EFFECT OF AGE AND GENDER ON MOTOR PROFICIENCY AND VISUAL MOTOR INTEGRATION AS A MEASURE OF HANDWRITING READINESS

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ABSTRACT

EFFECT OF AGE AND GENDER ON MOTOR PROFICIENCY AND VISUAL MOTOR INTEGRATION AS A MEASURE OF HANDWRITING READINESS

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The purpose of present study was to compare handwriting readiness of first grade students in public schools with regard to age and gender. Totally 87 students at the age of 61-72 months (n=48), and 73-84 months (n=39) participated in this study (43 girls, 44 boys). Turkish versions of Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) and Turkish versions of Beery-Buktenica Developmental Test of Visual Motor Integration (VMI) were utilized orderly for each student. Also, each student participated in data collection procedure individual.

Two 2x2 ANOVAs were conducted for motor proficiency and visual motor integration. For the motor proficiency, no significant difference in BOTMP scores was found between two age groups and gender groups. However, significant age effect was found in VMI scores while gender effect on VMI scores was not significant.

In conclusion, children in old age group (73-84 months) have an advantage to handwriting readiness compared with their peers in young age group because they had better performance in visual motor integration. On the other hand, both female students and male students demonstrated similar levels in handwriting readiness in their age groups.

Key words: Handwriting readiness, school readiness, motor proficiency, visual motor integration, age, gender.

ÖZ

YAZMA BECERİSİNE HAZIR BULUNUŞLUK ÖLÇÜSÜ OLARAK YAŞ VE CİNSİYETİN MOTOR YETERLİK VE GÖRSEL MOTOR ENTEGRASYONU ÜZERİNE ETKİSİ

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Yüksek Lisans, Beden Eğitimi ve Spor Bölümü

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Bu çalışmanın amacı ilkokul birinci sınıfa başlayan öğrencilerin yaş ve cinsiyet bakımından yazma becerisine hazır bulunuşluklarını karşılaştırmaktır. Çalışmaya 61-72 aylık(48 öğrenci) ve 73-84 aylık (39 öğrenci) toplam 87 öğrenci (43 kız, 44 erkek), ailelerin izin formları ile gönüllü olarak katılmışlardır. Bu çalışmada Bruininks-Oseretsky Motor Yeterlik Testi'nin ve Beery-Buktenika Gelişimsel Görsel Motor Entegrasyon Testi'nin Türkçe uyarlamaları, her öğrenci için sırayla uygulanmıştır. Her öğrenci çalışmaya bireysel olarak katılmıştır.

Hem motor yeterlik hem de görsel motor entegrasyonu için iki faktörlü Varyans Analizi (ANOVA) yapılmıştır. Çalışmanın sonucunda yaş grupları ve cinsiyet açısından motor yeterlikte bir fark bulunamamıştır. Fakat görsel motor entegrasyonunda yaşın etkisi bulunurken cinsiyetin etkisi bulunamamıştır.

Sonuç olarak büyük yaş grubundaki çocuklar daha iyi görsel entegrasyon performansına sahip oldukları için küçük yaş grubundaki arkadaşlarına göre yazma becerisine hazır bulunuşlukta daha avantajlıdırlar. Diğer taraftan, hem kız öğrenciler hem de erkek öğrenciler kendi yaş gruplarında yazma becerisine hazır bulunuşlukta benzer seviyede olduklarını göstermişlerdir.

Anahtar Kelimeler: yazma becerisine hazır bulunuşluk, okula hazır bulunuşluk, motor yeterlik, görsel motor entegrasyonu, yaş, cinsiyet.

To my family

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CHAPTER I

1. INTRODUCTION

This chapter is divided into eight sub-sections. Firstly, the background of the study will be presented. Then, rationale of the study will be pointed out followed by the research questions, the purpose of the study, research hypotheses, delimitations and limitations. Finally, the definition of the terms used in this study will be explained.

1.1. Background of the Study

At the beginning with 2012-2013 academic semesters, new Turkish education system was put into operation due to 222nd Law of Primary Education Act and Amendment. By this regulation in education system, compulsory education period was increased from 8 years to 12 years (4+4+4) and entrance age for primary school was decreased from 7 years (84 months) to 5.5 years (66 months). In addition to these arrangements, parents of children who are between 5 years (61 months) and 5.5 years (66 months) were given the opportunity to send their children to primary school regarding of children's physical and mental readiness.

As regulation in Turkish education system, chronological age is considered a criterion to start to school. Similarly, when history of different countries' education system was looked over in addition to Turkish education system, chronological age is a benchmark for starting to school. For example, in United Kingdom, entrance age of primary school is 5 years, ending age of compulsory education is 16 years and compulsory education period is 11 years (Education Act, 1996) whereas in France, entrance age of primary

school is 6 years, ending age of compulsory education is 16 years and compulsory education span is 10 years. On the other hand, in Germany, entrance age of primary school is 6 years, ending age of compulsory education is 16 years and compulsory education span is 9 years (Lauer, 2001). In Ottaman Empire, school entrance age was 5 or 6 years and law on compulsory education in primary school was accepted by Mahmut II in 19th century (Erdem, 2005). When the Turkish Republic was established in 1923, education system was adopted by Turkish Ministry of Education (MoNE). John Dewey was consulted for national education system between 1924 and 1926 and compulsory education period was set to be 5 years and schooling age was set to be 7 years. However, parents had taken initiative for their children to send primary school at the age of 6 years. Primary school entrance ages of other countries are listed in Table 1.1.

Although there is a conflict on usefulness of chronological age as a measurement for school readiness (Meisels, 1999), several countries determine the chronological age as a sole criterion (Narahara, 1998). For example, considering the countries in the table, it is possible to say that there is not an exact school entrance age and countries has determined their schooling age based on chronological age that is the number of years that one has lived. In addition to criterion of school readiness, chronological age seems to be to a criterion for developmental norms, standards or milestones which are certain behaviors or abilities that most children demonstrate at a certain age. On the other hand, the importance of developmental age has begun to be recognized. For instance, Department of Education, Science and Training in Canberra (2005) compared chronological age and developmental age and they stated that children in the same age do not demonstrate the same developmental level and also they perform at different rates in different areas of their own development. On the same topic, as Lewit and Baker (1995) stated that children who meet the chronological age criterion may not be able to adapt strict school requirements because of chronological age range. So chronological age is not trustworthy for success of children in school although it is accepted as predictor for schooling (McTurk, Lea, Robinson, Nutton & Carapetis, 2011).

Table 1.1 *Primary School Entrance Age of Different Countries*

Country	**2009**	**2010**	**2011**	**2012**
Afghanistan	7	7	7	7
Armenia	7	7	6	6
Australia	5	5	5	5
Austria	6	6	6	6
Brazil	7	7	6	6
Canada	6	6	6	6
China	7	7	7	7
Denmark	7	7	7	7
Egypt, Arab Rep.	6	6	6	6
Finland	7	7	7	7
Greece	6	6	6	6
Hungary	7	7	7	7
Iran	6	6	6	6
Iraq	6	6		
Ireland	5	5	5	5
Israel	6	6	6	6
Japan	6	6	6	6
Moldova	7	7	7	7
Pakistan	5	5	5	5
Poland	7	7	7	7
Russian Federation	7	7	7	7
Sweden	7	7	7	7
Switzerland	7	7	7	7
United States	6	6	6	6

Note: Adapted from http://data.worldbank.org/indicator/SE.PRM.AGES. Copyright 2013 by the World Bank Group

There are many issues linked with chronological age vs. developmental age such as physical development, social/emotional development, cognitive development, school success/achievement and also school readiness which is a debatable issue. Researchers have a general idea about importance of school readiness and its components; nevertheless, there is neither a certain definition of school readiness nor items of school readiness' components.

National Education Goals Panel in USA (1991) defined school readiness as "ready to learn" in first place and it was reported that school readiness consisted of five parts

which are language use, cognition and general knowledge, physical health and wellbeing, social and emotional development, and attitudes to learning. Then, difference between "ready to learn" and "school readiness" was argued by authors and in addition to knowledge components, school readiness was defined as minimum developmental level of children in cognitive, language, motor and socioemotional domains to meet school requirements (Kagan, 1992; Carlton & Winsler, 1999; Scarpati & Silver, 1999).

Duncan et al. (2006) stated that early social skills and early academic skills including pre-reading, pre-writing and early math skills are essential for school readiness because of their effects on later achievement. Hence, emergent literature development including pre-reading and pre-writing skills seem to be one of the important areas by early childhood education teachers in order to make students ready to primary school program in which children are able to learn reading and writing (Elliott & Olliff, 2008).

Handwriting performance consists of coordination and integration among motor proficiency, perception, cognitive skills and linguistic skills (National Handwriting Association in UK, 2013). According to this claim, prewriting or early writing skills in motor development of school readiness seems essential for students in the first grade since children learn handwriting skill during the first year of their academic school life considering to the Turkish course curriculum of MonE for elementary school.

To learn handwriting, the cooperation of kinesthesia, fine motor development and control, visual perception, visual motor integration, sensory modalities and sustained attention are required (Maeland, 1992; Amundson, 1992; Cornhill & Smith, 1996) and children are expected to gain skills to provide this cooperation to learn handwriting.

Handwriting performance seems changeable in children. This might be caused by extrinsic factors such as chair/desk height, blackboard distance when copying, sitting position, and position of paper as well as intrinsic factors like maturation, attention

span, developmental level of motor skills, visual motor integration skills (Landy & Burridge, 1999; Rosenblum, Goldstand & Parush, 2006; Feder & Majnemer, 2007).

Among the intrinsic factors, there is no certain evidence about the effect of gender difference on writing performance. Results of various studies demonstrate gender differences on writing, copying, typing, motor skills, and VMI, (Anderson, 1969; Goetz, 1980; Moreno-Briseno, Diaz, Canpos-Romo & Fernandez-Ruiz, 2010), while results of many studies indicate that there is no gender difference in writing performance, motor skills or VMI (Beery, 1989; Lamme, 1979; Weil & Cunningham-Amundson, 1994).

The studies, reports and ideas on school readiness and handwriting performance give rise to the idea that developmental age which includes levels of developmental domains (cognitive, language, motor, social, and emotional) affects students' handwriting readiness as a part of the school readiness but new national education system was arranged with respect to chronological age only. Moreover, gender effect on handwriting ability is still unclear. Therefore, in this thesis, readiness of Turkish children for learning handwriting was examined and the influence of gender on handwriting readiness is investigated.

1.2. Rationale of the Study

Within the primary education act in Turkey, school starting age was decreased from 7 years to 5.5 years by ignoring the "developmental age" factor and consequently classrooms include multiage student groups. Although there is an age gap between students in the same classroom, school requirements, goals or objectives which are determined in the curriculum for first graders are the same for each student. Regarding Turkish course curriculum, handwriting readiness of students in different ages seems to be important because of the fact that handwriting skill is the main goal in the first grade.

Because of the education reform and decreasing school entrance age, teachers and parents became confused whether children are ready to begin primary school or not. They are especially hesitant about readiness of children to learn writing and reading. Although there are many studies on handwriting ability and readiness to handwriting in the literature, it is limited in Turkey. For instance, Yangın (2007) had a study on readiness for handwriting education of preschool children who were at the age of six. She used psychomotor goals and objectives in the preschool curriculum as an instrument. Hence, application of instruments which were used in the literature are able to provide comparing results of this study with results of previous studies. In addition to this study, children at the age of 60-72 months should be included in the researches on handwriting readiness because of the new school entrance age.

Beside the age factor, handwriting ability is considerably affected by gender. While many authors found main differences between boys and girls in terms of handwriting performance and its' components (Anderson, 1969; Goetz, 1980; Moreno-Briseno, Diaz, Canpos-Romo & Fernandez-Ruiz, 2010), others claimed that there are no difference between boys and girls (Beery, 1989; Lamme, 1979; Weil et al., 1994). As a result, gender seems to be still a debatable factor whether it has an effect on handwriting and their components or not.

From an applied perspective, it is expected that the results of the study will provide to determine the first grade pupils' readiness on handwriting by finding current status on motor proficiency and visual motor integration skills which are predictor components of handwriting ability before they begin to learn handwriting.

1.3. Research Questions

Considering the review of literature, motor proficiency including fine motor development, and visual motor integration including both visual perception and fine motor skills seem main components of handwriting performance. Hence, research

questions took shape depending on these components with respect to age and gender in order to predict the handwriting readiness of first grade students. Two main research questions and sub-questions are given below:

1. What is the effect of interaction between age and gender on motor proficiency measured by Bruininks-Oseretsky Test of Motor Proficiency (BOTMP)?
    a. What is the main effect of age on motor proficiency?
    b. What is the main effect of gender on motor proficiency?

2. What is the effect of interaction between age and gender on visual motor integration skill measured by Beery-Buktenica Developmental Test of Visual Motor Integration (VMI)?
    a. What is the main effect of age on visual motor integration skill?
    b. What is the main effect of gender on visual motor integration skill?

1.4. Purpose of the Study

It is aimed to examine the effects of age and gender on handwriting readiness handwriting readiness of first grade pupils by measuring motor proficiency and visual motor integration skills.

1.5. Research Hypotheses

Regarded to interaction between age and gender for motor proficiency:
H_0: There is no interaction between age and gender.
H_1: There is an interaction between age and gender.

Regarded to age factor and motor proficiency:
H_0: There is no significant difference between age groups in terms of motor proficiency.
H_1: There is a significant difference between age groups in terms of motor proficiency.

Regarded to gender and motor proficiency:

H_0: There is no significant difference between girls and boys in terms of motor proficiency.

$H_{1:}$ There is a significant difference between girls and boys in terms of motor proficiency.

Regarded to interaction between age and gender for visual motor integration:

H_0: There is no interaction between age and gender.

$H_{1:}$ There is an interaction between age and gender.

Regarded to age factor and visual motor integration:

H_0: There is no significant difference between age groups in terms of visual motor integration.

$H_{1:}$ There is a significant difference between age groups in terms of visual motor integration.

Regarded to gender and visual motor integration:

H_0: There is no significant difference between girls and boys in terms of visual motor integration.

$H_{1:}$ There is a significant difference between girls and boys in terms of visual motor integration.

1.6. Delimitations

1. Participants consisted of students at the age of 61-84 months.
2. Students grade level was limited to first grade.
3. Students who had parents' allowance participated in the study.

1.7. Limitations

1. Schools of the study were not selected randomly.
2. Participants were limited to first graders.
3. Two main components of handwriting ability among six components were examined to predict the handwriting readiness of students.
4. The study was conducted during school hours.

1.8. Definition of the Terms

School readiness: Necessary minimum developmental level for children to meet school requirements sufficiently (Carlton & Winsler, 1999) and cognitive, language, motor and socioemotional skills in addition to knowledge components were considered essential to perform in school (Scarpati & Silver, 1999)

Kinesthesia: Realization of an object's weight, ability to amplitude and control of movements, distinguish the body parts without visual or auditory indications (Feder & Majnemer, 2007).

Visual perception: Visual input interpretation of the brain (Kurtz, 2006).

Fine motor control: One's precise and small movements by controlling and using the muscles of the hands and wrists, and sensory perceptual development refer to give meaning to information which comes through the senses (Essa, 2003).

Visual Motor Integration: Ability to integrate the visual images of letters of shapes with the appropriate motor response (Tseng & Cermak, 1993).

CHAPTER II

2. LITERATURE REVIEW

The effects of age and gender on handwriting readiness in terms of motor behavior were examined in this thesis. Regarding to the aim of the study, basic information of the school readiness, handwriting ability and its components, and importance of school readiness for handwriting ability are presented in this chapter.

2.1. School Readiness

"School readiness" idea took attention with the National Education Goals Panel in 1991 in United States of America. In National Education Goals Panel (1991), six education goals were determined and the first goal was "By the year 2000, all children in America will start school ready to learn."

As stated before, it is still debatable issue what school readiness is. There is a misunderstanding on school readiness as it seems to be a cognitive capacity, learning a particular material, to learn and assimilate curriculum, and authors criticized that social skills are ignored (Kagan & Rigby, 2003; McTurk et al., 2011) while "readiness to school" includes all developmental domains, approach to learning and general knowledge of children (High, 2008; Janus & Offord, 2007; Halle, Hair, Wandner & Chien, 2012; Duncan et al., 2007).

In National Education Goals Panel report, it was defined as "ready to learn" and it divided school readiness into five dimensions which are language use (listening, speaking, vocabulary, literacy skills, print awareness, story sense, writing and drawing

process), cognition and general knowledge (sound-letter association, spatial relations, number concepts), physical health and wellbeing (health status, growth, disability), social and emotional development (turn-taking, cooperation, empathy, ability to express one's own emotions), and approaches to learning (enthusiasm, curiosity, temperament, culture, values) (cited in High, 2008). Kagan (1992) emphasized the difference between "ready to learn" and "school readiness" since human being is always ready to learn from birth to death. Other perspective is that school readiness is necessary minimum developmental level for children to meet school requirements sufficiently (Carlton et al., 1999) by cognitive, language, motor and socioemotional skills in addition to knowledge components were considered essentials to perform in school (Scarpati et al., 1999).

For school readiness, school requirements are changed among children in preschool, kindergarten and elementary school. Pre-schoolers are three- to five-year old children and school readiness skills are thought for kindergarten: language skills (receptive language, expressive language, symbolic language), independence skills (working alone on a task, self-caring), impulse control skills (working cooperatively with others), interpersonal skills (relationships with both adults and peers), experiential backgrounds (background of information), physical and mental health skills (good nutritional, mental, and physical health habits). Next, kindergarten seemed as transitional stage from program on social and emotional development through program on academics (early literacy, math and science). However, there have been ongoing debates and discussions on appropriate age for kindergarten entrance. While kindergarten of Froebel, who was the founder of kindergarten, was for children between three and seven years of age, kindergarten in USA is for five- and six- year-olds. Wood, Powell and Knight (1984) compared developmental age and chronological kindergarten entry age that is between 4 and 6 and they claimed that chronological age was not related with children's later success or failure, and calculation and determination the exact critical age of children for kindergarten entrance was also important regarded to developmental level of kindergarten curricula and school districts.

School readiness is an essential part of beginning academic education. Snows, Burns and Griffin (1998) emphasized the importance of pre-literacy skills in the National Research Council's Committee on the Prevention of Reading Difficulties in Young Children. National Association for the Education of Young Children (NAEYC) and the National Council of Mathematics (NCTM) focused on mathematics for children at the age of 3-6 years and adapted NCTM standards prekindergarten to grade 2 (NAEYC & NCTM, 2002). Duncan et al. (2007) found that school entry skills which are early math skills, early reading skills and attention impacted later learning of children.

Gredler (1980) supported it as chronological age was not an excuse of child's school readiness whereas other factors such as socioeconomic status, parent and teacher expectations affected on school achievement much than chronological age. On the other hand, McBryde, Ziviani and Cuskelly (2004) emphasized that task persistence, adaptable behaviours, gender and also "chronological age" impacted decisions of both parents and teachers on children's school readiness. Similar to McBryde et al. (2004), Angenent and de Man (1989) found the gender difference in Dutch students in first grade in terms of school readiness and results of their study indicated that female students were more ready to school than male students. On the other hand, Gullo and Burton (1992) found the effect of duration in preschool and age on school readiness whereas they stated no effect of gender on school readiness. On this topic, Yeşil-Dağlı (2012) claimed that child gender did not affect parents' decisions on child's readiness, child's beginning school on time or delaying school entrance one year, and Erkan (2011) pointed out that socioeconomic status had an effect on school readiness level of first graders while gender did not have a significant effect on it. Polat-Unutkan (2007) found that there was no difference in early mathematics skills for school readiness regarded to gender.

On the other hand, Matthews, Ponitz and Morrison (2009) stated that although there was no difference in academic achievement between girls and boys at the end of the kindergarten year, girls had advantages in school readiness because boys had less

behavioral regulation and control skills than girls. Cooper, Osborne, Beck and McLanahan (2011) supported previous study but explained the difference as boys were affected negatively by partnership instability which is associated with lower verbal ability and more externalizing and social problems much than girls and this caused reducing boys' readiness to begin formal school. Previous studies demonstrate that difference in school readiness seems an advantage for girls. Nevertheless, Al-Hassan and Landsford (2009) claimed that girls were lower level of school readiness than boys because boys were supported to go to school much than girls were supported.

Regarded to both age and gender, DiPasquale, Moule, & Flewelling (1980) stated that birthdate effect on school readiness was indicated in just male participants whereas there was not a birthdate effect for females in terms of school readiness.

2.2. Handwriting Performance

Handwriting was firstly characterized as connected strokes in an order based on rules (Eden, 1962). Then, handwriting description was modified as a hand movement in guidance of eyes and direction of motor memory (Landy & Burridge, 1999). In contemporary, "handwriting" term is defined as a complex skill associated with linguistic, cognitive, perception, and motor proficiency and their coordination and integration (National Handwriting Association in UK, 2013). Handwriting performance is the harmonization of visual-motor coordination abilities, motor planning, cognitive, and perceptual skills, tactile and kinesthetic sensitivities (Maeland, 1992). Motor and perceptual skills include fine motor control (in hand manipulation, motor planning), kinesthesia, eye-hand coordination, visuomotor or visual-motor integration, (Cornhill et al., 1996), visual perception, sensory modalities, and sustained attention (Amundson, 1992).

Handwriting performance starts with early scribbling at the age of 2 (Ajuriaguerra & Auzias, 1975; cited in Feder et al., 2007). Then, writing performance from late toddler

stage to the end of preschool years (from 2 or 2 ½ years to 5 ½ years) is developed from scribbling to script which children use small marks or drawing pictures for communication (Schickedanz & Casbergue, 2009; Gerde, Bingham & Wasik, 2012). In next stages, children are able to draw ordered or consistent shapes such as zigzag or looping pattern, copying geometric forms and children started to recognize the letter-like symbols or forms (Feder et al., 2007; Gerde et al., 2012). Quality of handwriting performance develops promptly in 1st grade (6-7yeras) this development continues on 2nd grade, and children begin to write in an organization, automatically and handwriting becomes an instrument for development of ideas (Blote & Hamstra-Bletz, 1991; Feder et a., 2007). Students learn manuscript writing in the first and second grades and cursive writing in the third grade (Graham & Miller, 1980). Furthermore, Graham, Weintraub, Berninger and Schafer (1998) stated that handwriting speed in handwriting performance increases from Grade 1 to Grade 9; nevertheless, the increasing is not stable. For instance, handwriting speed was in Grade 1 to 4 faster than Grade 4 to 5. Furthermore, authors claimed that handwriting speed of boys were slower than handwriting speed of girls. On the other hand, Graham, Berninger and Fan (2007) pointed out that although girls had positive attitudes to writing more than boys, there was no significant difference between girls and boys in their writing achievement.

In Turkey, academic instruction of writing and reading skills begins under the title of "first instruction of reading and writing" in grade 1. The goals are designed as preparation to rest, write, and read; perception and recognition phoneme; reading and writing phoneme/letter; composition of phoneme/letters to create syllables, words, and sentences; creation a text; achievement to be literate (MoNE, 2009). When the course durations of the lectures are compared, it is seen that the lecture durations of mathematics and physical activities take place for 5 hours each whereas Turkish course takes place for 10 hours of totally 26 hours of all courses in a week (MoNE). Moreover; Kathleen and Cermak (1992) found that first grade students spend thirty one to sixty percent of school day to practice fine motor tasks and to learn handwriting depends on their different levels in fine motor performance.

There are plenty of studies on handwriting ability and academic achievement in the literature. Rosenblum et al. (2003) pointed out that the quality of child's handwriting skills affects child's academic performance. Bara and Morin (2013) emphasized that handwriting is a required skill for many school activities related with academic achievement and development of fluency in handwriting is essential for children. Gerde et al. (2012) claimed that writing is an essential part of emergent literacy skill because it is one of the basics in later literacy and reading skills. For example, handwriting speed and legibility impact duration of written assignments and taking notes during lectures (Graham, 1992; Graham & Weintraub, 1996). Rice (1976) found that handwriting rapid and casual handwriting, legibility, copying rate are essential predictors of linguistic achievement and assignment completions.

In addition to academic achievement, handwriting performance has an effect on children's self-image, attitude and behavior. Also, it is believed as a demonstration of one's capability (Mather & Roberts, 1995; Sasoon, 1990).

2.2.1. Kinesthesia

For years, it has been thought that there are only five senses which are taste, smell, hearing, sight, and touch. However, authors began to criticize "only five senses theory", because the idea of "senses are systems" began to be acknowledged and proprioceptive system causes other senses such as pain, discomfort, vibration or pleasure (Zion, 1996). One of the examples of sense systems is kinesthesia and it is the sense of "position and movement". Although kinesthesia is the first developed sense, it is a latent sensory system that includes neurons, fibres of muscles, joints, tendons, and ligaments in addition to eyes, ears, nose, mouth or skin. As a result, it is so essential for proprioception that a problem in kinesthesia causes deficits in voluntary movements (Rothwell, Traub, Day, Obeso, Thomas & Marsden, 1982; Zion, 1996).

Children are supposed to have required skills based on hand maturation (Rueckriegel et al., 2008), kinesthetic sensitivity and achieve in handwriting with formal instruction by age of 10 to 12 years (Brink & Jacobs, 2011). Kinesthesis means the movement and positions of the limbs that occur with information from the muscles, joints and skin (McCloskey, 1978) and kinesthetic sensitivity or kinesthesia refers to realization of an object's weight, ability to amplitude and control movements, to distinguish the body parts without visual or auditory indications. This sensory awareness in fingers affects handwriting performance in children (Keogh & Sugden, 1985; Feder et al., 2007). Moreover, it is supported that kinesthetic input is essential during the process of skilled movement like handwriting (Ziviani et al., 1990; Laszlo & Bairstow, 1983) because kinesthesia gives feedback for error correction by controlling speed, extent and force of movements (Kushki, Chau & Anagnostou, 2011).

Kinesthesia has an important role in handwriting ability because it affects pencil grip, the amount of pressure on writing tool, and the ability to write between lines (Feder & Majnemer, 2007).

Copley and Ziviani (1990) found the positive relationship between handwriting quality and kinesthesia by conducting the Kinesthesia Test while they found that kinesthetic acuity, perception and memory were not related to handwriting quality by applying the Test of Kinesthetic Sensitivity. Furthermore, pupils with improficient handwriting performance did not demonstrate a difference in kinesthetic sensitivity compared with their peers with proficient handwriting performance (Brink et al., 2011). On the other hand, children with disability in kinesthetic functions performed awkward and weak pencil grip (Levine, 1987). In addition to this, pupils with poor handwriting and good kinesthetic awareness showed higher grip scores than their peers with poor handwriting and poor kinesthetic awareness, also there was a link between immature grasping patterns, poor handwriting and limitations in kinesthetic functions (Schneck, 1991). Moreover, Feder et al. (2005) stated that preterm children demonstrated significantly worse handwriting performance because of the difficulties on most sensorimotor skills.

Preterms had difficulty in sensory awareness of fingers or kinesthetic sensitivity of fingers which is one of the sensorimotor skills but no deficits were detected in samples of the study.

Kinesthetic and visual control processes are associated with each other during handwriting act but idiosyncratic letter forms that cause the individuality in handwriting are controlled by kinesthetic information exclusively (Zimmer, 1982).

Effectiveness of kinesthetic intervention is still debatable. In fact, Harris and Livesey (1992) stated that kinesthetic sensitivity practice improved handwriting performance of older children, especially; in the first grade whereas Sudsawad, Trombly, Henderson, and Tickle-Degnen (2002) claimed that improvement in kinesthesis did not have an effect on handwriting performance.

2.2.2. Visual Perception

Vision is a process that includes facing with multiple visual stimuli that continually change in time and space, and then ability to interpret and understand the meaning and significance of these stimuli. Also, visual perception means visual input interpretation of the brain (Kurtz, 2006).

The importance of visual perception was emphasized in structural pattern of motor actions to follow and the better visual perception conditions provided the better coordination in motor actions (Strauss & Kephart, 1955; Tseng & Cermak, 1993). However, it was stated that there were plenty of studies on the relationship between visual perception and reading ability while there were limited studies on the relationship between visual perception and writing ability (Tseng et al., 1993). Furthermore, Feder and Majnemer (2007) mentioned that although studies demonstrated the correlation between visual perception and writing ability, it stayed unclear.

Yost and Lesiak (1980) stated that visual perception skills which were measured by Frostig Developmental Test of Visual Perception (DTVP) do not have an importance on the development of handwriting ability. On the other hand, children with writing difficulties demonstrated less proficient performance than children without writing problems regarded to visual perception. Also, it is stated that poor visual memory for letter patterns caused difficulties in copying tasks and handwriting performance in students (Bain, 1991; Kurtz, 1994, cited in Feder et al., 2007). Moreover, Amundson et al. (1996) mentioned that steadiness of visual perception enabled students to realize differences between similar letters and/or words such as d-b or saw-was. In addition to these, it was claimed that the performance of normal speed handwriters was motor based while the performance of slow speed handwriters was related to visual processing (Tseng et al., 1999). Furthermore, handwriting legibility of children with autistic spectrum disorder was moderately related with visual perceptual ability (Cartmill, Rodger & Ziviani, 2009).

2.2.3. Fine Motor Development and Control

Child development includes three broad parts or domains: physical, cognitive and emotional/social (Berk, 2006). Physical development also follows a developmental direction which is predictable and ordered sequence of motor control (Gallahue & Ozmun, 1996). Firstly, cephalocaudal development refers to head-to-tail sequence. It is the slow progression of increased motor control from the head to the feet. In other words, motor control of the head is achieved first, then comes the control of arms and trunk before the control of the legs (Heriza, 1991; Gallahue et al., 1996; Berk, 2006). Secondly, proximodistal development refers to centre-to-peripheral sequence. The motor control begins with the centre of the body and continues to the most distant parts. In other words, the control of the head is achieved first. The control of trunk, shoulder, arm, wrist, hand, and fingers follows the control of head in a sequence (Heriza, 1991; Gallahue, 1996; Berk, 2006). Harvey and Simmard (1984) designed a methodology based on proximodistal development for left writing reeducation.

There are three important terms in this development with respect to theories of physical development gross motor development, fine motor development and sensory perceptual development (Essa, 2011). Gross motor development means that one's control and use the large muscle masses of his/her body (Williams & Monsma, 2006). Spessato, Gabbard, Valentini and Rudisill (2013) stated that although boys had better performance in fundamental movement skills at the age of 7 to 10 years, this motor performance of girls and boys seemed similar at the age of 3 to 6. Followed by the definition of gross motor development, fine motor development refers one's precise and small movements by controlling and using the muscles of the hands and wrists, and sensory perceptual development refers to give meaning to information which comes through the senses (Essa, 2011).

Bruininks (1978) stated that development of motor ability increases depending on chronological age. On the other hand, van Galen (1980) claimed that motor development is one of the key factors in handwriting performance because graphic performances of 4 to 6 year old children have better correlation with motor scores than with chronological age (cited in Longcamp, Zerbato-Poudou & Velay, 2005). Furthermore, although performance in many fundamental motor tasks improves by the age during early childhood, motor performance in early childhood is not extensive as in middle childhood and adolescence because of intraindividual/biological and interindividual/environmental variability in performance among young children (Malina, Bouchard & Bar-Or, 2004)

Berk (1996) emphasized the difference in motor skills between girls and boys. While boys were prone to edge force and power in physical skills, girls had better performance in fine motor skills and gross motor skills included precision (cited in Developmentally Appropriate Practice in Early Childhood Programs, 1999). On the other hand; Ammons, Alprin and Ammons (1955) and Piper (2011) found that there was a definite

developmental progression in motor skills from Grade 3 to Grade 12 with the advantage of males.

Ohtoshi, Muraki and Takada (2008) stated that motor speed improve steeply by age; however, improvement nearly finished after age 10 years. Gasser, Rousson, Caflisch and Jenni (2010) stated that motor speed improves step by step in children from 5 year-olds to 10 year-olds, and although effect of gender differences was small in size, males were faster in repetitive hand movements whereas females were faster in sequential finger movements.

Compared with gross motor skills, Grissmer, Grimm, Murrah and Steele (2010) claimed that fine motor skills were predictor of later achievement because of its strong relationship with attention.

Fine motor skills in writing ability provide to produce letters with a definite form and size at a definite position on the writing surface and enable fluent manipulation (Van Galen et al., 1993) and children usually achieved the dynamic tripod grasp at the age of 4-6 years because of improvement in the child's fine motor control (Dennis & Swinth, 1999).

Firstly, Stott, Moyes and Henderson (1972) found that children with poor handwriting did not have worse performance in fine motor skills compared with children in control group and they claimed that there was no direct relationship between fine motor skills and handwriting. However, results of recent studies are opposite of this idea. Levine et al. (1981) children with low writing performance had problems in fine motor activities. Hamstra-Bletz and Blöte (1993) found that dysgraphia or writing disability is still a problem in higher grades, and inadequate fine motor control in the execution of motor programs was related to problems of students with dysgraphia. Smits-Engelsman, Niemeijer and van Galen (2001) emphasized that seven of the twelve children, between the ages of 5-6.8, with handwriting difficulties had problems with fine motor skills.

Volman, van Schendel and Jongmans (2006) found that quality of hand writing was related to fine motor coordination in children with writing difficulties.

Fine motor deficits were related to language disorders, behavioural disorders learning disorders and attention deficits; moreover, the extent of the motor deficits affects academic achievement in the first three years of school whereas proficiency in fine motor skills like cutting, folding, writing supported children for further academic achievements (Ericsson, 2008; John, 2013).

2.2.4. Visual Motor Integration

Fine motor skills and visual perceptual skills are increased sharply in kindergarten age and coordination of these provides children to perform activities including visual motor integration, especially handwriting (Beery, 1997; cited in Daly, Kelley, Krauss, 2003). Visual motor integration is defined as "ability to integrate the visual images of letters or shapes with the appropriate motor response." (Tseng & Cermak, 1993), and it allows children to reproduce letters and number to write school assignments (Amundson, 1992).

Benbow, Hanft and Marsh (1992) mentioned that visual motor skills and fine motor coordination are primary components of handwriting ability and Daly et al. (2003) emphasized the necessity of visual motor integration skills for handwriting ability. Weil and Amundson (1994) stated that respect with the relationship between visual motor integration and handwriting skills, most children with typically developing in the latter part of their kindergarten year will be ready for handwriting instruction as Decker, Englund, Carboni and Brooks (2011) claimed that both age-related variance and specific cognitive abilities related to visual motor integration skills had an effect on visual motor integration skills in children.

Marr and Cermak (2002) and Kaiser, Albaret and Doudin (2009) claimed that the Beery-Buktenica Developmental Test of Visual Motor Integration (VMI) scores, which is the most commonly used instrument to assess visuomotor skills, were not alone a predictor of letter-copying scores or readiness for handwriting instruction because the first nine VMI figures were associated with handwriting performance of girls solely (Marr et al., 2002). Moreover, VMI scores of most children with handwriting difficulties were within the normal range (Goyen & Duff, 1995). On the other hand, Feder, Majnemer and Synnes (2000) claimed that VMI was applied by Canadian occupational therapists to assess handwriting difficulties in children. Cornhill and Case-Smith (1996) stated that VMI scores were the predictor of writing quality. Moreover, there is a significant relationship between visual motor integration and copying letters among children in kindergarten age and it has an important role for learning letter formation in the primary stages (Sovik, 1975, cited in Weil & Amundson, 1994; Daly et al., 2003). Also, Oliver (1990) emphasized the usefulness of VMI for handwriting readiness by assessing paper-pencil and fine motor skills easily and quickly. On the topic of handwriting performance and visual motor integration skill, although there was not a significant relationship between handwriting scores and visual motor integration score after the 3rd grade (Phelps & Stempel, 1987); Sovik (1975; cited in Weil et al., 1994) and Maeland (1992) found the relationship between visual motor integration and handwriting performance in children at the age of 7 to 11 years.

Kulp (1999) stated that there was a relationship between VMI and academic achievement in 7, 8, and 9 year olds while there was not a relationship between and academic achievement in 5- and 6 year olds. However, authors claimed that results of kindergarten children (5- and 6 year olds) were not accurate because of difficulty in observation and evaluation in the school timing.

In addition to age effect on relationship between visual motor integration and handwriting performance, Lachance and Mazzocco (2006) found that girls had better performance than boys in terms of visual motor integration skills from kindergarten to

3rd grade. Also, Chinese female students demonstrated better performance in VMI than male students at early ages (Cui, Zhu, Hannu & Jeff, 2012). On the other hand, although gender difference was found with the favor of female children among children from USA and India in the first grade in terms of visual motor integration skill, it was not a significant difference (Soderman, Chhikira, Hsui-Ching & Kuo, 1999).

Poor handwriting performance is related to impaired visual motor integration in children with minor neurological dysfunction and impaired visual motor integration is caused by coordination problems, fine manipulative disability, dysfunctional muscle tone regulation, and sensory dysfunction (van Hoorn, Maathuis, Peters & Hadders-Algra, 2010). For instence, girls with learning disability had significantly lower performance in a task of complex visual motor integration than girls with typically development (Sutherland & Algozzine, 1979).

2.2.5. Sensory Modalities

Sensory information seems the initial organizer or regulator for many motor acts. This regulation is achieved by a complex feedback mechanism that might act through many sensory modalities simultaneously (van Bergeijk & David, 1959). These modalities can be verbal, auditory, visual or physical. In learning and cognitive development, haptic exploration of tangible objects play an important role respect with studies in experimental psychology, evolutionary psychology, and cognitive anthropology (Greenfield, 1991, Lederman & Matula, 1993; Wilson, 1998; Hatwel, Strari & Gentaz, 2003; Klatzky, Lederman, & Mankinen, 2005; Bara, Gentaz, & Cole, 2007; cited in Mangen & Velay; 2010). While verbal modalities have a vital role for learning reading skills (Sadoski & Paivio; 2004), they may be insufficient to teach or transfer motor skills such as handwriting as well as medical procedures, painting and sculpting techniques, and skills in sport. Hence, haptic modality which is the sense of touch in physical guide might be necessary for motor skills (Eid, Mansour, El Saddık & Iglesias, 2007). At the beginning of the handwriting acquisition, retroactive control of movement which

depends on sensorial, visual, and kinesthetic feedback directs movements whereas proactive control which is an internal representation of motor acts guides the movement, writing becomes automatic with practices (Palluel-Germain, Bara, Boisferon, Hennion, Gouagout & Gentaz, 2007). Haptic-visual modality systems improves learning handwriting (Bara, Gentaz, Colé, 2004; Palluel-Germain et al., 2007) as well as a haptic sensory modality with audio information provides to increase learning ability and fluency of handwriting (Mansour et al. 2007). Moreover, visual modality and feedback affects positively handwriting performance of people with Parkinson's disease (Smith & Fucetola, 1995). Handwriting Movement Sonification, which includes visual modality feedback, proprioceptive feedback and audiovisual modality feedback, supports children with dysgraphia to improve their handwriting movements. While proprioceptive and visual feedback is used by children naturally, audio feedback might be used to complete other modalities (Danna et al., 2013).

Cheatum and Hammaond (2000) presented the sensory modalities and systems needed for school work in a table (cited in Glazener, 2004) (Table 2.1).

Table 2.1 *Senses, Sensory Systems and School Skills*

Sense*	Sensory Organs	Sensory System	School Skill
Balance	ears	vestibular	sitting, standing, maintaining a posture
Movement	Joints and muscles	proprioceptive	maintaining a posture, moving safely through space and around obstacles
Touch	skin	tactile	fine motor activities
Sight	eyes	visual	reading and writing
Hearing	ears	auditory	communicating/understanding

*Taste and smell are not included in this list because their sensory input is rarely used to learn within the classroom setting.

Note. From *Sensorcises Active Enrichment for the Out-of-Step Learner*, p. 66, by Glazener, 2004, USA: Corwin Press

2.2.6. Sustained Attention

In motor performance, Schneider and Shiffrin (1977) proposed automatic and controlled processing model. In this model, controlled processing demands attention and performance in this processing is slow whereas automatic processing does not demand attention and performance is fast in this processing. Furthermore, controlled process is important for tasks at low levels of practice while automatic process is essential for tasks which are consistently trained. Palluel-Germain et al. (2007) stated that handwriting movement is slow at the beginning of learning; next, it develops into automatic with practices. Respect with the previous studies, students who begins to learn handwriting seems at the controlled processing of which attention is necessary.

Attention deficit hyperactivity disorder (ADHD) causes inability to organize and sustain attention, adjust activity level, and moderate impulsive actions (Rappley, 2005) and the importance of attention in handwriting performance is seen clearly in the handwriting performance of students with ADHD. For instance, depends on the parents' perception, 58% of the participants consisted of 38 students with ADHD poorer handwriting performance compared with their peers with developed typically (Doyle, Wallen & Whitmont, 1995). A high percentage (approximately 63%) of boys with ADHD has motor difficulties (Piek, Pitcher & Hay, 1999) and approximately 50% of children with ADHD demonstrate fine motor coordination difficulties (Piek et al., 1999; Steger et al., 2001). Moreover, children with ADHD demonstrated poorer handwriting performance by inconsistent letter shapes and size (Lerer, Artner & Lerer, 1979). On the other hand, handwriting may provide the attention to increase. Indeed, Lange et al. (2007) stated that methylphenidate, which is a kind of medicine, is not sufficient to treat ADHD, and it might be better for children with ADHD how they use their increased attentional capacities like focusing on handwriting.

In addition to studies on handwriting and ADHD, Tseng et al. (2000) found that children with slow handwriting demonstrated poorer performance than children with

normal handwriting speed in attention in addition to graphomotor output, level of perceptual-motor skills and proficiencies. Moreover, children with dysgraphia or writing disorders had more attentional difficulties and they were prone to have lower mathematics achievement and verbal IQ (Sandler et al. 1992).

2.3. Affected Factors

Handwriting performance is affected by many variables which can be divided as intrinsic (children's capabilities, age and gender) and extrinsic (environmental/biomechanical issues) (Landy et al., 1999; Rosenblum, Goldstand & Parush, 2006; Feder et al., 2007; Rueckriegel, Blankenburg, Burghardt, Ehrlich, Henze, Mergl, Driever, 2008; Accardo, Genna & Borean, 2013). Children's capacity of intrinsic variables includes maturation (hand size), motor skills like muscle tension, muscle strength, fluency of arm transport, force control, manipulation speed, hand steadiness, kinesthetic sensitivity, vision, emotion, visual-motor integration (hand-eye coordination), attitude, perception/spatial, attention/memory (Landy et al., 1999), whereas extrinsic variables include environmental issues such as chair/desk height, writing instrument used, type of paper used and its placement on the desk, environmental lighting and noise, blackboard distance when copying, difficulty level of handwriting (Landy et al., 1999; Feder et al., 2007) and biomechanical ergonomic issues such as posture, pencil grip, position of paper (Feder et al., 2007; Rosenblum, Goldstand & Parush, 2006; Landy et al., 1999).

2.3.1. Intrinsic Factors

Intrinsic factors that affect handwriting performance might be acknowledged as children's actual capabilities on perceptual and motor skills (Feder et al. 2007), age and gender (Rueckriegel, 2008; Kakebeeke et al., 2012; van Mier, 2006; Mergl, Tigges, Schröter, Möller and Hegerl, 1999; Vlachos and Bonoti, 2006).

Children's actual capabilities on perceptual and motor skills were discussed in the previous sections where components of handwriting performance are mentioned.

Regarded to age, Rueckriegel et al. (2008) mentioned that age indicated effect of motor maturation on kinematic parameters. Kinematic parameter and schooling demonstrated that motor and cognitive maturation had an effect on handwriting skills (Accardo et al., 2013). On the other hand, Kakebeeke et al. (2012) emphasized the effect of age on gross motor performance in 3- to 5-year-olds. However, performance of sequential movements of the fingers was similar in children between 3 years old and 5 years old.

In addition to capacity of children and age, gender seems to be a factor that effect handwriting performance, but the effects of gender is still unclear. For example, van Mier (2006) claimed that drawing performance which is a prewriting skill (zigzag and slalom performance) became better by increasing age between 4 and 12 years but no difference was found in drawing performance between girls and boys. Mergl et al. (1999) emphasized the effects of age, verbal intelligence and preference motor activities on handwriting performance while gender and personality factors did not affect handwriting. On the other hand; Rueckriegel et al. (2008) stated that gender difference in hand movement development was obvious in childhood and found that males demonstrated faster and less accurate performance in fine motor movements than females. Vlachos et al. (2006) stated in neurobiological perspective that writing performance improved by both age and gender. An improvement in handwriting performance with age was observed in all children and girls had better writing performance because of rapid development in the left hemisphere in early childhood span.

2.3.2. Extrinsic Factors

Extrinsic factors that affect handwriting performance may be assumed as environmental factors (Landy et al., 1999; Feder et al., 2007) and biomechanical ergonomic factors

(Feder et al., 2007; Rosenblum et al., 2006; Landy et al., 1999). Ergonomics factors provide safe, comfortable and efficient human use related to tools, systems, machines, tasks, jobs and environment (Chapanis, 1991).

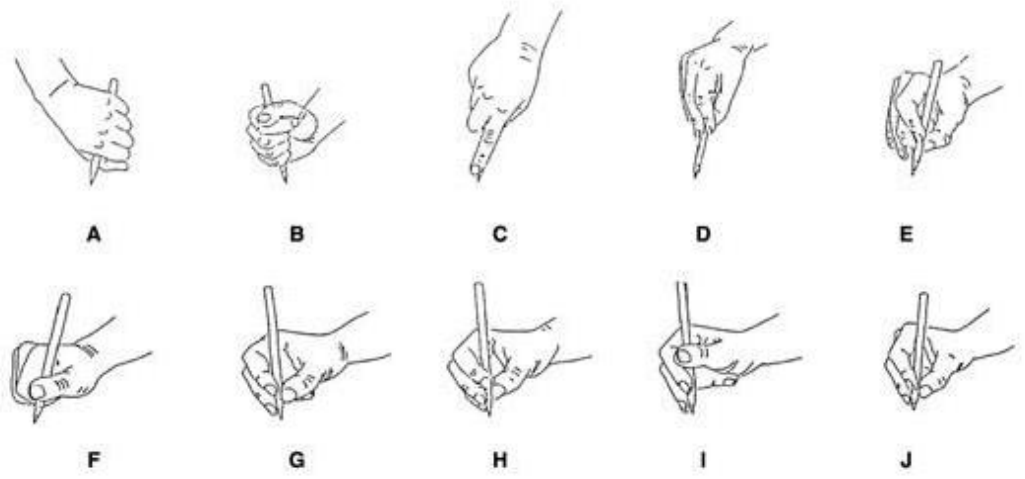
To begin with environmental ergonomic factors, it involves chair/desk height, writing instrument used, type of paper used and its placement on the desk, environmental lighting and noise, blackboard distance when copying, difficulty level of handwriting. Good lightening should be provided for children and no shadows are cast on the work. The desk and chair support children's posture as legs should not be cramped under the desk, feet should be flat on the floor, hips and low back should be supported with the chair back and angles of knees should be approximately 90^{o}. There should not be clutter on the desk for the arms free movement on the desk by elbows slight flexing with forearms. Furthermore, there should be soft surface to make writing easier and appropriately pencils should be preferred to pretend grip problems. Finally, children with right-handers and with left-handers should not sit in close proximity in the same chair and children should sit parallel to the board (Penso, 1990; Landy et al, 1999, Feder et al., 2007).

Next, biomechanical ergonomic factors include sitting position, posture, pencil grip, and position of paper. As mentioned in chair and desk height, sitting position is defined as children's feet should flat on the floor, knees should be at the angle of approximately 90^{o}, backs should be supported by chair, and arms should be provided free movement on the surface of the desk.

Building and organization of coordinated activity which includes learning to correct posture is the first step of skill acquisition (Welford, 1951). Landy et al. (1999) stated the physical characteristics of good posture. Firstly, fingers, hands, wrists, arms, shoulders, neck are in a relaxed condition. Children should sit with the back straight forward from the hips rather than the neck. The feet should be on floor with flat

position. Furthermore, position of paper is related to posture. Paper on the desk surface should have an appropriate angle considering the forearms.

Improperly pencil grip causes the poor formation of letters and the deficiency to attach letters together in order to create words (Callewaert, 1963). Schneck (1991) emphasized the importance of pencil grip which allows to necessary fine motor movement for handwriting and found that children with handwriting problems demonstrated poor pencil grip compared to children with good handwriting. Schwellnus et al. (2012) suggested four pencil grips/grasps which are functional for handwriting in the literature. The first position is dynamic tripod. In this position, thumb, index and middle fingers create a tripod position by the thumb opposite of index and middle fingers (Benbow et al., 1992). The second position is lateral (thumb) tripod. The thumb is close the lateral border of the index finger or arches top of the pencil in this position. The hand movements are provided by index and middle fingers (Schwellnus et al., 2012). The name of the third position is dynamic quadrupod. The ring finger participated in this position by on the barrel of the pencil, and it is similar to the dynamic tripod (Benbow, 1987; Schwellnus et al., 2012). The final position is lateral (thumb) quadrupod. This pencil grip includes four fingers, either. The thumb is close to the index finger, and the middle and ring fingers are adjacent of the pencil barrel (Dennis and Swinth, 2001). Among the types of pencil grip, dynamic tripod is recommended the most (Schneck 1991; Schwellnus, 2012). Other pencil grip postures are given in Figure 2.1.



A. radial cross palmar grasp; B. palmar supinate grasp; C. digital pronate grasp, only index finger extended; D. brush grasp; E. grasp with extended fingers; F. cross thumb grasp; G. static tripod grasp; H. four fingers grasp; I. lateral tripod grasp; J. dynamic tripod grasp

Figure 2.1 Pencil grip postures. *Note:* Adapted from "Pencil Grip Development and Why It matters" by A. Annandale, 2013.

Regarded to the biomechanical ergonomic factors, Parush (1998) found that children with poor writing demonstrated lower ability on pencil-paper-body positioning, stabilization of paper, and consistency of pressure than children with good handwriting.

2.4. Relationship between School Readiness and Handwriting Readiness

Depending on the history of "school readiness" definition, prior tests which were utilized to assess the school readiness focused on reading and writing skills of children (Janus & Offord, 2007). However, related to new definitions of school readiness, young children are expected to demonstrate plenty of requirement skills in in cognitive, language, motor and socioemotional areas before they begin formal education (Carlton et al., 1999; Scarpati et al., 1999). Hence, current tests including Early Developmental Instrument (EDI) (Janus et al., 2007) and Marmara School Readiness Test (Marmara İlköğretime Hazır Oluş Testi) (Polat, 2003), early education programs involving Head

Start, Maryland Model for School Readiness (Maryland State Department of Education, 2006) were created by considering children's overall development (language and literacy development, physical development and wellbeing, cognitive development, personal and social development which are the components of handwriting performance , either) and readiness for school. Duncan et al. (2006) emphasized the importance of school readiness for later achievement respect to early social skills and early academic skills including pre-reading, pre-writing and math skills. Because children are usually able to read and write in primary school program, emergent literature development including pre-reading and writing skills becomes one of the areas that early childhood education teachers focus on (Elliott & Olliff, 2008). Hence, many early childhood programs enhance prewriting skills as a pre-academic skill in addition to social skills for school readiness and academic achievement. For example, Tulsa Public Schools Pre-K program supports prewriting skills by seven months, Tulsa Head Start program enhances these skills by three months (cited in Gormley, Philips & Gayer, 2008).

For acquisition pre-writing skills in school readiness, appropriate motor development involving physical coordination is required to control a pencil, turn the pages without tearing them. If a student has insufficient age appropriate motor skills, s/he might perceive himself/herself incompetent and s/he may not participate in school activities (Doherty, 1997).

Related to importance of pre-writing skills for school readiness and academic achievement, Lust and Donica (2011) applied a handwriting readiness program in Head Start. In this study, children who participated in Handwriting Without Tears®–Get Set for School (HWT–GSS) programming demonstrated better performance in prewriting, kindergarten readiness, and fine motor skills compared with their peers who did not participate in the program. In addition to program on pre-writing skills, Longcamp et al. (2005) applied typing and handwriting trainings and they stated that handwriting training improved older children for character recognition whereas it was not effective

for children younger than fifty months because of the inadequate maturation in fine motor control for handwriting performance.

Moreover, during early writing development, detecting difficulties in learning to write is essential in order to supply more special attention to at-risk children (Maki, Voeten, Vauras & Pskiparta, 2001)

CHAPTER III

3. METHOD

This chapter presents an overview of the research methodology used in the study which was designed to examine the effects of age and gender on handwriting readiness by measuring motor proficiency and visual motor integration skills. In this respect, the chapter consists of five parts: overall design of the study, participants, instruments utilized for data collection, data collection procedures and data analysis.

3.1. Overall Design of the Study

The first design of the study had been created depending on age gaps in the same classroom. Age, gender and attending to preschool had been determined as independent variables and school readiness, motor proficiency and visual motor integration skills had been dependent variables. Moreover, it had been decided that totally 72 participants divided into six groups as girls in 66-72 months age group (n=12), boys in 66-72 months age group (n=12), girls with early childhood education in 78-84 months age group (n=12), boys with early childhood education in 78-84 months age group (n=12), girls without early childhood education in 78-84 months age group (n=12), and boys without early childhood education in 78-84 months age group (n=12). Nevertheless, modification was applied in the design of study because majority of children in first grade were between 70-76 months; there were a few students who had not attended preschools in 78-84 months age group, and differences between last version and Turkish version in Early Developmental Instrument (EDI) which is a school readiness test.

After the research design modified because of changes, the aim was determined to examine whether there was a significant difference in handwriting readiness of first grade students with regard to age and gender by considering their motor proficiency and visual motor integration skills. Related with the aim, causal-comparative research method, which is one of the quantitative research methods, was utilized because group difference or independent variable such as age and gender in the causal-comparative design cannot be manipulated.

In order to investigate the effects of age and gender on motor proficiency and visual motor integration skills in the present study, quantitative data were collected through performance tests: Bruininks-Oseretsky Test of Motor Proficiency and Beery-Buktenica Developmental Test of Visual-Motor Integration. In Bruininks-Oseretsky Test of Motor Proficiency, items which include paper-pencil tasks such as copying shapes or making dots in circles were completed by students. Other items which include tasks on balance or gross motor skills were completed by administer via observing students' performance. Following Bruininks-Oseretsky Test of Motor Proficiency, students completed all tasks in Beery-Buktenica Developmental Test of Visual-Motor Integration which had two parts as motor performance and visual perception. Data collection process began at 26th September and finished at 11th October, it lasted 3 weeks. Firstly motor proficiency test was applied, and then visual motor integration test was implemented. Throughout the test, the instruments were utilized one by one in a single session which was approximately 50 minutes.

3.2. Participants

The study involved 87 first grade students from 3 public schools and 7 classes in Çankaya, Ankara. Firstly, school selection was applied via convenience sampling in order to reduce the effect of socioeconomic status on readiness. Then, target number which represents all students in selected schools was determined in order to investigate the effect of age and gender. Classrooms were selected by considering the target number,

number of classrooms, and number of students in each classroom. Based on this selection, three classes were chosen in one school which had six classes, two classes were chosen in one school which had four classes, and two classes were chosen in other school which had three classes.

Participants were divided into four groups considered to independent variables which were age and gender: a) girls at the age of 61-72 months (n= 25), b) girls at the age of 73-84 months (n= 18), c) boys at the age of 61-72 months (n= 23), d) boys at the age of 73-84 months (n= 21). Therefore, 43 girls and 44 boys, totally 87 students, participated in this study.

3.3. Data Collection Instruments

Considering the existing literature and previous studies on the field of handwriting skills in motor performance perspective, the data collection instruments were chosen as performance tests.

Data were collected by Turkish version and short forms of two instruments: Bruininks-Oseretsky Test of Motor Proficiency and Beery-Buktenica Developmental Test of Visual-Motor Integration.

3.3.1. Bruininks-Oseretsky Test of Motor Proficiency

Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) measures gross and fine motor skills of children from 4.5 years to 14.5 years of age. BOTMP is provided to assess the motor proficiency of pupils, to determine students with moderate motor skill deficits and to evaluate motor training programs.

There are two forms of BOTMP. One of the forms is “Complete Battery”. This form includes eight subtests and 46 items, requires 45 to 60 minutes for administration and

assesses comprehensive index of motor proficiency. Another form is "Short Form". It consists of eight subtests which have 14 items from the "Complete Battery" form. Approximately 15-20 minutes are required for administration of "Short Form", and it presents a brief survey of general motor proficiency. As seen in the Figure 3.1, eight subtest of the instrument are in three parts which are gross motor, gross and fine motor, and fine motor. Gross motor part includes running speed and agility, balance, bilateral coordination, strength, gross whereas fine motor part includes response speed, visual-motor control, upper-limb speed, and dexterity. Moreover, gross and fine motor part includes upper-limb coordination (Bruininks, 1978).

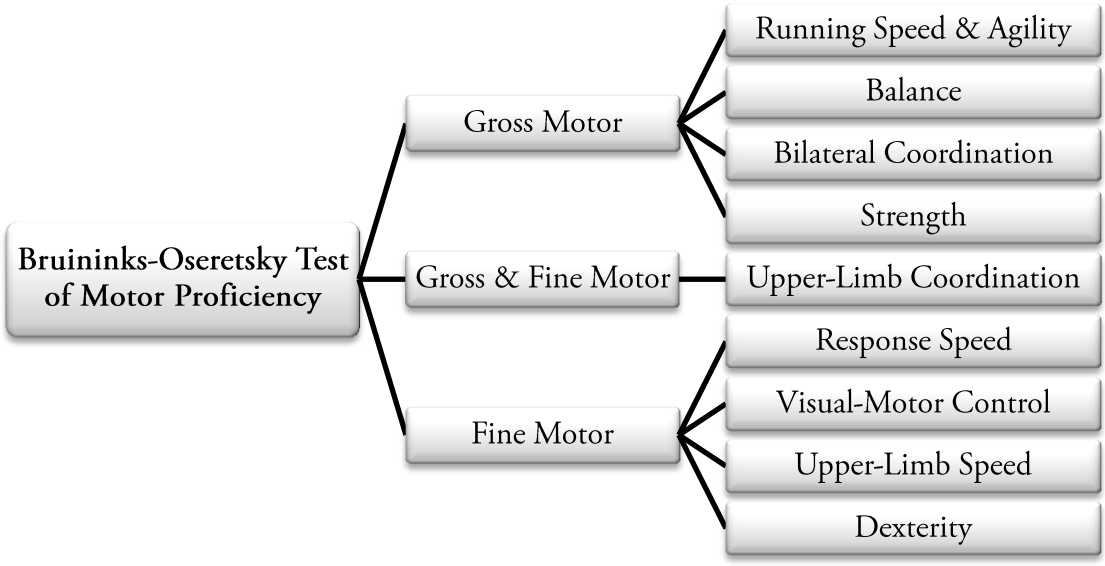


Figure 3.1 Parts and subtests of Bruininks-Oseretsky Test of Motor Proficiency (BOTMP).

Normative data was collected on the basis of 765 typically developing children between 4.5 to 14.5 ages. Correlation of test scores and chronological age is stated as between .57 and .86 and the median is .78. For gender, correlation is stated as from .56 to .86 for boys and from .58 to .87 for girls (Bruininks, 1978).

In the instrument, the formal trial of items are designated individually and scoring divers from a 2-point (pass/fail) to a 16-point scale (Wiart & Darrah, 2001). Standard

scores of short form are derived from total point score by "considering Standardization Sample Table" in the manual.

In this study, short form of BOTMP was utilized because the mature stage of most fundamental movement skills is approximately at the age of six in children (Gallahue et al., 1995) and difference in fine motor developmental level exists between children at the age of 3-5 and 6-8 (Bredekamp et al., 1997). In addition to developmental issues, one researcher, classroom environment, limited time for data collection, age of children, and available Turkish version of this instrument influenced the selection the short form of this instrument.

Mülazımoğlu-Ballı (2006) adapted the instrument in Turkish as a part of her dissertation. She examined the effects of gymnastic education program, age and gender on the motor development of children at the age of five-six. Totally 128 students participated in the study and she found internal consistency coefficient of total score of BOTMP was .87, test –retest correlation coefficient of total score of BOTMP was .89 and interrater correlation alpha coefficient was between .80 and .98. As Mülazımoğlu-Ballı mentioned, results demonstrated that BOTMP is valid and reliable for children at the age of five-six.

3.3.2. Beery-Buktenica Developmental Test of Visual Motor Integration

Beery-Buktenica Developmental Test of Visual Motor Integration (VMI) is a neuropsychological assessment tool to analyze visual construction skills, and is non-verbal and culture-free. It is a paper-and-pencil assessment tool and completed by participants. It includes one core and two supplemental tasks.

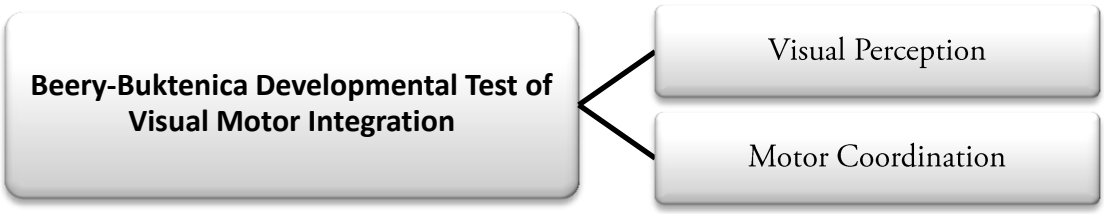


Figure 3.2 Subtests of Beery-Buktenica Developmental Test of Visual Motor Integration (VMI).

Core task is visual-motor integration and it includes practices on imitating and copying geometric forms. This task involves 30 forms in a developmental sequence. Examples were given in the Figure 3.1. Scoring in VMI is based on "score" or "no score" criteria and each form is assessed with respect to ratio of lines, angles, defined sides, gaps between lines and so on. Results of this task provide raw scores of children and standard scores are derived from raw scores according to table given in manual which considered the age criterion. Mean of standard scores is 100 and standard deviation is 15 for all age groups.

Supplemental tasks are visual perception and motor coordination. Visual perception subtest includes practices on pointing to the item in the array that is identical to the target figure and it is provided to detect visual problems. Motor coordination subtest includes forms of VMI and it aims that children complete the tasks by following dots or path guides.

Internal consistency coefficient is given as .96, interscorer reliability is given as .93, and test-retest coefficient is given as .88. Moreover, compared to other tests that evaluate similar constructs such as Drawing subtest of the Wide Range Assessment of Visual

Motor Abilities (WRAWMA Drawing) and Copying subtest of the Developmental Test of Visual Perception (DTVP-2 Copying), concurrent validity is provided for this test.

In this study, similar to the literature, core task which is visual motor integration was applied. This test was utilized to compare handwriting performance or to examine visual motor integration skill which is one of the predictor of handwriting. Furthermore, the test was adapted to Turkish by Demirci (2010) and Ercan and Aral (2011). Demirci applied the instrument to 308 children at the age of five-six from public preschools to provide reliability and validity of Turkish version as a part of her dissertation. She found Cronbach's Alpha value between .57 and .85, depending on the age. On the other hand, Ercan and Aral utilized the instrument to adapt it for Turkish six year-old (60-72 months) children and they found inter consistency reliability coefficients as between .67 and .79. Both studies demonstrated that the instrument was reliable for children at the age of five-six. Communication with Demirci and Ercan was provided for permission of the instrument application, Demirci shared the Turkish version of test so it was utilized in this study.

3.4. Data Collection Procedures

3.4.1. Ethical Procedure

Before the application of study, the approval letters for utilization of Turkish versions of instruments were obtained from authors. Then, the purpose, rationale/importance, design of the study in the form of a proposal was submitted to the Human Research Ethical Committee at the Middle East Technical University with Turkish versions of instruments. After committee approval was received (Appendix A), proposal and design of the study with Turkish versions of instruments and approval letter of ethical committee were submitted to District of National Education (Appendix B).

After approval letter was received from District of National Education, visiting to schools were implemented for each school to get consent of school administers and teachers. Then, parent consent letters (Appandix C) were completed by parents from three classes via parent meetings. Other parent consent letters were sent and collected via children.

All parent consent letters, child information forms and test forms of instruments were stored in a cabinet in the advisor's office. Only researcher and her advisor had access to the forms. During data collection process, numbers were written on the forms for each child rather than names, except children whose parents wanted to get information on performance of their children. For these participants, only first name of children was written on the forms.

After the data collection process was completed and all data from the instruments and child information form in parent consent letter were entered into computer, all the forms were destroyed except instrument forms which used numbers for participants rather than their names.

3.4.2. Data Collection Procedure

Parent consent letter collection process lasted 2 days and data collection process continued 3 weeks at the beginning of the 2013-2014 academic year fall semester before teachers began the handwriting instruction. Data collection days were arranged with classroom teachers to prevent interruption of children's participation in the classroom activities.

Instruments were applied in the available classrooms or in the rooms that were arranged by the school administrators. Each child participated in data collection procedure individually.

Before the application of instruments, researcher met with children, informed them about activities, explained why they participated in the activities and importance of their participation, and stated that they had chance to quit from activities whenever they wanted. Next, forms of both instruments were completed in sequence. BOTMP was utilized first. In this phase, researcher demonstrated the movements by following the directions in manual of the instrument and encouraged children to participate in the activities. Application of this instrument continued approximately 30 minutes.

VMI was applied following by utilization of BOTMP. In this phase, researcher supported children to apply instruments according to the directions in the manual of the instrument. It is expected that children copy the geometric forms of instrument attentively. This part lasted approximately 20 minutes.

During the application of instruments, environmental factors such as desk/chair height, lightening or appropriate tools were provided to achieve the best performance of children.

3.5. Data Analysis

In this section, many steps were followed to analyse the data to explain each research question. Prior to data analysis, data screening procedures were implemented to control the accuracy of input, to identify missing values and outliers by Q-Q plots. After three cases as outliers had been excluded from the data set, assumption approach including normality and homogeneity of data was checked in order to justify the usage of the statistical models for data analysis.

Next, descriptive statistics were performed to obtain the main characteristics of the variables such as frequencies, distribution of the demographic variables, and to provide mean score, standard deviation, minimum and maximum score, and range of each group in terms of standard scores of BOTMP and VMI.

Following to assumption approach and descriptive statistics, Two-Factor Analysis of Variance (Two-way ANOVA) was conducted using the software; IBM SPSS Statistics version 21 in order to examine the differences between young age group and old age group in terms of standard scores of BOTMP and VMI and in order to examine the differences between girls and boys with regard to standard scores of BOTMP and VMI. Moreover, interaction between age and gender factors on standard scores of both instruments was tested via 2x2 ANOVA. Alpha level adjusted .05 for analyses in this study.

CHAPTER IV

4. RESULTS

This chapter presents results of the thesis into three sections. The first section includes preliminary data analysis. Descriptive statistics of participants was presented in the second section. The third section involves results of motor proficiency and visual motor integration skill with respect to age and gender.

4.1. Preliminary Data Analysis

Missing value and outlier analysis, and normality analysis were conducted in preliminary data analysis. In addition, assumptions of the ANOVA's were checked.

4.1.1. Missing Value and Outlier Analysis

Most statistical analyses omit cases with missing value problem (Buchner & Findley, 1991). Although child information survey that was completed by parents included some missing values, there was no missing value which is required to complete the data of BOTMP and VMI.

Secondly, outlier analysis was applied via Q-Q plots in preliminary data analysis part and 2 cases in the first age group and 1 case in the second age group were treated as outlier. Among the total of 90 participants, 3 cases were excluded from the data set. As a result, the ANOVAs were conducted with data obtained from 87 cases.

4.1.2. Assumptions for Two-Way Analysis of Variance (ANOVA)

The main assumptions underlying two-way analysis of variance (ANOVA) are as (1) the dependent variable should be a continuous variable; (2) independent observations (the responses of participants should be independent from each other); (3) normality (the dependent variable should be normally distributed at each level of the independent variables); (4) homogeneity of variance (the groups of the independent variables should have equal variances) (Green & Salkind, 2004).

To start with, in all of the two-way ANOVAs performed, the dependent variables are standard scores of BOTMP and VMI, which constitute continuous variables. The second assumption can be considered to be met for the present study since the researcher observed the participants' applications to tasks independently of one another in the data collection process.

Next, normality tests of the dependent variable (standard scores of BOTMP and VMI) at each level of the each independent variable (age and gender) were explored to examine the validity of normality assumption by IBM SPSS Statics 21. In normality exploration of standard scores of BOTMP, Kolmogorov-Smirnov test indicated that normality was provided for both age groups (p>.05) (Table 4.1). In addition to age factor, Kolmogorov-Smirnov tests provided normality for gender groups (p>.05) (Table 4.2). For normality of interaction between gender and age, Kolmogorov-Smirnov test indicated that normality was provided for all four groups (Table 4.3).

Table 4.1 *Normality Tests for Age Groups*

Test of Normality

	Age Group	Kolmogorov-Smirnov[a]		
		Statistic	*df*	*p*
Standard Scores of BOTMP	61-72 months	.11	48	.20*
	73-84 months	.13	39	.11

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 4.2 *Normality Tests for Gender Groups*

Test of Normality

	Gender	Kolmogorov-Smirnov[a]		
		Statistic	*df*	*p*
Standard Scores of BOTMP	Girls	.11	43	.20*
	Boys	.12	44	.15

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 4.3 *Normality Tests for Interaction between Age and Gender Groups*

Tests of Normality

	Gender	Age Groups	Kolmogorov-Smirnov[a]		
			Statistic	*df*	*p*
Standard Scores of BOTMP	Girls	60-72 months	.14	25	.20*
		73-84 months	.12	18	.20*
	Boys	60-72 months	.16	23	.14
		73-84 months	.13	21	.20*

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

In normality exploration of standard scores of VMI, Kolmogorov-Smirnov test indicated that normality was provided for both age groups (p>.05) (Table 4.4). In addition to age factor, Kolmogorov-Smirnov tests provided normality for gender groups (p>.05) (Table 4.5). For normality of interaction between gender and age, Kolmogorov-Smirnov test indicated that normality was provided for all four groups (Table 4.6).

Table 4.4 *Normality Tests for Age Groups*

Test of Normality

	Age Group	Kolmogorov-Smirnov[a]		
		Statistic	*df*	*p*
Standard Scores of VMI	61-72 months	.13	48	.05
	73-84 months	.13	39	.16

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 4.5 *Normality Tests for Gender Groups*

Test of Normality

	Gender	Kolmogorov-Smirnov[a]		
		Statistic	*df*	*p*
Standard Scores of VMI	Girls	.09	43	.20*
	Boys	.11	44	.20*

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 4.6 *Normality Tests for Interaction between Gender and Age Groups*

Tests of Normality

	Gender	Age Groups	Kolmogorov-Smirnov[a]		
			Statistic	*df*	*p*
Standard Scores of VMI	Girls	60-72 months	.14	25	.20*
		73-84 months	.13	18	.20*
	Boys	60-72 months	.15	23	.20
		73-84 months	.17	21	.11

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Lastly, homogeneity of variance tests (Levene's test) for two-way ANOVA demonstrated the equality of variances among the levels of each independent variable ($p>.05$). Therefore, the homogeneity of variance assumption can be assumed for all of the ANOVAs performed (Table 4.7 and 4.8).

Table 4.7 *Homogeneity of Variance Test of Standard Scores of BOTMP*

Levene's Test of Equality of Error Variances[a]

Dependent Variable: *Standard Scores of BOTMP*			
F	*df1*	*df2*	*p*
.24	3	83	.87

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Gender + Age Groups + Gender * Age Groups

Table 4.8 *Homogeneity of Variance Test of Standard Scores of VMI*

Levene's Test of Equality of Error Variances[a]

Dependent Variable: *Standard Scores of VMI*			
F	*df1*	*df2*	*p*
.55	3	83	.65

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Gender + Age Groups + Gender * Age Groups

4.2. Descriptive Statistics

The sample of the study was consisted of 87 (43 girls & 44 boys) students in first grade. As can be seen from Table 4.9, number of participants in four groups regarding gender and age for the two groups: 61 months through 72 months (n=48) and 73 months through 84 months (n=39).

Table 4.9 *Frequency Statistics of Gender and Age Groups Variables*

Gender and Age Groups

Gender	Age Groups	*f*
Girls	61 - 72 months	25
	73 - 84 months	18
	Total	43
Boys	61 - 72 months	23
	73 - 84 months	21
	Total	44

Mean, standard deviation, minimum and maximum scores, and score ranges of age groups and gender groups are given in Table 4.10 for the standard scores of BOTMP. Histograms on distribution of standard scores of BOTMP are given by Figure 4.1 for children at the age of 61-72 months and Figure 4.2 for children at the age of 73-84 months. Moreover, histogram on distribution of standard scores of BOTMP in female students is given by Figure 4.3 and histogram on distribution of standard scores of BOTMP in male students is given by Figure 4.4.

Table 4.10 *Age and Gender Groups Statistics for Standard Scores of BOTMP*

	N	*M*	*SD*	*min.*	*max.*	*Range*
Age Groups Statistics						
61 - 72 months	48	60.98	7.83	43	73	30
73 - 84 months	39	60.15	7.43	45	73	28
Gender Groups Statistics						
Girls	43	60.28	7.31	44	73	29
Boys	44	60.93	7.98	43	73	30
Total	87	60.61	7.62	43	73	30

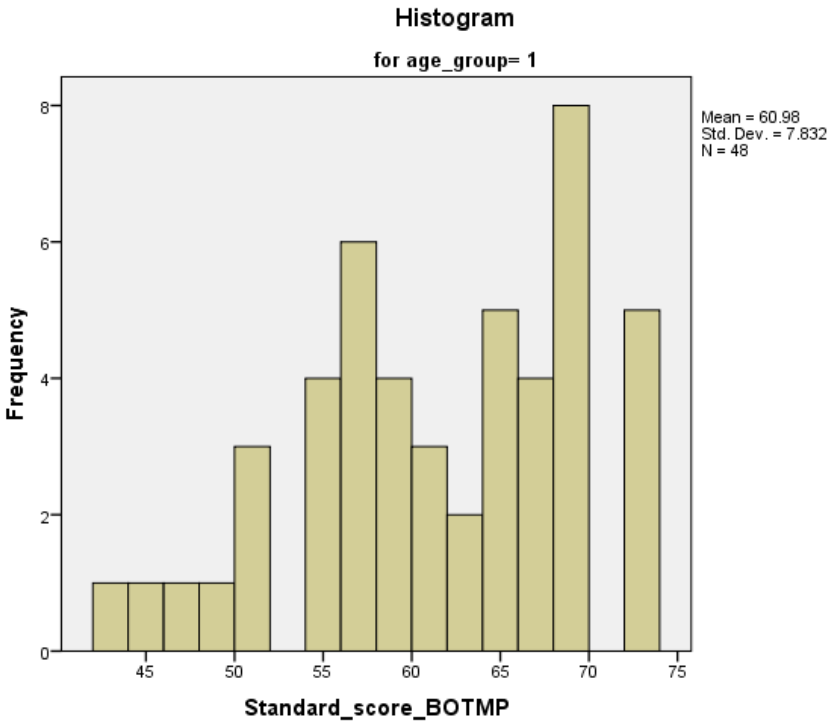


Figure 4.4.1. Distribution of standard scores of BOTMP in children at the age of 61-72 months.

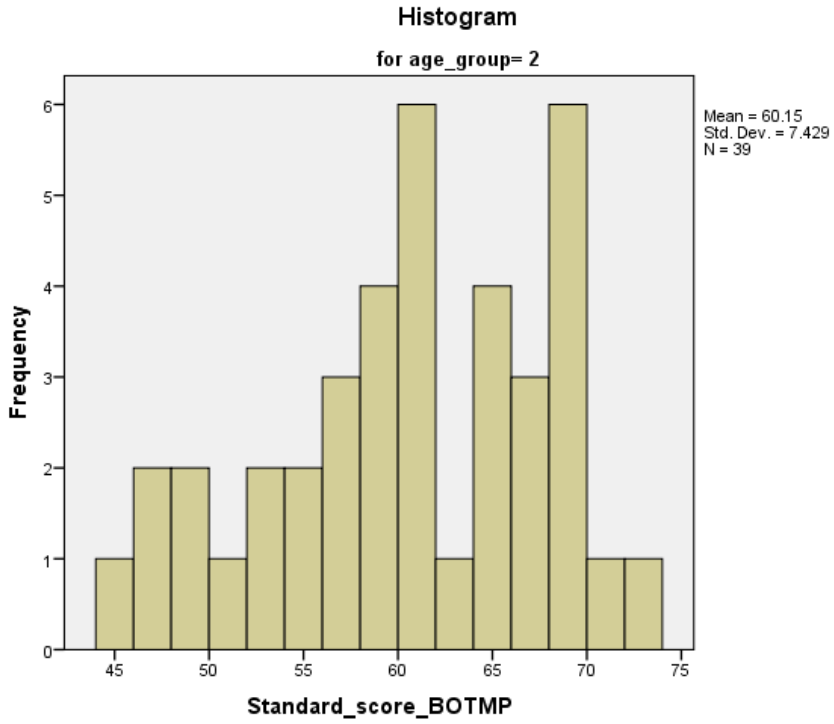


Figure 4.4.2. Distribution of standard scores of BOTMP in children at the age of 73-84 months

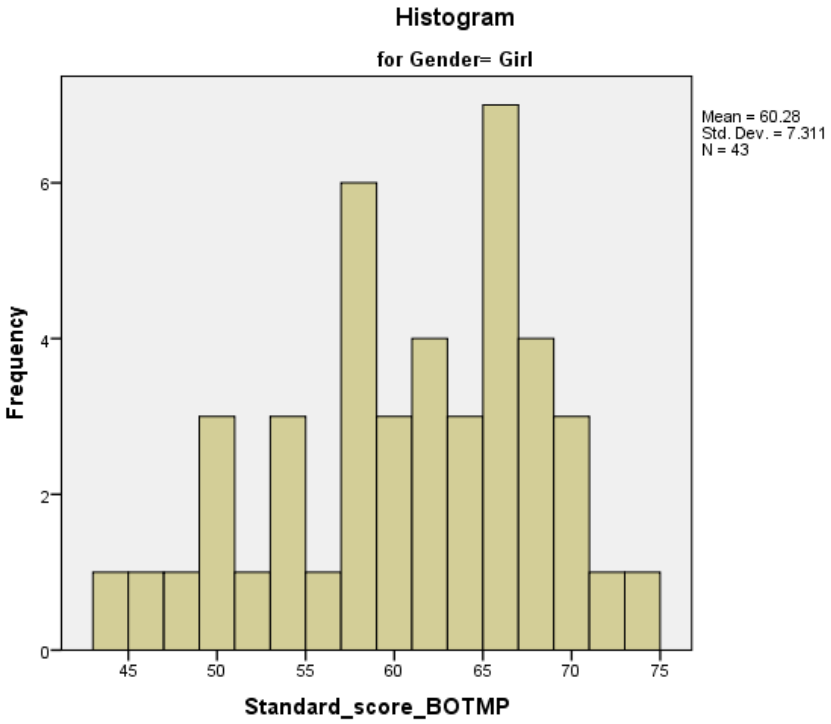


Figure 4.4.3. Distribution of standard scores of BOTMP in female participants.

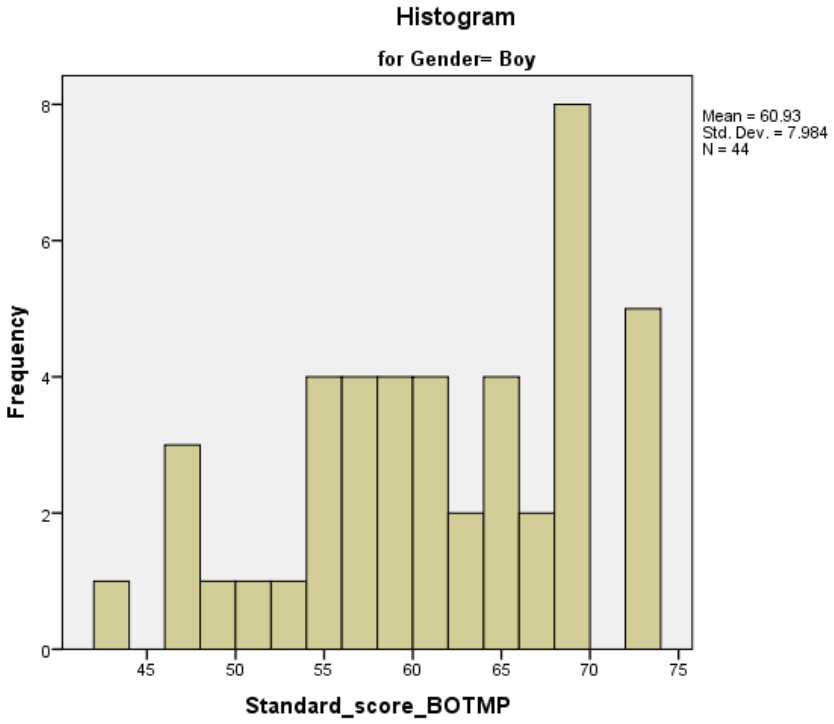


Figure 4.4.4. Distribution of standard scores of BOTMP in male participants.

Mean, standard deviation, minimum and maximum scores, and score range of age groups and gender groups are given in Table 4.11 for the standard scores of VMI. Histograms on distribution of standard scores of BOTMP are given by Figure 4.5 for children at the age of 61-72 months and Figure 4.6 for children at the age of 73-84 months. Furthermore, histogram on distribution of standard scores of BOTMP in female students is given by Figure 4.7 and histogram on distribution of standard scores of BOTMP in male students is given by Figure 4.8.

Table 4.11 *Age and Gender Groups Statistics for Standard Scores of VMI*

	N	*M*	*SD*	*min.*	*max.*	*Range*
Age Groups Statistics						
61 - 72 months	48	95.02	6.72	80	104	24
73 - 84 months	39	100.09	6.04	90	109	19
Gender Groups Statistics						
Girls	43	96.74	7.18	81	109	28
Boys	44	96.09	5.98	80	109	29
Total	87	96.41	6.57	80	109	29

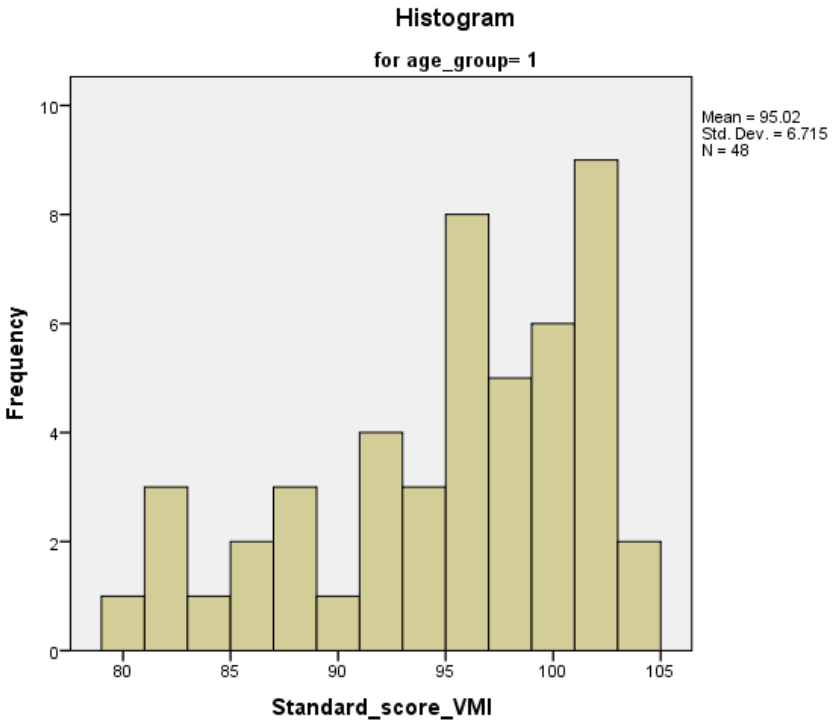


Figure 4.4.5. Distribution of standard scores of VMI in children at the age of 61-72 months.

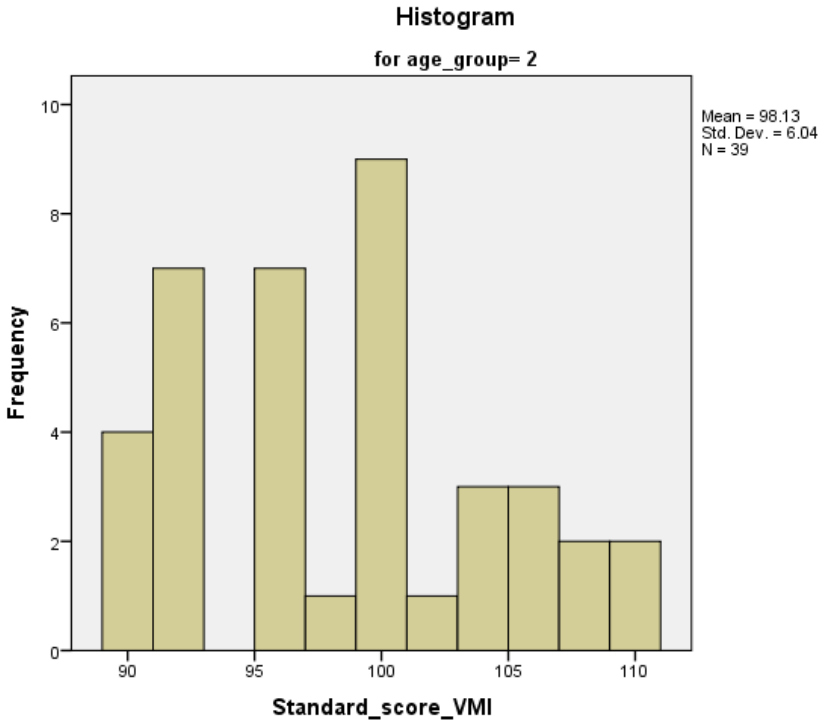


Figure 4.4.6. Distribution of standard scores of VMI in children at the age of 73-84 months.

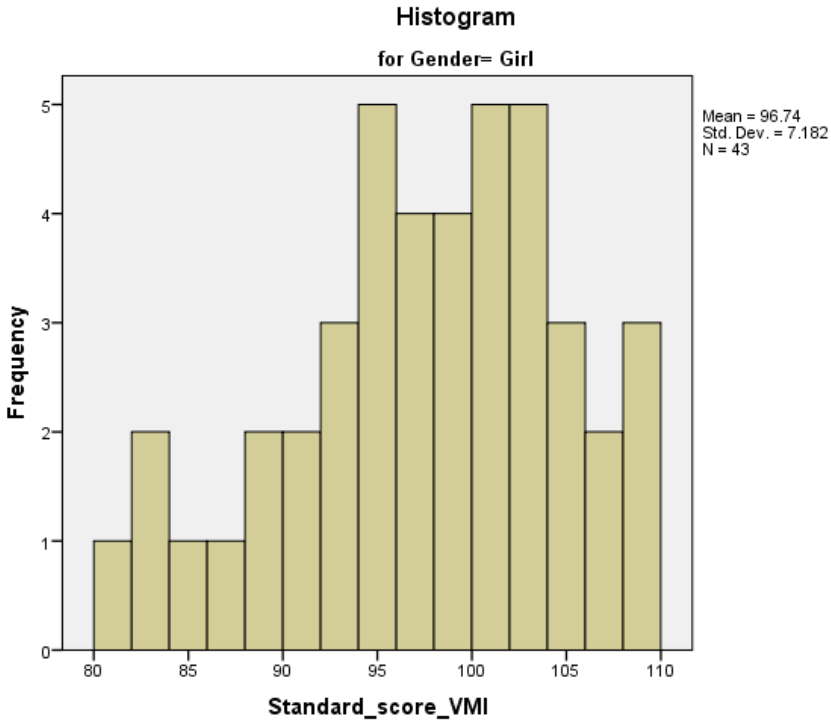


Figure 4.4.7. Distribution of standard scores of VMI in female participants.

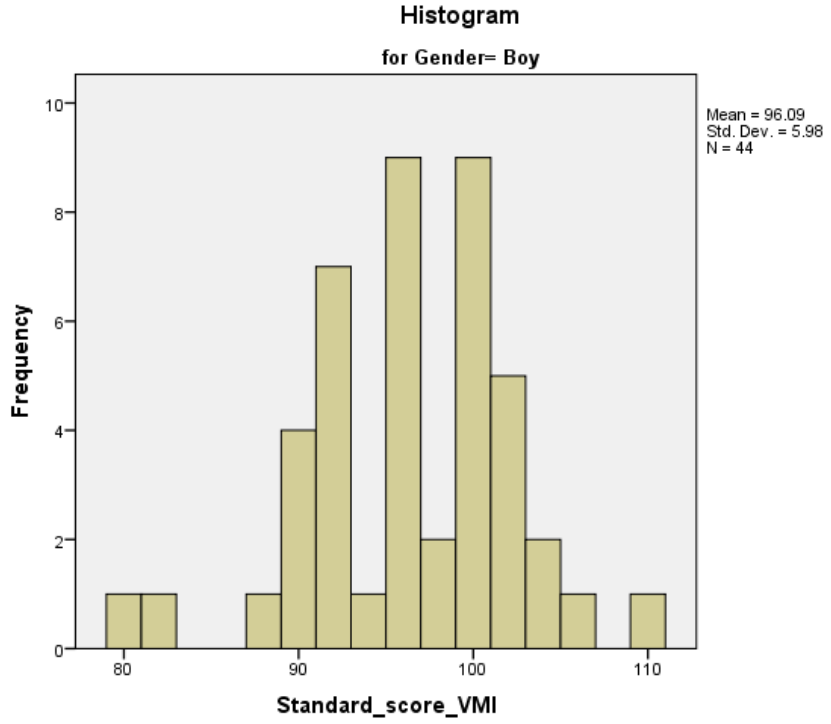


Figure 4.4.8. Distribution of standard scores of VMI in male participants.

4.3. Results of Motor Proficiency and Visual Motor Integration Skill

In this study, 2x2 ANOVAs were conducted for standard scores of both BOTMP and VMI individually with respect to age and gender. All statistical methods were applied by International Business Machines (IBM) SPSS Statics 21.

4.3.1. Results of Motor Proficiency

A 2x2 ANOVA was conducted on standard scores of BOTMP with regard to differences in gender and age. Neither age $F(1, 83) = .25$, $p > .05$, $\eta^2 = .003$, nor gender $F(1, 83) = .12$, $p > .05$, $\eta^2 = .001$ had a statistically significant impact on standard scores of BOTMP. Furthermore, there was not a statistically significant interaction between gender and age, $F(1, 83) = .53$, $p > .05$, $\eta^2 = .006$ (Table 4.12).

Table 4.12 *ANOVA Results for the Effect of Gender and Age Group on Standard Scores of Motor Proficiency*

Dependent Variable:	Standard Score of BOTMP				
Source	*SS*	*df*	*MS*	*F*	η^2
Age	15.05	1	15.05	.25	.003
Gender	7.09	1	7.09	.12	.001
Age x Gender	31.79	1	31.79	.53	.006
Error	4937.54	83	59.49		
Total	324587.00	87			

Note. η^2 = effect size
* $p < .05$.

4.3.2. Results of Visual Motor Integration Skill

A 2×2 ANOVA was also conducted on standard scores of VMI with respect to differences in gender and age. Statistically significant difference was found in standard scores of visual motor integration skill between age groups, $F(1, 83) = 5.48$, $p < .05$, η^2

= .06. Old age group (M = 100.09, SD = 6.04) had significantly better performance in visual motor integration skill than young age group (M = 95.02, SD = 6.72). However, there was no significant difference between girls and boys in terms of visual motor integration skill performance, $F(1, 83) = .64$, $p > .05$, $\eta^2 = .01$. Moreover, there was not a statistically significant interaction between gender and age, $F\ (1, 83) = 3.26$, $p > .05$, $\eta^2 = .04$ (Table 4.13).

Table 4.13 *ANOVA Results for the Effect of Gender and Age Group on Standard Scores of VMI*

Dependent Variable: Standard Score of BOTMP					
Source	*SS*	*df*	*MS*	*F*	η^2
Age	221.69	1	221.69	5.48*	.06
Gender	25.94	1	25.94	.64	.01
Age x Gender	131.72	1	131.72	3.26	.04
Error	3358.38	83	40.46		
Total	812432.00	87			

Note. η^2 = effect size
* p < .05.

CHAPTER V

5. DISCUSSION

The purpose of this study is to examine the effects of age and gender on motor proficiency and visual motor integration skills of the first grade students. Hence, data were obtained from four groups of children which were created according to factors of age and gender.

5.1. The Effects of Age and Gender on Motor Proficiency

To examine the effects of age and gender on motor proficiency, six hypotheses were researched in the current study. Firstly, null hypothesis (There is no interaction between age and gender) and alternative hypothesis (There an interaction between age and gender) of interaction were inquired. Then, due to examine the main effects of age and gender on motor proficiency, null hypothesis of age (There is no significant difference between age groups in terms of motor proficiency), alternative hypothesis of age (There is a significant difference between age groups in terms of motor proficiency), null hypothesis of gender (There is no significant difference between gender groups in terms of motor proficiency), and alternative hypothesis of gender (There is a significant difference between gender groups in terms of motor proficiency) were researched in the study.

Related to research hypotheses on motor proficiency, the short of Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) was applied to measure the motor proficiency of children. Results indicated that there was no interaction between age and gender for motor proficiency. Hence, it failed to reject null hypothesis on interaction. Then, main

effects of age and gender were analyzed independently. Based on results, children in the age group of 61-72 months (5 years) had similar performance as children in the age group of 73-84 months (6 years) so it failed to reject null hypothesis on age and motor proficiency. Also, difference between performance of female students and performance of male students was not found in terms of motor proficiency in this study and it failed to reject null hypothesis on gender and motor proficiency.

Considered to age factor, there were several studies in the literature in terms of motor performance. In the literature review of this study, studies which found a difference between age groups in terms of both fine and gross motor performance were more than other studies which found no difference between age groups in terms of both fine and gross motor performance.

Kakebeeke et al. (2012) found the effect of age on gross motor performance in 101 children with typically development at the age of 3 and 5 years. They measured performance of children with 5-point scale and standardization was not applied in scores. According to raw scores, they stated that older children had better performance on the tasks which were standing on one leg, walking on a beam, hopping on one leg, running and taking stairs.

Furthermore Spessato et al. (2012) had a study to compare fundamental motor performance of 1248 children at the age of 3 to 10 years from public schools in Brazil. Raw scores of the Test of Gross Motor Development (TGMD-2) were used in the study. Results of the study demonstrated that motor performance developed with increasing age from 3 years to 10 years.

In addition to previous studies, Saraiva et al. (2013) studied on the effect of age, gender and selected biological factors which were height, weight and BMI with 367 Portugal children at the age of 3 to 5 years in public preschools. They applied grasping, visuo-motor integration, stationary, locomotion, and object manipulation subtests of Peabody

Developmental Motor Scales-2 in which data were standard scores, percentile ranks and age equivalents. Results of the study demonstrated that age and gender were predictors of motor performance, and motor performance and selected biological factors were changed by age.

Larson et al. (2007) studied on effects of age and gender on motor performance of 144 children, ages 7-14, in terms of neurological perspective. Physical and Neurological Examination for Subtle Signs (PANESS) was implemented in the study. Gaits and stations, overflow, dysrythmia, and timed movements were examined with the instrument. They claimed that age-related differences were not observed for all tasks. Indeed, no age effect was found in gaits and stations tasks (hopping, balancing, etc.) in youngest age group (7 years). This demonstrated that these motor functions reached adult level of maturity by age 7 years.

Bruininks (1978) emphasized the development of motor ability with age, and stated that point score and chronological age had a close relationship in BOTMP. Hence, correlation between age and total point score of students was examined additionally, and a positive relationship between total point score and age of children was found in this study (Appendix D). In other words, raw scores and motor performance of children increased with age.

On the other hand, standardization on chronological age was applied in the instrument because motor performance with increasing age was not standard in children. Considered to the assessment procedure of the instrument, standard scores were used in the study. Depending on standard scores of children, children in young age group displayed age-equivalents performance much than children in old age groups.

When results of this study were compared with previous studies, results in raw scores of this study supported the studies of Kakebeeke et al. (2012), Spessato et al. (2012) and

Bruininks (1978). On the other hand, results in standard scores of this study contradicted the study of Saraiva et al. (2013) which included standard scores to analyse.

Heinz (2006) found that physical fitness, body coordination, and manual dexterity were influenced positively by age in 1194 preschool children at the age of 3.5 years to 7 years; however, Malina et al. (2004) stated that increasing motor performance in early childhood was not as much as in middle childhood and adolescence. Moreover, changes in motor performance by age should be considered with intraindividual factors such as biological, genetic, and hormonal factors and interindividual factors such as environmental factors, early childhood education, and culture.

Considering to intraindividual and interindividual factors, it can be speculated that results on age and motor proficiency in this study may be affected by these factors rather than age factor.

With regard to gender, the effect of gender on motor skill performance was unclear. Several studies did not find the effect of gender on motor performance whereas other studies found gender difference favoring girls or favoring boys in motor skill performance.

Study of Spessato et al. (2012) which was applied for motor performance via raw scores of TGMD-2 with 1248 students demonstrated that although boys at the age of 7-8 years and 9-10 years had better performance than girls at the same age groups, both girls and boys in 3-4 year-old and 5-6 year-old groups had similar performance in TGMD-2. Authors speculated that the gender difference in motor performance among 7-8 year-old and 9-10 year-old students was home and family factors as Gonçalves, Hallal, Amorim, Arau´jo, and Menezes (2007) claimed that male adolescents were supported by family and community more than female adolescents in Brazil (cited in Spessato et al., 2012) Moreover, curriculum difference between daycare and elementary schools was considered as the second factor that affected the gender difference in motor

performance. For example, physical education was taught classroom teachers with minimal formal training in daycare centers while physical education in elementary schools was scheduled for 45 min. twice a week with free play mode in which male students mainly participated rather than motor skill instruction in Brazil (Spessato et al., 2012).

Furthermore, Kakebeeke et al. (2012) researched gender effect in addition to age effect on gross motor performance with 101 children at the age of 3 and 5 years by 5-point scale scoring. They claimed that boys and girls demonstrated similar performance in gross motor tasks.

Bonvin et al. (2012) had a study about the effects of weight and gender on motor skills and physical activity with 529 children at the age of 2 to 4 years. In the study, 5 motor skills which were running, climbing, balancing, getting up and landing after jumping were rated by using a 5-point scale scoring. They claimed that although boys had better performance than girls in task of running and climbing stairs, neither weight nor gender had an effect on overall motor skills performance.

Giagazoglou et al. (2011) examined the effects of age, gender, birth order, and physical activity on motor performance of Greek preschoolers. Movement Assessment Battery for Children (M-ABC) was applied with 412 preschoolers, 4 to 6 years old. Results demonstrated that although boys had better performance than girls in ball skills, no gender effect was found on overall task performance of children.

On the other hand, Berk (1996) claimed that girls had better performance in motor skills with precision while boys tended to edge force and power in physical skills (cited in Developmentally Appropriate Practice in Early Childhood Programs, 1999). To contrast, Ammons et al. (1955) studied on motor skills via rotary pursuit performance with 350 children in Grades 3, 6, 9, 11, and 12. Results demonstrated that although performance of both girls and boys improved with age, development of boys in motor

skills was superior compared with development of girls in motor skills. Moreover, motor proficiency of girls decreased from Grade 9 to Grade 12.

Piper (2012) also had a study on the effect of age, handedness and sex on motor behavior in children at the age of 9 to 13 years. Data were collected with a computer game which was based on fine motor performance in rotary pursuit tasks. Results about gender of this study was similar to previous study as there was a gender effect on fine motor behavior favoring with male students.

To compare with the previous studies on gender effect and motor proficiency, findings in the current study supported the results in which no difference was found between female and male students in terms on motor skill performance. In other words, result on gender and motor skill performance in this study was convergent with results in studies of Spessato et al. (2012), Kakebeeke et al. (2012) and Bonvin et al. (2012), Giagazoglou et al. (2011) whereas it was divergent with claims and findings of Berk (1996), Ammons (1955) and Piper (2012).

5.2. The Effects of Age and Gender on Visual Motor Integration Skill

To research the effects of age and gender on visual motor integration skill, six hypotheses were examined in this study. Firstly, null hypothesis (There is no interaction between age and gender) and alternative hypothesis (There an interaction between age and gender) of interaction were inquired. Then, due to examine the main effects of age and gender on visual motor integration skill, null hypothesis of age (There is no significant difference between age groups in terms of visual motor integration skill), alternative hypothesis of age (There is a significant difference between age groups in terms of visual motor integration skill), null hypothesis of gender (There is no significant difference between gender groups in terms of visual motor integration skill), and alternative hypothesis of gender (There is a significant difference between gender groups in terms of visual motor integration skill) were researched in the study.

Considered the research hypotheses on visual motor integration skills, Beery-Buktenica Developmental Test of Visual Motor Integration (VMI) was utilized to measure the visual motor integration skills of children. Because no interaction between age and gender was found for visual motor integration skills, it failed to reject null hypothesis on interaction between age and gender.

After a nonsignificant interaction was found between age and gender, main effects of factors were examined independently. Results on age indicated that children in old age group demonstrated better performance than their peers in young age group in terms of visual motor integration skills. Hence, it rejected the null hypothesis of age and visual motor integration skills. On the other hand, both female and male students had similar performance for visual motor integration in this study so it failed to reject null hypothesis of gender and visual motor integration skills.

Beery and Beery (2010) studied with 600 children between the ages of 2 and 15 years for edited format of Beery VMI. Authors found a high correlation score (.89) between chronological age and VMI scores. Moreover, they created developmental trends for each shape in VMI according to chronological age. These trends indicated that visual motor integration skill was developed step by step with age.

Decker et al. (2011) had a study to examine the effects of maturation and cognitive development which are related to age on visual motor integration skills of 856 children from 4 to 7 year-old. Stanford-Binet Intelligence Scale: 5th edition and Bender Visual-Motor Gestalt Test: 2nd edition were implemented in the study. Result on age and VMI scores in the study demonstrated that maturation related with age influenced visual and perceptual motor integration ability. Indeed, age had an essential role for "Copy" and "Recall" procedures. In addition to age, specific cognitive abilities affected visual-motor integration skill.

Moreover, Cui et al. (2012) examined the development of visual-motor integration skills with regard to age, gender, school and city in 356 children at the age of 3 to 12 year from public schools in China. The VMI 4th Edition was utilized to measure visual-motor integration skills. Results demonstrated that except 3 years and 10 years age group, Chinese children had higher scores than the normative mean for U.S. children and authors suggested that different cultures and educational background may cause the differences in visual-motor integration performance among children.

In addition to age, gender was examined as another factor that may influence the visual motor integration. Lachance and Mazzocco (2006) had a study on gender differences in math and spatial skills in 249 children at the age of kindergarten (5 years) through 3rd Grade (8 years) from a large suburban public school district in USA. Developmental Test of Visual Perception Second Edition (DTVP-2) and Beery VMI Fourth Edition were implemented to measure the visual spatial skills. Results demonstrated that girls had better performance than boys in Figure Ground subtest in DTVP-2; on the other hand, gender effect was not found in other three subtests (Position in Space, Visual Closure, or Form Constancy) of DTVP-2. However, gender effect was determined in VMI score favouring with girls in each grade.

Continue with gender part in study of Cui et al. (2012), results demonstrated that VMI performance of female Chinese children was superior compared to VMI performance of male Chinese children at early ages.

On the other hand, Soderman et al. (1999) searched gender differences that effect emerging literacy in first grade children in U.S., India, and Taiwan. The VMI was utilized to measure perceptual-motor abilities of 601 children from India and U.S. Results displayed that no difference was found in gender groups on visual-motor integration performance which was a part of emerging reading skills in the study.

Result on gender and visual motor integration skills in this study supported the findings of Soderman et al. (1999) and Decker (2011) whereas it conflicted with the studies of Lachance et al. (2006) and Cui et al. (2012).

5.3. Effect of Age and Gender on Handwriting Readiness with regard to Motor Proficiency and Visual Motor Integration Skill

Scarpati et al. (1999) stated the importance of motor, cognitive, language, and socioemotional skills for school readiness. Similar to school readiness, association, coordination and integration of motor proficiency, linguistic, cognitive, and perception skills are requirements of handwriting performance (National Handwriting Association in UK, 2013). Children usually begin to learn writing and reading skills in primary school so early childhood education professionals give importance to pre-reading and pre-writing skills (Elliot et al., 2008) for reading and handwriting readiness which is a part of school readiness.

Gredler (1980) studied on American and English children and he claimed that socioeconomic status or teacher expectancy impacted school readiness rather than chronological age. On the other hand, McBryde et al. (2004) studied with 215 preschool children at the age of approximately 62 months, parents of children and 75 preschool teachers. Interview, observation, questionnaires and standardized measures (Battelle Developmental Inventory, Behavior Assessment System for Children–Preschool, and Temperament Assessment Battery for Children–Revised) were utilized in the study. They found that chronological age, gender, presence of adaptability, well-developed social skills and the ability to persist with an activity impacted perception of parents and teachers on school readiness.

In addition to school readiness, age affected the handwriting development. Handwriting performance begins with early scribbling such as vertical strokes at the age of 2 years, then horizontal strokes and circles follows vertical strokes in children at the age of 3

years. In handwriting development, imitation and copying of shapes are observed in children at the age of 4 years. Quality of handwriting develops in 1st grade children at the age of 6-7 and handwriting development continues to 3rd grade (Beery et al., 1989; Graham et al., 1998; Feder et al., 2007).

Considered to age and motor proficiency, age effect on motor proficiency was not found between age groups in this study. This result supported the Gredler's (1980) claim on school readiness and chronological age. On the other hand, related to age and visual motor integration skills, children in old age group displayed better performance than children in young age group in VMI. This finding was convergent to the studies of McBryde et al. (2004), Beery et al. (1989), Graham et al. (1998), and Feder et al. (2007).

This finding might be an advantage for students in old age group to learn handwriting because of the important role of visual motor integration for learning letter formation in the prior stages of handwriting (Sovik, 1975, cited in Weil et al., 1994; Daly et al., 2003).

Furthermore, Sovik (1975, cited in Weil et al., 1994) found the relationship between visual motor integration and handwriting performance in children at the age of 7, 9, 11 years whereas Phelps et al. (1987) claimed that effect of visual motor integration skill continued to 3rd grade. Although these studies had similar results in different ages, both of them mentioned the importance of visual motor skill for handwriting in 1st grade. Hence, children in old age group which had higher score seems to be ready to handwriting activities more than their peers in young age group considered to effect of visual motor integration skill on handwriting performance.

Beery (1997) stated that fine motor skills and visual perceptual skills enable children to perform activities which need visual motor integration such as handwriting. Tseng et al. (1993) claimed that there were few studies on relationship between visual perception

and handwriting performance and Feder et al. (2007) stated that relationship between visual perception and handwriting performance was unclear. In this study, both age groups had similar scores in BOTMP whereas children in old age group had significantly higher scores in VMI compared with the children in young age group so the difference in VMI scores might be interpreted as the effect of visual perception which is the other component of visual motor integration.

In addition to age, McBryde et al. (2004) found the gender effect on perception of teachers on school readiness of children favoring with girls. Angenent et al. (1989) also found gender difference in 125 Dutch first graders in terms of school readiness like girls were ready to school more than boys. To contrast, Al-Hassan et al. (2009) studied with 4681 children in first grade claimed that boys were higher level in school readiness in Jordan.

On the other hand, Gullo et al. (1992) did not find gender effect on school readiness among 4539 children at the age of 3-5 years in public preschools. Also, Erkan (2011) studied with 179 children in first grade. Metropolitan School Readiness Tests and demographic information survey were utilized in the study. The effects of socio-economic level, preschool education and education level of mothers on school readiness level of children were found while the effect of gender and education level of fathers was not found in the study.

In addition to previous study, Yeşil-Dağlı (2012) studied with 115 parents who had children in preschool to determine the perspectives and level of importance of parents on school readiness components. A survey was utilized in the study. Study demonstrated that gender and education level of fathers did not impact on perspectives of parents on school readiness.

Similar to school readiness, gender issue was researched for handwriting performance. Graham et al. (1998) found the gender difference on handwriting speed and they

claimed that handwriting speed of female students were faster than handwriting speed of male students from grade 1 to grade 9 whereas Graham et al. (2007) did not found difference between female and male students for writing achievement in grade 1 and grade 3.

In the current study, the effect of gender on motor proficiency and visual motor integration was not found in terms of handwriting readiness and performance. As a consequence, results on gender and motor proficiency in the current study were divergent the studies of McBryde et al. (2004), Angenent et al. (1989), Al-Hassan et al. (2009), and Graham et al. (1998) which found the gender differences in terms of school readiness and handwriting performance whereas findings in this study were convergent the studies of Gullo et al. (1992), Erkan (2011) and Yeşil-Dağlı (2012), and Graham et al. (2007) which found no gender difference in terms of school readiness and handwriting performance.

CHAPTER VI

6. CONCLUSION AND RECOMMENDATIONS

This study was conducted to examine the handwriting readiness of first grade students with regard to age and gender. To achieve the results, two research questions with their sub-questions were answered via Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) and Beery-Buktenica Developmental Test of Visual Motor Integration (VMI).

6.1. General Conclusion

Motor proficiency and visual motor integration skills were measured to determine the handwriting readiness of first grade students in terms of age and gender. Depending on independent variables (age and gender) and dependent variables (motor proficiency and visual motor integration), following conclusions were drawn for each question:

1. What is the effect of interaction between age and gender on motor proficiency measured by Bruininks-Oseretsky Test of Motor Proficiency (BOTMP)?
    a. What is the main effect of age on motor proficiency?
    b. What is the main effect of gender on motor proficiency?

Firstly, an interaction between age and gender was examined in terms of motor proficiency of children and no interaction was found in the study. Then, the main effects of age and gender on motor proficiency were researched. Results illustrated that no difference in motor performance was found between age groups, and male and female students. In other words, students in young age group demonstrated similar

performance in motor proficiency compared to performance of their peers in old age group. Furthermore, both female and male students demonstrated similar performance in motor proficiency in this study.

These results were found via using standardized scores of students, but raw scores were used in many studies. As a result, relationship between age and total point scores (raw scores) of students was analysed additionally and a relationship between age and total point scores of students was found in the current study.

2. What is the effect of interaction between age and gender on visual motor integration skill measured by Beery-Buktenica Developmental Test of Visual Motor Integration (VMI)?

a. What is the main effect of age on visual motor integration skill?
b. What is the main effect of gender on visual motor integration skill?

Secondly, no interaction between age and gender was found in terms of visual motor integration skill similar to motor proficiency. When main effects of age and gender were investigated in the current study, age effect was found in VMI scores whereas gender effect was not found in VMI scores. That is, students in old age group demonstrated superior performance in visual motor integration skill than their peers in young age group. On the other hand, performances of both male and female students were similar in visual motor integration skill.

In summary, both age groups had similar scores in motor proficiency; however, higher scores of students in old age group in VMI provide them advantage for handwriting readiness compared with their peers in young age group.

On the other hand, it is thought that handwriting readiness of male students is not different from handwriting readiness of female students in the same age group because

interaction between age and gender and main effect of gender were not found in this study in terms of both motor proficiency and visual motor integration skills.

6.2. Recommendations for Future Research

In this study, data were collected via two instruments. While a difference was found between performances of age groups in terms of visual motor integration, no difference was found performance of age groups in motor proficiency test. Low disparity in age groups may cause to find difference in motor performance between age groups. As a result, disparity in age may increase between age groups.

Moreover, a school readiness test can be applied to compare school readiness levels of students. This might support results of both motor proficiency and visual motor integration skill in terms of handwriting readiness of students.

Samples were selected from public schools in the same district of Ankara in order to reduce socioeconomic effect. Hence, future research may investigate the effect of socioeconomic factor by conducting the study in both public and private schools in different districts of Ankara or in different cities in Turkey.

Another factor may affect this study is early experiences of children in preschools and kindergartens. The effect of early childhood education on handwriting readiness may be examined in future research. Also, effects of private and public school programs on school readiness especially handwriting readiness can be another impressive study.

This study had been applied at the beginning of the academic semester before teachers began to handwriting instruction so a study can be applied in kindergartens at the end of the academic semester before children start to grade 1.

Finally, both qualitative and other quantitative research methods may be conducted to support the study in future studies. For example, observation in handwriting activity, checklists in curriculum of Ministry of National Education may provide to compare participants and strengthen the study. Moreover, perception of parents and teachers on handwriting and school readiness of children might be investigated because studies in literature demonstrated that decisions of parents and teachers affected the children's starting to grade 1.

LIST OF REFERENCES

Accardo, A. P., Genna, M., & Borean, M. (2013). Development, maturation and learning influence on handwriting kinematics. *Human movement science, 32*(1), 136-146.

Al-Hassan, S. M., & Lansford, J. E. (2009). Child, family and community characteristics associated with school readiness in Jordan. *Early Years*, *29*(3), 217-226.

Ammons, R. B., Alprin, S. I., & Ammons, C. H. (1955). Rotary pursuit performance as related to sex and age of pre-adult subjects. *Journal of Experimental Psychology*, *49*(2), 127-133.

Amundson, S. J., & Weil, M. (1996). Prewriting and handwriting skills. *Occupational Therapy for Children*, *3*, 524-541.

Amundson S. J. (1992) Handwriting: evaluation and intervention in school settings. In J. Case-Smith, & C. Pehoski (eds.) *Development of Hand Skills in the Child* (pp. 63–78). Rockville, MD: American Occupational Therapy Association.

Anderson, D. (1969). What makes writing legible? *Elementary School Journal, 69,* 365-368.

Angenent, H., & Man, A. D. (1989). Intelligence, gender, social maturity, and school readiness in Dutch firstgraders. *Social Behavior and Personality: An International Journal*, *17*(2), 205-209.

Bara, F., Gentaz, E., Colé, P., & Sprenger-Charolles, L. (2004). The visuo-haptic and haptic exploration of letters increases the kindergarten-children's understanding of the alphabetic principle. *Cognitive Development*, *19*(3), 433-449.

Bara, F., & Morin, M. F. (2013). Does the handwriting style learned in first grade determine the style used in the fourth and fifth grades and influence handwriting speed and quality? A comparison between French and Quebec children. Psychology in schools, 50(6), 601-617.

Barnett, L. M., Van Beurden, E., Morgan, P. J., Brooks, L. O., & Beard, J. R. (2009). Childhood motor skill proficiency as a predictor of adolescent physical activity. *Journal of Adolescent Health*, *44*(3), 252-259.

Beery, K. E., & Buktenica, N. A. (1989). *The VMI developmental Test of visual-motor integration*. Cleveland: Modern Curriculum Press.

Beery, K. E., & Buktenica, N. A. (2010). *The VMI developmental Test of visual-motor integration*, pp. 113, USA: NCS Pearson, Inc.

Benbow, M., Hanft, B. E., & Marsh, D. (1992). *Handwriting in the classroom: Improving written communication*. American Occupational Therapy Association.

Berk, L. E. (2006). *Child development* (7th ed.). Boston: Pearson Education, Inc.

Blote, A. W., & Hamstra-Bletz, L. (1991). A longitudinal study on the structure of handwriting. *Perceptual and Motor Skills*, *72*(3), 983-994.

Bonvin, A., Barral, J., Kakebeeke, T. H., Kriemler, S., Longchamp, A., Marques-Vidal, P., & Puder, J. J. (2012). Weight status and gender-related differences in motor

skills and in child care-based physical activity in young children. *BMC Pediatrics*, *12*(23), 1-9.

Bredekamp S., & Coople C. (eds.). (1999). *Developmentally appropriate practice in early childhood programs.* Washington DC: National Association for the Education of Young Children.

Brink, A. O. L., & Jacobs, A. B. (2011). Kinesthetic Sensitivity and Related Measures of Hand Sensitivity in Children With Nonproficient Handwriting.*Pediatric Physical Therapy*, *23*(1), 88-94.

Buchner, D. M., & Findley, T. W. (1991). Research in physical medicine and rehabilitation: VIII. Preliminary data analysis. *American Journal of Physical Medicine & Rehabilitation*, *70*(1), 68-83.

Carlton, M. P., & Winsler, A. (1999). School readiness: The need for a paradigm shift. *School Psychology Review*, *28*(3), 338-352.

Cartmill, L., Rodger, S., & Ziviani, J. (2009). Handwriting of eight-year-old children with autistic spectrum disorder: An exploration. *Journal of Occupational Therapy, Schools, & Early Intervention*, *2*(2), 103-118.

Chickedanz, J. A., & Casbergue, R. M. (2009). *Writing in preschool: Learning to orchestrate meaning and marks (*2nd ed.). International Reading Association, p. 7.

Cooper, C. E., Osborne, C. A., Beck, A. N., & McLanahan, S. S. (2011). Partnership instability, school readiness, and gender disparities. *Sociology of education*, *84*(3), 246-259.

Copley, J., & Ziviani, J. (1990). Kinaesthetic sensitivity and handwriting ability in grade one children. *Australian Occupational Therapy Journal*, *37*(1), 39-43.

Cornhill, H., & Case-Smith, J. (1996). Factors that relate to good and poor handwriting. *The American Journal of Occupational Therapy*, *50*(9), 732-739.

Cui, Y., Zhu, Y., Hannu Laukkanen, O. D., & Rabin, M. J. (2012). Evaluation of visual-motor integration skills in preschool and elementary school-aged Chinese children. *Journal of Behavioral Optometry*, *23*(5-6), 124.

Daly, C. J., Kelley, G. T., & Krauss, A. (2003). Relationship between visual-motor integration and handwriting skills of children in kindergarten: A modified replication study. *The American Journal of Occupational Therapy*, *57*(4), 459-462.

Danna, J., Vietminh, V., Thoret, E., Gondre, C., Kronland-Martinet, R., Capel, A., Petroz, C., Pierre, P., Cazés, O., Limozin, A., & Velay, J. L. (2013, July). Sonifying handwriting movements as real-time auditory feedback for the rehabilitation of dysgraphia. In *IXth International Conference on Progress in Motor Control (PMCIX)*.

De Ajuriaguerra, J., & Auzias, M. (1975). Preconditions for the development of writing in the child. *Foundations of language development: A multidisciplinary approach*, *2*, 311-328.

Decker, S. L., Englund, J. A., Carboni, J. A., & Brooks, J. H. (2011). Cognitive and developmental influences in visual-motor integration skills in young children. *Psychological Assessment*, *23*(4), 1010-1016.

Demirci, A. (2010). *The Effect of Visual Perception Education on the Development of Visual Perception in the Children of Five-Six Ages* (Doctoral dissertation). Retrieved from http://www.acikarsiv.gazi.edu.tr/File.php?Doc_ID=4139&ses=

Dennis, J. L., & Swinth, Y. (2001). Pencil grasp and children's handwriting legibility during different-length writing tasks. *The American Journal of Occupational Therapy*, *55*(2), 175-183.

DEST (2005). *Teaching Reading: Report and Recommendations: National Inquiry into the Teaching of Literacy*. Department of Education Science and Training, Canberra.

DiPasquale, G. W., Moule, A. D., & Flewelling, R. W. (1980). Birthdate effect. *Journal of Learning Disabilities, 13*(5), 234-238.

Doherty, G. (1997). *Zero to six: The basis for school readiness.* Ottawa: Human Resources Development Canada, Applied Research Branch, Strategic Policy.

Doyle, S., Wallen, M., & Whitmont, S. (1995). Motor skills in Australian children with attention deficit hyperactivity disorder. *Occupational Therapy International*, *2*(4), 229-240.

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., Pagani, L., Feinstein, L., Engel, M., Brooks-Gun, J., Sexton, H., Duckworth, K., & Japel, C. (2007). School readiness and later achievement.*Developmental psychology*, *43*(6), 1428-1446.

Eden, M. (1962). Handwriting and pattern recognition. *Information Theory, IRE Transactions on*, *8*(2), 160-166.

Education Act (1996). (c. 56), SCHEDULE 38, Repeals & Revocations Document Printed: 2010-09-10, http://www.educationengland.org.uk/documents/pdfs/1996-education-act.pdf

Eid, M. A., Mansour, M., El Saddik, A. H., & Iglesias, R. (2007, September). A haptic multimedia handwriting learning system. *Proceedings of the International Workshop on Educational Multimedia and Multimedia Education* (pp. 103-108). ACM.

Elliott, E. M., & Olliff, C. B. (2008). Developmentally appropriate emergent literacy activities for young children: Adapting the early literacy and learning model. *Early Childhood Education Journal*, *35*(6), 551-556.

Ercan, Z. G., & Aral N. (2011). Adaptation of the Beery-Buktenica Developmental Test of Visual-Motor Integration to six years (60-72 months) olds Turkish children. *H. U. Journal of Education Faculty, 41,* 136-145.

Erdem, A. R. (2005). İlköğretimimizin Gelişimi ve Bugüne Gelinen Nokta. *Üniversite ve Toplum, 5 (2),* Retrieved December 10, 2012, from http://www.universitetoplum.org/text.php3?id=240

Erkan, S. (2011). A study on the school readiness of first graders from different socio-economic levels. *H. U. Journal of Education Faculty, 40,* 186-197.

Ericsson, I. (2008). Motor skills, attention and academic achievements. An intervention study in school years 1–3. *British Educational Research Journal*,*34*(3), 301-313.

Erkan, S. (2011). A study on the school readiness of first graders from different socioeconomic levels. *H. U. Journal of Education, 40,* 186-197.

Essa, E. L. (2003). *Introduction to early childhood education* (Annotated Student's Edition, 4th ed.). Clifton Park, NY: Thomson Delmar Learning.

Feder, K. P., & Majnemer, A. (2007). Handwriting development, competency, and intervention. *Developmental Medicine & Child Neurology*, *49*(4), 312-317.

Feder, K. P., Majnemer, A., Bourbonnais, D., Platt, R., Blayney, M., & Synnes, A. (2005). Handwriting performance in preterm children compared with term peers at age 6 to 7 years. *Developmental Medicine & Child Neurology*, *47*(3), 163-170.

Feder, K., Majnemer, A., & Synnes, A. (2000). Handwriting: Current trends in occupational therapy practice. *Canadian Journal of Occupational Therapy,67*(3), 197-204.

Gallahue, D. L., & Ozmun, J. C. (1996). *Understanding motor development: infants, children, adolescence, adults* (3rd ed.). USA: Brown & Benchmark.

Gasser, T., Rousson, V., Caflisch, J., & Jenni, O. G. (2010). Development of motor speed and associated movements from 5 to 18 years. *Developmental Medicine & Child Neurology*, *52*(3), 256-263.

Gerde, H. K., Bingham, G. E., & Wasik, B. A. (2012). Writing in Early Childhood Classrooms: Guidance for Best Practices. *Early Childhood Education Journal*, *40*(6), 351-359.

Giagazoglou, P., Kabitsis, N., Kokaridas, D., Zaragas, C., Katartzi, E., & Kabitsis, C. (2011). The movement assessment battery in Greek preschoolers: the impact of age, gender, birth order, and physical activity on motor outcome. *Research in Developmental Disabilities*, *32*(6), 2577-2582.

Glazener, L. (2004). *Sensorcises active enrichment for the out-of-step learner.* California: Corwin Press.

Goetz, E. (1980). *Early writing: A developmental approach.* (ERIC Production Document Service No. ED 198939).

Gonçalves, H., Hallal, P. C., Amorim, T. C., Araújo, C. L., & Menezes, A. (2007). Sociocultural factors and physical activity level in early adolescence. *Revista Panamericana de Salud Pública*, *22*(4), 246-253.

Gormley, W. T., Phillips, D., & Gayer, T. (2008). Preschool programs can boost school readiness. *Science*, *320*(5884), 1723-24

Goyen, T. A., & Duff, S. (2005). Discriminant validity of the Developmental Test of Visual–Motor Integration in relation to children with handwriting dysfunction. *Australian Occupational Therapy Journal*, *52*(2), 109-115.

Graham, S., Berninger, V., & Fan, W. (2007). The structural relationship between writing attitude and writing achievement in first and third grade students. *Contemporary educational psychology*, *32*(3), 516-536.

Graham, S., Berninger, V., Weintraub, N., & Schafer, W. (1998). Development of handwriting speed and legibility in grades 1–9. *The Journal of Educational Research*, *92*(1), 42-52.

Graham, S., Weintraub, N., & Berninger, V. W. (1998). The relationship between handwriting style and speed and legibility. *The Journal of Educational Research*, *91*(5), 290-297.

Graham, S., & Miller, L. (1980). Handwriting research and practice: A unified approach. *Focus on exceptional Children*, *13*(2), 1-16.

Green, S. B., & Salkind N. J. (2004). *Using SPSS for windows and macintosh: Analyzing and understanding data (*4th Ed.). Prentice Hall PTR.

Grissmer, D., Grimm, K. J., Aiyer, S. M., Murrah, W. M., & Steele, J. S. (2010). Fine motor skills and early comprehension of the world: Two new school readiness indicators. *Developmental Psychology*, *46*(5), 1008.

Gredler, G. R. (1980). The birthdate effect, fact or artifact? *Journal of Learning Disabilities, 13,* 239-242.

Gullo, D. F., & Burton, C. B. (1992). Age of entry, preschool experience, and sex as antecedents of academic readiness in kindergarten. *Early Childhood Research Quarterly*, *7*(2), 175-186.

Halle, T. G., Hair, E. C., Wandner, L. D., & Chien, N. C. (2012). Profiles of school readiness among four-year-old Head Start children. *Early Childhood Research Quarterly*, *27*(4), 613-626.

Hamstra-Bletz, L., & Blöte, A. W. (1993). A longitudinal study on dysgraphic handwriting in primary school. *Journal of Learning Disabilities*, *26*(10), 689-699.

Harris, S. J., & Livesey, D. J. (1992). Improving handwriting through kinaesthetic sensitivity practice. *Australian Occupational Therapy Journal*, *39*(1), 23-27.

Harvey, G., & Simard, T. (1984). Functional reeducation and electromyographic evaluation of left handwriting in right hemiplegic patients: A pilot study.*Canadian Journal of Occupational Therapy*, *51*(5), 225-230.

Heriza, C. (1991). Motor development: traditional and contemporary theories. In *Contemporary Management of Motor Control Problems: Proceedings of the II STEP Conference. Alexandria, Va: Foundation for Physical Therapy* (pp. 99-126).

High, P. C. (2008). School readiness. *Pediatrics*, *121*(4), e1008-e1015.

Janus, M., & Offord, D. R. (2007). Development and psychometric properties of the Early Development Instrument (EDI): A measure of children's school readiness. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, *39*(1), 1-22.

John, S. S. (2013). Factoring in fine motor : How improving fine motor abilities impacts reading and writing. *Illinois Reading Council Journal*, *41*(4), 16-24.

Kagan, S. L. (1992). Readiness past, present, and future: Shaping the agenda. *Young Children*, *48*(1), 48-53.

Kagan, S. L., & Rigby, D. E. (2003). *Improving the Readiness of Children for School: Recommendations for State Policy: a Discussion Paper for the Policy Matters Project*. Center for the Study of Social Policy.

Kakebeeke, T. H., Caflisch, J., Locatelli, I., Rousson, V., & Jenni, O. G. (2012). Improvement in gross motor performance between 3 and 5 years of age. *Perceptual and Motor Skills*, *114*(3), 795-806.

Keogh, J., & Sugden, D. A. (1985). *Movement skill development*. New York: Macmillan.

Kaiser, M. L., Albaret, J. M., & Doudin, P. A. (2009). Relationship between visual-motor integration, eye-hand coordination, and quality of handwriting.*Journal of Occupational Therapy, Schools, & Early Intervention*, *2*(2), 87-95.

Kulp, M. T. (1999). Relationship between visual motor integration skill and academic performance in kindergarten through third grade. *Optometry & Vision Science*, *76*(3), 159-163.

Kushki, A., Chau, T., & Anagnostou, E. (2011). Handwriting difficulties in children with autism spectrum disorders: A scoping review. *Journal of autism and developmental disorders*, *41*(12), 1706-1716.

Kurtz, L. A. (2006). *Visual perception problems in children with AD/HD, autism, and other learning disabilities: a guide for parents and professionals*. London: Jessica Kingsley Publishers.

Lachance, J. A., & Mazzocco, M. M. (2006). A longitudinal analysis of sex differences in math and spatial skills in primary school age children. *Learning and Individual Differences*, *16*(3), 195-216.

Lamme, L. L. (1979). Handwriting: In an Early Childhood Curriculum. *Young Children*, *35*(1), 20-27.

Landy, J. M., & Burridge, K. R. (1999). *Ready-to-use fine motor skills & handwriting activities for young children* (Vol. 2). West Nyack: The Center for Applied Research in Education.

Lange, K. W., Tucha, L., Walitza, S., Gerlach, M., Linder, M., & Tucha, O. (2007). Interaction of attention and graphomotor functions in children with attention deficit hyperactivity disorder. In *Neuropsychiatric Disorders An Integrative Approach* (pp. 249-259). Springer Vienna.

Lauer, C. (2001). Educational attainment: a French-German comparison, ZEW Dokumentation, No. 01-02.

Laszlo, J. I., & Bairstow, P. J. (1983). Kinaesthesis: Its measurement, training and relationship to motor control. *The Quarterly Journal of Experimental Psychology*, *35*(2), 411-421.

Lerer, R. J., Artner, J., & Lerer, M. P. (1979). Handwriting deficits in children with minimal brain dysfunction effects of methylphenidate (ritalin) and placebo. *Journal of Learning Disabilities*, *12*(7), 450-455.

Larson, J. C. G., Mostofsky, S. H., Goldberg, M. C., L. E., Denckla, M. B., & Mahone, E. M. (2007). Effects of gender and age on motor exam in typically developing children. *Developmental Neuropsychology, 32*(1), 543-562.

Levine, M. D., Gordon, B. N., & Reed, M. S. (1987). *Developmental variation and learning disorders*. Cambridge, MA: Educators Publishing Service, Inc.

Levine, M. D., Oberklaid, F., & Meltzer, L. (1981). Developmental output failure: A study of low productivity in school-aged children. *Pediatrics*, *67*(1), 18-25.

Lewit, E. M., & Baker, L. S. (1995). School readiness. *The Future of Children*, *5*(2), 128-139.

Longcamp, M., Zerbato-Poudou, M. T., & Velay, J. L. (2005). The influence of writing practice on letter recognition in preschool children: A comparison between handwriting and typing. *Acta Psychologica*, *119*(1), 67-79.

Lust, C. A., & Donica, D. K. (2011). Effectiveness of a handwriting readiness program in Head Start: A two-group controlled trial. *The American Journal of Occupational Therapy*, *65*(5), 560-568.

Maeland, A. F. (1992). Handwriting and perceptual-motor skills in clumsy, dysgraphic, and 'normal' children. *Perceptual and motor skills*, *75*, 1207-1217.

Mäki, H. S., Voeten, M. J., Vauras, M. M., & Poskiparta, E. H. (2001). Predicting writing skill development with word recognition and preschool readiness skills. *Reading and Writing*, *14*(7-8), 643-672.

Malina, R. M., Bouchard, C., & Bar-Or, O. (2004). *Growth, maturation, and physical activity* (2nd ed.). USA: Human Kinetics.

Mangen, A., & Velay J. L. (2010). Digitizing Literacy: Reflections on the Haptics of Writing. In M. H. Zadeh (Ed.), *Advances in Haptics*. ISBN: 978-953-307-093-3, InTech, DOI: 10.5772/8710. Retrieved from: http://www.intechopen.com/books/advances-in-haptics/digitizing-literacy-reflections-on-the-haptics-of-writing

Marr, D., Cermak, S., Cohn, E. S., & Henderson, A. (2003). Fine motor activities in Head Start and kindergarten classrooms. *The American Journal of Occupational Therapy*, *57*(5), 550-557.

Mather N, Roberts R. (1995) Informal Assessment and Instruction in Written Language: A Practitioner's Guide for Students with Learning Disabilities. Brandon, VT: Clinical Psychology Publishing Company.

Matthews, J. S., Ponitz, C. C., & Morrison, F. J. (2009). Early gender differences in self-regulation and academic achievement. *Journal of Educational Psychology*, *101*(3), 689.

McCloskey, D. I. (1978). Kinesthetic sensibility. *Physiological Reviews*, *58*(4), 763-820.

McBryde, C., Ziviani, J., & Cuskelly, M. (2004). School readiness and factors that influence decision making. *Occupational Therapy International*, *11*(4), 193-208.

McHale, K., & Cermak, S. A. (1992). Fine motor activities in elementary school: Preliminary findings and provisional implications for children with fine motor problems. *The American Journal of Occupational Therapy*, *46*(10), 898-903.

McTurk, N., Lea, T., Robinson, G., Nutton, G., & Carapetis, J. R. (2011). Defining and assessing the school readiness of Indigenous Australian children. *Australasian Journal of Early Childhood*, *36*(1), 69-76.

Meisels, S.J. (1999). Assessing readiness. R. C. Pianta, & M. J. Cox (eds.), *The transition to kindergarten* (pp. 39-66). Baltimore, Maryland: Paul H. Brookes Publishing.

Mergl, R., Tigges, P., Schröter, A., Möller, H. J., & Hegerl, U. (1999). Digitized analysis of handwriting and drawing movements in healthy subjects: methods, results and perspectives. *Journal of Neuroscience Methods*, *90*(2), 157-169.

Moreno-Briseño, P., Díaz, R., Campos-Romo, A., & Fernandez-Ruiz, J. (2010). Sex-related differences in motor learning and performance. *Behavioral and Brain Functions*, *6*(74), 1-4.

Mülazımoğlu-Ballı, Ö. (2006). *The Study of Validity and Reliability of Bruininks-Oseretsky Motor Proficiency Test and the Effects of Gymnastics Education Program on Motor Development of Five-Six– Years–Old Children* (Doctoral dissertation). Retrieved from http://www.arastirmax.com/en/bilimsel-yayin/hacettepe-universitesi-spor-bilimleri-dergisi/23/3/104-118_bruininks-oseretsky-motor-yeterlik-testinin-bes

Narahara, M. (1998). Kindergarten Entrance Age and Academic Achievement. Long Beach, CA: California State University (ERIC Production Document Service No. ED 421218).

National Education Goals Panel (1991). *The Goal 1 Technical Planning Subgroup report on school readiness.* Washington, DC: Author.

National Handwriting Association in UK (2013). *What is handwriting.* Retrieved from http://www.nha-handwriting.org.uk/handwriting/what-is-handwriting

Ohtoshi, T., Muraki, T., & Takada, S. (2008). Investigation of age-related developmental differences of button ability. *Pediatrics International*, *50*(5), 687-689.

Oliver, C. E. (1990). A sensorimotor program for improving writing readiness skills in elementary-age children. *The American Journal of Occupational Therapy*, *44*(2), 111-116.

Palluel-Germain, R., Bara, F., de Boisferon, A. H., Hennion, B., Gouagour, P., & Gentaz, E. (2007, March). A Visuo-Haptic Device-Telemaque-Increases Kindergarten Children's Handwriting Acquisition. In *EuroHaptics Conference, 2007 and Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems. World Haptics 2007. Second Joint* (pp. 72-77). IEEE.

Parush, S., Levanon-Erez, N., & Weintraub, N. (1998). Ergonomic factors influencing handwriting performance. *Work*, *11*(3), 295-305.

Phelps, J., & Stempel, L. (1987). Handwriting: Evolution and evaluation. *Annals of Dyslexia*, *37*(1), 228-239.

Piek, J. P., Pitcher, T. M., & Hay, D. A. (1999). Motor coordination and kinaesthesis in boys with attention deficit–hyperactivity disorder. *Developmental Medicine & Child Neurology*, *41*(3), 159-165.

Piper, B. J. (2011). Age, handedness, and sex contribute to fine motor behavior in children. *Journal of neuroscience methods*, *195*(1), 88-91.

Polat Unutkan, Ö. (2007). Okul öncesi dönem çocuklarının matematik becerileri açısından ilköğretime hazır bulunuşluğunun incelenmesi. *H. U. Journal of Education, 32*, 243-254.

Rappley, M.D. (2005). Attention deficit-hyperactivity disorder. *N Engl J Med, 352*, 165-173.

Rice, R. R. (1976). The Use of Handwriting Rate for Predicting Academic Achievement and Suggesting Curriculum Modification. *Dissertation Abstract International: Section A, 37*, 1887.

Rosenblum, S., Goldstand, S., & Parush, S. (2006). Relationships among biomechanical ergonomic factors, handwriting product quality, handwriting efficiency, and computerized handwriting process measures in children with and without handwriting difficulties. *The American journal of occupational therapy*, *60*(1), 28-39.

Rothwell, J. C., Traub, M. M., Day, B. L., Obeso, J. A., Thomas, P. K., & Marsden, C. D. (1982). Manual motor performance in a deafferented man. *Brain,105*(3), 515-542.

Rueckriegel, S. M., Blankenburg, F., Burghardt, R., Ehrlich, S., Henze, G., Mergl, R., & Hernáiz Driever, P. (2008). Influence of age and movement complexity on kinematic hand movement parameters in childhood and adolescence. *International Journal of Developmental Neuroscience*, *26*(7), 655-663.

Sadoski, M., & Paivio, A. (2004). A dual coding theoretical model of reading.*Theoretical Models and Processes of Reading*, *5*, 1329-1362.

Sandler A. D., Watson T.E., Footo M., Levine M.D., Coleman W.L., & Hooper S.R. (1992) Neurodevelopmental study of writing disorders in middle childhood. *Developmental and Behavioral Pediatrics, 13*, 17–23.

Saraiva, L., Rodrigues, L. P., Cordovil, R., & Barreiros, J. (2013). Influence of age, sex and somatic variables on the motor performance of pre-school children. *Annals of Human Biology*, *40*(5), 444-450.

Sassoon R. (1990) Handwriting: A New Perspective. Cheltenham, UK: Stanley Thornes.

Scarpati, S., & Silver, P. G. (1999). Readiness for academic achievement in preschool children. In E. V. Nuttall, I. Romero, & J. Kalesnik (Eds.), *Assessing and screening preschoolers: Psychological and educational dimensions* (2nd ed., pp. 262 – 280). Needham Heights, MA: Allyn & Bacon.

Schneck, C. M. (1991). Comparison of pencil-grip patterns in first graders with good and poor writing skills. *The American Journal of Occupational Therapy*,*45*(8), 701-706.

Schwellnus, H., Carnahan, H., Kushki, A., Polatajko, H., Missiuna, C., & Chau, T. (2012). Effect of pencil grasp on the speed and legibility of handwriting in children. *The American Journal of Occupational Therapy*, *66*(6), 718-726.

Shiffrin, R. M., & Schneider, W. (1977). Controlled and automatic human information processing: II. Perceptual learning, automatic attending and a general theory. *Psychological Review*, *84*(2), 127-190.

Smith, M. C., & Fucetola, R. (1995). Effects of delayed visual feedback on handwriting in Parkinson's disease. *Human Movement Science*, *14*(1), 109-123.

Smits-Engelsman, B. C., Niemeijer, A. S., & van Galen, G. P. (2001). Fine motor deficiencies in children diagnosed as DCD based on poor grapho-motor ability. *Human Movement Science*, *20*(1), 161-182.

Snow, C. E., Burns, M. S., & Griffin, P. (1998). Preventing reading difficulties in young children: Committee on the prevention of reading difficulties in young children. *Washington, DC: National Research Council*.

Soderman, A. K., Chhikara, S., Hsiu-Ching, C., & Kuo, E. (1999). Gender differences that affect emerging literacy in first grade children: US, India, and Taiwan. *International Journal of Early Childhood*, *31*(2), 9-16.

Spessato, B. C., Gabbard, C., Valentini, N., & Rudisill, M. (2013). Gender differences in Brazilian children's fundamental movement skill performance.*Early Child Development and Care*,183(7), 1-8.

Steger, J., Imhof, K., Coutts, E., Gundelfinger, R., Steinhausen, H. C., & Brandeis, D. (2001). Attentional and neuromotor deficits in ADHD.*Developmental Medicine & Child Neurology*, *43*(3), 172-179.

Strauss, A. A., & Kephart, N. C. (1955). Psychopathology and education of the brain-injured child. New York: Grune & Stratton.

Sudsawad, P., Trombly, C. A., Henderson, A., & Tickle-Degnen, L. (2002). Testing the effect of kinesthetic training on handwriting performance in first-grade students. *The American journal of occupational therapy*, *56*(1), 26-33.

The World Bank Group (2013). *Primary school starting age (years)*[Data file]. Retrieved from http://data.worldbank.org/indicator/SE.PRM.AGES

Tseng, M. H., & Cermak, S. A. (1993). The influence of ergonomic factors and perceptual–motor abilities on handwriting performance. *The American Journal of Occupational Therapy*, *47*(10), 919-926.

Van Bergeijk, W. A., & David Jr, E. E. (1959). Delayed handwriting. *Perceptual and Motor Skills*, *9*(3), 347-357.

Van Galen, G. P., Portier, S. J., Smits-Engelsman, B., & Schomaker, L. R. (1993). Neuromotor noise and poor handwriting in children. *Acta Psychologica*, *82*(1), 161-178.

Van Hoorn, J. F., Maathuis, C. G., Peters, L. H., & Hadders-Algra, M. (2010). Handwriting, visuomotor integration, and neurological condition at school age. *Developmental Medicine & Child Neurology*, *52*(10), 941-947.

Van Mier, H. (2006). Developmental differences in drawing performance of the dominant and non-dominant hand in right-handed boys and girls. *Human movement science*, *25*(4), 657-677.

Vlachos, F., & Bonoti, F. (2006). Explaining age and sex differences in children's handwriting: A neurobiological approach. *European Journal of Developmental Psychology*, *3*(2), 113-123.

Volman, M. J. M., van Schendel, B. M., & Jongmans, M. J. (2006). Handwriting difficulties in primary school children: A search for underlying mechanisms. *The American Journal of Occupational Therapy*, *60*(4), 451-460.

Welford, A. T. (1951). *Skill and age: An experimental approach.* Oxford University Press for the Nuffield Foundation

Weil, M. J., & Cunningham Amundson, S. J. (1994). Relationship between visuomotor and handwriting skills of children in kindergarten. *The American Journal of Occupational Therapy*, *48*(11), 982-988.

Wiart, L., & Darrah, J. (2001). Review of four tests of gross motor development. *Developmental Medicine & Child Neurology*, *43*(4), 279-285.

Williams H., & Monsma E. (2006). Assessment of gross motor development in preschool children. In B. Barcken, R. Nagle (eds.), *The Psychoeducational Assessment of Preschool Children.* New Jersey Lawrence Erlbaum Associates, Inc.

Wood, C., Powell, S., & Knight, R. C. (1984). Predicting School Readiness The Validity of Developmental Age. *Journal of Learning Disabilities*, *17*(1), 8-11.

Yangın, B. (2007). The degree of readiness for writing education of six year olds in preschool education. *H. U. Journal of Education Faculty, 32*, 294-305.

Yeşil-Dağlı, Ü. (2012). Çocukları okul öncesi eğitim kurumlarına devam eden velilerin ilkokula hazırbulunuşluk ile ilgili görüşleri (Opinions of parents whose children attending kindergarten and prekindergarten about school readiness). *Ekev Akademi Dergisi, 16*(52), 231-243.

Yost, L. W., & Lesiak, J. (1980). The Relationship between Performance on the Developmental Test of Visual Perception and Handwriting Ability. *Education*,*101*(1), 75-77.

Zimmer, A. (1982). Do we see what makes our script characteristic—or do we only feel it? Modes of sensory control in handwriting. *Psychological Research*,*44*(2), 165-174.

Zion, L. C. (1996). Making Sense: Kinesthesia. *ETC: A Review of General Semantics*, *53*(3), 300-314.

APPENDIX A

PERMISSION FROM ETHIC COMMITTEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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17.09 2013

Gönderilen : Y. Doç. Dr. Sadettin KİRAZCI
Beden Eğitimi ve Spor Bölümü

Gönderen : Prof. Dr. Canan Özgen
IAK Başkanı

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz Beden Eğitimi ve Spor Bölümü Yüksek Lisans öğrencisi Yasemin Harmancı Başkut'un "İlkokul 1. Sınıf Öğrencilerinin Yaş ve Cinsiyet Bakımından Yazma Becerisine Hazır Bulunuşlukları" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

17/09/2013

Prof.Dr. Canan Özgen
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkanı
ODTÜ 06531 ANKARA

APPENDIX B

PERMISSION FROM DISTRICT OF NATIONAL EDUCATION

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

Sayı : 14588481/605.99/2636251 24/09/2013
Konu: Araştırma İzni
(Yasemin HARMANCI BAŞKUT)

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE
(Eğitim Fakültesi)

İlgi : a) MEB Yenilik ve Eğitim Teknolojileri Genel Müdürlüğünün 2012/13 nolu genelgesi
b) 09/09/2013 tarih ve 229 sayılı yazınız.

Fakülteniz Beden Eğitimi ve Spor Bölümü yüksek lisans öğrencilerinden Yasemin HARMANCI BAŞKUT'un "İlkokul 1. Sınıf Öğrencilerinin Yaş ve Cinsiyet Bakımından Yazma Becerisine Hazır Bulunuşlukları" konulu tez önerisi kapsamında uygulama yapma isteği Müdürlüğümüzce uygun görülmüş ve araştırmanın yapılacağı İlçe Milli Eğitim Müdürlüğüne bilgi verilmiştir.

Anketlerin uygulama yapılacak sayıda çoğaltılması ve çalışmanın bitiminde iki örneğinin (CD ortamında) Müdürlüğümüz Strateji Geliştirme-1 Şube Müdürlüğüne gönderilmesini arz ederim.

İlhan KOÇ
Müdür a.
Şube Müdürü

Bu belge, 5070 sayılı Elektronik İmza Kanununun 5 inci maddesi gereğince güvenli elektronik imza ile imzalanmıştır
Evrak teyidi http://evraksorgu.meb.gov.tr adresinden 3531-a6b6-34dd-91df-dc54 kodu ile yapılabilir.

Emniyet Mh. Ahmet Ihsan Türkeş Cd. No: 4/A Yenimahalle/ANKARA Ayrıntılı bilgi için: Murat YILMAZER

APPENDIX C

PARENT CONSENT LETTER

VELİ ONAY MEKTUBU

25.09.2013

Sayın Veli,

Orta Doğu Teknik Üniversitesi, Eğitim Fakültesi, Beden Eğitimi ve Spor Bölümü'nde yüksek lisans öğrencisi olarak çalışmaktayım. Yüksek lisans tez projem kapsamında 60-84 aylık yaş grubu çocukların fiziksel hazır bulunuşluk, küçük kas gelişimi, görsel algı ve el-göz koordinasyonlarını inceleyerek, yazma becerisine olan etkisini araştırmayı hedeflemekteyim. Bu mektubun yollanış amacı, size araştırma kapsamı hakkında bilgi vermek ve onayınızı almaktır.

Çalışmanın amacı iki farklı yaş grubunun yazma becerilerinin karşılaştırılmasıdır. Veriler, ulusal ve uluslararası düzeyde uygulanmış olan, çocukların gelişim düzeylerine yönelik üç ölçüm aracıyla toplanacaktır ve yaklaşık olarak 45 dakika sürecektir. Görüntü veya ses kaydı gibi uygulamalar olmadığından çocukların fiziksel ya da ruhsal durumlarını etkileyecek risk etkenleri yoktur.

Araştırma için katılımcılar numaralandırılacak, yaş ve cinsiyetleri hakkında bilgiler alınacaktır. Fakat bu bilgiler, katılımcının gizliliğinin korunması için sadece araştırmacıda kalacak ve diğer şahıslara karşı kapalı olacaktır.

Bu araştırma için öğrencinin gönüllülüğü esastır ve arzu ettiği takdirde, herhangi bir yaptırıma maruz kalmadan katılımdan vazgeçme hakkına sahiptir.

Çalışmaya ya da çocuğunuzun katılımına yönelik daha fazla bilgi için bana ulaşabilirsiniz. Teşekkür ederim,

Yasemin HARMANCI BAŞKUT

Adres: ODTÜ Eğitim Fakültesi, Beden Eğitimi ve Spor Bölümü
Tel: 0505 202 56 33
e-posta: ysmnhrmnc@gmail.com

Yukarıda açıklamasını okuduğum çalışmaya, oğlum/kızım _____'nin katılımına izin veriyorum. Ebeveynin:
Adı, soyadı: _____ İmzası: _____ Tarih: __ / __ /2013

İmzalanan bu formu lütfen çocuğunuz aracılığı ile sınıf öğretmenine ulaştırınız.
Çocuğunuzun katılımı ya da haklarının korunmasına yönelik sorularınız varsa ya da çocuğunuz herhangi bir şekilde risk altında olabileceğine, strese maruz kalacağına inanıyorsanız Orta Doğu Teknik Üniversitesi Etik Kuruluna (312) 210-37 29 telefon numarasından ulaşabilirsiniz.

ÖĞRENCİ BİLGİ FORMU

Çocuğunuz daha önce herhangi bir okul öncesi eğitim kurumuna gitti mi?

Evetse özel kuruma mı devlet kurumuna mı gitti?

Kaç sene okul öncesi eğitim kurumuna gitti?

Çocuğunuzun gelişimini etkileyecek herhangi bir fiziksel ya da zihinsel rahatsızlığı var mı?

Çocuğunuz en son ne zaman göz sağlığı için kontrolden geçti?

Çocuğunuzun ilköğretime başlaması için hazır olduğunu düşünüyor musunuz? Neden?

Sosyoekonomik durumunuzun hangi seviyede olduğunu düşünüyorsunuz?

A. Düşük B. Orta C. Yüksek D. Çok Yüksek

Öğrencinin Doğum Tarihi:

İmzalanan bu formu lütfen çocuğunuz aracılığı ile sınıf öğretmenine ulaştırınız. Çocuğunuzun katılımı ya da haklarının korunmasına yönelik sorularınız varsa ya da çocuğunuz herhangi bir şekilde risk altında olabileceğine, strese maruz kalacağına inanıyorsanız Orta Doğu Teknik Üniversitesi Etik Kuruluna (312) 210-37 29 telefon numarasından ulaşabilirsiniz.

APPENDIX D

Correlation between Total Point Score of Children in BOTMP and Age (Months)

		Total point score in BOTMP	Age (Months)
Total point score in BOTMP	Pearson Correlation	1	.40**
	Sig. (2-tailed)		.00
	N	87	87
Age (Months)	Pearson Correlation	.40**	1
	Sig. (2-tailed)	.00	
	N	87	87

**. Correlation is significant at the 0.01 level (2-tailed).

Age Groups Statistics for Total Point Score of Children in BOTMP

	N	*M*	*SD*	*min.*	*max.*	*Range*
61 - 72 months	48	35.00	6.12	18	46	28
73 - 84 months	39	39.59	5.28	28	49	21

APPENDIX E

TÜRKÇE ÖZET

GİRİŞ

Yeni Türk eğitim sistemi 222 sayılı İlköğretim ve Eğitim Kanunu ile 2012-2013 eğitim-öğretim yılında uygulamaya konmuştur. Bu yeni sistem ile zorunlu eğitim 8 yıldan 12 yıla çıkarılmış, okula başlama yaşı 5.5 yaşına (66 aya) düşürülmüştür. Buna ek olarak, fiziksel ve ruhsal gelişim yönünden hazır olduğu düşünülen 61-66 ay arasındaki çocukların velilerine, yazılı istekleri üzerine, çocuklarını ilkokula başlatma hakkı verilmiştir.

Türk eğitim sistemindeki bu değişilikte kronolojik yaş ölçüt olarak alınmıştır. Farklı ülkelerin eğitim sistemleri incelendiğinde, Türk eğitim sisteminde olduğu gibi okula başlama yaşı kronolojik yaş ölçüt olarak alınmıştır. Mesela İngiltere'de okula başlama yaşı 5, okulu bitirme yaşı 16; Fransa'da ve Almanya'da okula başlama yaşı 6, okulu bitirme yaşı 16 olarak belirlenmiştir.

Her ne kadar okula başlama yaşı için kronolojik yaşın ölçüt olarak alınması tartışılsa da (Meisels, 1999) pek çok ülke kronolojik yaşı tek ölçüt olarak almaktadır (Narahara, 1998). Fakat aynı yaş grubundaki çocuklar aynı gelişimsel özelliklerini göstermeyebilir (Department of Education, Science and Training in Canberra, 2005) hatta kronolojik yaş ölçüt alınarak okula başlayan çocuklar okuldaki koşulları ya da gereklilikleri aynı şekilde yerine getiremeyebilir (Lewit ve Baker, 1995).

Kronolojik yaş ve gelişimsel yaş birçok konuda tartışılmıştır. Bunlardan birisi de okula hazır bulunuşluktur. Araştırmalarda okula hazır bulunuşluğun önemi ve unsurları hakkında genel bir fikir oluşturulsa da okula hazır bulunuşluğun tanımı tam olarak ortaya konamamıştır. Okula hazır bulunuşluk ilk olarak 1991 yılında Amerika'da Milli Eğitim Hedefleri Paneli'nde dikkat çekmiştir. Bu panelde okula hazır bulunuşluk, "öğrenmeye hazır bulunuşluk" olarak tanımlanmış ve 5 alana bölünmüştür: dilin kullanımı; genel bilgi, biliş, kavrayış; fiziksel sağlık; sosyal ve duygusal gelişim; öğrenmeye yaklaşım. Kagan (1992) "öğrenmeye hazır bulunuşluk" ile "okula hazır bulunuşluk" arasındaki farkı vurgulamıştır. Diğer bir bakış açısı ile okula hazır bulunuşluk çocukların okuldaki koşulları ve gereklilikleri yerine getirmeleri için bilgi unsurlarının yanı sıra bilişsel, dil, motor ve sosyoduygusal alanlarda gereken asgari gelişimsel seviyedir (Carlton ve diğ., 1999; Scarpati ve diğ., 1999).

Gredler (1980) okula hazır bulunuşlukta sadece kronolojik yaşın ölçüt olamayacağını, sosyoekonomik durumun; ebeveynlerin ve öğretmenlerin okul başarısı için beklentilerinin çocukların okula hazırbulunuşları üzerine kronolojik yaştan daha etkili olduğunu savunmuştur. McBryde ve diğ. (2004) ise görevi sürdürme, uygun davranışlar, cinsiyet ve kronolojik yaşın ebeveyn ve öğretmenlerin çocukların okula hazır bulunuşlukları hakkındaki fikirlerini etkilediğini savunmuşlardır.

Kronolojik yaş-gelişimsel yaş etkisinin yanı sıra cinsiyetin okula hazır bulunuşluk üzerindeki etkisi de tartışılmaya devam etmektedir. Bazı araştırmacılar cinsiyetin, çocukların okula hazır bulunuşluklarının üzerinde önemli bir etkisinin olduğunu savunurken (McBryde ve diğ., 2004; Angenent ve diğ., 1989)bazı araştırmacılar cinsiyetin, çocukların okula hazır bulunuşluklarının üzerinde önemli bir etkisinin olmadığını savunmuşlardır (Gullo ve diğ., 1992; Yeşil-Dağlı, 2012; Erkan, 2011; Polat-Unutkan, 2007).

Okula hazır bulunuşluk çocukların sonraki başarılarını etkilediğinden erken sosyal beceriler ve ön yazma becerileri, ön okuma becerileri, erken matematik becerileri gibi

erken akademik beceriler okula hazır bulunuşluk için oldukça önemlidir (Dundan ve diğ., 2006). Nitekim ön okuma ve ön yazma becerilerini içeren küçük yaştaki çocuklardaki edebiyat gelişimine, çocukların okuma ve yazma içeren ilkokul programına hazır olabilmesi için okul öncesi öğretmenleri tarafından oldukça önem verilmektedir (Elliott ve diğ., 2008).

Çocukların kalem tutma ve kalemi kontrol edebilme becerileri, sayfaları yırtmadan veya kırıştırmadan çevirebilmesi çocukların okula hazır bulunuşluk durumlarında beklenilen ön yazma becerilerinin kazanması, uygun motor gelişimleri ve fiziksel koordinasyonları ile sağlanmaktadır. Eğer bir öğrenci yaşından beklenen motor gelişimini gösteremiyorsa kendini yetersiz hissedecek ve okul etkinliklerine katılmak istemeyecektir (Doherty, 1997).

Yazma becerisi ilk olarak belirli kurallar çerçevesinde birbirine bağlı çizgiler olarak tanımlanmıştır (Eden, 1962). Daha sonra bu tanım motor hafızanın komutları ve gözlerin takibini içeren el hareketleri/becerileri olarak değiştirilmiştir (Landy ve diğ., 1999). Günümüzde ise yazma becerisi dil, bilişsel, algı ve motor yeterliğin koordinasyon ve bütünleşmesine bağlı olaran karmaşık bir becereri olarak tanımlanmıştır (National Handwriting Association in UK, 2013).

İlköğretimde yazma becerisi öğretiminde anlaşılır yazma becerisi ön sırada yer almaktadır. Bu duruma sıranın yüksekliği, yazı tahtasına olan uzaklık, oturma pozisyonu, ışık gibi dışsal faktörler etki ederken, bu durum için asıl önemli olan çocukların yazma becerisi için hazır bulunuşluk durumudur. Çünkü yazma becerisi; kinestezi, ince motor gelişimi ve kontrolü, görsel algı, görsel motor entegrasyonu, duyusal uyaranlar ve sürekli dikkatten oluşan karmaşık bir yapıdır (Maeland, 1992; Amundson, 1992; Cornhill ve diğ., 1996) ve yazma kazanımını öğrenirken çocuklardan bu becerilerin kazanılması ve bu becerilerin beraber kullanılması beklenmektedir.

Kinestezi: İlk fakat gizli gelişen; beş duyu organının yanı sıra nöronları, kasları, eklemleri, tendonları ve bağ dokuyu içeren bir duyu sistemidir. Bu sistem "konum ve

hareket" algısını sağlamaktadır. Kinestezideki bir problem istemli hareketlerde eksikliğe neden olacağından içalgı (proprioseptif) için oldukça önemlidir (Rothwell ve diğ., 1982; Zion, 1996). Kinestezi, bir nesnenin ağırlığını fark etme, hareketleri kontrol etme, görsel ve işitsel uyaranlar olmadan vücut bölümlerini ayırt etme gibi becerileri sağlar. Parmaklardaki kinestezi algısı yazma becerisi için oldukça önemli bir unsurdur (Keogh ve diğ., 1985). Örneğin, kinestezi kalem tutma şeklini etkilediği için yazma becerisi açısından oldukça önemlidir (Feder ve diğ., 2007). Copley ve Ziviani (1990), Brink ve diğ. (2011), Levine (1987), Feder ve diğ. (2005) ve Schneck (1991) kinestezi ve yazma becerisi arasında olumlu bir ilişki bularak, kinestezinin yazma becerisi öğrenimi ve kalitesi için önemini belirtmişlerdir.

Görsel Algı: Görsel uyaranların beyinde yorumlanmasıdır (Kurtz, 2006). Görsel algı, motor hareketlerde daha iyi bir koordinasyon sağlamaktadır (Strauss ve diğ., 1955; Tseng ve diğ., 1993). Ayrıca görsel algı, okuma-yazma öğreniminde çocukların benzer harfleri (d-b) ya da kelimeleri (saw-was) ayırt etmesini sağlamaktadır (Amundson ve diğ., 1996). Buna rağmen görsel algı ve okuma becerisi ile ilgili daha çok çalışma mevcut iken görsel algı ve yazma becerisi ile ilgili çalışmalar sınırlıdır (Tseng ve diğ., 1993).

İnce Motor Gelişimi ve Kontrolü: Kişilerin bileklerini, ellerini, ve parmaklarını kullandığı ince ve hassas hareketlerin yapılması ve kontrolüdür (Essa, 2011). Cephalocaudal ve proximodistal gelişim basamakları göz önüne alındığında once kaba motor gelişiminin sonra ince motor gelişiminin başladığı görülmektedir (Allahue ve diğ., 1996). Yazma becerisindeki ince motor beceriler, harflerin formunun ve büyüklüğünün sağlanmasına ve yazma sırasında akıcı hareketlere yardımcı olmaktadır (Van Galen ve diğ., 1993). İnce motor becerilerinin gelişmesi ile çocuklar genellikle 4-6 yaş civarında istenilen kalem tutma pozisyonunu gösterebilmektedirler (Dennis ve diğ., 1999). Çalışmaların çoğu yazma becerisindeki problemlerin çoğunun ince motor gelişimden kaynaklandığını ve bu problemlerin ileride akademic başarıyı olumsuz etkileyeceğini göstermektedir (Levine ve diğ., 1981; Hamstra-Bletz ve diğ., 1993; Smits-Engelsman ve diğ., 2001; Volman ve diğ., 2006; Ericsson, 2008; John, 2013).

Görsel Motor Entegrasyonu: görsel algı ile motor becerilerin koordinasyonudur. Nitekim Tseng ve Cermak (1993) görsel motor entegrasyonunu "harflerin ve/veya şekillerin görünümleri ile uygun motor tepkilerinin entegrasyonu" şeklinde tanımlamıştır. Çocuklarda görsel motor entegrasyonunun gelişmesi ile çocukların büyük bir kısmının anasınıfının son dönemlerinde yazmayı öğrenmeleri için hazır bulundukları iddia edilmektedir (Weil ve diğ., 1994). Görsel motor entegrasyonundaki problemlerin, koordinasyon problemlerine, ince manipulatif yetersizliklere, kasların kontrolünde ve duyusal alanlarda sorunlara neden olmaktadır. Bu durum da yazma becerisinde kötü performansa sebep olmaktadır (van Hoorn ve diğ., 2010).

Duyusal Uyaranlar: Sözel, işitsel, görsel ve fiziksel olan duyusal uyaranlar birçok motor hareket için öncelikli düzenleyici olmaktadır (Bergeijk ve diğ., 1959). Okuma becerisi için önemli olan sözel uyaranlar, yazma becerisi için yeterli olmayabilir. Motor becerilerin öğrenilmesi ya da transferi için sözel uyaran yerine fiziksel ya da görsel yardım daha etkili olabilmektedir (Sadoski ve diğ.; 2004; Eid ve diğ., 2007).

Sürekli Dikkat: Yazma becerisi öğrenilirken, çocuklar ilk aşamada Schneider and Shiffrin'in kontrollü işlem sürecinde bulunmaktadır. Bu süreç, dikkati gerektirirken; motor hareketler yavaş yavaş oluşmaktadır. Sürekli dikkatin önemi, dikkat eksikliği ve hiperaktivite bozukluğu olan çocukların yazma performansları ile aynı yaşta normal gelişim seyreden çocukların yazma performansları karşılaştırıldığında anlaşılmaktadır.
Weil ve Amundson görsel motor entegrasyonunu yazma becerisinin gelişimi için en önemli bölümü olduğunu savunurken, Benbow ve diğ. (1992) görsel-motor becerilerinin ve ince motor koordinasyonun önemini savunmuştur (Daly, Kelly ve Krauss'tan alınmıştır, 2003).

Bu çalışmada da eğitim sistemindeki değişiklik ve yazma becerisinin boyutları göz önüne alınarak ilkokul birinci sınıfa başlayan çocuklarda yazma becerisine hazır bulunuşluk

ölçüsü olarak yaşın ve cinsiyetin motor yeterlik ve görsel motor entegrasyonunu etkileyip etkilemediği incelenmiştir.

YÖNTEM

Çalışmaya Ankara Çankaya'da bulunan 3 devlet okulundaki 7 sınıftan toplam 87 ilkokul birinci sınıf öğrencileri katılmıştır. Sosyoekonomik durumun çocukların okula hazır bulunuşluklarının üzerindeki etkisini düşürmek için aynı çevreden belirli okullar seçilmiştir.

Çalışmada, katılımcılar yaş ve cinsiyetleri göz önüne alınarak 4 gruba ayrılmışlardır: a) 61-72 aylık kız öğrenciler (n=25), b) 73-84 aylık kız öğrenciler (n=18), c) 61-72 aylık erkek öğrenciler (n=23) ve d) 73-84 aylık erkek öğrenciler (n=21).
Çocukların motor yeterlik ve görsel motor entagrasyon becerilerini ölçmek için iki tane performans testi kullanılmıştır: Bruininks-Oseretsky Motor Yeterlik Testi ve Beery-Buktenica Görsel Motor Entegrasyon Testi.

Buininks-Oseretsky Motor Yeterlik Testi (BOTMP), 1978'te Bruininks-Oseretsky tarafından tasarlanmış ve son versiyonu 2005'te yayımlanmıştır. Ölçüm aracı, Mülazımoğlu-Ballı (2006) tarafından doktora tezi için Türkçe'ye çevrilmiş ve Türkiye'de uygulanmıştır. Geçerlilik değeri .67-.79 arasında değişen ve test-retest değeri .72-.84 olan testin Türk çocukları için geçerli ve güvenilir olduğunu saptamıştır. Testin uzun formu 46 maddeden oluşmaktadır ve formun uygulanabilmesi için 45-60 dakika süre gerekmektedir. Testin kısa formu ise 14 maddeden oluşmuştur ve formun uygulanması için 15-20 dakika süre gerekmektedir. Kısıtlı zaman, öğrenci sayısı, sınıf ortamında ölçüm yapılması nedenleri ile bu çalışmada BOTMP'nin kısa formu kullanışmıştır.

Beery-Buktenica Görsel Motor Entegrasyon Testi (VMI) literatüre bakıldığında araştırmalarda en yaygın kullanılan görsel motor entegrasyonu ölçme aracıdır. Test, Demirci (2010) doktora tezi kapsamında Türkçe'ye uyarlanmıştır. Ayrıca Ercan ve Aral

(2011) tarafından Türk çocuklarına uyarlanma çalışması yapılmıştır. Her iki çalışmada bu testin Türk çocukları için geçerli ve güvenilir bir ölçme aracı olduğunu belirtmiştir. Testin tam formu 30 maddeden oluşmaktadır ve uygulama süresi 10-15 dakikadır. Bu çalışmada Demirci'nin paylaşımı ve onayıyla, doktora tezi için uyarladığı test uygulanmıştır.

Çalışma 2013-2014 eğitim öğretim yılının başında öğretmenler yazma öğretimine başlamadan uygulanmıştır. Önce 2 gün içerisinde ailelerden onay formları alınmış, sonra 3 hafta süren testler uygulanmıştır. Öğrenciler testlere okullarda bulunan boş bir sınıf ya da testlere uygun bir odada bireysel olarak katılmışlardır. Çocukların en iyi performanslarını gösterebilmeleri için uygun sıra/sandalye yüksekliği, uygun ışık, uygun araç ve gereçler gibi dış etkenler sağlanmıştır.

İlk olarak çocuklar testler hakkında, çalışmaya neden katıldıkları ve katılımlarının niçin önemli olduğu hakkında bilgilendirilmiş ve çocuklara istedikleri zaman testi bırakabilecekleri belirtilmiştir. Sonrasında motor yeterlik testi ve görsel motor entegraston testi sıra ile uygulanmıştır. Her çocuk için motor yeterlik testinin uygulanması ortalama 30 dakika ve görsel motor entegrasyon testinin uygulanması ortalama 20 dakika olmak üzere toplamda ortalama 50 dakikada bir katılımcıdan veri toplanmıştır.

Veriler toplandıktan sonra ilk olarak eksik veri kontrolü yapılmış ve Q-Q grafiği ile 3 uç değer saptanarak veri dizisinden çıkarılmıştır. Verilerin normallik ve homojenlik testleri yapıldıktan sonra verilerin analizinde tanımlayıcı istatistikler ve iki faktörlü varyans analizi (Two-way ANOVA) kullanılmıştır. Analiz uygulamalarında alfa değeri .05 olarak saptanmıştır.

BULGULAR

Motor Yeterlik Bulguları

Birinci araştırma sorusunu (yaş ve cinsiyetin Bruininks-Oseretsky Motor Yeterlik Testi ile ölçülen motor yeterlik üzerindeki etkisi nedir) cevaplayabilmek için çocukların Bruininks-Oseretsky Motor Yeterlik Testi'ndeki standart puanları ile iki faktörlü varyans analizi uygulanmıştır. Analizde hem yaşın ($F(1, 83) = .25$, $p > .05$, $\eta^2 = .003$) hem de cinsiyetin ($F(1, 83) = .12$, $p > .05$, $\eta^2 = .001$) motor yeterlik üzerinde anlamlı bir etkisinin olduğu bulunamamıştır. Ayrıca bağımsız faktörlerin (yaş ve cinsiyet) birbirlerini anlamlı derece etkilemediği bulunmuştur ($F(1, 83) = .53$, $p > .05$, $\eta^2 = .006$).

Görsel Motor Entegrasyon Bulguları

İkinci araştırma sorusunu (yaş ve Beery-Buktenica Görsel Motor Entegrasyon Testi ile ölçülen görsel motor entegrasyon becerileri üzerindeki etkisi nedir) cevaplayabilmek için çocukların Beery-Buktenica Görsel Motor Entegrasyon Testi'nden aldıkları standart puanları ile iki faktörlü varyans analizi uygulanmıştır. Analizin sonucunda yaş gruplarının VMI testi standart puanları arasında anlamlı bir fark bulunmuştur ($F(1, 83) = 5.48$, $p < .05$, $\eta^2 = .06$). Görsel motor entegrasyon becerileri açısından büyük yaş grubundaki çocuklar ($M = 100.09$, $SD = 6.04$) küçük yaş grubundaki çocuklara ($M = 95.02$, $SD = 6.72$) oranla daha iyi performans göstermişlerdir.

Diğer taraftan bağımsız faktörlerin (yaş ve cinsiyet) birbirlerini anlamlı derece etkilemediği ($F(1, 83) = 3.26$, $p > .05$, $\eta^2 = .04$) ve cinsiyetin görsel motor entegrasyon becerisi üzerinde anlamlı bir etkisinin olmadığı saptanmıştır ($F(1, 83) = .64$, $p > .05$, $\eta^2 = .01$).

TARTIŞMA VE SONUÇ

Bu çalışmada ilkokul birinci sınıf öğrencilerinin yazma becerisine hazır bulunuşluk durumlarını karşılaştırmak için yaşın ve cinsiyetin motor yeterlik ve görsel motor entegrasyon becerileri üzerindeki etkisi incelenmiştir. İlk araştırma sorusu bulguları büyük yaş grubundaki çocukların motor yeterlikleri ile küçük yaş grubundaki çocukların motor yeterlikleri arasında bir performans farkı olmadığını ortaya koymuştur. Ayrıca kız öğrenciler ile erkek öğrenciler arasında da motor yeterlik açısından bir fark olmadığı bulunmuştur. Kakebeeke ve diğ. (2012) çalışmalarında 5_puanlı ölçek kullanarak ham puanlar ile yaşın 3 ve 5 yaş arasındaki çocukların kaba motor performanslarını etkilediğini idafe etmişlerdir. Spessato ve diğ. (2012) Kaba Motor Gelişim Testi'nin ham puanlarını kullanarak motor performansın 3 yaşından 10 yaşına kadar geliştiğini göstermişlerdir. Buna ek olarak Saraiva ve diğ. (2013) Peabody Gelişimsel Motor Ölçeği-2'yi kullanarak 3-5 yaşındaki çocukların motor performansının ve motor performansını etkileyen faktörlerin yaş ile değiştiğini ortaya koymuşlardır. Larson ve diğ. (2007) ise yaş ve cinsiyetin 7-14 yaş arasındaki çocukların motor performansı üzerindeki etkilerini nörolojik açıdan incelemiş ve en küçük yaş grubunda (7 yaş) bütün görevlerde yaşa bağlı bir farklılık bulamamışlardır. Bruininks (1978) de motor becerilerin yaş ile geliştiğini, yaş ile Bruininks-Oseretsky Motor Yeterlik Testi'ndeki ham puanların oldukça yakın ilişkisi olduğunu belirtmişlerdir. Buna bağlı olarak ANOVA hesaplamalarına ek olarak çocukların Bruininks-Oseretsky Motor Yeterlik Testi'ndeki ham puanları ile yaşları arasındaki ilişkiye bakılmış ve ikisi arasında olumlu bir ilişki saptanmıştır (Appendix D). Diğer taraftan çocukların puanlarının standartlaştırılması ile yaşa bağlı olarak gelişen motor performansın her çocuk için standard olmadığı görülmüştür ve küçük yaş grubunun yaşlarına bağlı olarak beklenen performansı büyük yaş grubuna göre daha çok göstermektedirler.

Çalışmanın bu sonuçları göz önüne alındığında ham puanlar ile ulaşılan bulgular Kakebeeke ve diğ. (2012), Spessato ve diğ. (2012) ve Bruininks'nin (1978) çalışmalarını

desteklerken, standard puanlar ile ulaşılan bulgular Saravia ve diğ.'nin (2013) çalışmalarını desteklememektedir.

Malina ve diğ. (2004) erken çocukluk dönemindeki yaşa bağlı motor performanstaki değişimin/gelişimin, orta çocukluk dönemi ile ergenlik dönemindeki kadar çok olmadığı belirterek bu değişimler için biyolojik, genetic, hormonal faktörler gibi kişisel faktörler ve çevresel faktörler, okul öncesi eğitimi, kültür gibi dış faktörlerin de göz önüne alınması gerektiğini vurgulamışlardır. Bu çalışmada da yaş ve motor yeterlik ile ilgili bulguları belirtilen kişisel ve dış faktörler etkilemiş olabilir.

Çalışmanın ikinci bağımsız değişkeni olan cinsiyet göz önüne alındığında, cinsiyetin motor yeterlik üzerindeki etkisi hâlâ kesinleşmemiştir. Bazı çalışmalar cinsiyetin motor yeterlik üzerinde etkisi olduğunu savunurken (Berk, 1996; Ammons ve diğ., 1955; Piper, 2012), diğer çalışmalar cinsiyetin motor yeterlik üzerinde bir etkisi olmadığını savunmuşlardır (Spessato ve diğ., 2012; Kakebeeke ve diğ., 2012; Bonvin ve diğ., 2012); Giagazoglou ve diğ., 2011). Bu çalışmada da kız öğrenciler ve erkek öğrenciler motor yeterlik testinde benzer performans göstermişlerdir ve bu çalışmadaki bulgular cinsiyetin motor yeterlik üzerinde bir etkisinin olmadığını savunan çalışmaları desteklemektedir.
Çalışmadaki ikinci araştırma sorusu bulguları ise büyük yaş grubundaki çocukların küçük yaş grubundaki çocuklara göre görsel motor entegrasyon becerileri açısından daha iyi performans sergilediğini göstermiştir. Diğer yönden, çalışmada görsel motor entegrasyon becerilerinde kız öğrenciler ile erkek öğrenciler benzer performans sergilemişlerdir.

Beery ve diğ. (2010) Beery-Buktenica Görsel Motor Entegrasyon Testi'nde bulunan geometrik şekillerin kopyalanışının yaşın artışı ile birlikte geliştiğini belirterek yaş ve görsel motor entegrasyon becerileri puanları açısından olumlu bir ilişkinin olduğunu göstermişlerdir. Decker ve diğ. (2010) 4-7 yaş arasındaki çocuklarda yaşa bağlı olan olgunlaşma görsel ve algı motor entegrasyonu becerilerini etkilediği savunarak yaşın "kopyalama" ve "hatırlama" süreçlerini de etkilediğini vurgulamışlardır. Ayrıca Cui ve

diğ. (2012) 3-12 yaş arasındaki Çinli çocukların Beery-Buktenica Görsel Motor Entegrasyon Testi'nde Amerikalı çocuklara göre daha iyi puanlar aldığını bularak bunun nedeninin kültür farkının ve çocukların aldıkları eğitimin (education background) olabileceğini belirtmişlerdir.

Diğer bağımsız değişken olan cinsiyetin etkisi ise motor yeterlikte olduğu gibi görsel motor entegrasyon becerileri içinde hâlâ tartışılmaktadır. Lachance ve diğ. (2006) cinsiyetin her sınıf kademesinde görsel motor entegrasyonu becerileri açısından kız öğrenciler lehinde daha çok etkilediğini bulmuşlardır. Cui ve diğ. (2012) de erken yaşlarda kız öğrencilerin görsel motor entegrasyon becerilerinde erkek öğrencilere göre daha iyi performans gösterdiklerini belirtmişlerdir. Diğer yönden Soderman ve diğ. (1999) ön okuma becerileri için görsel motor entegrasyon becerilerini incelemiş ve cinsiyet grupları arasında bir fark bulamamıştır.

Bu çalışmanın görsel motor entegrasyon bulguları da Soderman ve diğ. (1999) ve Decker'in (2011) çalışmalarının bulgularını desteklerken Lachance ve diğ. (2006) ve Cui ve diğ.'nin (2012) yaptığı çalışmalarının bulgularını desteklememiştir.

Görsel motor entegrasyon becerileri, yazma kazanımının ön aşamalarından biri olan harf bilgisini öğrenme için oldukça önemlidir (Sovik, 1975, Weil ve diğ. alınmıştır, 1994; Daly ve diğ., 2003).

Sovik (1975, Weil ve diğ. alınmıştır, 1994) 7, 9, 11 yaşındaki öğrencilerin görsel motor entegrasyon becerileri ve yazma becerileri arasında olumlu bir ilişkinin olduğunu ortaya koymuştur. Phelps ve diğ. (1987) görsel motor entegrasyonun yazma becerisini ilkokul üçüncü sınıfa kadar etkilediğini belirtse de her iki çalışma ilkokul birinci sınıfta görsel motor entegrasyon becerilerinin yazma becerileri açısından önemli olduğunu vurgulamışlardır. Bu değerlendirmelere bağlı olarak bu çalışmada farklı yaş gruplarındaki çocuklar motor yeterlik açısından benzer performans sergilese de büyük yaş grubundaki çocukların görsel motor entegrasyon becerilerinde küçük yaş grubuna göre daha iyi performans sergilemeleri, büyük yaş grubundaki çocuklara yazma öğreniminde avantaj kazandırmıştır.

Ayrıca Beery (1997) ince motor becerilerinin ve görsel algı becerilerinin, yazma becerisi gibi görsel motor entegrasyon becerileri isteyen etkinliklerin yapılmasını sağladığını belirtmiştir. Tseng ve diğ. (1993) görsel algı ile yazma becerisini inceleyen çok az sayıda çalışma olduğunu belirtirken Feder ve diğ. (2007) yazma becerisi ile görsel algının arasındaki ilişkinin hâlâ belirsiz olduğunu belirtmişlerdir. Bu çalışmada öğrenciler motor yeterlik açısından benzer performans sergilerken görsel motor entegrasyon becerilerinde büyük yaş grubu daha iyi performans göstermişlerdir. Bu durumda görsel algının, görsel motor entegrasyon becerilerini etkileyerek yazma becerisini dolaylı olarak etkilediği düşünülebilir.

Çalışmanın ikinci faktörü olan cinsiyetin okula hazır bulunuşluğa etkisi, önceki konularda olduğu gibi, tartışılmaktadır. McBryde ve diğ. (2004) öğrencilerinin okula hazır bulunuşluk durumları hakkında cinsiyet faktörü öğretmenlerin görüşlerini kız öğrenciler lehine etkilediğini savunmuşlardır. Diğer taraftan Al-Hassan ve diğ. (2009) ise Ürdün'de erkek çocukların kız çocuklara göre okula hazır bulunuşluk düzeylerinin daha yüksek olduğunu belirtmişlerdir. Bu çalışmaların tersine cinsiyetin, çocukların okula hazır bulunuşluk durumlarını etkilemediğini savunan çalışmalar da mevcuttur (Gullo ve diğ., 1992; Erkan, 2011; Yeşil-Dağlı, 2012).

Cinsiyet faktörünün yazma becerileri üzerindeki etkisi de araştırılmaya devam etmektedir. Graham ve diğ. (1998) birinci sınıftan dokuzuncu sınıfa kadar kız öğrencilerin yazma hızlarının erkek öğrenciler ile kıyaslandığında daha yüksek olduğunu bulmuşlardır. Graham ve diğ. (2007) ise birinci sınıftan üçüncü sınıfa kadar yazma başarısı açısından cinsiyet farkının olmadığını savunmuşlardır.

Bu çalışmada cinsiyetin hem motor yeterliği hem de görsel motor entegrasyon becerilerini etkilemediği bulunduğundan yazma becerisine hazır bulunuşluk ve yazma başarısında cinsiyet farkının bulunmadığı söylenebilir. Buna bağlı olarak bu çalışma okula hazır bulunuşlukta ve yazma becerilerinde cinsiyet etkisi bulan McBryde ve diğ. (2004), Angenent ve diğ. (1989), Al-Hassan ve diğ. (2009) ve Graham ve diğ.'nin

(1998) çalışmaları desteklemezken cinsiyet etkisi bulamayan Gullo ve diğ. (1992), Erkan (2011) and Yeşil-Dağlı (2012) ve Graham ve diğ.'nin (2007) çalışmalarının bulguları ile uyumlu olmuştur.

APPENDIX F

TEZ FOTOKOPİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ■

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

YAZARIN

Soyadı : HARMANCI BAŞKUT
Adı : Yasemin
Bölümü : Beden Eğitimi ve Spor – Physical Education and Sports

TEZİN ADI (İngilizce): Effect of Age and Gender on Motor Proficiency and Visual Motor Integration as A Measure of Handwriting Readiness

TEZİN TÜRÜ : Yüksek Lisans ■ Doktora ☐

1. Tezimin tamamı dünya çapında erişime açılsın ve kaynak gösterilmek şartıyla tezimin bir kısmı veya tamamının fotokopisi alınsın. ☐
2. Tezimin tamamı yalnızca Orta Doğu Teknik Üniversitesi kullancılarının erişimine açılsın. (Bu seçenekle tezinizin fotokopisi ya da elektronik kopyası Kütüphane aracılığı ile ODTÜ dışına dağıtılmayacaktır.) ☐
3. Tezim bir (1) yıl süreyle erişime kapalı olsun. (Bu seçenekle tezinizin fotokopisi ya da elektronik kopyası Kütüphane aracılığı ile ODTÜ dışına dağıtılmayacaktır.) ☐

Yazarın imzası Tarih