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Implementation of visual motor ability enhancement program for 5 years old

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Abstract

The aim of this study was to test the effectiveness of the "Visual Motor Ability Enhancement Program" (VMAEP) designed to improve visual perception, motor coordination and visual-motor integration skills in 5-year-old children. Participants were a total of 33 five-year-old children, 17 in the experimental group and 16 in the control group. Data collection instruments were family child information form and Visual Perception (VP), Motor Coordination (MC) and Visual-Motor Integration (VMI) Tests (Beery, 2004) in order to test the program. The resulting pretest – posttest mean scores showed a statistically meaningful difference in favor of the posttest in the VP, MC and VMI dimensions in the experimental group, and in the VP dimension in the control group. In the posttest comparisons of the experimental and control groups, a statistically meaningful difference in favor of the former was found in the VP, MC and VMI dimensions. In sum, the VMAEP support VP, MC and VMI skills.

Key Words: Preschool, visual motor integration,

1. Introduction

Human sense organs, which are essential to people's perception of the world, develop and mature quickly during the preschool period when development is at its fastest. Visual, auditory, tactile perceptions help people's perception of their environment. Also known as visual analysis skills and visual cognitive skills (Kurtz, 2006), visual perception has a major role in perception (Karatepe, 1992; Morgan, 1993). The visual system of a baby starts to mature automatically with birth. However, the early visual perception of a baby is not the same as a child's or an adult's (Smith et al., 2003; Kurtz, 2006; San Bayhan and Artan, 2009). Babies are reported to only recognize primary colors in months 3 and 4, and even though the coordination of the eyes and following of moving objects occurs in the first few months after birth, it is stated that their development is complete around months 8 or 9 (Başaran, 2005; Gabbart, 2008). In order to develop their visual perception, children need experiences and visual input (Kurtz, 2006, Gabbart, 2008).

Visual perception provides children with a base in their cognitive activities to adapt and control their behaviors. Visual perception skills are important in matching shapes, recognizing colors, and actualize tasks such as reading and writing (Marriot, 2000; Bezrukikh and Terebova, 2009). The visual system feeds itself back about the approximate body position, the position and movement of body parts in relation to each other and the environment, and proximity. Daily behaviors are controlled by the perception-movement link that is formed with the information coming from movement and optic receptors. Visual perception information reveals whether there is a safe

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environment for movement and leads to perception which is necessary to realize actions in a certain order (Smith et al. 2003; Cinelli, 2006; Gabbart, 2008).

Motor development and coordination starts with a baby's inborn reflexes and random bodily movements. These reflexes disappear as the baby gains control over the muscles, followed by the ability to control the body and move consciously (Gleitman, 1995; Davaslıgil, 1998; Aydın et al., 2002; Senemoğlu, 2005; Aydın, 2005). Learning is assisted by conscious movements that are conditional on certain factors such as precision of supervision, coordination of organs, direction of movement, arm movement speed, arm-hand-finger sensitivity, muscle strength, attention, balance and flexibility (Başaran, 2005). Mastery in movement, which is managed by cognitive and perceptual functions, is important for children to use their movement appropriately in the right conditions and to guide their behavior (Wuang et al., 2008). The continuity and harmony of conscious movement, in other words motor coordination, is crucial to motor development (Atay, 2005; Siyez, 2007).

Referring to hand movements, small motor skills allow children to discover, compare and classify and thus learn the environment better. At the same time, they help children become independent in self-care (doing buttons, ringing a bell, etc.). By using small motor skills, children are able to creatively express their thoughts through play and artistic activities. In addition, using small motor skills helps children to develop a self concept, and social and emotional skills by playing with their peers and participating in school activities (Pieterse and Treloar, 1996; Güngörmüş, 2005).

In the development of skills such as grasping, leaving, throwing, cutting and drawing, visual perception development plays a major role together with small motor development. These skills are at the same time also important for the development of writing skills, a major milestone in children's elementary education (Oktay and Unutkan, 2003; Gabbart, 2008; Payne and Isaacs, 2008).

Establishing coordination between visual perception and body movements, particularly hand movements, is called visual-motor integration (Beery and Beery, 2004; Başaran, 2004). Visual-motor integration is the transformation of visual perception into motor output. This skill is accompanied by skills such as visual perception, psychomotor speed and hand-eye coordination (Weil and Amundson 1994).

The importance of visual perception, motor coordination and visual-motor integration skills for school achievement has been shown in various studies. This link is especially evident between mathematics, literacy skills and these ones. Many researchers have found a statistically meaningful relationship between writing problems and low visual perception, motor coordination and visual-motor integration skills. Children with low visual-motor integration skills have problems in skills such as writing speed, spacing words and letters, and copying words correctly (Maeland, 1992; Fletcher, 1997; Borsting and Barnhardt, 2001; Marr et al., 2001; Case-Smith, 2002). Studies that have focused on the relationship between mathematical skills, an important indicator of school achievement, and visual-motor integration found a relationship between mathematical skills and visual-motor integration, visual perception and motor coordination skills (Borsting and Barnhardt, 2001; Sortor and Kulp 2003), Borsting and Barnhardt (2001) showed that children with low visual-motor integration skills have problems with ordering numbers, organizing mathematical problems and solving problems.

There are studies mentioned in the literature that have tested the effectiveness of programs designed to support visual perception, motor coordination and visual motor integration skills. Their results have indicated that different support programs may support the development of visual perception (Tuğrul et al, 2001; Cengiz, 2002; Görener, 2006), small muscle and motor coordination (Case-Smith, 1994; 2000; Rule and Stewart, 2002; Stewart et al., 2007) and visual motor integration (Desai and Rege, 2005; Sanghavi and Kelkar, 2005; Bazyk et al., 2009; Ratzon, Lahav et al., 2009) skills. Theer are also programs that support visual perception, motor coordination and visual-motor integration skills (Daly, 2000; Dankert et al., 2003, Denton et al., 2006).

This study aims to test the effectiveness of the Visual Motor Ability Enhancement Program (VMAEP) designed to support 5-year-old children's visual perception, motor coordination and visual–motor integration skills, which are crucial to children's development and school achievement, by combining different methods and techniques (3D materials, play cards, storybooks and dramatization).

2. METHODS

Aiming to test the effectiveness of the Visual Motor Ability Enhancement Program" (VMAEP) designed to improve 5-year-old children's visual perception, motor coordination and visual–motor integration skills, this experimental study is based on experimental and control group pre and posttest measurements.

2.1. Participants

The study was conducted in a state school attended half day by 3-5-year-old children from middle socio-economic level families. The school had 4 classes for 5-year-olds (2 in the morning, 2 in the afternoon). In identifying experimental and control groups, each class was taken as a group, and the researcher implemented the VP, MC, VMI tests (Beery, 2004) as pretest in all classes. No statistically meaningful difference was found in the test results of the 4 groups. After this, as the school management specified morning hours for the study, one of the 2 morning classes was assigned as the experimental group and the other as the control group.

As there was an H1N1 virus threat during the implementation of the VMAEP, children who did not participate the study for two consecutive weeks were excluded. Pupils who were absent for a week or less did compensation work before each session. Two experimental pupils were excluded for non-attendance and the results were obtained with 17 pupils (8 girls, 9 boys; age range 60-69 months). There were absent pupils in the control group as well. As 3 of the 19 previously specified pupils were absent due to the epidemic, the posttest of the control group was given to 16 pupils with regular attendance (5 girls, 11 boys, age range 60-69 months).

Experimental pupils underwent the VMAEP designed by the researcher 3 times weekly for 10 weeks. Control pupils underwent their regular education. The VP, MC and VMI Tests (Beery, 2004) were re-administered 10 weeks later as posttest on the 17 experimental and 16 control pupils who completed the VMAEP.

2.2. Procedure

2.2.1. Development of the VMAEP

Publications on educational technologies and materials development lay the rules of designing instructional materials. They state that the more sensory organs that participate in learning, the better learning and the more retention; learning by doing is best; people can remember 90% of what they do and say; learning is mostly done through the eyes; and instruction should be organized to proceed from the concrete to the abstract, and from simple to complex (Yalın, 2000; Demirel, Seferoğlu and Yağcı, 2002). While designing the VMAEP, these recommendations were followed and storybooks with 3D and 2D materials were prepared. In order to support the VP, MC, VMI skills, exercises that proceed from the simple to the complex (labyrinths, dot completion, finding the hidden object, drawing a given shape, etc.) were designed. The books designed by Beery, Beery and Evans (2004) and other related publications were examined in the process (Beery and Beery, 2004; Ayres, 2005; Kurtz 2006, 2007; Gabbart, 2008). It was ensured that the activities did not use figures that resembled those in the test items.

The exercises were embedded into 10 different stories. In order to keep pupils' interest alive during the story writing process, daily situations (such as shopping, repairs, birthdays) and interesting activities (such as kite-making, hiking in the forest, treasure-hunting) were chosen. The stories were examined by an academic in the field of Turkish. The characters and scenes in the stories were designed by the researcher. After the stories were written and draft pictures were drawn, the books were illustrated and colored by a graphic designer on the computer following the researcher's ideas and guidance.

The stories were supported with models, board games and dramatization for children. The 3D and 2D materials were designed by the researcher, based on the worksheets in the stories. Once the VMAEP was ready, it was submitted for the review of 3 academics in the field and 4 preschool teachers.

In order to observe the effects of the stories on children and the appropriateness of the exercises, a pilot implementation was performed with 5 children in a private kindergarten. It was observed during this pilot study that children enjoyed the stories and were interested in the exercises.

2.2.2. Implementation of the VMAEP

The VMAEP developed by the researcher for the experimental group children was implemented during the fall term of the 2009-2010 academic year 3 days weekly for 10 weeks. Each week:

Day 1: The storybooks were read and children were made to follow the story from their own books. Time: 15-20 minutes

Day 2: The story activities that aim to improve visual-motor integration, visual perception and motor coordination skills were supported by 3D models, board games and drama studies. In this stage, children worked directly on the target skills. Time: 40-45 minutes

Day 3: Children reinforced their experiences gained through 3D and 2D materials by using pencils on the worksheets included in stories. Time: 25-30 minutes

Children were thus supported by repeating the target skills, trying out different materials, and receiving feedback on particularly the 3D and 2D activities of Day 2.

2.3. Measures

2.3.1. Family-Child Information Form:

Designed by the researcher, this form is a chart to record children's gender, age, and parents' educational level. The information was recorded by the class teacher during the validity and reliability testing stage in the 2007-2008 school year; and by the researcher in early 2009-2010 academic year in line with children's registration forms under the supervision of the school management.

2.3.2. The Beery Developmental Test of Visual-Motor Integration, 5th Edition (The Beery VMI):

Developed by Keith E. Beery, Norman A. Buktenica and Natasha A. Beery in 1967, the full name of this visual-motor integration test is "The Beery-Buktenica Developmental Test of Visual-Motor Integration". It was revised later in 1982, 1989, 1997 and 2004. The Beery VMI test is a valid and economical visual-motor survey battery consisting of a main test (Visual-Motor Integration) and two standardized additional tests (Visual Perception and Motor Coordination, 1997, 2004) and aiming at children aged between 2-18. The tests may be used together or separately.

3. RESULTS

In order to evaluate the effects of the VMAEP, the VP, MC and VMI tests were re-administered on the experimental and control children at the end of the 10-week period. The Wilcoxon Signed Rank Test results of the pre and posttest scores showed that there was a .001 increase in the scores of experimental children on all tests. This indicates that participating in the VMAEP caused statistically meaningful differences in favor of the posttests of experimental children in VP, MC and VMI skills (Table 1). The pre and posttest comparison of control children showed that the only meaningful difference existed in favor of the posttest in the VP (.05) skill (Table 2). It was thus concluded that the MC and VMI skills of the control children who did not attend the VMAEP did not improve, while their improvement in the VP skills was less than their counterparts in the experimental group (experimental; $p<.000$).

The posttests of VP, MC and VMI tests of the experimental and control groups were analyzed by using the Mann-Whitney U Test. This analysis revealed meaningful differences in favor of the experimental group regarding all skills (Table 3). Thus it may be stated that the VMAEP was effective in improving experimental group children's VP, MC and VMI skills.

Table 1. Wilcoxon Signed Rank Test Results of Experimental Group Pre and Posttests

Groups	N	Mean Rank	Sum of Ranks	Z	p
VP					
Decreasing	1	1,5	1,5	-3,566	,000
Increasing	16	9,47	151,5		
Unchanging	0				
Total	17				

MC					
Decreasing	0	,00	,00	-3,53	,000
Increasing	16	8,50	136		
Unchanging	1				
Total	17				
VMI					
Decreasing	0	,00	,00	-3,638	,000
Increasing	17	9,00	153,00		
Unchanging	0				
Total	17				

Table 2. Wilcoxon Signed Rank Test Results of Control Group Pre and Posttests

Groups	N	Mean Rank	Sum of Ranks	Z	p
VP					
Decreasing	3	6,83	20,50	-2,017	,044
Increasing	11	7,68	84,50		
Unchanging	2				
Total	16				
MC					
Decreasing	3	7,33	22,00	-1,008	,313
Increasing	8	5,50	44,00		
Unchanging	5				
Total	16				
VMI					
Decreasing	1	1,50	1,50	-1,897	,058
Increasing	5	3,90	19,50		
Unchanging	10				
Total	16				

Table 3. Mann-Whitney U Test Results Concerning Experimental-Control Group Posttests

Groups	N	Mean Rank	Sum of Ranks	U	p
VP					
Experimental	17	21,15	359,5	65,5	,01
Control	16	12,59	201,5		
Total	33				
MC					
Experimental	17	22,21	377,5	47,5	,001
Control	16	11,47	183,5		
Total	33				
VMI					
Experimental	17	23,32	396,5	28,5	,000
Control	16	10,28	164,5		
Total	33				

4. DISCUSSION

The statistical analyses conducted after the completion of the 10-week VMAEP mirror those cited in the literature. This previous research has focused on visual perception support programs, small muscle and motor coordination skills support activities and occupational therapies or visual perception, motor coordination and visual motor integration skills support programs.

Evaluating the effectiveness of programs designed to support **visual perception** skills, Tuğrul et al. (2001) implemented the Frostig Visual Perception Training Program for visual perception through bi-weekly 45-minute sessions for 4 months on 6-year-old children. They found that other than the Figure-Ground Distinction (FGD), all other subfields had significantly different pre and posttest results. Similarly, Cengiz (2002) studied the effects of a support training program on 5.6-6 year-old children's visual perception development by offering musical, artistic, dramatic and play activities based on visual-motor integration, figure-ground relationship, figure constancy, space-position relationship and space relationship to an experimental group. His control group attended the regular program offered at the school. The pretest used in the study was the Frostig Visual Perception Test. The results of the study showed that the experimental group had a statistically meaningful achievement. Having prepared an artistic education model for **visual perception** and skills development, Görener (2006) ran his model three times weekly for 12 weeks. The posttest results showed that the study group made a significant improvement in eye-motor coordination, figure-ground perception, figure constancy perception, space and position perception and space relationship skills. Parallel to our study, these results show the positive effects of support programs on **visual perception** development.

One program designed to support **motor development** is Case-Smith's (1994) study. This study examined the effects of occupational therapy services offered as part of an educational program on preschoolers' **fine motor skills** and functional performance acquisition. Participants were 26 preschoolers aged between 4 and 6, who were receiving weekly occupational therapy and whose eye-hand coordination, strength grasping, mobility, maintenance and social functional performance was measured. The children had weekly 30-45-minute sessions to improve these skills by painting with finger paint, taking small objects out of clay, and catching small metal objects by using magnetic sticks. The results showed that occupational therapy had positive effects on children's small motor skills. Rule and Stewart (2002) studied the effects of activities done with daily materials (tweezers, tong, etc.) on children's **small muscle development** and divided 101 preschool children into experimental and control groups. Experimental children studied 50 different educational sets for 6 months. Even though both groups of children improved their **small muscle skills** in the end, experimental children were more successful than control children. In the present study, similar findings were reached in the **motor coordination** field. In the pre and posttest analysis of experimental children there was a statistically meaningful difference in favor of the posttest; and in the posttest analysis of experimental and control groups, there was a statistically meaningful difference in favor of the experimental group. These results suggest that support programs affect motor coordination development positively.

Results from studies that evaluate the effectiveness of programs designed to improve **visual-motor integration** skills are parallel to those of the present study. Sanghavi and Kelkar (2005) studied 32 children with learning difficulties who were aged between 10-14 years. Experimental children underwent a training program for 12 weeks by therapists at a center and families at home. Control children did not receive any individual support but only counseling. At the end of the 12 weeks, the experimental children who received support had meaningfully higher **visual-motor integration** scores than control children. Similarly, Ratzon, Lahav et al. (2009) compared the effectiveness of three different short-term support services on 147 first graders who had **visual-motor skill** difficulties. Those children who scored under 21% in the Visual-Motor Integration Test were included in this study and grouped into 3 experimental and 1 control group. The experimental groups were supported in three different ways: the Combined Treatment Model (CT) (n=29), the Direct Treatment Model (DT) (n=38), and the Cooperative-Counseling Treatment Model (CCT) (n=24). On the whole, support services included pen-and-paper activities that aimed to improve **visual-motor skills** and manipulative skills. According to the results of the tests given to the experimental and control groups (n=56) prior to and after the program, students in all 3 intervention groups were more successful in **visual-motor skill** tests than those in the control group. Bazyk et al. (2009) studied the effects of occupational therapy in a preschool class receiving integration education. The study was planned as a single group pre and posttest study with 37 students (aged 60-83 months). All students in the class with and without developmental problems participated in the study, and the support program continued for a whole academic year. The disabled children additionally followed an individualized education plan (IEP). The results showed that the support program improved children's **visual-motor skills** and writing skills.

Daly (2000) and Denton et al. (2006) concluded that support work improves **visual perception, motor coordination and visual-motor integration** skills. Daly (2000) studied the relationship between **visual-motor**

skills and handwriting for 4 months with 2 experimental (30 children) and 2 control (26 children) groups aged between 59-71 months. Experimental students were supported with activities to improve their small muscle development, in line with the preschool program and teacher views. These activities supported children's hand-finger strength and resilience, skill and coordination, visual-motor integration and coordination. When the results of the experimental and control groups were compared, the support program was found to statistically meaningfully increase the **visual perception, motor coordination and visual-motor integration skills** of experimental children. Denton et al. (2006) studied 38 children aged 6-11 years and investigated the effects of sensory-motor and therapeutic approaches on children's handwriting development. The children were randomly divided into 3 groups. The first group was subjected to the sensory-motor (SM) approach; the second group therapeutic approach (TA), and the third group their regular education. Two experimental groups attended 40-minute training sessions 4 times a week for 5 weeks. The **visual perception, visual-motor integration** and handwriting development of the children was tested with 4 different instruments before and after the study. As a result, SM group children were shown to develop in the areas studied (**visual perception, visual-motor integration**, movement perception). As can be seen, children's **visual perception, motor coordination and visual-motor integration** were expected to improve with the support program, and statistically meaningfully positive results were obtained.

Corroborating the results of previous studies, the findings of the present study showed that the Visual Motor Ability Enhancement Program (VMAEP) statistically meaningfully supported the development of 5-year-old children in all target skill areas (VP, MC, VMI) in a positive way.

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