nail, catching plastic fishes using magnets, stringing rosary beads, putting building blocks on a straight line or on a circle, shooting a ball in a straight line, separating balls from matches and stringing the tree leaves or sized cardboards.

During the exercises, balls of different sizes (small, medium and large) and different materials (plastic, sandbags, cloth, sponge) were used. As mentioned earlier, the period of exercises was 8 weeks including 3 sessions (each session, 45 minutes) in each week (total 24 sessions). In both groups, the first 15 minutes of each session were dedicated to stretching and flexibility exercises (practicing) and the rest 30 minutes were dedicated to perceptual-motor activities. In the end of each session, 5 minutes were spent for recovery movements. A day after 24 exercise sessions, the final test (posttest) which was exactly like the pretest was taken. 24 tennis balls were thrown into the basket, the first 3 balls were for practicing and the rest 21 balls were for getting points in the same situation for all children. At the end of pretest and posttest, throws were extracted by DDST.

### Statistical method

The information was analyzed by use of descriptive and inferential statistics and by help of SPSS computer software. The data was described by descriptive statistics. Kolmogorov-Smirnov test was used in order to assess dependent variables and check if they are normal. Then T-test was used in different levels of the research. The data had a normal distribution in all dual levels of the research. Therefore, parametric tests were used to evaluate the hypothesis of the research.

By using inferential statistics, the test of probable differences was calculated among subjects. Then two-way analysis of variance (ANOVA) was used to compare the difference between experimental groups and control groups after experimental group pass a series of perceptual-motor exercises (table1).

### Section 1:

Table 1 shows the comparison between pretest scores and posttest scores for the number of successful throws in each groups of 6 and 7 years old boys. The average of this variable in experimental group is 12.17 and has increased compared to the control group (average 11.03).

Table 1- Comparison between pretest scores and posttest scores forth number of successful throws in each groups of 6 and 7 years old boys

| maximum throws | minimum throws | Standard deviation | average | number | statistical indicator /Groups | |
|---|---|---|---|---|---|---|
| 7 | 3 | 2.993 | 9.07 | 30 | Pretest | Experimental group |
| 16 | 15 | 1.949 | 12.17 | 30 | Posttest | |
| 19 | 5 | 3.419 | 9.97 | 30 | Pretest | Statistical indicator |
| 18 | 6 | 3.011 | 11.03 | 30 | Posttest | |

**Section 2:**
Testing hypotheses

**First hypothesis**: Perceptual-motor activity has not the same effect on eye-hand coordination of 6-7 years old children.

Table 2-Summary of Kolmogorov-Smirnov test for 6 and 7 years old boys

| pvalue | Ks z | Standard deviation | average | session | number | Indicator/Groups |
|---|---|---|---|---|---|---|
| 0.897 | 0.541 | 2.993 | 9.07 | pretest | 30 | Experimental group |
| 0.385 | 0.763 | 1.949 | 12.17 | posttest | | |
| 0.407 | 0.625 | 3.419 | 9.97 | pretest | 30 | Statistical indicator |
| 0.529 | 0.601 | 3.011 | 11.03 | posttest | | |

Table 2 shows that the difference between the groups is not meaningful. Therefore, the distribution of scores in all tests for 6 and 7 years old boys are normal.

Table 3- Results of student's t-test for number of throws between two experimental and control groups of 6 and 7 years old boys

| p-value | df | Statistics | Experimental & control groups |
|---|---|---|---|
| 0.00 | 58 | -0.653 | |

The calculated P-value in student's t-test to compare the difference of average throws between pretest and posttest in both experimental and control groups is 0.00 and it is less than $\alpha = 0.05$. Therefore, there is a meaningful difference between the average throws of pretest and posttest in both experimental and control groups. Perceptual-motor activities are effective on improving eye-hand coordination in 6 and 7 years old boys.

**Second hypothesis**:
Perceptual-motor activities have no effect on improving eye-hand coordination in 6 years old boys (pre-elementary school boys).

Table 4- Summary of Kolmogorov-Smirnov test for 6 and 7 years old boys

| pvalue | Ks z | Standard deviation | average | session | number | Indicator/Groups |
|---|---|---|---|---|---|---|
| 0.247 | 0.825 | 3.292 | 8.53 | pretest | 15 | Experimental group |
| 0.452 | 0.825 | 1.846 | 12.38 | posttest | | |
| 0.297 | 0.905 | 2.503 | 8.13 | posttest | 15 | Statistical indicator |
| 0.311 | 0.955 | 2.350 | 9.33 | posttest | | |

Table 4 shows that the difference between numbers of throws in groups is not meaningful. Therefore, the distribution of scores in all tests for 6 years old boys is normal.

Table 5- Results of student's t-test for number of throws between two experimental and control groups of 6 and 7 years old boys

| p-value | df | -statistics | Experimental & control groups |
|---|---|---|---|
| 0.00 | 28 | -5.137 | |

The calculated P-value in student's t-test to compare the difference of average throws between pretest and posttest in both experimental and control groups is 0.00 and it is less than $\alpha=0.05$ Therefore, there is a meaningful difference between the average throws of pretest and posttest in both experimental and control groups. Perceptual-motor activities are effective on improving eye-hand coordination in 6 years old boys.

**Third hypothesis**: Perceptual-motor activities have no effect on improving eye-hand coordination in 7 years old boys (first grade of elementary school boys).

Table 6 - Summary of Kolmogorov-Smirnov test for 6 and 7 years old boys

| pvalue | Ks z | Standard deviation | average | session | number | Indicator/Groups |
|---|---|---|---|---|---|---|
| 0.0721 | 0.673 | 2.677 | 9.60 | pretest | 15 | Experimental group |
| 0.452 | 0.852 | 2.042 | 11.80 | posttest | | |
| 0.301 | 0.567 | 3.278 | 11.80 | pretest | 15 | Statistical indicator |
| 0.031 | 1.443 | 2.658 | 12.73 | posttest | | |

Table 6 shows that the difference between numbers of throws in groups is not meaningful. Therefore, the distribution of scores in all tests for 7 years old boys is normal.

The calculated P-value in student's t-test to compare the difference of average throws between pretest and posttest in both experimental and control groups is 0.01 and it is less than $\alpha = 0.05$ Therefore, there is a meaningful difference between the average throws of pretest and posttest in both experimental and control groups. Perceptual-motor activities are effective on improving eye-hand coordination in 7 years old boys (first grade of elementary school boys).

Table 7- Results of student's t-test for number of throws between two experimental and control groups of 6 and 7 years old boys

| p-value | df | -statistics | Experimental & control groups |
|---|---|---|---|
| 0.001 | 28 | -3.647 | |

The calculated P-value in student's t-test to compare the difference of average throws between pretest and posttest in both experimental and control groups (for 6 and 7 years old boys) is 0.004 and it is less than $\alpha=0.05$ Therefore, there is a meaningful difference between the average throws of pretest and posttest in both experimental and control groups. Perceptual-motor activities have not the same effects on improving eye-hand coordination in 6 years old boys (pre-elementary school boys) and 7 years old boys (first grade of elementary school boys).

## Conclusion

The results show that perceptual-motor activity has a positive meaningful effect on eye-hand coordination of 6 and 7 years old children. Also, the results show that:

- The average number of throws in 6 years old experimental group has a meaningful difference after a trial course. However, there is no meaningful difference in the control group.
- The average of pretest and posttest of 6 years old experimental group has a meaningful difference after a trial course. However, there is no meaningful difference in the control group.
- There is no meaningful difference between averages of throws of 7 years old experimental and control groups after a trial course.
- The average of pretest and posttest of 7 years old experimental group has a meaningful difference after a trial course. However, there is no meaningful difference in the control group.
- There is a meaningful difference between posttests of both 6 and 7 years groups after a trial course. This difference was higher in 6 years old boys than in 7 years old boys. However, there is no meaningful difference between pretests of both groups.

## Suggestions

1- According to the results of this research about the effect of perceptual-motor activities on eye-hand coordination of children, it is suggested to use perceptual-motor activities in pre-elementary and elementary schoolsin order to improve motor and cognitive skills.
2- Combining physical education with other educational subjects (combining motor skills and educational concepts) can help teachers of physical education diagnose this issue better. Therefore, it is suggested that students learn some scientific concepts through games and motor activities, especially in the first 3 years of elementary schools.
3- Since perceptual-motor activities have effects on 6 and 7 years old children, conducting research and studies about this issue in 8 and 9 years old children is highly suggested.
4- The effects of perceptual-motor skills are evaluated through eye-foot coordination, physical awareness, lateralization and other factors of motor fitness.

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