A COMPARISON BETWEEN FIVE AND SIX YEAR OLD GRADE 1 CHILDREN REGARDING THEIR READINESS FOR ACQUIRING HANDWRITING SKILLS

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DECLARATION

I, Belia Margaretha Bekker, hereby declare that the work in this dissertation is my own. Acknowledgement was given to work done by others. The work in this dissertation has not been previously submitted at another university for degree purposes.

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Signature

Date : 31 October 2013

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ABSTRACT

This study evolved because of the researcher's need to inquire whether visual-motor integration and fine motor coordination contribute to a child's readiness to acquire handwriting skills. As school-going age is a controversial topic in the South-African context, the researcher set out to compare the readiness to acquire handwriting skills between two groups of Grade 1 children.

This study was developed to determine whether a relationship existed between visual-motor integration and fine motor coordination as part of handwriting readiness, and acquiring handwriting skills in two age groups namely five-year-old children and six-year-old children. Initially the characteristics of the two age groups were determined. This was followed by establishing the level of development for visual-motor integration, fine motor coordination and handwriting skills in both age groups as well as comparing the levels of development. The abovementioned was obtained through the Miller Function and Participation Scales en the Minnesota Handwriting Assessment. Lastly, the scores for visual-motor integration and fine motor integration were correlated to the six categories of the Minnesota Handwriting Assessment.

Both age groups presented with overall age appropriate abilities in visual-motor integration and fine motor coordination. The six-year-old group did better on all six of the categories for handwriting in the Minnesota Handwriting Assessment when compared to the five-year-old group. There was a significant difference ($p=0.0049$) between the visual-motor integration scores between the two age groups. No significant difference between the two age groups was recorded in fine motor coordination.

A significant negative correlation was detected between visual-motor integration and the categories of legibility ($r=-0.4029$), form ($r=-0.4300$), size ($r=-0.4087$) and spacing ($r=-0.3832$) in the five-year-old group. The six-year-old group presented with a strong negative correlation between visual-motor integration and the category of rate ($r=-0.3930$).

When correlating the fine motor coordination score with the categories of the Minnesota Handwriting Assessment, a strong negative correlation was detected with the categories of legibility (r=-0.3850) and spacing (r=-0.4697) in the five-year-old group. The six-year-old group did not present with significant correlations between fine motor coordination and the six categories of the Minnesota Handwriting Assessment.

This study confirmed that a relationship exists between visual-motor integration, fine motor integration and handwriting skills. This relationship was not always clear and was influenced by different aspects such as age, maturity as well as the assessment instruments used.

This study focused on only one district in Tshwane, which limited the data. The two age groups in this study were not matched for gender, ethnicity and handedness.

KEYWORDS:
Handwriting, handwriting readiness, pre-requisites for handwriting, pre-writing skills, fine motor coordination, visual-motor integration

LIST OF ABBREVIATIONS

ADL	Activities of Daily Living
CAPS	Curriculum Assessment Policy Statements
ECD	Early Childhood Development
DoE	Department of Education
FMC	Fine-motor coordination
M-FUN	Miller Function and Participation Scales
MHA	Minnesota Handwriting Assessment
NCDS	National Child Development Study
NICHD	National Institute of Child Health and Human Development Early Child Care Research Network
RNCS	Revised National Curriculum Statement
VMI	Visual-motor integration

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CHAPTER 1
ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Handwriting is used by members of society to take down messages, make lists or in some cases, to complete assignments. Handwriting is a skill acquired within the first three years of primary school from Grade 1 to Grade 3. Graham, Weintraub and Berninger (1998:292-295) report on the refinement of handwriting through schooling and with age. Although acquiring handwriting is considered part of a child's development, previous studies have emphasised the fact that primary school children consider activities such as reading and especially writing as work (Wing 1995:224, 243). Goodnow (1988:7) defines children's work as an activity that requires effort, is regarded as useful, and involves relationships with others in the community. King (cited in Larson 2004:371) identifies the qualifiers children use to describe work. The first qualifier is that work is directed by the teacher; secondly it requires participation performed simultaneously with classmates; in the third place it involves the use of the same materials to produce similar products and, lastly, it must be completed with sufficient effort. These qualifiers are especially relevant to Grade 1 children who are exposed to handwriting for the first time, as not all Grade 1 children are introduced to handwriting in nursery school (Schneck & Amundson 2010:565).

At school children who struggle with handwriting have difficulty in successfully completing written assignments according to outcomes set for Grade 1. In some cases poor handwriting is the result of neurological impairments, learning problems, attention deficits and developmental disabilities. These children spend a lot of time and effort on learning how to write legibly (Bergman & McLaughlin 1988:01). Oliver (1990:111) points out that it is "commonly believed that children with learning or neurological disabilities often have an irregular academic readiness profile with a delay of one or more of the perceptual motor components." This is to be expected since the problems mentioned above affect the pre-requisites for handwriting. Van Hoorn, Maathuis, Peters & Hadders-Algra (2010:945) add to the

statement of Oliver in a study which indicate that impaired handwriting and visuomotor integration are related to minor neurological dysfunction. Denton, Cope and Moser (2006:24) state that deficits with visual perception, visual-motor integration and in-hand manipulation not only exist with dysfunctional handwriting but also in typically developing children.

However, there is another group of children who are at risk of experiencing difficulty in acquiring handwriting. This group includes children who have not yet developed the pre-requisites because of their young age. They have therefore not matured up to a level where they are ready to learn handwriting. Handwriting is a complex skill that involves postural motor, visual perceptual and sensory pre-requisites. Handwriting also requires pre-writing skills such as drawing, cutting, colouring and tracing.

It is ideal that a child should be neurologically healthy, be exposed to an optimum environment and be given time to become ready for the requirements of school. Even when the first two requirements are met the child must be allowed to reach the age at which he or she is ready for meeting the demands set in academic learning. Although opportunities to learn and stimulation are of the utmost importance, the maturational process is dependent on time and cannot be forced. Zaner-Bloser (cited in Marr, Windsor & Cermak 2001:2) states kindergarten is often the first time that a child is exposed to formal handwriting. In the United States of America kindergarten is the year in which the five-year-old child turns six (Ackerman & Barnett 2005:1). Within the South African context kindergarten is similar to Grade R. Therefore if handwriting is a new activity, deficient handwriting performance might only be temporary. Marr and Cermak (2002:161) mention deficient handwriting performance can be lessened by developmental maturation, academic instruction and practice. Expectations set in the foundation phase can be so high that, although the child is maturing, taught in a specific manner and given time to practice, he or she will not necessarily be able to catch up with the rest of the class.

Poor handwriting is one of the most common reasons for referral of schoolaged children to occupational therapy (Oliver 1990:111; Reisman 1990:851; Hammerschmidt & Sudsawad 2004:185; Miller et al. 2001:5). Berninger (cited in Mackay, McCluskey & Mayes 2010:30) state that approximately 20% of primary schoolage children were identified as being at risk for developing possible handwriting problems. Occupational therapists are therefore often asked to assess children's handwriting when it interferes with written assignments (Reisman 1990:849).

Feder, Majnemer and Synnes (2000:198-199) reported on the role of the occupational therapist in the remediation of handwriting. Remediation includes making adaptations in the environment, consultation with the teacher and/or providing direct services to the client. According to Amundson (2005:588), the occupational therapist's role in the intervention process is to determine "the student's personal context relating to cultural, temporal, spiritual and physical features and the student's abilities, experiences, and performance skills that are interfering with handwriting production." The results from this study could contribute to any three of the aspects in the remediation of handwriting identified by Feder, Majnemer and Synnes (2000:198-199). These three aspects are firstly; consulting with the teacher and therefore providing assistance to the teacher and student; secondly, making adaptations to the classroom/educational environment and lastly; providing direct services to the student in assisting him or her in developing skills.

The occupational therapist plays an important part in the evaluation and intervention of pre-writing and handwriting readiness skills in children (Olivier 1990:111-112). Amongst the approaches available for the occupational therapist to direct the process of intervention are strategies to restore skills where abilities have been impaired, but also to promote health and prevent disabilities where there are risks involved. Occupational therapists consider their clients' health and well-being as pivotal. Pre-writing and handwriting skills form only a small part in the process of getting a child functional within the school context.

During normal development the pre-requisites for handwriting are stimulated and developed through the child's participation in Activities of Daily Living (ADL) and in

play. This exposure leads to the child's readiness to start with his or her education. Activities of Daily Living, play and education are all areas of occupation that fall within the domain of occupational therapy as defined by the Occupational Therapy Practice Framework (Smith Roley, Delany, Barrows, Brownigg, Honaker & Sava 2008:628). The key concepts in this study, namely readiness for acquiring handwriting, pre-requisites for handwriting and pre-writing skills are included in the areas of play and education. Education "includes activities needed for being a student and participating in a learning environment" (Smith Roley et al. 2008:632). Within the South African context all of the abovementioned aspects have to be considered of the utmost importance because enrolling a child in Grade 1 at the age of five years is a reality in the country.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

Traditionally children in South Africa entered into Grade 1 at the age of six years. However, the South African Schools Act 84 of 1996 as amended by the Education Laws Amendment Act (Act No. 50 of 2002) stipulates that a child can enter Grade 1 at the age of five years if the child turns six before 30 June of that year. This resulted in children being admitted to Grade 1 at the age of five-and-a-half years even though they may not be ready for formal learning. In South Africa children can complete a Grade 0/Grade R (reception year) during which they are prepared for the expectations of Grade 1. This implies that children can be as young as between four-and-a-half and five-and-a half years old when in Grade R. Attending Grade R is not compulsory and children can therefore enter into Grade 1 without having attended a Grade R (Act No. 50 of 2002).

A report prepared for the United Nations Children's Fund (UNICEF) South Africa, by the Human Research Council (HRC) on Child, Youth and Family Development, (HRC 2004:4) indicates that the enrolment of children in Grade R increased from 150 000 to 280 000 between 1999 to 2002 in the Western Cape, Gauteng and KwaZulu-Natal. Although enrolling their child/children in Grade R is an option for parents, it seems that as if this alternative is not used optimally. In the UNICEF report it is noted that poor service as well as the substandard quality of education

was experienced in Grade R in the Western Cape and Gauteng. It is possible that these two negative aspects can be the reason why parents do not perceive Grade R as an option for their child/children.

In 2004 the Department of Education (DoE) introduced a curriculum for Grades R to 9 that teachers and children must adhere to. This is called the Revised National Curriculum Statement (RNCS) (DoE 2002:1-28). Within the RNCS there are certain learning outcomes and assessment standards that must be conformed to by teachers and children. Without being prepared in advance and without a developmental readiness, children will find it difficult to adhere to the outcomes (DoE 2002:1-28).

The question can be raised as to why developmental readiness is so important in order for a child to adhere to the outcomes of a curriculum.

According to Kagan, Moore and Bredekamp (1995:3), school readiness is determined by the following dimensions: “health and physical development, emotional well-being and social competence, approaches to learning, communicative skills and cognition and general knowledge”. Confirming these authors’ statement, Wesley and Buysse (2003:252) from the Frank Porter Graham Child Development Institute (University North Carolina, United States of America [USA]) emphasise that academic readiness such as recognizing the alphabet, counting, and knowing basic concepts is, in fact not as critical for determining school readiness as the measurements noted by Kagan, Moore and Bredenkamp (1995:3). It is therefore vital to recognise that the child’s normal development as well as his or her social and emotional development should be considered when assessing whether he or she is ready for school since academic readiness can only develop in conjunction with a healthy body and mind.

South Africa is a country with various cultures within which peoples’ socio-economic status, demographical distribution, health and socio-emotional status differs. In an attempt to improve the development of all South African children, especially those from disadvantaged backgrounds (refer to Section 1.6.1); the DoE

initiated a concept called Early Childhood Development (ECD). This concept is defined as "the provision of physical, emotional, social, spiritual and moral development for children aged between zero and nine years" (Williams, Samuels & Mouton 2001:5). A nationwide audit of Early Childhood Education by the DoE in South Africa was carried out on all identifiable ECD sites. During this audit it was established that approximately half of the five-to-six-year cohort (413 000 out of an estimated 960 000) were accommodated on the ECD sites visited. The ECD sites visited included rural, urban formal and informal areas. A tenth of all of these pre-school sites did not have access to piped water, flushing toilets and mains electricity. It is clear from the statistics that many children are not accommodated in pre-school programmes and are enrolled in Grade 1 without being prepared for formal learning (Williams et al. 2001:1-2).

Handwriting does not only form an integral part of Grade 1 education, but is used throughout a child's schooling to communicate, convey messages and knowledge. Amundson (2005:587) makes the following important statement pertaining to handwriting: "The functional skill of handwriting supports the academic task of writing and allows students to convey written information legibly and efficiently while accomplishing written school assignments in a timely manner." According to Mather and Roberts (cited in Feder & Majnemer 2007:312), problems with handwriting can interfere with academic achievement or more complex tasks such as spelling and story composition.

In their normal development children of different ages present with different levels of handwriting readiness. Karweit and Wasik (1994:102-121) discuss readiness in terms of kindergarten and first grade and how important foundation skills are before the child learns a new task. In an attempt to explain the term of writing readiness, Marr, Windsor and Cermak (2001:2) refer to Sovik's (1975) description that a child presents with writing readiness when he or she can benefit from the different instructions used in the teaching of handwriting throughout primary school. The difference in the rates of maturity, interest levels as well as environmental factors influence the age at which handwriting readiness appears. The sensorimotor systems need to be intact and letter formation requires integration between the

visual, motor, sensory and perceptual systems. If handwriting instruction is initiated too early, children may become discouraged and develop poor handwriting habits (Amundson 2005:589). The abovementioned is confirmed in a report by Dunsmuir and Blatchford (2004:462-463), in which they referred to a study done by Lazlo (1986). He determined that one third of all five-year-old children do not have sufficient perceptual motor skills to produce writing of a size and quality that would be accepted by adults.

Based on the researcher's clinical experience it was evident that the younger the child was when he or she entered Grade 1, the greater the probability of the child failing because of immaturity in different developmental areas, including pre-writing skills. It can result in a child becoming demotivated, presenting with slow work speed, exhibiting poor quality in written work and who does not progress in accordance with academic standards

The child's ability to progress academically is confirmed by various studies on children's academic achievement. The mechanical aspects of handwriting, which refers to transcription, can interfere with higher order processes that are important for the composition of text (Berninger & Hooper 2006:1-4). Additionally, teachers tend to award higher marks for neatly written papers, as the work of children with handwriting difficulties may take longer to decipher (Briggs 1980:185; Chase 1986:33; Graham, Harris & Fink 2000:620; Hughes, Kneeling & Tuck 1983:65). Thus, it may be suggested that a child whose handwriting skills has not been mastered in his or her early years may experience the school-going years as emotionally challenging and difficult.

1.3 PROBLEM STATEMENT

Although studies have been conducted internationally, and are still ongoing, to determine whether children's school-going age has an influence on their performance, none of these studies included handwriting. Research studies to explore and investigate the phenomenon of school-going age versus academic performance are ongoing. No empirical data has been found within the South African context to indicate whether five-and-a-half or six years is the better age for

a child to start school. In South Africa the younger school-going age may pose a problem because of the socio-economic, socio-emotional, cultural and demographic distribution of the population.

Although the term 'school readiness' has been described in many ways, it remains a concept that elicits controversy amongst professionals, as it is interpreted in different ways. Children that can be enrolled in Grade 1 at the age of five years, results in children being admitted to Grade 1 even though they may not be ready for learning. The age discrepancy in the Grade 1 classes can then range from five-and-a-half to seven years. The concern is that the age discrepancy not only impacts on the differences in the children's developmental maturity but also their ability to meet the expectations set on an academic level. Bosga-Stork et al. (cited in Overvelde & Hulstijn 2011:540) stated that difficulty with handwriting is one of the most common reasons why school-age children are referred to occupational therapists. It is therefore very relevant to occupational therapists in clinical practice to know if a difference exists between the readiness to acquire handwriting skills in five-year-old and six-year-old children.

1.4 RESEARCH QUESTION

The research question in this study was:

"What is the difference in the readiness to acquire handwriting skills between five- and six-year-old children in Grade 1 when comparing the level of visual-motor integration and fine motor coordination?"

1.5 RESEARCH AIM AND OBJECTIVES

The aim of this study was to establish whether a difference existed in the readiness to acquire handwriting skills between five- and six-year-old children in Grade 1.

The research objectives were:

- to determine the level of development of visual-motor integration, fine motor coordination and handwriting skills between groups of five- and six-year-old children on standardised tests

- to compare the level of development of visual-motor integration, fine motor coordination and handwriting skills in groups of five- and six-year-old children on standardised tests

- to determine whether a correlation exists between the level of visual-motor integration and acquiring handwriting skills of five- and six-year-old children on a criterion-related test

- to determine whether a correlation exists between the level of fine motor coordination and acquiring handwriting skills of five- and six-year-old children on a criterion-related test.

1.6 DEFINITION OF TERMS

Following, the key terms and operational definitions used within the context of this research study are defined for the purposes of a clearer understanding of the terms used as well as for consistency.

1.6.1 Children from disadvantaged backgrounds

Scaramella and Neppl (2008:725) state that 'socioeconomic disadvantage may consist of fewer years for formal education, low income and low occupational status.'

Operational definition: Within the South African context being 'disadvantaged' does not only refer to the socioeconomic aspect, but also to the historical differences between black and coloured and white and indian schools. Brailsford (2005) and Van der Berg (2008) explain the differences in education over the last few years.

1.6.2 Fine motor coordination

Jacobs and Jacobs (2004:87) define 'fine motor coordination as follows: "Motor behaviors involving manipulative, discreet finger movements, and eye-hand coordination."

Operational definition: This term includes unilateral and bilateral activities of the hands where the small muscles in the hand and the fingers work together to produce different grasps. Examples of fine motor activities are threading, tracing, drawing and cutting.

1.6.3 Foundation phase

In the South African context the 'foundation phase' in school refers to Grade R – Grade 3 (http://www.education.pwv.gov.za).

Operational definition: Grade 1 is the first year of the foundation phase in primary school. Grade 1 is between Grade R and Grade 2.

1.6.4 Handwriting

'Handwriting' is a "complex perceptual-motor skill which is dependent upon the maturation and integration of cognitive, perceptual, and motor skills" (Maeland 1992:1207).

Operational definition: It is the ability to form letters and transfer the letters onto paper. The term 'handwriting' is used synonymously with 'handwriting skills'.

1.6.5 Handwriting readiness

'Handwriting readiness' means **"**having the needed characteristics to profit satisfactorily from the instruction given in the teaching of handwriting at different

stages through elementary school" (Sovik (1975) cited by Marr, Windsor & Cermak 2001:2).

Operational definition: 'Handwriting readiness' is when a child has developed certain abilities or skills that enable him or her to learn how to write.

1.6.6 Kindergarten

Clifford and Crawford (2009:3) state 'kindergarten' begins typically in the year the child turns six following through 5th grade (which typically begins at age 10).

Operational definition: In South Africa kindergarten is similar to Grade 1, as children can start Grade 1 at the age of five-and-a-half years old.

1.6.7 Pre-requisites for handwriting

The term 'pre-requisites for handwriting' refers to "motor and perceptual components related to handwriting performance may include fine motor control (in-hand manipulation, bilateral integration, and motor planning), visual-motor integration, visual perception, kinesthesia, sensory modalities, and sustained attention" (Cornhill & Case-Smith 1996:732-738).

Operational definition: This term includes sensory-, postural motor and visual perceptual requirements that form the basis for the development of handwriting. Bilateral integration, visual-motor integration, kinesthesia and fine motor coordination are some of the aspects.

1.6.8 Pre-writing skills

'Pre-writing skills' are the skills "necessary to learn to write" (Klein 1990:1).

Operational definition: In this research 'pre-writing skills' indicates the mastering of activities such as colouring, cutting and drawing which precede handwriting.

1.6.9 Readiness to learn

'Readiness to learn' can be described as "a stage of maturity when an individual is able to understand and grasp those concepts and skills that have been deemed necessary for a child of a specific age to attain" (Davin & van Staden 2005:5). The term 'academic readiness' denoting 'readiness to learn' was also found in literature; the researcher assumed that 'academic readiness' referred to the stage where a child would be ready for formal learning within the school context.

Operational definition: 'Readiness to learn' is the stage at which a child is susceptible for stimulation which leads to the development of new skills.

1.6.10 School readiness

Janus and Offord (2000:74) identify developmental areas which describes a 'child's readiness for school'. These developmental areas are: 1) physical health and well-being, 2) social competence, 3) emotional maturity, 4) language and cognitive development and 5) communication skills and general knowledge.
Operational definition: A child can only meet the requirements of Grade 1 by showing an emotional-, social-, intellectual-, physical-, and a perceptual readiness.

1.6.11 Visual-motor integration

'Visual-motor integration' (VMI) is "the degree to which visual perception and finger-hand movements are well coordinated" (Beery & Beery 2010:13).

Operational definition: 'Visual-motor integration' is the ability to respond to a visual stimulus by using a motor response.

1.7 SIGNIFICANCE OF THIS STUDY

Children entering Grade 1 at the age of five-and-a-half years is a controversial and much talked about topic amongst professionals and parents in South Africa. According to literature, the desirable age for a child to start school has always been considered as six years old. From clinical experience the researcher determined that five-year-old children were not developmentally and emotionally ready for the expectations set in Grade 1. Her observation prompted the researcher to conduct a study to compare the level of readiness to acquire handwriting skills of children in the five-year-old and six-year-old age groups.

The researcher envisaged that the results derived would add to the body of knowledge on the development of handwriting in five- and six-year-old children since handwriting forms an important part of a child's education in the South African context. As occupational therapists are involved in the assessment and the treatment of pre-school as well as school-age children, the results from this study would assist therapists in advising parents and teachers on handwriting. School-age children could benefit from the outcome of this study, as teachers would be more aware of their readiness to acquire handwriting as well as on what to expect from a specific child. It was also the researcher's hope that this study would pioneer continuous future research into the underlying mechanisms involved in the development of handwriting.

Importantly, in the time frame this study was conducted (2009-2012) the Revised National Curriculum Statement (RNCS) was amended by the Department of Education (DoE) and came into effect in January 2012. A National Curriculum Assessment Policy Statement (CAPS) replaced Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grade R – 12. The amended National Curriculum and Assessment Policy Statements (January 2012) replace the National Curriculum Statements Grades R - 9 (2002) and the Revised National Curriculum Statements Grades 10 - 12 (2004). Details of the DoE amendment of the RNCS and CAPS can be viewed at the DoE website <http://www.education.gov.za/Curriculum/CurriculumAssessmentPolicyStatements/

tabid/419/Default.aspx>. As with the RNCS, CAPS has specific outcomes in different areas such as languages to which children must adhere to. The problem of having children of varying ages in Grade 1 will persist and the teacher would be responsible to determine if a child is able to reach the outcomes in CAPS.

Results from this study as well as possible similar future studies could assist in formulating specific and mutual outcomes for handwriting development in Grade 1. Occupational therapists are involved in the assessment and remediation of children with difficulties in Grade R and Grade 1. Results from this study will provide occupational therapists with relevant information regarding the development of handwriting and how it relates to a child's readiness to learn.

1.8 SCOPE AND DELIMITATIONS OF THE STUDY

This study fell within the scope of paediatric occupational therapy. In the South African context, occupational therapists provide a service to a large part of the school-going population. This service is rendered not only in private practices, but also at schools and in the community. The Occupational Therapy Practice Framework: Domain and Process (Smith Roley et al. 2008:628) identifies education as one of the areas of occupation. Formal educational participation includes the area of academic participation. Handwriting, mathematics and reading form part of the latter.

The development of handwriting is not only a very important aspect of school readiness, but also of the readiness to learn. Research regarding handwriting is an ongoing process. In planning the research study, the researcher wanted to indicate that the development of handwriting is not isolated but is closely linked with different systems and aspects of normal development. Through the Miller Function and Participation Scales, the researcher was able to identify different components influencing handwriting (Miller 2006:3-4).

1.9 LAYOUT OF THE STUDY

The study report comprises of the following chapters:

Chapter 1: Introduction to the study.

Chapter 2: Literature review

- Handwriting and handwriting readiness
- Pre-writing skills
- The child's readiness to enter into grade 1 within the South African context
- Measurement Instruments

Chapter 3: Research design and methodology

Chapter 4: Results and findings

Chapter 5: Discussion and conclusion

1.10 CONCLUSION

In South Africa, a developing country with a fast growing population, there is an urgent need for quality education. Handwriting and writing remain the primary means through which information is transferred and children across the country are taught. Within South Africa school-going children with handwriting difficulties are regularly referred to occupational therapists; however, interventions for poor handwriting are not accessible to everyone. Through clinical experience the researcher found that a difference existed between children of two different ages (five and six) entering Grade 1 and their ability to comply with the demands in Grade 1. Examples of these demands are emotional (feeling confident within a

group of peers) and academic (completing tasks within a specific time) demands. Handwriting was observed as one of these demands.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

Chapter 1 provided the backdrop against which the core concepts relating to this study could be addressed and clarified. Embarking on the research process meant that the researcher had to analyse and compare different concepts. This journey developed an understanding of how literature from the past and the present provided not only evidence but also stimulated new directions of thought.

The research question and the aim identified terms that needed to be clarified and put into context with reference to each other. The terms included readiness, handwriting, five-year-old children, six-year-old children, Grade 1, visual-motor abilities and fine-motor abilities. Defining each of these terms provided its own challenges.

Composing the literature review involved the integration of work from different authors. The researcher utilised resources such as books and journals available at the Prinshof campus and Groenkloof campus libraries of the University of Pretoria, as well as e-journals and the internet. The period for the data search was from 1990-2013. From the start it was clear that research done years ago were still referenced in more contemporary articles and that the information was still relevant. This was true in the case of work done on handwriting, automaticity, pre-writing skills, visual-motor abilities and fine-motor abilities. This resulted in secondary resources, which the researcher sometimes had difficulty finding. Two librarians from the Prinshof campus library assisted her with locating some of these articles. Despite their efforts, a few of the secondary resources were not found. In compiling the literature review the researcher accessed 195 books, articles and websites. Eighty of these references were included in the literature review.

Terminology posed a second challenge in composing the literature review. Not only did literature refer to terms such as ‘writing’ and ‘handwriting’ inconsistently and

interchangeably, but authors approached topics from their own frames of reference. An example is that an occupational therapist and a teacher may approach handwriting differently because despite similarities, there are differences between the medical and the educational models.

2.1.1 Handwriting versus writing

The terms handwriting and writing are often used interchangeably in literature; however, handwriting and writing are very different from each other. Writing is a global term used to explain the process of putting letters together to convey certain messages and to attach meaning to them. Davin and Van Staden (2005:110) refer to writing as an "act of communicating by expressing thoughts by means of written words." Handwriting on the other hand is part of the writing process. It refers to the formation and the correct transference of letters onto paper. Years ago Levine (1987:308) referred to handwriting as being a combination of different developmental functions. Davin and Van Staden (2005) as well as Levine (1987) explain handwriting thus as a way of producing written language in either a manuscript or cursive form.

It is vital to differentiate between writing and handwriting, as writing did not form part of this study. The researcher found that the term 'writing' is used in literature to imply handwriting as well. Authors do not always differentiate clearly between the two terms. Although Klein (1985:33) refers to handwriting as a mechanical performance skill as opposed to writing which is expressing ideas or composing language, one should not underestimate the importance of understanding how handwriting develops and the skill development which precedes handwriting. The latter is thus important when referring to the research question (refer to Section 1.4), as visual-motor integration and fine motor coordination are part of the skill development which precedes handwriting.

2.1.2 Foundations for handwriting

Skill development is part and parcel of learning in children. Children develop skills while engaging in different activities. Although the terms 'pre-writing' skills and 'pre-

requisites' are still being used when working with children, literature indicates that these terms are used inconsistently. For this reason, both these terms are discussed in depth followed by how they applied to this study.

2.1.2.1 Pre-writing skills

In literature the term pre-writing skills, as a precursor to handwriting, is not only used to refer to the mastering of activities, but also as a descriptive term for pre-requisites for handwriting. This poses a challenge when interpreting literature, as skills and activities are used interchangeably. In the existing literature authors refer to the term pre-writing skills without defining the concept properly. This is the case in an article by Hannon and James (1990:259-271) in which pre-school teachers indicated that the purpose and meaning of pre-writing activities were not well established. In the researcher's opinion, although occupational therapists understand the meaning and purpose of pre-writing skills, they do not use the term consistently in a manner that demonstrates an understanding of the underlying concepts.

The term 'pre-writing skills' is not a modern concept. Work done by Klein (1985) and Klein (1990) constitutes the following as pre-writing skills. Klein (1985:28-29) refers to Montessori's early handwriting programme. In this programme Montessori classified activities such as sewing, weaving, colouring, cutting and drawing between the boundaries as 'pre-writing' activities/'pre-writing skills'. She emphasised the importance of small muscle development, eye-hand coordination and making use of sensory experiences in developing pre-writing skills. In her book 'Pre-writing Skills Revised', Klein (1990) adds to the description of pre-writing skills by including scribbling, imitating, copying and colouring. This description was confirmed by the findings of Neumann, Hood and Neuman (2009:313-319). Through scaffolding of emergent literacy, a two-year-old boy was observed as he used scribbling, drawing and copying initially until he was able to write a sentence at the age of six years. Bayley (1993), Beery (1982) and Tan-Lin (1981 cited in Schneck & Amundson 2010:556) as well as Weil and Cunningham Amundson (1994:983) researched the development of pre-writing and handwriting in children.

These authors mention scribbling, drawing and copying activities being pre-writing skills while drawing is also considered by Hall (2009:180-181) to be a pre-writing skill.

Pretorius and Naudé (2002:446) refer to pre-writing as "the gradual acquisition of concepts about written language". The reference to 'written language' can imply communication and conveying a certain message as explained in Section 2.3, and not necessarily to the skill of handwriting. This opinion is echoed, for example, by Mason and Shriner (2008:22). In their article they refer to pre-writing as something that happens before a student starts writing, for example, selecting an idea and organising notes.

An example of conflicting use of terms can be found in Joubert, Bester and Meyer (2006:180). They refer to certain 'skills' necessary for writing such as fine-motor coordination, eye-hand coordination and visual perceptual functions. They firstly referred to the term 'writing' which includes handwriting. Secondly, fine motor coordination, eye-hand coordination and visual perceptual functions are described as 'skills'. All three of these concepts refer to abilities needed to execute pre-writing activities such as colouring and cutting.

The researcher concluded that children develop pre-writing skills to acquire handwriting by taking part in activities such as scribbling and drawing, which stimulate these skills. Every pre-writing skill can be analysed and broken down into smaller steps or parts.

2.1.2.2 Pre-requisites required for handwriting

As early as the 1970s authors discussed possible underlying functions that might influence handwriting. As children develop and grow older, handwriting becomes an automatic process. Children are then able to make use of the skill without thinking about what they are doing. Medwell and Wray (2007:40) as well as Medwell, Strand and Wray (2009:329) mention that non-automatisation of handwriting can hamper the process of writing. Before automatisation can take

place; acquiring handwriting is part of a learning process. This urged the researcher to inquire about the different functions which play a role in the development of handwriting.

Literature provides sufficient evidence regarding the existence of underlying functions in the development of handwriting. However, these functions are referred to in different ways such as internal factors, motor and perceptual components, perceptual-motor skills, sensorimotor components, performance components and developmental skills. These terms mentioned serve as collective terms for other specific functions. Laszlo and Bairstow (1983), Ziviani, Hayes and Chant (1990), Levine, Oberklaid and Meltzer (1981) and Tseng and Cermak (1993) (cited in Kavak & Bumin 2009:346) refer to performance components such as motor planning, eye-hand coordination and visual perception, visual motor integration, kinesthetic perception and in-hand manipulation. Denton, Cope and Moser (2006:17) use the term sensorimotor components to include visual perception, kinesthesia, in-hand manipulation, and visual-motor integration. Feder and Majnemer (2007:313) as well as Cornhill and Case-Smith (1996:733-734) refer to motor and perceptual components which include fine motor control, visual-motor integration, visual perception, kinesthesia and sensory modalities as part of handwriting performance.

Occupational therapists analyse activities before using them as part of the intervention process. The intervention process includes evaluation/assessment and treatment. It is during the analysis of activities that all the body functions, necessary to execute an activity, are listed. Body functions refer to the “physiological function of body systems (including psychological functions)” (WHO 2001:10) (cited in Smith Roley et al. 2008:635). ‘Body functions’ is a term used nationally and internationally in occupational therapy. Occupational therapists determine which body function needs to be addressed. Body functions are linked to functional activities of which handwriting is one.

In Table 2.1 the researcher reports on work by six authors regarding the underlying functions in the development of handwriting. All the functions mentioned in the left

hand column, are body functions and for the purpose of this study will be referred to as pre-requisites for handwriting.

Table 2.1: Summary of pre-requisites for handwriting as identified by different authors

	Cornhill & Case-Smith (1996:733-734)	Feder & Majnemer (2007:313)	Joubert, Bester & Meyer (2006:180)	Marr, Windsor & Cermak (2001:2)	Maeland (1992:1207-1208)	Denton, Cope & Moser (2006:17)
Kinesthesia	X	X		X		X
Motor Planning	X	X		X	X	
Eye-hand coordination	X		X			
Visual-motor integration	X	X		X	X	X
In-hand manipulation skills	X	X		X		X
Bilateral integration		X				
Visual perception		X		X	X	X
Sensory modalities		X				
Sustained attention		X				
Fine motor coordination			X			
Visual figure-ground			X			
Visual memory			X			
Spatial			X			

orientation						

Already during the imitation phase every child integrates visual perceptual and postural motor components in order to produce handwriting. There is a subtle interaction between these different pre-requisites to eventually equip the child to firstly imitate and later form letters independently. Therefore, if handwriting is not well developed, proper and accurate writing may lag behind. Children who experience difficulty with handwriting will not be able to complete written assignments in time. They may attend too much to the skill of forming the letters, and therefore not realise what the cognitive component is (Graham & Weintraub 1996:7). Chu (1997:515) report on various studies done to indicate that, although difficulty with handwriting surfaces in the early school years, it can persist into high school and even into adulthood.

According to Volman, van Schendel and Jongmans (2006:452) all the underlying mechanisms which add to handwriting difficulty are not fully understood because it is such a complex skill. This statement is reinforced by Table 2.1, which presents work by six different authors. From Table 2.1 it is clear that the most common pre-requisites for handwriting are in-hand manipulation, motor planning, visual-motor integration, visual perception, kinesthesia and eye-hand coordination. It is interesting to note that these authors could not agree on one pre-requisite, except for visual-motor integration, which was identified as a pre-requisite by five of the six authors. Visual-motor integration has been associated with handwriting, despite the fact that this association is not always clear (Overvelde & Hulstijn 2010:542; Bara & Gentaz 2010:747).

From the six resources listed in Table 2.1, four of these refer to studies done namely Cornhill & Case-Smith (1996), Marr, Windsor & Cermak (2001), Maeland (1992) and Denton, Cope & Moser (2006). Joubert, Bester and Meyer (2006) as wel as Feder & Majnemer (2007) only discussed the pre-requisites for handwriting. The main differences between the four research studies were a) the number of participants, of which Marr, Windsor & Cermak (2001) had the most namely 138; b) the assessment tools used and c) the ages of the participants. Different

assessment tools were used in all four studies, except Cornhill & Case Smith (1996) and Marr, Windsor & Cermak (2001) who both used the The Developmental Test of Visual-Motor Integration (1989, 1997). In two of the four studies a visual perceptual test was used. Marr, Windsor & Cermak (2001:4) used the Boehm Test of Basic Concepts (1986) and Denton, Cope & Moser (2006:19) used The Developmental Test of Visual Perception (1993). From clinical experience the researcher knows that although a standardized assessment tool is designed to assess specific aspects, development is complex and there are always other variables to consider. Participants' responses on the different assessment tools could also have been influenced by whether the assessment tool requires a motor output or if it requires only a visual perceptual response. The ages in the different studies ranged from four years and eleven months to ten years. Considering that handwriting matures with age, the researcher can assume that the results from the various studies would differ considerably. Lastly the handwriting profile of the participants in the four studies differed as not only typically developing children were included but also children with handwriting difficulties, dysgraphic children and clumsy children.

Volman, van Schendel and Jongmans (2006:459) support the concept that fine motor coordination visual-motor integration underlie the quality of handwriting and visual-motor integration is a good predictor for children with handwriting difficulties. The findings from Volman, van Schendel and Jongmans' study (2006:459) emphasise the importance of including fine motor coordination and visual-motor integration when screening for the performance components of handwriting.

Schneck & Amundson (2010:557-558), Temur (2011:2200) and Schwellnus et al. (2012:718-720) emphasises the importance of pencil grasp and handwriting. Koziatek & Powell (2003:286) identify six different ways of holding a pencil. These include the dynamic tripod pencil grip, the dynamic quadrupod pencil grip, the lateral tripod pencil grip, the lateral quadrupod pencil grip, the four-finger pencil grip and the interdigital pencil grip. Schneck and Henderson (2010:558) identify the following as mature pencil grips: the dynamic tripod grip, the lateral tripod grip, the dynamic quadrupod grip and the lateral quadrupod grip. These authors mention

that although the dynamic tripod grip has traditionally been preferred, the lateral tripod grip, the dynamic quadruped grip and the lateral quadruped grip are now considered as alternative grips. Literature refers to the relationship between writing speed and legibility as well as how pencil grip develops in children. In this study Miller (2006) refers to a mature pencil as one of the neurological foundations in the Miller Function and Participation Scales. However she does not provide a definition for a mature pencil grip. The researcher used the classification of Schneck and Henderson (2010:558) as a guideline for mature pencil grips.

2.1.2.3 The application of pre-writing skills and pre-requisites to this study

The Miller Function and Participation Scales (M-FUN) (Miller 2006:1-191) were used as one of the measurement instruments in this study. The reasons for selection will be addressed later in the literature study.
In the M-FUN Miller (2006:1) selected three different areas in which she wanted to assess the performance of children, namely visual-motor, fine motor and gross motor. She selected activities within each of these three areas that a child must execute.

The activities chosen as part of the visual-motor component of the M-FUN included drawing, writing and copying activities which are considered pre-writing skills as discussed previously. Two visual-perceptual activities were added to the visual-motor component, one for visual figure ground and another for visual discrimination.

The fine-motor component of the M-FUN includes activities for cutting, playing with clay, posting pennies into a slot, folding, opening a bottle of water, and eating a biscuit.

Each activity was analysed to identify ‘underlying neuro-motor foundational abilities’ (Miller 2006:1). These neuro-motor foundational abilities were then categorised into four areas namely hand function, postural abilities, executive

function and participation, and non-motor visual perception. (Refer to Appendix A for the Neurological Foundations Profile).

In Table 2.1 visual-motor integration and fine motor coordination were identified as two of the pre-requisites for handwriting. In the M-FUN (Miller 2006:1-191) the author constantly refers to visual-motor abilities and fine motor abilities. She only refers to visual-motor integrative functions and fine motor performance when explaining the two terms. Visual-motor integration and fine motor coordination can be viewed independently as pre-requisites. However, in the M-FUN (Miller 2006:3-4) each has been analysed and broken down into 'underlying neuro-motor foundational abilities' or also called visual-motor abilities and fine motor abilities. These are abilities which are unique to visual-motor and fine motor but can sometimes overlap in the test as seen in Table 2.2.

Table 2.2: Summaries of the neurological foundations

Neurological foundations	Neuro-motor foundational abilities	Visual-motor	Fine-motor
Hand function	Hand strength		x
	Pincer grasp		x
	In-hand manipulation		x
	Mature grasp	x	
	Motor accuracy	x	x
	Motor planning	x	x
	Crossing midline		x
Non-motor visual perception	Figure-ground	x	
	Scanning/Sustained attention	x	
	Visual discrimination	x	
Postural abilities	Bilateral coordination	x	x
	Unilateral coordination		x
	Motor accuracy		x
	Strength		x
Executive function and participation	Sustained attention	x	x
	Regulation and control	x	x
	Motor planning	x	x
	Socialization		x
	Sharing/Turn-taking		x

When comparing Table 2.1 with Table 2.2 it is important to note that the following body functions appear on both tables: in-hand manipulation, motor planning, visual perception (specifically visual figure ground and visual discrimination) and sustained attention. This indicates that visual-motor integration and fine motor coordination have been identified as pre-requisites for handwriting development. Both of these functions can be analysed to include additional body functions.

Literature presents us with evidence that various authors have investigated different body functions as possible pre-requisites for the development of handwriting. The best way to observe the pre-requisites is by engaging a child in a

pre-writing activity in order to present with the pre-writing skill. The exposure to pre-writing activities will assist the child in developing handwriting readiness.

2.1.3 Handwriting readiness

As early as the 1970s authors already wrote about factors influencing handwriting readiness. Mildred Donoghue (1970) (cited in Wright & Allen 1975:431) identified ten factors which are important before handwriting instruction can begin: (i) a mental age of 6-6 to 7-0; (ii) interest in writing and a desire to write; (iii) adequate visual acuity and ability to make visual discriminations; (iv) understanding of the concept of left-to-right progression; (v) adequate muscular coordination; (vi) proper bone development of the arm; (vii) hand dominance; (viii) social and emotional maturity; (ix) language maturity, and (x) a school writing programme suitable for the child's level of maturity. Around the same time Lamme (1979) (cited in Marr, Windsor & Cermak 2001:2) also identified six pre-requisite skills before the child is ready for handwriting instruction. These were (i) small muscle development; (ii) eye-hand coordination; (iii) the ability to hold utensils or writing tools; (iv) the capacity to form basic strokes smoothly; (v) letter perception and, lastly, (vi) orientation to printed language. In the late nineties Chu (1997:515) identified sensory, perceptual, motor, cognitive and language functions as pre-requisites to handwriting and also emphasised their importance in handwriting readiness.

Amundson (2005:589) asserts that handwriting readiness involves different sensorimotor systems while Beery and Beery (2010) advise that formal handwriting instruction should only start when a child can copy the oblique cross in the Beery-Buktenica Developmental Test of Visual-Motor Integration (2010:134). Ultimately though, various authors including Barchers (1994) and Benhow et al. (1992) (cited in Amundson 2005:589) and Wright and Allen (1975:430-435) concluded that enhancing fine motor control and isolated finger movements, improving right-left discrimination and orientation to printed language are considered important in the development of handwriting readiness.

As illustrated in the above discussion, handwriting readiness has been intensively researched and investigated for decades. The mentioned authors were all in agreement that there are pre-requisites without which children cannot be ready for handwriting, but the literature reviewed did not reflect on the importance of pre-requisites to handwriting readiness. Handwriting readiness has relevance to the concepts of readiness to learn and school readiness.

2.1.4 Readiness to learn and school readiness

Pre-writing skills, pre-requisites for handwriting and handwriting readiness play an important role in the transition process which children make from pre-school to primary school. Pianta and Kraft-Sayre (2003) (cited in Lam & Pollard 2006:125) indicate that a child's transition to school "is a process and is understood in terms of the influence of different contexts experienced by the child, including home, classroom and community and the connection between these contexts over time." The consideration of the development transitional model was significantly relevant to the current study as the children in the sample came from different communities, socio-economic backgrounds and had different home circumstances. Although they had all experienced the transition process from pre-school to primary school, their exclusive diverse backgrounds, cultures and home environments had a profound influence on their individual transitions. Each child's preparation to become ready to learn was distinctive.

Over the years school readiness has been a point of controversial discussion between many professionals such as psychologists, educationalists, speech therapists and occupational therapists. One of the older definitions of school readiness is that of Grové (1977) (cited in Davin & van Staden 2005:4) that states a child is ready for school when he or she can meet the formal demands of school. In this definition the focus is on the demands of the school and not on the 'possibilities' of the child. This implies that, irrespective of the individual child's abilities, the school expects the child to comply with the expectations. If this definition is to be applied, it can have serious repercussions for the school and, more importantly, for the child as she or he might not be ready to learn.

However, Grove's definition (1977) of school readiness does show similarities to but also differences from Bustin's (2007) interpretation of school readiness. According to Bustin (2007:19), the ecosystemic factors as identified by the National Institute of Child Health and Human Development Early Child Care Research Network (NICHD) play a significant role in school readiness. These factors are the maternal levels of literacy, relationships, socio-economic status and pre-school attendance. Although Bustin (2007) and Grové (1977) identified external factors that impact on the child's school readiness, Bustin (2007:21) went further by listing the most common criteria for school readiness within the child as identified in literature. These criteria pertain to the child's physical well-being, motor development, approach to learning, social and emotional development, language ability, cognition and general knowledge.

Readiness to learn coincides with school readiness and these two concepts have common features. Davin and van Staden (2005:5) make the following statement: "Readiness to learn can be described as a stage of maturity when an individual is able to understand and grasp those concepts and skills that have been deemed necessary for a child of a specific age to attain." These authors note the following six factors that determine the child's readiness to learn:

- the child's ability to concentrate and pay attention
- the child's own motivation to learn
- the child's health
- the child's emotional maturity
- the child's intellectual ability
- the environment in which the child grows up in.

In their definition of readiness to learn, Davin and van Staden (2005:5) emphasise that children present with a certain level of maturity that is closely linked with normal development. Within the normal development of five- and six-year-old children there is a gradual maturation in the acquiring of skills. With every year of development there is a difference in the quality of the execution of tasks as well as the refinement of movements and skills (Refer to Appendix B). Normal development enables a specific child to react to age-appropriate challenges and to succeed. The expectations set in Grade 1 remain the same, but the child's age, normal developmental milestones and emotional maturity can keep him or her from being ready to learn and meeting the expectations set in Grade 1.

Bustin (2007:19) as well as Davin and Van Staden (2005:4-6) identify socio-economic status, attendance at pre-school and the environment in which the child grows up in as important factors influencing school readiness. Concurring with them, Wesley and Buysse (2003:353) however also recognise the following as negatively influencing school readiness: a lack of academic skills, difficulty of a child to work independently, lack of pre-school experience, inability to work as part of a group and a disorganized home environment.

According to Rogers and Rose (2007:47), age has been considered an important marker for school readiness. However, this does not explain why, irrespective of their age, children are sometimes unable to cope in the first year of primary school. Within the South African context children are enrolled in Grade 1 from as young as five- and-a-half years old even though they may not be ready to learn. This warranted further investigation into the different aspects which might influence a child's readiness to learn.

2.1.4.1 Age

Internationally South Africa is not the only country where the child's school-going age is critically debated. In the United Kingdom (UK) children are admitted to school at the age of four or five, but five years is the compulsory age for starting school whereas the more common European and international ages are six and

sometimes even seven years. In the UK the school entry system is based upon age rather than on "school readiness" (Rogers & Rose 2007:51). Sharp and Hutchinson's (1997:112) research in the UK revealed that older children who had completed a reception year, had performed better academically. In the United States of America (USA) it is more common to delay a child's entry into school if he or she is not school ready and ready to learn. However, Rogers and Rose (2007:52-53) posit that delaying school entry may be viewed as a controversial matter because not enough research has been done to support the possible benefits of delaying school entry.

Evidence from literature was sometimes contradictory as to whether five years or six years is the better age to start primary school. Fogelman (1983:1-7) mentions data from the National Child Development Study (NCDS). A sample of 10 300 born in one week of March 1958 were divided into two equal groups. Group 1 (ages between four years and six months and five years and 11 months) started school early and Group 2 (ages between five years and five years six months) started school later. Both groups of children were all assessed again at the age of 11 years. The younger group did significantly better than the older group.

Crosser (1986:140-145) compared a small sample of children of whom some started kindergarten at age five and the others at age six. The two groups were matched regarding gender and intelligence. These groups were assessed by the time they reached the fifth and sixth grades. The 29 boys who started kindergarten at the age of six did significantly better than the 29 boys who started at age five. The 16 girls who started kindergarten at age six did not do significantly better in reading and mathematics than the 16 girls who had started at school when they were five years old, but they did significantly better on the cognitive tests. Although the sample was very small in the case of Crosser's (1986) study, the results remain interesting.

Data from Statistics Canada: National Longitudinal Survey of Children and Youth (Thomas 2006:13) indicated that variations regarding readiness among five- year-old children exist according to their sex, family and home environments. A cross-

cultural study on school readiness by De Lemos (2008:95-96) showed that relatively few six-year-old children were not school ready.

Literature states the importance of fine-motor activities, specifically writing tasks, in primary school. McHale and Cermak (1992:898-903) ascertain that children of different ages in elementary school spend a substantial part of their day on fine motor tasks. In a study done in Kentucky, USA, involving 54 000 children, Davis, Scott Trimble and Vincent (1980:136) found that children who started school at the age of six did significantly better than those who started school at the age of five years. Saluja, Scott-Little and Clifford (2000:4) reported that five-year-old children differed greatly with regard to the following aspects of development: physical, social, emotional and cognitive.

Locally, Venter (2000:171) notes that children who start pre-school/nursery at the ages of three and four years do significantly better at school readiness than those who start at the age of five years.

Since literature signified that the dispute regarding school-going age is an ongoing global debate, the researcher chose five-and-a-half and six-and-a-half years old as appropriate for the purpose of this study. Firstly, she perceived that five years is the school-going age which is referred to in literature as being controversial and secondly, in South Africa five years is also by law the age at which children are allowed to enter into Grade 1. It was nonetheless noted that it was apparent in literature that six years is the more acceptable and beneficial age to start primary school.

2.1.4.2 Gender

Literature refers to different studies on gender differences in handwriting. These studies however do not refer to the same aspects of handwriting. Hartley (1991:141) states there are clear differences between handwriting in males and females. He also notes that these differences can be seen very early and that continues through life. Hartley (1991:143) attributes this to the advanced

development of fine motor coordination of girls when compared to that of boys. In their review article of handwriting research, Graham and Weintraub (1996:33) state they found no evidence indicating that boys' handwriting was better than that of girls and they suggest further research. Spear (1989:274) confirms this by referring to her study conducted with teachers in which the latter ascertained that the written work of girls was neater, larger and more legible than those of boys. Spear (1989:271) went on to say that cultural stereotypes might influence the development of handwriting as girls are expected to be neater than boys. Judd, Siders, Siders and Atkins (1986:311) concluded that Grade 1 girls did better at symbol copying than boys of the same age after they had done a study where Grade 1 boys and girls were compared regarding fine motor tasks.

More recent studies presented with the following results. Junaid and Fellowes (2006:8) did a study on a group of 103 randomly selected children (60 boys and 43 of seven and eight years old. The girls did significantly better than the boys on the manual dexterity items. A South African study by Meyer and Sagvolden (200610) describe that girls with Attention-Deficit/Hyperactivity Disorder (ADHD) in a group of 528 children did poorer on the Grooved Pegboard and the Maze Coordination Task than the boys. The reasoning behind this was that although ADHD is less frequent in girls, the symptoms can be more severe. Studies by Temur (2011:2204) and Schwellnus et al (2012:723) indicated that gender affects speed of handwriting. Girls write faster than boys. In a longitudinal a study on the predictors of school readiness in five- and six-year old children, Prior, Bavin and Ong (2011:11) found that a lower level of school readiness among boys when compared to girls. Although this study referred to school readiness one can assume that readiness to acquire handwriting skills will be affected.

2.1.4.3 A reception year

Preparation for Grade 1 by attending a reception year is of the utmost importance. Van Hartingsveldt et al. (2011:506) confirmed this through referring to research which emphasised the importance of good transition between kindergarten and elementary school. Prior, Bavin and Ong (2010:4) add the following "the pre-

school period is highly significant for the acquisition of social and pre-literacy skills." Although this may not change the child's home environment or socio-economic background, it provides a stable environment in which learning can take place. The importance of good transition is echoed by Arnold, Bartlett, Gowani and Shallwani (2008:27) who state school readiness and transition are closely related. In their article 'Transition to School: Reflections on Readiness', Arnold et al (2008:28) focused on the importance of early child development. According to these authors, the advantages of early child development included improved enrollment, retention and achievement for children. Although early child development is known to start from directly after birth, a retention year before enrolling in Grade 1 concludes early child development and ensures a smoother transition to Grade 1.

2.1.5 What happens in the South African context?

2.1.5.1 Grade R

Grade R was initiated because of children entering into Grade 1 without being able to hold a pen or pencil, difficulty in understanding or speaking the medium language and not having adequate perceptual skills. Grade R, otherwise known as a reception year, is different from an ordinary pre-school year. It focuses on learning outcomes, assessment standards from various learning programmes, is more specialised and activities prepare the child for each different perceptual facet (Meij & Sullivan 2007:iii). It was the DoE's aim to have 800 000 learners enrolled in Grade R by 2010. However, attending Grade R is not compulsory. The lack of infrastructure and funds did not only apply to school going children but also to opportunities provided to younger children being prepared for Grade 1.

According to Ms Angie Motshekga, Minister of Basic Education, the number of children attending Grade R in South Africa has increased from 487 222 in 2007 to 707 203 in 2010 (Kruger 2011:13). Grade R has not been implemented in all the primary schools in South Africa. This can be attributed to various reasons. Schools which struggle financially cannot afford Grade R. Grade R teachers at government schools are only expected to have a qualification equivalent to matric (Grade 12),

whereas teachers at independent primary schools hold a tertiary qualification. The quality of education is therefore not consistent throughout the different primary schools.

2.1.5.2 The Revised National Curriculum Statement

In the South African context The Revised National Curriculum Statement (RNCS) is applicable to Grades R to 9. The aim of the RNCS is to conform to the goals of the Constitution of the Republic of South Africa. The RNCS strives to develop the full potential of each learner. The following principles as stipulated in the Grade 1 teachers' guide in 'Best Book Panels' (2003:1) underlie the RNCS:

- "social justice and equity (non-racism, non-sexism)
- outcomes based education (OBE) which means a high level of skills and knowledge for all
- clarity and accessibility
- respect, responsibility and accountability
- progression, integration, reconciliation and the Rule of Law."

Within the RNCS there are learning outcomes for the different learning areas such as home language, first additional language, mathematics and so forth. Writing is a learning outcome under home language as well as under first additional language.

When comparing Grade R to Grade 1 there is a very important difference between the learning outcomes and the way in which they are assessed. In Grade R the child is experimenting with equipment and still in the process of identifying his or her effect on the surroundings and coming to terms with who they are. In Grade 1 the child is expected to work towards an end product and be able to use equipment in a functional manner. If the child is therefore not in a phase where he or she is ready to learn, he or she may fail in meeting the expectations set by the curriculum.

(Refer to Appendix C for a comparison between the learning outcomes for Grade R and Grade 1 as stated in the RNCS).

Professionals, working in the field of paediatrics, might agree on a common definition or description of school readiness. However, school-going age and determining appropriate expectations for Grade 1, appears to be international problems. Every country, including South Africa, has its own challenges as far as assessing a child's readiness for school is concerned.

2.1.6 Measurement instruments

Occupational therapists are trained to use a variety of standardised tests. These assess different aspects such as postural motor, sensory and visual perceptual abilities. A test might assess all three areas or only one of the three areas. Below, the choices of measurement instruments for this study are discussed.

Vision forms a very important part of development and learning in children (Chaiken 2006:863-864). When assessing a child, it is therefore crucial to determine whether a child has good vision before introducing the standardised tests. This is illustrated by Schneck (2010:375-377) who reports on visual-receptive and visual-cognitive functions and how the interaction between these two groups allows a human being to react on stimuli from the environment. The researcher compiled a visual screening test in cooperation with a qualified optometrist. The researcher was able to identify children at risk for possible vision difficulties before testing.

The Miller Function and Participation Scales (M-FUN) was chosen because it can assess a variety of abilities through functional activities. Two of these, namely fine motor coordination and visual-motor integration, are closely related to two of the objectives in this study. The Miller Function and Participation Scales allows for input from people such as the teacher and parent(s). This measurement instrument provides different scores to present the therapist with an even better impression of the child's performance.

The Minnesota Handwriting Assessment (MHA) was designed to assess handwriting through near point copying of letters. In this assessment a child's performance is compared with that of her or his peers.

2.1.6.1 Visual screening

A well-integrated visual system is of the utmost importance in the development of good visual perceptual skills. Schneck (2005:412) observes that problems with the visual system can result in deficits with daily tasks such as eating, dressing, reading, writing, locating objects, driving and other activities.

Normal vision is an integral part of learning and normal development. Kramer and Hinojosa (2010:349) refer to work done by different authors which indicated that ocular motor skills are one of the internal factors which influence handwriting. It was found in a study by Goldstand, Koslowe and Parush (2005:377) that non-proficient readers presented with poorer visual screening scores when compared to proficient readers. This finding emphasises the importance of good vision.

The importance of a visual screening by an occupational therapist before doing standardised assessments is emphasised by Schneck (2010:370). This visual screening is not a substitute for an evaluation by an optometrist, ophthalmologist or visual specialist, but it can assist the occupational therapist in knowing when to refer. The researcher did a visual screening with each participant before completing the standardised assessments. An optometrist assisted the researcher in compiling a visual screening test for this study. The aspects that were addressed during the visual screening are depicted in Table 2.3.

Table 2.3: Aspects included in the visual screening

Visual aspect	**Tool/ Test**
1. Visual acuity	Lea cards <http://www.good-lite.com/Details.cfm?AProdID=31>
2. Suppression of one eye	3 dot lustre Test <http://www.ontrackreading.com/dyslexia-puzzle/alternating-suppression>
3. Eye movements (pursuits, jerkiness and saccades)	A pencil with an object at the end
Visual aspect	**Tool/ Test**
4. Focus	The participant had to follow a target, with one eye closed, as it came closer to his or her face. He or she had to speak and tell the researcher and optometrist as soon as the target became "fuzzy/blurry". This happened at approximately 10 cm from the participant's face. The distance had to be the same for the left as well as the right eye.
4. Squinting	Hirshberg test or unilateral cover test <http://www.vision.about.com/od/eyeexamination/f/Cover_Test.htm>
5. Accommodation	"Flippers" <http://www.bernell.com/product/4715/279>

The participants were to be excluded from the sample when deficits were observed in one or more of the following aspects: suppression of the one eye, visual acuity and accommodation.

2.1.6.2 The Miller Function and Participation Scales

This developmental assessment tool was developed to determine how a child's motor competency affects his or her ability to take part in home and school activities and to participate socially in her or his world (Miller 2006:1). The M-FUN can be administered to children between the ages of two-years-six months to seven-years-11 months. Administration time is 40 to 60 minutes, depending on the age and responsiveness of the child. The caregiver and teacher will need approximately five to ten minutes to complete the checklists.

The M-FUN assesses the child's participation and performance. The test consists of the following parts:

- activities to assess visual-motor abilities
- activities to assess fine motor abilities
- activities to assess gross motor abilities.

All three of the above activities mentioned form part of the workbook. (Refer to Appendix D). The rest of the M-FUN test assessments comprise:

- home observations checklist - completed by the parent/guardian (Refer to Appendix E)
- classroom observations check list - completed by the teacher (Refer to Appendix F)
- test observations checklist - this is included in the record form and completed by the examiner (Refer to record form in Appendix A)
- a record form (Refer to Appendix A).

Next, a list of subtests included in the visual-motor integration and fine motor coordination areas as well as the motor abilities that are addressed in every subtest are shown in Table 2.4 (Miller 2006:3-4).

Although the developer of this test divided the activities into the two groups of visual-motor coordination and fine motor coordination, they all have elements of pre-writing skills. They all include a motor output response and involve aspects such as drawing, tracing and copying. The motor abilities that are listed on the right hand side refer to the pre-requisites for handwriting. The developer of this table

used pre-writing activities in order to test the different pre-requisites for handwriting (Miller 2006:3-4).

Table 2.4: The subtests of the visual-motor integration and fine- motor coordination areas

Visual-motor integration	**Motor abilities**
1. Clouds/Race car	Motor accuracy
2. Amazing mazes	Mature grasp Motor accuracy Motor planning
3. Hidden forks	Visual discrimination Figure ground Motor accuracy Scanning
4. Find the rabbits/puppies	Visual discrimination Figure ground Motor accuracy Scanning Sustained attention
5. Copying shapes	Motor accuracy
6. Draw a kid	Motor accuracy Body awareness
7. Writing	Motor accuracy Mature grasp
8. Go fishing (Items 1-4)	Motor accuracy Bilateral coordination Automatic assist
9. Examiner rates behaviour during visual-motor games	Attention to detail Planning Self-control

Fine motor coordination	Motor abilities
1. Go fishing (Items 5-7)	Motor accuracy Bilateral coordination Automatic assist
2. Clay play	Hand strength Bilateral coordination Unilateral coordination
3. Penny bank	Crossing midline Pincer grasp Motor accuracy In-hand manipulation
4. Origami	Motor accuracy Bilateral coordination Motor planning
5. Snack time	Motor accuracy Bilateral coordination Strength Socialisation Sharing/Turn taking
6. Fine motor behavior rating	Attention to detail Planning Self-control

The M-FUN includes a participation assessment that consists of the home observations checklist, the classroom observations checklist and the test observations checklist. The home and classroom observations checklists use 4-point scales to rate the child's participation in Activities of Daily Living (ADL), leisure activities and classroom activities. These checklists are completed by the caregiver and the teacher respectively. The 4-point scale of the test observations checklist rates the child's behaviour during the assessment of the M-FUN and is completed by the examiner (Miller 2006:11).

a) Reliability

The reliability of the M-FUN was examined, as reported in the manual, by using test-retest reliability, internal consistency, and inter-rater reliability as discussed next.

- **Test-retest reliability**

Test-retest reliability is examined by administering the same test twice with a child. The time that elapses between the test and retest must be short enough to minimise changes in the child, but long enough that experience from memory and practice does not make a difference.

This aspect was evaluated in a study that included a sample of 27 children from the standardization sample. The test was repeated within 0-21 days. The test-retest reliability was estimated using Pearson's product moment correlation co-efficient. The study showed that the M-FUN possesses moderately high reliability across time for all ages. The corrected reliability coefficients ranged from .77 for the visual-motor and gross motor, to .82 for the fine motor. The data also indicated that the mean retest scores were slightly higher than the scores from the first test. The mean retest scores were less than 1 scaled score point higher than the mean. The differences were minimal, therefore suggesting that measurement of the children's performances were reliable (Miller 2006:101-102).

- **Internal consistency**

Information on internal consistency was presented on the standardisation sample and a clinical group. Reliability coefficients for the visual-motor, fine motor and gross motor tests were examined using Cronbach's coefficient alpha. The average reliability coefficients were good (.85 for the visual-motor test) to excellent (.90 for the fine motor test and .92 for the gross motor test). The average reliability coefficients for the home, classroom and test observations checklists were excellent, ranging from .95-.96.

The internal consistency reliability evidence for the clinical group was obtained with coefficient alpha from a sample of 66 children. The data showed that the reliability coefficients of the clinical group on each scale were similar to those reported for the normative sample. This suggests that the M-FUN is equally reliable for measuring the visual-motor, fine motor, and gross motor skills of children from the general population and children who are at risk of motor impairment (Miller 2006:103).

- **Inter-Rater Agreement**

A number of subtests on the M-FUN require clinical judgment and therefore may result in variability in scoring. Scoring rubrics were developed for most of the subtests of the standardisation edition of the M-FUN. Five pairs of examiners rated the M-FUN performance of 29 children. One person administered the test while the other observed the child's performance and independently scored the child's responses on another test protocol. The correlation between the raters' scores was .91 for visual-motor, .93 for fine motor and .91 for gross motor. The average decision agreement was 96% for visual-motor, 97% for fine motor and 93% for gross motor. This indicated a high degree of consistency between scorers' interpretations (Miller 2006:104).

b) Validity

A test must be valid to the extent that it measures what it is supposed to measure. A test's validity refers to the degree to which data, research, or theory support that the test measures the concepts it purports to measure and that it can be applied to the intended population. Evidence of validity of M-FUN was based on test content, internal structure, relationship to other variables and clinical validity studies (Miller 2006:108).

2.1.6.3 Minnesota Handwriting Assessment

The Minnesota Handwriting Assessment (MHA) is one of many tests which assess handwriting. Feder and Majnemer (2003:65-84) wrote an article in which they compared four other handwriting assessments to the MHA. The tests were compared regarding the test domains, scores obtained and their psychometric properties. The authors reported that the MHA shows good reliability and that it was specifically designed for younger children. The MHA was chosen for this study because it expects near point copying of letters without the child necessarily being able to read. It can be used for Afrikaans and English pupils. Evaluating readiness for acquiring handwriting was part of the aim of this study.

This test is a norm-referenced test that was developed to identify children with handwriting difficulties. Children are asked to copy words from a near point example in manuscript handwriting. (Refer to Appendix G). The child's example is then scored for quality and rate. There are five aspects of qualitative errors: legibility, form, alignment, size and spacing. (Refer to Appendix H). When the child has completed the example a rate score can be obtained by counting the number of letters completed in 2, 5 minutes. (Refer to Appendix H).In the development of the MHA, 67% of 90 second graders who were tested completed 31 of the 34 letters. Therefore, rate was included as one of the measures in the research version of the MHA.

a) Reliability

An inter-rater reliability study was initially done on the pilot version of the MHA. A second inter-rater reliability study was later done on the research version of the test. In this study raters scored 20 samples independently. Two of these raters were experienced and one was less experienced. Inter-rater reliability was determined by using Pearson correlation. Between the experienced raters, the inter-rater reliability ranged from .90 for form to .99 for alignment and size. Between the inexperienced rater and the author the inter-rater reliability ranged from .87 for form to .98 for alignment and size (Reisman 1999:88).

Intra-rater reliability studies were done to determine the individual rater variability. The author, an experienced rater and an inexperienced rater all scored a set of 20 identical photocopied samples. A second set of photocopied samples was re-scored by the same raters 5 to 7 days later. The study found that the correlation for rate was perfect and a high degree of intra-rater reliability was found for the five quality categories. Intra-rater correlations were averaged using Fisher's z transformation (Reisman 1999:88).

b) Test-Retest Reliability

A group of 99 second-grade pupils were assessed twice in 5- to 7- day period. The examiners were either therapists or teachers. Trained research assistants and the author scored the samples. The scores on both the test administrations were translated into performance levels. The pupil's placement on both the tests was compared. Moderate to high decision consistency was noted in the analysis of performance level placement on the comparison of the two test administrations (Reisman 1999:89).

c) Validity

In the MHA manual the author refers to legibility being a primary aspect to consider when critiquing handwriting. It is difficult to obtain reliable measurements for the other categories if a letter is illegible. Legibility, form, alignment and size were all part of the pilot version of the MHA. Rate and spacing were added to the research version. All the categories except for legibility- and in part form- can be judged by ruler measurement. This makes the MHA a relatively objective measure of handwriting. The measurements in the MHA give a one sixteenth of an inch rule for an error allowance (Reisman 1999:90).

2.1.6.4 Selection of measuring instruments

The M-FUN and the MHA were considered as appropriate measurement instruments for the current study. It was envisaged that the fine motor coordination

component of the M-FUN would provide a statistical composite score for the following pre-requisites: motor accuracy, bilateral coordination, automatic assist, hand strength, unilateral coordination, crossing the midline, pincer grasp, in-hand manipulation, motor planning, socialisation, sharing, attention to detail and self-control.

The visual-motor integration component of the M-FUN would assumedly also provide a statistical composite score for the following pre-requisites: motor accuracy, mature grasp, motor planning, visual discrimination, figure ground, scanning, sustained attention, body awareness, mature grasp, bilateral coordination, automatic assist and attention to detail. These pre-requisites correlate with the findings on pre-requisites for handwriting of other authors, as mentioned in Table 2.1.

Handwriting is assessed by the MHA. A child must copy from a near point example and handwriting is scored regarding legibility, form, alignment, size and spacing. Hammerschmidt and Sudsawad (2004:190) mention different studies which indicated that teachers do not only assess handwriting on account of the legibility, but also take letter formation, spacing, size and letters written on the line into account.

There are a vast number of standardised assessments available within the scope of occupational therapy. The M-FUN is a relatively new test. At the time when the researcher had to decide on an assessment tool for this study, there was no literature available on the use of the test as part of a research study. As readiness to acquire handwriting skills is an important concept in this study, the M-FUN provided the researcher an opportunity to assess visual-motor integration (VMI) and fine motor coordination (FMC) as key components in reaching a level of maturity and developing handwriting skills. The M-FUN does not only provide a raw score for VMI and FMC but also a list of neurological foundations which could influence the raw scores obtained for VMI and FMC. The MHA is a well-known assessment tool for handwriting and has already been compared to other available assessment tools. Importantly, the researcher believed both these assessment

tools would provide her with relevant and rich data to achieve the objectives of this study.

2.2 CONCLUSION

At the onset of this research study it was clear that the terms related to the topic were not well defined in literature or among professionals. In this chapter the researcher attempted to define terms such as handwriting, writing, pre-requisites, pre-writing, readiness to learn and school readiness as well as to explain the relationship between these terms. A description of the measurement tools was also provided. The literature review is proof that the concept of handwriting has been under discussion for many years and yet it is still not properly understood. Chapter 2 provided information which guided the researcher in the methodology for this study in order to answer the research question of comparing the readiness for acquiring handwriting in five- and six-year-old children in Grade 1.

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

The researcher set out to determine the level of readiness of five- and six-year-old children in the process of acquiring handwriting skills. The methodology was designed to provide the researcher with data on performance levels for visual-motor abilities, fine motor abilities and acquiring handwriting skills.

The aim and objectives are discussed in this chapter to provide clarity to the reader as to what the researcher was working towards. The research design, aspects concerning the sample and the method were discussed. The ethical considerations adhered to in this study are commented on. The measuring instruments, used in this study, were comprehensively discussed in Chapter 2, but are referred to again regarding the order in which they were used as well as how data were recorded and analysed.

3.2 AIM AND OBJECTIVES

The aim of this study was to establish whether a difference exists in the readiness to acquire handwriting skills between five- and six-year-old children in Grade 1.

The four objectives in this study were to:

- determine the level of development of visual-motor integration, fine motor coordination and handwriting skills between groups of five- and six-year-old children on standardised tests

- compare the level of development of visual-motor integration, fine motor coordination and handwriting skills between groups of five- and six-year-old children on standardised tests

- determine whether a correlation exists between the level of visual-motor integration and acquiring handwriting skills of five- and six-year-old children on a criterion-related test

- determine whether a correlation exists between the level of fine motor coordination and acquiring handwriting skills of five- and six-year-old children on a criterion-related test.

3.3 METHODOLOGY

3.3.1 Research design

A non-experimental approach was applied. According to De Vos et al. (2011:158) this implies that the participants in a study are assessed over the same time on certain variables. The design was comparative and descriptive and there was no experimental or control group. Two groups of children of the ages of five and six were compared regarding their readiness to acquire handwriting skills. Two aspects of readiness, namely visual-motor integration and fine motor coordination were correlated with the results of the mean of the two age groups on the handwriting assessment.

3.3.2 Sample

3.3.2.1 Population and setting

The target population for this research was all the school-going children in Grade 1 in mainstream government schools in Tshwane, South Africa where either Afrikaans or English was used as the medium language. As the researcher needed to assess school-going children in Grade 1, the Department of Education (DoE) was approached regarding the division of schools in Gauteng. Schools are divided according to districts. A list of schools in the Tshwane North District was obtained from the DoE. According to the list, the Tshwane North District is divided into three

areas, namely Soshanguve, Temba and City. The researcher chose to do the study at the primary schools in the City division. It provided a sample of convenience as it included easily accessible primary schools where Afrikaans or English are used as the medium language. As the researcher made use of standardised tests it was important that the selected participants should have been able to understand instructions given in the language they understand. Including areas such as Soshanguve and Temba would have increased the variables with regard to demographic information such as socio-economic background, attendance of a Grade R class and the medium language used at the school.

Twenty primary schools are situated in the City division. The total population was approximately 2000 Grade 1 children in 2009 and 2010 respectively. At the time this study was conducted three out of the twenty listed schools, were traditionally English schools and seventeen were traditionally Afrikaans schools. The need for English schools has increased over the last few years. Black parents enroll their children in schools situated closer to their workplace and they choose to select a school where their child is educated in English or Afrikaans and not necessarily in their mother tongue language. Although the schools in the City division normally accommodate children who live in the surrounding areas, children who live in Mamelodi, Soshanguve, Temba, Eersterust, Hammanskraal and Atteridgeville also attend these schools. Therefore five of the traditionally Afrikaans schools have converted to using English as the medium language or give the option of an English class to the parents. All of the schools in the City division, except five of them, are situated on the southern side of the Magaliesberg and are geographically situated close to one another. This area is known as the “Moot”.

3.3.2.2 Sampling procedure

Convenience sampling was done. This ensured that there were only schools included in the sample where either Afrikaans or English was the medium language. Purposive sampling was furthermore done by applying specific inclusion and exclusion criteria.

The DoE gave permission for the researcher to conduct the study after which the researcher contacted the principals of the schools telephonically during the fourth term of 2008. This was followed by a written invitation to provisionally agree to be part of the research study. (Refer to Appendix I). Appointments were scheduled at the beginning of 2009 with each of those principals who agreed that their Grade 1 learners could be part of the study. During these meetings the researcher obtained lists of enrollments of the Grade 1 learners and a consent letter was handed over to the principal. (Refer to Appendix J).

Through the Education Laws Amendment Act (Act No. 50 2002) the school-going age was changed to five-and-a-half years if the child turns six before 30 June of that year. In order to have a sufficient number of participants, the researcher selected two groups of participants: one group turned six and the other seven in May and June 2009. At the time of data collection these participants were all five years and 11 months and six years and 11 months old. According to the selection criterion 28, five-year-11-month old participants were identified on the class lists in 2009. By using the same process, 205 six-year-11-month old participants were identified in 2009. According to the number of five-year-old participants, random sampling was used to select the same number of six-year-old participants. This was done by listing all the names of the children in the six-year-old group and selecting every 28th child as a possible participant. In 2009 twenty of the five-year-old participants' parents and 20 of the six-year-old participants' parents gave consent for their child to take part in the study.

As the number of participants tested in 2009 did not amount to the required sample size (refer to Section 3.3.2.4), the abovementioned process was repeated in 2010. On the 2010 class list 30 five-year-11-month old participants were identified, as well as 247 six-year-11-month old participants. Random sampling was again used to identify the same number of six-year-old participants as in the five-year-old group. The number of participants from 2009 was therefore supplemented by the number of participants from 2010. In 2010 twenty four of the five-year-old participants' parents and 23 of the six-year-old participants' parents gave consent for their child to take part in the study.

In collaboration with the principals and the teachers, a consent letter and a background information form were sent to the parents of the selected participants. (Refer to Appendices K and L). The final number of participants included in the study had to comply with specific selection criteria.

3.3.2.3 Selection criteria

A lay-out of the inclusion and exclusion criteria as they were applied in this study is found in Table 3.1.

Table 3.1: Inclusion and exclusion criteria

Inclusion criteria
• Age – children who were five-and-a-half and six-and-a-half years old when they entered into Grade 1 at the beginning of 2009 and 2010.
• Males and females.
• All ethnic groups were included.
Exclusion criteria
• Use of medication such as stimulants and non-stimulants.
• Children with neurological and neuro-psychological conditions.
• Children who did not understand instructions given in the medium language, as identified by the teachers. A question pertaining to this criterion was also included in the background form for the parents to respond to.
• Children who had been assessed by an occupational therapist in the previous six months and/or were involved in an occupational therapy programme at the time of the study.
• Children who presented with visual problems during the researcher's screening.

The **inclusion criteria** were applied when the researcher selected the participants. As stated in Section 3.3.2 the researcher selected five-year-old participants who turned six before the 30 June. The age bands in the M-FUN, through which the raw

scores are converted to scaled scores, is divided into 11 month periods, for example 5:00-5:11. Participants, who were five years 11 months in April and May and therefore turned six in May and June, were selected. A similar number of children who were six years 11 months were then selected to match the five-year-group according to when they had their birthdays. Both males and females were included, but gender was not used to match or pair the two age groups. All ethical groups were included in the sample. For the purpose of this study the intent was not a comparison between gender and ethnicity in the two groups.

Four of the five mentioned **exclusion criteria** in Table 3.1 were listed in the background information form for the parents/caregivers in order for the researcher to determine who would be eligible as research participants. In the same form the parents were provided with examples of medication as well as examples of neurological and neuro-psychological conditions to assist the parents/caregivers in understanding what the researcher meant. If a neurological and a neuro-psychological condition were present or the participant was using medication, it would have indicated that there were associated problems, which could have influenced the participant's responses and therefore the results.

A question was put to the parents to determine whether they thought their child was able to understand instructions given in the medium language of the school. As the standardised tests used in this study consisted mostly of verbal instructions the participants would need to be able to understand when instructions were given. Two exceptions occurred when a teacher indicated, before the consent forms went to the parents that two of the selected participants were unable to understand instructions in the academic language of the school. The parents of all the other participants indicated that their children were able to understand instructions given in the medium language.

It was important for the researcher to know whether any of the selected children had been assessed by an occupational therapist in the six months before the study was conducted or whether they had received therapy in that time. If this was the case, the child could already have been exposed to the M-FUN. A standardised

test such as the M-FUN can only be repeated after a period of six months, otherwise the results are not valid and reliable. If a child had received therapy in the six months before the study, he or she might have taken part in activities which addressed anyone of the areas assessed through the M-FUN and thus the results would have been affected.

3.3.2.4 Sample size and timeframe

Using the sample size of (√2 * range/6=N) as a guide, approximately 35 children in each group, thus a total of 70, would have been sufficient. During April and May 2009 the researcher assessed only a total of 36 five-and six-year-old participants. Because of the required size of the sample, the data collection was repeated during April and May 2010. During April and May 2010 the researcher assessed 37 five- and six-year-old participants. This amounted to a total of 73 participants.

3.4 MEASUREMENT INSTRUMENTS USED IN DATA RECORDING

The reliability of the scores obtained from the different measurement instruments depended upon the researcher's ability to execute the assessments in the manner that they were standardised. The standardised instructions were used for English participants and translated, by the researcher, for the Afrikaans participants. (Refer to Appendix M).

The following measurement instruments were used in the study: the background information form, the visual screening, the Miller Function and Participation Scales (M-FUN) and the Minnesota Handwriting Assessment (MHA). The order in which they are described also reflects the order in which they were used.

3.4.1 Background information form

The background information form (Refer to Appendix L) could be divided into two sections. The first section related to biographical information and was used to

describe the characteristics of the sample. The biographical information collected in Section 1 is listed below.

- Name of the child.
- The child's date of birth.
- Address.
- Her or his mother tongue.
- Where did the participant stay during the day in the year before he or she started school? Possible answers to this question included: at home (with mother, father, grandparents), at a nursery school, at a playgroup or at a friend's house.
- Did your child complete a Grade R before entering into Grade 1? ('Yes' or 'No').
- Does the child have any visual problems? (This does not include wearing glasses).
- Did your child undergo a screening test before to entering Grade 1?

The second section of the background information form included four questions which addressed the exclusion criteria. The relevance of these questions requires further explanation.

Question 1 inquired about the use of medication. The use of medication usually indicates a possible underlying neurological, psychological or physiological condition. Medication can influence a child's behaviour and/or concentration.

Question 2 referred to the possibility that the specific participant was assessed or treated by an occupational therapist during the six months before the study. If this

was the case, then the participant might have been exposed to the same or similar measurement instruments. If the participant attended therapy, functions such as visual-motor integration and fine motor coordination could have been addressed in treatment, which could have skewed the results of this study.

Question 3 inquired about the possibility of the participant suffering from conditions such as attention hyperactivity disorder, cerebral palsy or depression. These conditions can co-exist with learning difficulties and/or developmental delays. The reliability of answers to this question is discussed in Chapter 5.

Question 4 inquired about the parents' perception of their child's understanding of instructions given in the medium language. This could have been Afrikaans or English, depending on the school. **Question 4** was included to avoid assessing a participant who presented with receptive language difficulties.

3.4.2 Visual screening

In the literature review the importance of the visual system in the development of handwriting was emphasised (Refer to Chapter 2 Section 2.1.6.1). When participants presented with a visual problem, he or she was referred accordingly and excluded from the sample.

The following aspects formed part of the screening of the participants' vision before starting with the standardised assessments:

- visual acuity
- suppression of one eye
- eye movements
- focus

- squinting

- accommodation

A comprehensive description of each of the abovementioned aspects was provided under Section 2.5.1 in the literature review (Chapter 2). The responses of each participant on the visual screening were recorded on a form designed by the researcher. (Refer to Appendix N).

3.4.3 Miller Function and Participation Scales (M-FUN)

The researcher has been working in the field of paediatric occupational therapy since 1992. During this time the researcher used various standardised assessment tools. Prior to using the M-FUN as part of the study the researcher familiarised herself with the M-FUN, regarding the different subtests, the scoring as well as the interpretation of results.

The participants were assessed on the visual-motor abilities subsections and the fine motor abilities subsections of the M-FUN (refer to Table 2.4). Within the visual-motor abilities part of the test there were eight different subtests. Adding up the participant's correct responses on these subtests then formed the visual motor raw score. All of these subtests were scored in accordance with the guidelines stipulated in the record form. The highest raw score that could be obtained was 95. (Refer to Appendix A, page 2 of the Record Form).

Within the fine motor abilities part of the test there were six different subtests. Adding up the participant's correct responses on these subtests then formed the fine motor raw score. All the subtests were scored in accordance to the guidelines stipulated in the record form. The highest raw score that could be obtained was 122. (Refer to Appendix A, page 2 of the Record Form)

The two sets of raw scores were then converted to scaled scores by using the tables for ages 5:0-5:11 and 6:0-6:11 in the examiner's manual. Scaled scores are

normative scores that are used to compare a child's performance to the performance of other children in the same age peer group. These scores have a mean of 10, a standard deviation (SD) of 3 and the scaled scores range from 1-19. Scores between 7 and 13 are considered the range for typical performance. Miller reports that about two-thirds of all children with typical motor performance earn scaled scores between 7 and 13 (Miller 2006:49).

3.4.4 Minnesota Handwriting Assessment (MHA)

It was expected of every participant to copy words from a near-point example. The number of letters written within the first two-and-a-half minutes determined the rate score. The examiner then scored the participant's responses with regard to legibility, form, alignment, size and spacing. The participant's responses were recorded on the MHA Record Form. (Refer to Appendix H). The participants' responses with regard to rate, legibility, form, alignment, size and spacing were rated according to whether they fell within one of the following performance categories: "performing like peers", "performing somewhat below peers" and "performing well below peers". This information was then recorded onto a spreadsheet to indicate whether there were differences regarding rate, legibility, form, spacing and size between the two age groups.

3.5 PROCEDURE

3.5.1 Data collection

The steps indicated here provide an overview of the data collection process. A detailed description of some of the steps was provided under previous headings.

- A list of schools in Tshwane North District was obtained from the Department of Education.

- Ethical approval for the study was received from the Research Ethics Committee of the Faculty of Health Sciences at the University of Pretoria.

- The 20 primary schools in the City division were invited to participate in this study. The researcher contacted the principals of the schools telephonically. This was followed by sending them a facsimile which they were requested to return and provisionally agree to form part of the study. Of the 20 schools, 17 indicated that they would agree to participate in the study.

- The researcher made an appointment with each principal to obtain the class lists of the Grade 1 learners.

- During this appointment the principals were given a consent letter which needed to be completed by the principal as well as the teachers involved.

- Random sampling as discussed in Section 3.3.2 was performed.

- The researcher delivered a set of documents, containing the consent form for the parent/caregiver and the background information form, to the participating schools. These documents were sent to the parents of the selected participants.

- The consent and background information forms were completed by every participant's primary caregiver and returned to the teacher before the assessment.

- The researcher sent confirmation letters to all the schools involved in the study. These letters provided the dates and times the researcher planned to visit the school to perform the assessment. (Refer to Appendix O). The researcher did not deviate from this schedule except when a participant was absent or the school had arranged an outing for the Grade 1 learners.

- On the day of the assessment a visual screening was done before the assessment commenced. When a participant showed signs of insufficient sight or poor visual skills, he or she was eliminated from the study. This was

communicated to the parent in a letter from the researcher and a recommendation was made to have the participant's vision tested.

- Each participant was assessed individually by the researcher in an area with no distractions. The participant was positioned on a chair at a table of the correct size and height. When the table and the chair were not the correct size, the researcher made adaptations to ensure that the sitting position was ergonomically correct. The researcher ensured that the participant's feet were flat on the floor, with 90 degree angles at the hips, knees and ankles. When doing the written work the participants were able to maintain a distance of about 30 cm from the table surface. Kramer and Hinojosa (2010:439) emphasise the fact that a good position allows the child's body and arms to be in the correct relationship to the task, so that the child can work efficiently. This ensured that the child's position did not compromise the tests results.

- The participant was then assessed by using the M-FUN as well as the MHA. The participant was provided with a rest period of ten minutes between the two tests. The M-FUN and the MHA were executed by the researcher.

- Scoring of the two standardised tests was done after completion of the assessment, according to the specific criteria of each test, and recorded onto the applicable record form.

3.5.2 Variables

The independent variable in this study was age. A group of five-year-old children and a group of six-year-old children formed the sample. The children in the groups were five years and 11 months and six years and 11 months respectively at the time of data collection.

The dependent variable in this study was readiness for acquiring handwriting skills. Some extraneous variables were identified which could be associated with the dependent variable. According to Polit and Hungler (1993:152) extraneous

variables can be divided into two groups. Firstly, external factors which originate from the research situation. Secondly, factors which influence the characteristics of the research subjects. (Refer to Table 3.2 which indicates how the extraneous variables were controlled).

Table 3.2: Measures of control for variables

Extraneous variables	
External factors	Control
Teaching methods of the teachers	All of the schools selected for the study were government schools which imply that the curriculums used at the schools were similar. This study was done during the first part of the year when formal handwriting had not yet been established. The effect of teaching methods was therefore reduced as a significant external factor.
Surroundings and conditions	The participants were individually tested at the schools in areas with sufficient light. The areas could all be closed off by a door to eliminate disturbances. At 14 of the 15 schools the researcher had to make adaptations to the participants' positioning to ensure ergonomically correct sitting positions. (Refer to Section 3.5.1).
External factors	Control
Time	The researcher conducted the study from 15 April 2009 to 30 May 2009 and 15 April 2010 to 18 May 2010. This was at the beginning of the second quarter. By this time the participants would have only been exposed to handwriting in the form of writing patterns and the beginning of letter formation. All the participants were assessed during the morning, from 8h00 to 12h30. This agreed with the participants' ability to concentrate

	and their routine at school. The second round of data collection in 2010 was done because of an insufficient number of participants in 2009. During both the periods of data collection the number of participants were similar (refer to Table 4.1). The area in which the data collection took place remained the same. The curriculum used in the schools namely the RNCS did not change from 2009 to 2010.
Communication	Instructions were available in English and Afrikaans, depending on the language medium at the school. If the participant had difficulty to follow instructions, he or she was excluded from the study. There were two cases where teachers indicated prior to participants being assessed, that those particular participants struggled with receptive and expressive language. These participants were excluded from the study. A set of the translated instructions has been provided (refer to Appendix M) for similar studies in the future.
Measures of control for subject characteristics	
Method	Application
Randomisation	There were two groups of participants included in the study namely five- and six-year-old participants. The five-year-old participants were identified first. Through random sampling the researcher selected a matching number of participants from the six-year-old group.
Method	Application
Homogeneity	The following characteristics did not vary

	between the different groups: • The use of medication. Children who were taking stimulants, for example Ritalin and Wellbutrin, or non-stimulants, for example Stratera or Tofranil, were excluded from the study. • Receiving occupational therapy. Children that had been assessed by an occupational therapist within the previous six months and/or children who were at the time of the study in an occupational therapy programme were excluded from the study. • Neurological/Neuropsychological conditions. Children that were known to have been diagnosed with conditions such as ADHD, cerebral palsy or depression were excluded from the study. • Vision: the researcher used a screening test to detect visual problems. Children who exhibited problems during this screening were excluded from the study and referred to an optometrist.
Matching	The researcher matched the two groups regarding age. The researcher did not match the two age groups regarding gender and their attendance of a Grade R in the year before they started Grade 1.
Bias	The researcher made use of two external raters who inspected the scores of the completed assessments. They each received
Method	Application

	the assessments of eight participants, four from the group of five-year-old participants and four from the group of six-year-old participants. The external raters are two qualified occupational therapists with more than five years' experience each. This contributed to the reliability of the study.

3.6 DATA ANALYSIS

Descriptive statistics were used to provide a description and summary of the data collected. The information collected from the background information form and the visual screening was classified into categories by using nominal measurement. This information was therefore represented by numbers and percentages in table format.

Given the relatively small sample size and scores, the nonparametric Mann Whitney Test was used to compare the continuous data between the five-year-old and six-year-old groups. This included data from the M-FUN as well as the MHA. In both age groups the participants obtained scaled scores. A bar chart was used to indicate the differences in the distribution of scaled scores between the two age groups. As the data from the MHA could also be analysed through nominal measurement, it was represented in table format using numbers and percentages.

To determine whether there was a correlation between the data from the M-FUN and the data from the MHA, the Spearman's rho (correlation coefficient) was used. The level of significance was set at 0.05. Through this the researcher attempted to control the risk of making a Type I error.

Table 3.3: Level of measurement for measurement instruments

Measurement instrument	**Level of measurement**
Background information form	Nominal measurement
Visual screening	Nominal measurement
M-FUN	Ordinal measurement

MHA	Nominal measurement Ordinal measurement

3.7 ETHICAL CONSIDERATIONS

In the research process the researcher had a responsibility towards the research participants, the University of Pretoria and her profession. This implied that the researcher acknowledged those who guided and assisted in the process, made the results known accurately and honestly managed the resources.

The researcher commenced with the execution of this study after permission had been granted by the Department of Education of Gauteng (refer to Appendix P)and she had received ethical clearance from the Research Ethics Committee of the Faculty of Health Sciences at the University of Pretoria. (Refer to Appendix Q). Permission to conduct this study was also granted by:

- the Postgraduate Research Committee, School of Healthcare Sciences, University of Pretoria

- the Academic Advisory Committee of the University of Pretoria

The researcher took the following fundamental ethical considerations into account when executing the study.

3.7.1 Respect for persons

All the participants had the right to self-determination. The principal of each school had the right to decide whether or not the school should take part in the study or to terminate his or her school's participation at any stage. The parent/caregiver of every participant had the right to decide, on behalf of his or her child or the child in his or her care, to decline or accept participation. As the participants were not seven years old yet, they were not expected to complete an assent form. This was confirmed by the Ethics Committee. The parent/caregiver of every participant also

had the right to keep information from the researcher. The principal of each school was required to agree to participation of all the school's Grade 1 learners. (Refer to Appendix J).

The parent/caregiver was required to give consent on behalf of his or her child or alternatively the child that was in his or her care, to participate in the study. (Refer to Appendix K). This consent entailed that personal information could be processed into an article or report and that the parent/caregiver was given enough time to respond with questions. The parents/caregiver also acknowledged that he or she could withdraw the child participant from the study at any time as well as the researcher's right to exclude the participant from the study on account of the exclusion criteria. The consent letter also informed the parents/caregiver that no results would be made available to the school and the child participant's personal details would be kept confidential at all times.

3.7.2 Principle of beneficence

The participants had the right to be protected from discomfort or harm. The assessments did not include aspects through which the participants could be harmed. The researcher introduced herself to each participant before the assessment commenced and confirmed whether the parent/caregiver had informed the participant of the researcher's visit. The researcher also initiated conversation with the participant by enquiring about her or his family and how they were experiencing Grade 1. To make the participant feel at ease, the researcher explained exactly what the assessments entailed. All the activities included in the assessments were typical activities for five- and six-year-old children. The researcher gave appropriate and realistic feedback throughout the assessment.

None of the participants indicated that they were not willing to participate in the required tasks. The researcher completed a short letter addressed to the parent/caregiver at the end of each session. In this letter the researcher indicated whether the participant was able to overall meet the expectations set in the assessment or not. A recommendation was made regarding an assessment by an

optometrist if deficits were observed during the visual screening. The researcher's contact number was provided in case parent/caregiver would have the need for feedback on the results of the child participant's assessment.

3.7.3 Principle of justice

All the participants had the right to fair selection. This was done by including all the primary schools in the City division of the Tshwane North District in the sample. The researcher committed to arrangements made with the principals, parents/caregivers and the participants regarding dates and times of the assessments. After the researcher had received the consent forms from the schools, she provided the principal with a confirmation letter providing information on the date and the time at which a specific participant would be assessed. (Refer to Appendix O). The researcher did not deviate from this schedule except when a child was absent or the school had arranged an outing for the Grade 1 learners.

The participants had the right to privacy. The researcher made no information regarding the results of a specific participant known to the school. No reference to the specific school or participant was made in the discussion of the results of the study or will be made in a future research report and/or article. The parent/caregiver retained the right to contact the researcher in order to arrange an interview where the results of their child's assessment would have been made available to them. In the case of external raters, the names of the participants and the schools were kept confidential by giving a code to each child. All the assessments will be kept at the Occupational Therapy Department of the University of Pretoria for a period of 15 years.

3.8 CONCLUSION

In Chapter 3 the research aim and objectives were provided. The research design, method and ethical considerations were discussed.

A non-experimental approach was followed with a comparative and descriptive design. Two age groups, namely five- and six-year-old participants were compared. The sample was selected according to inclusion and exclusion criteria. A sample of convenience was used as all the schools were easily accessible and either Afrikaans or English were used as the medium languages. The sample consisted of 73 participants. A visual screening was done before to the M-FUN as well as the MHA was done. Additional background information was gained by using a background information form.

The researcher collected all the data by assessing each child individually. The process took place during April and May 2009 and April and May 2010.

All the data were transferred onto spreadsheets to allow for data analysis. Chapter 4 addresses the specific results obtained through the data analysis.

CHAPTER 4
RESULTS AND FINDINGS

4.1 INTRODUCTION

In Chapter 4 the results of the study are presented and discussed. In Section 4.2 a layout of the composition of the sample is presented and in Sections 4.2.1 - 4.2.3 specific information about the number and age of participants, their gender, culture and language are given. Information related to how the participants were divided among the primary school, their attendance of Grade R and the results of the visual screening are given in Sections 4.2.4 – 4.2.6.

The results pertaining to **Objective 1** are addressed in Section 4.3.1, namely the data pertaining to the level of performance between the five-year-old group and the six-year-old group.

Section 4.3.1 deals with the results from **Objective 1** and deals with the level of performance in visual-motor integration (VMI), fine motor coordination (FMC) and handwriting skills of the two age groups were determined.

In Section 4.3.2 the results from **Objective 2** are provided. These results pertain to the comparison of the level of performance in VMI, FMC and handwriting skills between the two groups.

In Section 4.4.1 the results form **Objective 3** are presented. Section 4.6 addresses the data indicating a possible correlation between VMI and acquiring handwriting and FMC and acquiring handwriting. This correlation was done with both age groups. The relationship between the six categories of the MHA and the VMI scaled score in the five-year-old and the six-year-old groups is discussed.

Section 4.4.2 is a presentation of the results from **Objective 4.** The relationship between the six categories of the MHA and the FMC scaled score in the five-year-old group and the six-year-old group is presented.

4.2 COMPOSITION OF SAMPLE

Clear differences were identified between the five-year-old and the six-year-old groups. The biographical factors which impacted on these differences are outlined and discussed in Section 4.2.1.

4.2.1 Number and age of participants

In South Africa parents can enroll their child in Grade 1 at the age of five, provided that he or she turns six by 30 June of year of enrollment (refer to Section 1.2). The researcher therefore assessed children who had their birthdays during the months of May and June; thus, before the abovementioned cut-off date.

Because the data collection was done during 2009 and 2010 four groups of participants were involved in the study. The original number of participants selected from the class lists in 2009 and 2010 were 116. The number of 28 five-year-old participants in 2009 was matched with the same number (28) of six-year-old participants. The number of 30 five-year-old participants in 2009 was matched with the same number (30) of six-year-old participants in 2010.

The effect of the factors presented in Table 4.1 lead to a final sample that consisted of a total of 73 (N=73) participants. The sample of 37 (n=37) five-year-old participants included a group of 18 participants from 2009 and 19 participants from 2010. The sample of 36 (n=36) six-year-old participants included a group of 18 participants from 2009 and 18 participants from 2010.

Figure 4.1 is a visual representation of the four groups from 2009 and 2010 included in the sample of 73 (N=73).

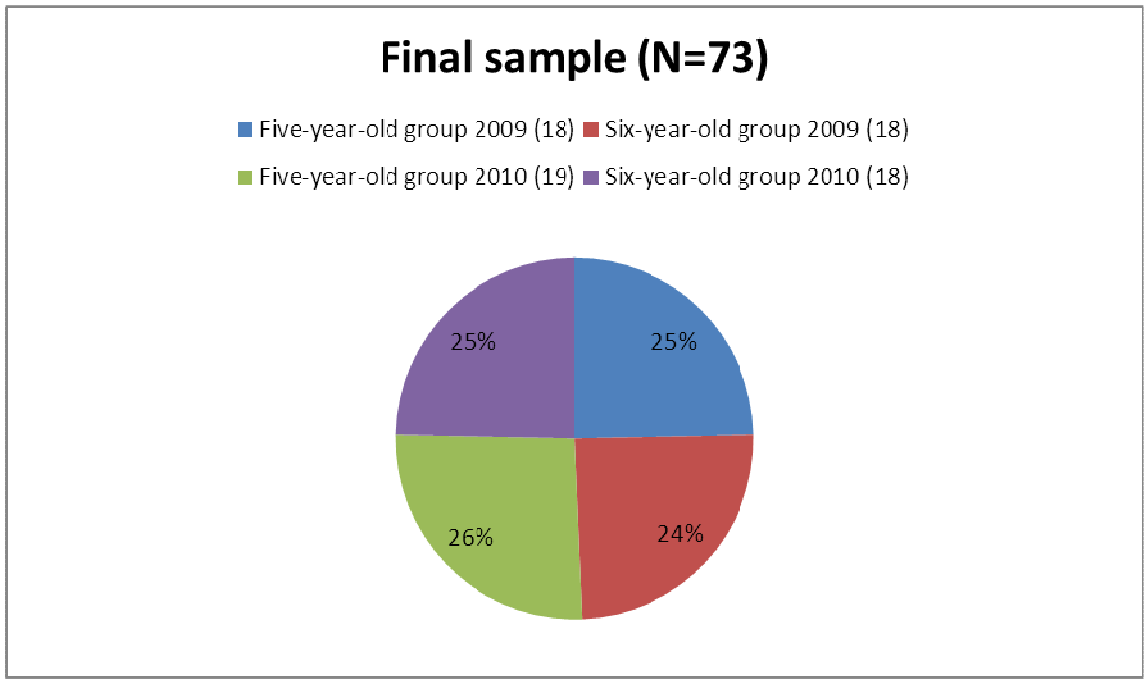

Figure 4.1: Distribution of five- and six-year-old participants in final sample (N=73)

The composition of the sample and the size of the sample were influenced by a number of factors. The different factors are visually presented in Table 4.1 below.

The factors which influenced the sample size were as follows:

- consent forms not returned
- consent from parents withheld
- forms returned but incomplete
- exclusion on account of the visual screening
- children who had been assessed by an occupational therapist during the six months before the study was conducted or who were in a therapy programme at the time of the assessment

- enrolled in Grade 1 but then kept back in the Grade R class

- exclusion because of poor understanding of medium language.

Table 4.1: Composition of sample

	A	B	C	D	E	F	G	H	I	J
2009 5 -year- olds	28	7	1						2	
Sub-total										18
6-year-olds	205 (28)	6	2	1	1					
Sub- total										18
2010 5-year-olds	30	6			4	1				
Sub-total										19
6-year-olds	247 (30)	7			2		2	1		
Sub-total										18
Total	510 (116)	26	3	1	7	1	2	1	2	73

Please note:

- A = number of children selected from class lists and through random sampling.
- B = Number of children's forms not returned.
- C = consent from parents withheld.
- D = excluded after visual screening.
- E = assessed by an occupational therapist during the past 6 months/presently in an occupational therapy programme.
- F = kept back in Grade R.

- G = absent on the day of evaluation.
- H = forms returned but not completed.
- I = excluded because of poor understanding of the medium language.
- J = subtotals and total of final sample.

The symmetry between the numbers of the five-year-old group and the numbers of the six-year-old group indicated a strong possibility for comparing the data of the two age groups.

4.2.2 Gender

The researcher did not pair the five-year-old group of participants with the six-year-old group of participants regarding gender. Even though there was no matching regarding gender, the number of female and male participants in the final sample was similar. Figure 4.2 is a visual representation of the gender distribution in the final sample.

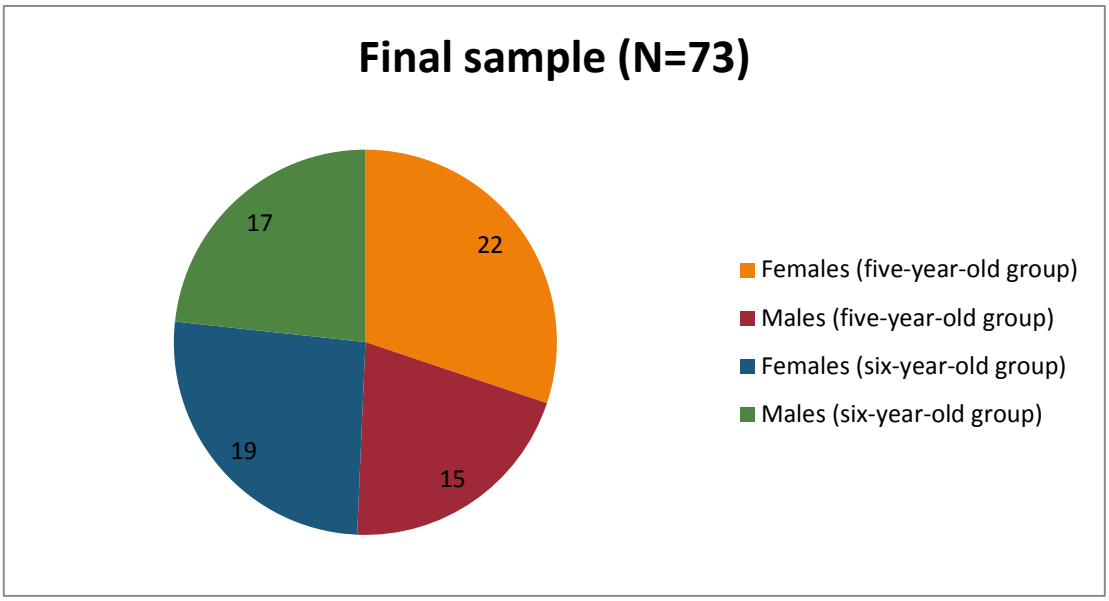

Figure 4.2: Distribution of gender in the sample of 73 participants (N=73)

Table 4.2 provides a distribution of gender in the two age groups. This distribution is discussed in Chapter 5.

Table 4.2: Frequency distribution of gender in the sample of 73 participants (N=73)

Gender	Five-year-old participants	Six-year-old participants	Total
Female	22 (59.46%)	19 (52.78%)	41 (56.16%)
Male	15 (40.54%)	17 (47.22%)	32 (43.84%)
Total	37	36	73

4.2.3 Culture and language

The sample included white, black and coloured children. Table 4.3 indicates the numbers and percentages in which these three groups were represented in the sample.

Table 4.3: Frequency distribution of culture

Culture	Five-year-old participants	Six-year-old participants	Total
1) Black	**34 (91.89%)**	7 (19.44%)	41 (56.16%)
2) Coloured	0 (0.00%)	3 (8.33%)	3 (4.11%)
3) White	3 (8.11%)	**26 (72.22%)**	29 (39.73%)
Total	37	36	73

The majority of children in the five-year-old group were black participants (91.89%) as compared to the majority in the six-year-old group who were white (72.22%). Because of the high percentage of black five-year-old participants they also formed 56.16% of the total sample. There was thus a significant difference of p=0.00

between the two age groups regarding culture. Refer to Figure 4.3 for a visual representation of the distribution of culture between the two age groups.

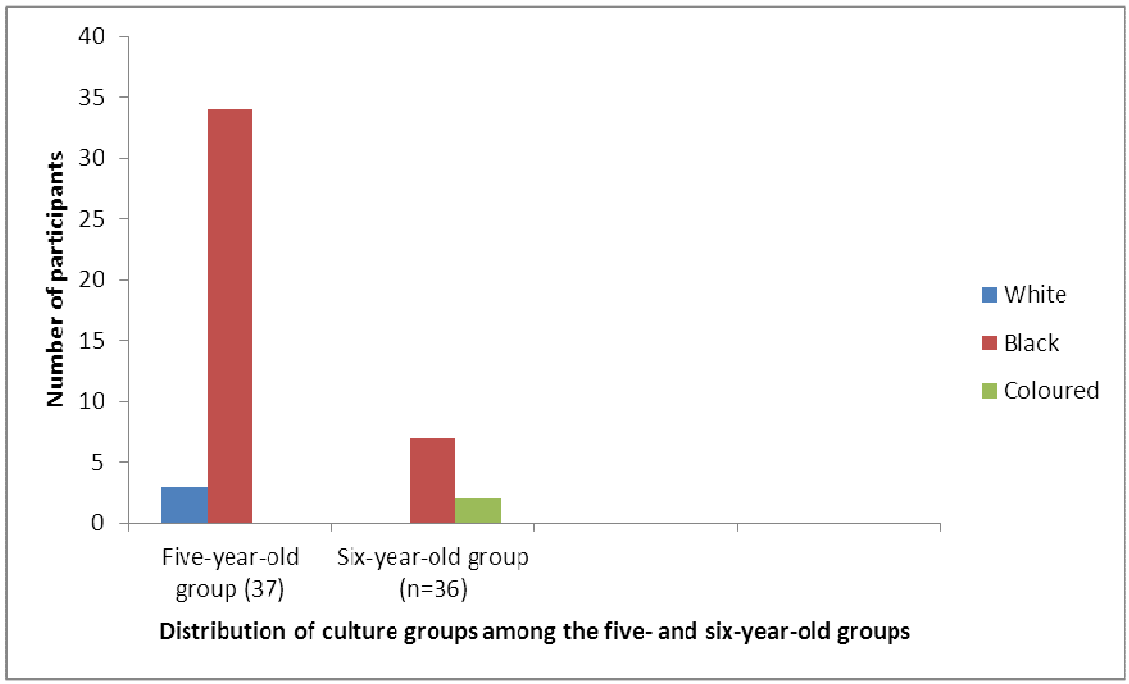

Figure 4.3: Distribution of culture groups amongst the five- and six-year-old groups

In the background information form the parents were asked to indicate their child's mother tongue language. Figure 4.4 indicates the variation of mother tongue languages among the participants.

From the numbers in Figure 4.4 it is evident that in the five-year-old group Tswana was the most spoken mother tongue language (29.73%). In the six-year-old group Afrikaans was spoken by the majority (75%).

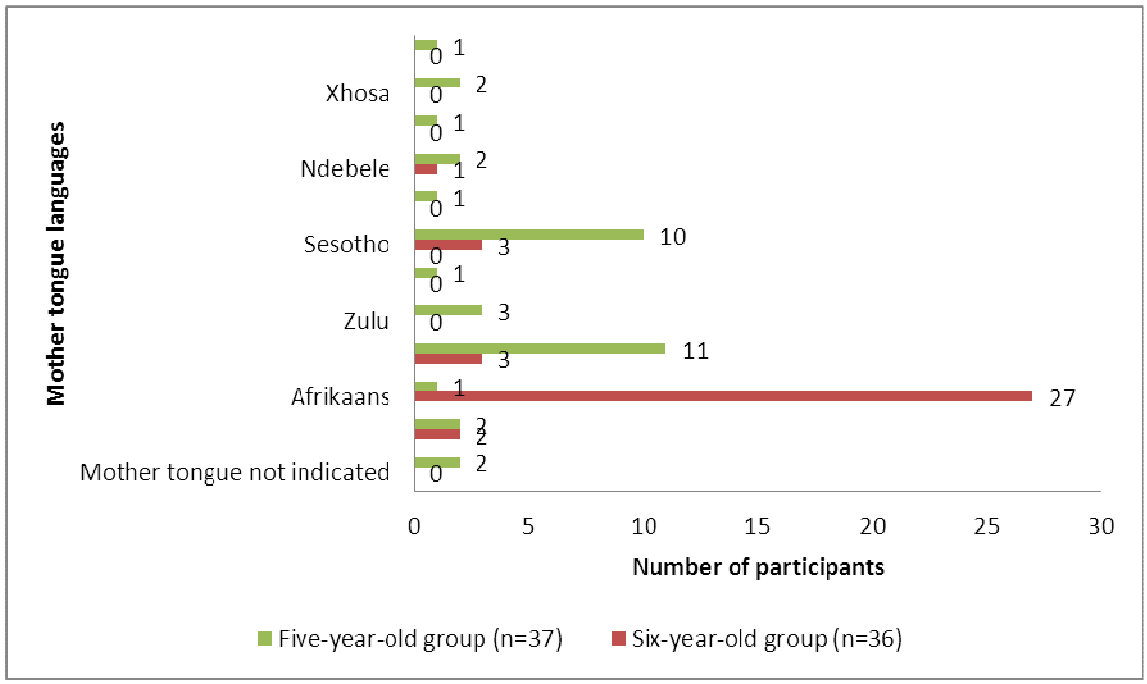

Figure 4.4: Distribution of the representation of the mother tongue languages (N=73)

The abovementioned statistics is related to the cultural division as shown in Table 4.3. There was a statistical significant difference of p=0.00 between the two age groups regarding their mother tongue language. Culture and language are further discussed in Chapter 5.

4.2.4 Primary schools

The sampling frame included Afrikaans and English schools. The traditionally Afrikaans schools made English classes available as an option to parents. The researcher found more five-year-old children at Afrikaans schools who were enrolled for education in English. Table 4.5 provides the distribution of children among the 15 participating primary schools.

Table 4.4 lists the 15 primary schools from which the participants were selected. It is clear that the highest number of five-year-old participants (n=34) came from schools 2, 6 and 14 where English was the language medium in the classroom. All three of these schools were traditionally Afrikaans schools but English classes were formed to accommodate English learners.

Table 4.4: Frequency distribution of participants among the 15 participating schools

Medium language and primary school	Five-year-old participants	Six-year-old Participants
Afrikaans and English (Schools 1, 2, 6, 13, and 14)	34	10
Afrikaans (Schools 3, 4, 5, 7, 8, 10, 11 and 12)	0	25
English (Schools 9 and 15)	3	1
Total	37	36

The highest number of six-year-old children came from Afrikaans primary schools (schools 3, 4, 5, 7, 8, 10, 11 and 12). (Refer to Figure 4.5 for a visual representation of the distribution of participants in schools according to the medium language). The distribution of languages was similar between the 2009 and 2010 participants.

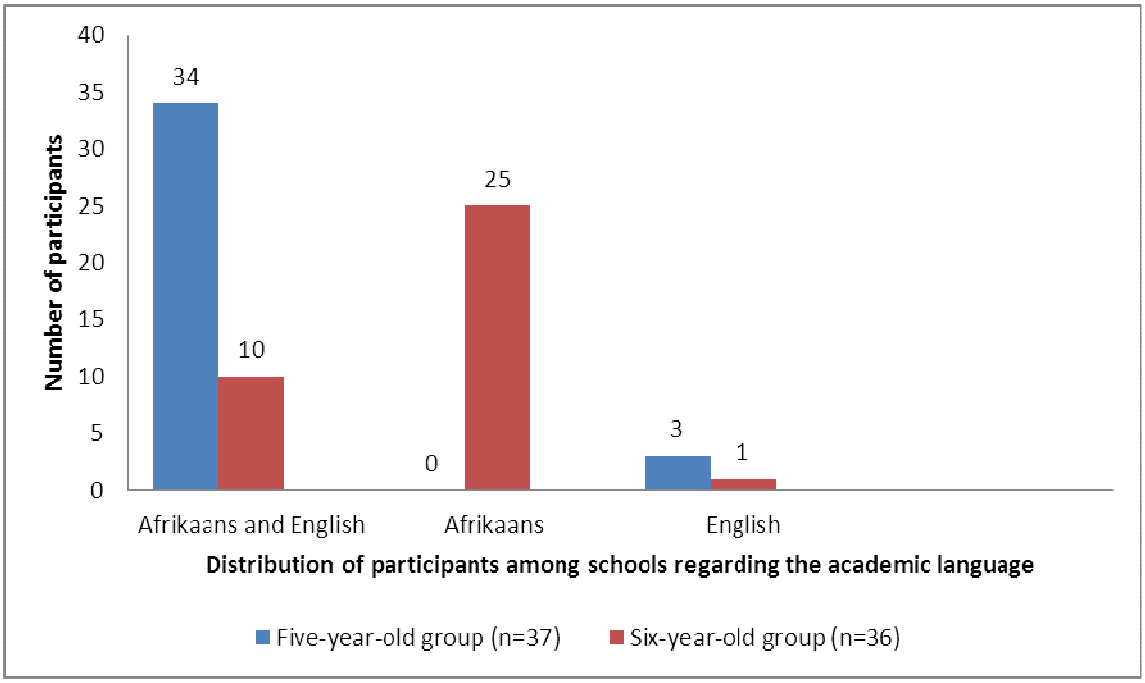

Figure 4.5: Number of participants (N=73) distributed among the three groups of schools according to medium language

4.2.5 Pre-school year/Grade R

One of the questions asked in the background information form was whether or not the participant had attended a Grade R class before being enrolled in Grade 1 as this could shed light on the participant's level of academic readiness. (Refer to Table 4.5).

Table 4.5: Frequency distribution of children's attendance of Grade R

Grade R	Five-year-old participants	Six-year-old participants	Total
No information	3 (8.11%)	1 (2.78%)	4 (5.48%)
Yes	28 (75.68%)	34 (94.44%)	62 (84.93%)
No	6 (16.22%)	1 (2.78%)	7 (9.59%)
Total	37	36	73

Table 4.5 indicates that 84.93% of the total sample attended a Grade R before entering Grade 1. With 94.44% of the six-year-old group and 75.68% of the five-year-old group attending Grade R, there was no significant difference (p=0.080) between the two age groups.

4.2.6 Visual screening

The researcher completed a visual screening with every participant before using the standardised measurement tools. As described in Chapter 2 Section 2.1.6.1 the screening included:

- the 3 dot lustre test
- visual acuity

- accommodation

- the unilateral cover test

- eye movements.

As described in Chapter 3 (refer to Section 3.4.2) participants were excluded from the study when they presented with one or more of the following: the 3 dot lustre test, visual acuity and the unilateral cover test. These deficits could result in the participant not getting an accurate visual image to work from. Participants who were able to successfully complete these three subtests, but presented with insufficient eye movements, were allowed to participate in the study, but referred to an optometrist. Refer to Figure 4.6 for the exact number of referrals to an optometrist.

In the five-year-old group nine participants were referred and from the six-year-old group seven participants were referred. These participants were all referred on account of deficits identified during the eye movement subtest.

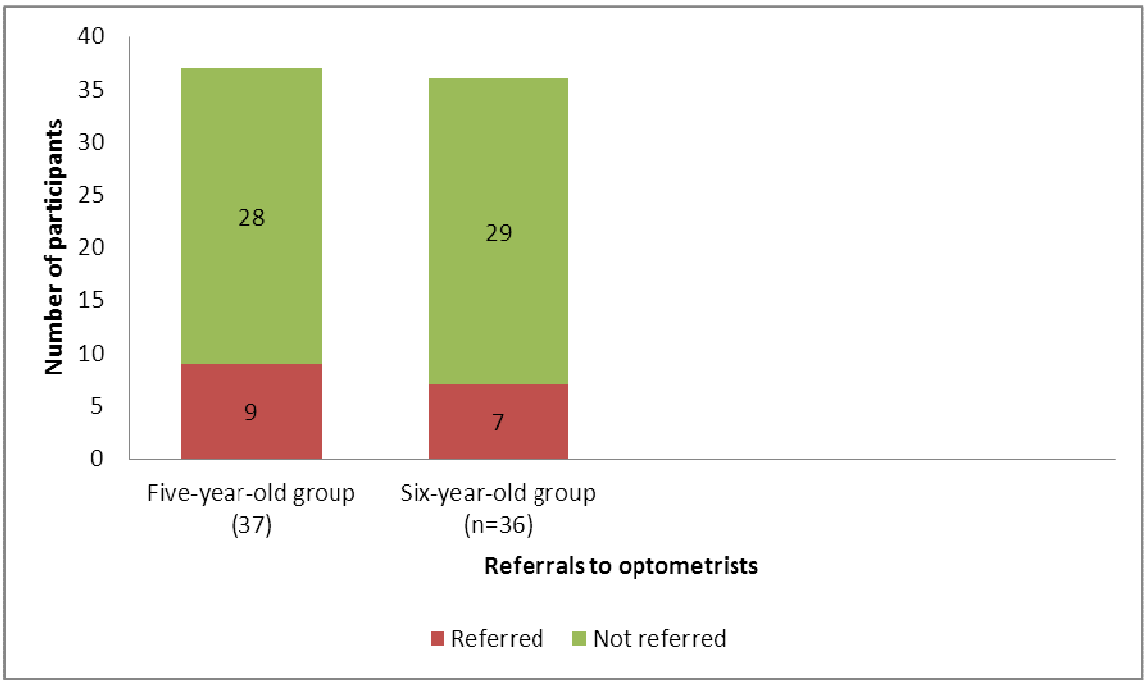

Figure 4.6: Number of referrals to optometrists

4.3 DATA REGARDING LEVEL OF PERFORMANCE

The researcher wanted to establish whether a difference in readiness to acquire handwriting existed between five-and six-year-old children in Grade 1. Before this difference could be established, the researcher examined the two age groups with regard to four objectives. (Refer to Chapter 3 Section 3.2.) The data from each of these objectives are presented below.

4.3.1 Results related to Objective 1

The first objective was *to determine the level of development of visual-motor integration, fine motor coordination and handwriting skills in groups of five- and six-year-old children on standardised tests.*

The researcher could only compare the data between the two different age groups once she had established whether the participants adhered to developmental norms as determined by the standardised measurement tools. To do this the researcher analysed the participants' performance with VMI and FMC on the M-FUN as well as their performance on the MHA as illustrated in Table 4.6.

Table 4.6: Level of development of VMI and FMC in the five- and six-year-old groups on the M-FUN

M-FUN Scaled scores	Five-year-old group (n=37) Median	Six-year-old group (n=36) Median	p-value
VMI	9 (7-10)	10 (9-11)	0.0049
FMC	8 (7-9)	8 (7.5-9.5)	0.1899

Table 4.6 provides the median of the scaled scores for VMI and FMC in both the age groups. In the M-FUN all the raw scores were converted to scaled scores. These scaled scores had a mean of 10 and a standard deviation of 3. The scaled scores ranged from 1-19 (Miller 2006:49). When a participant therefore presented with a scaled score between 7-13, it was considered to be within the norm.

4.3.1.1 Visual-motor integration (VMI)

The two age groups received a scaled score median of 9 and 10 respectively for VMI. Although the scaled score of the six-year-old group was one point higher than the 9 of the five-year-old group, both groups fell within the range of 7-13 which is considered to be the norm. The five-year-old group's range (7-10) was slightly wider than that of the six-year-old group (9-11). Although both ranges were still within the norm, the spread of the scaled scores were different as reflected in Figure 4.7.

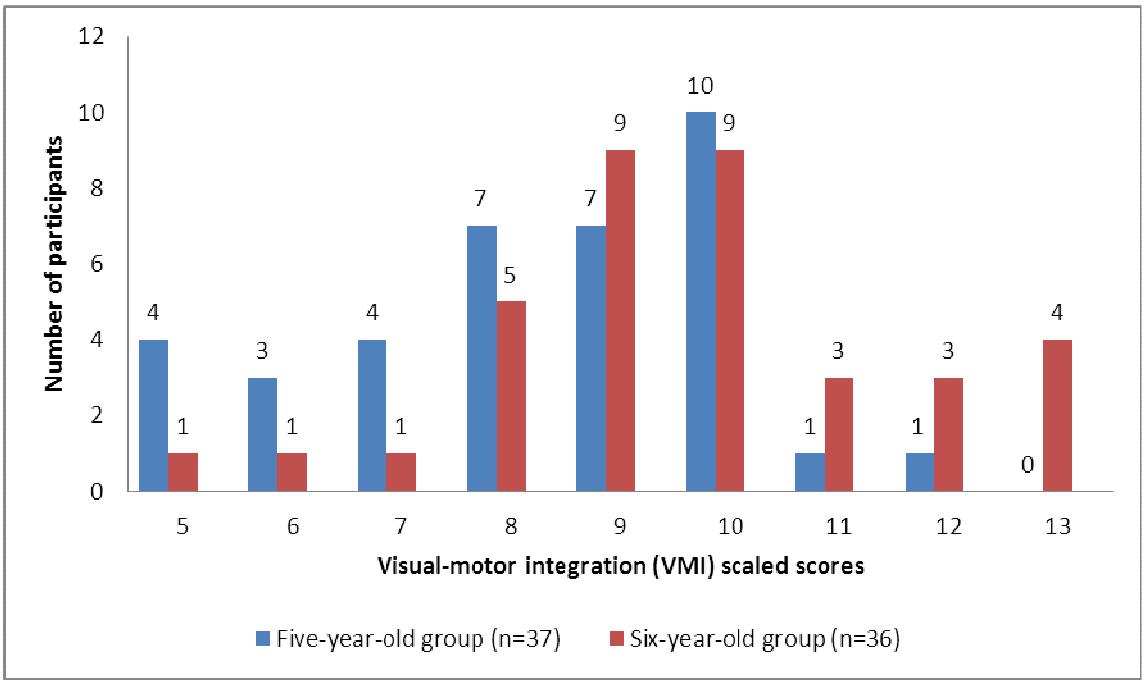

Figure 4.7: Clustered bar chart of the distribution of the VMI scaled scores in the two age groups

As shown in Figure 4.7, the differences in the spread of the scaled scores between the two groups were as follows:

- the five-year-old group was strongly represented in the range of five-10
- the six-year-old group was strongly represented in the range of eight-13

- seven five-year-old participants obtained a scaled score of five or six which is considered below average

- two six-year-old participants obtained a scaled score of five and six which is considered below average.

4.3.1.2 Fine motor coordination (FMC)

Both age groups received a scaled score median of eight in the FMC subtests. The groups fell within the ranges of seven to nine and 7.5 to 9.5 respectively which is

considered to be the norm. Refer to Figure 4.8 which indicates the spread of the scaled scores for FMC.

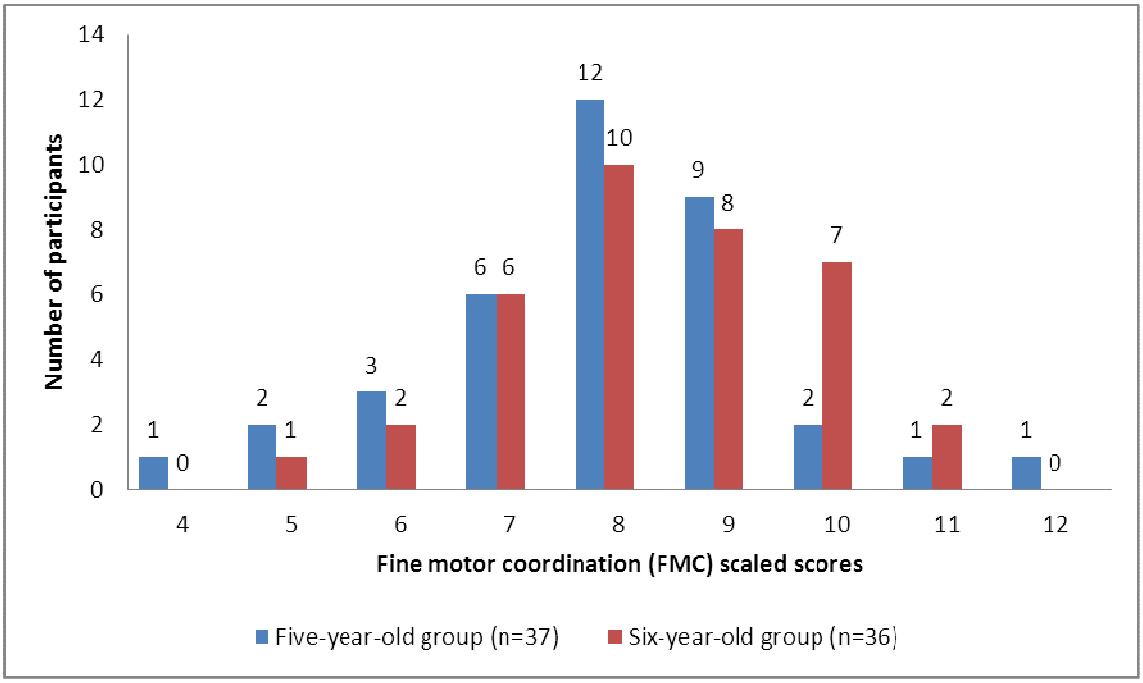

Figure 4.8: Clustered bar chart of the distribution of the FMC scaled scores in the two age groups

The following was observed in Figure 4.8:

- The five-year-old group was strongly represented in the range of six-nine.
- The six-year-old group was strongly represented in the range of seven-10.
- Six five-year-old children obtained a scaled score from four-six which was considered below average.
- Three six-year-old children obtained a scaled score five and six which was considered below average.
- The graph in indicates a more even distribution of scaled scores between the two age groups.

4.3.1.3 Handwriting skills

According to the score that they achieved, each participant was placed on one of three levels for example “performing like peers”; “performing somewhat below peers” and “performing well below peers”. It is important to note that occupational therapists usually work with standardised assessments where a child can obtain a score equal to below average, average and above average. Two of the levels in the MHA, namely “performing somewhat below peers” and “performing well below peers” indicate handwriting performance below average. The other level indicates handwriting performance equal to average (“performing like peers”). The MHA therefore does not allow for handwriting performance above average.

The results of the performance of the five-year-old group and the six-year-old group in the six categories of the MHA follow. Refer to Figure 4.9 and Figure 4.10 for the charts on the development of hand skills in the five-year- and the six-year-old groups respectively.

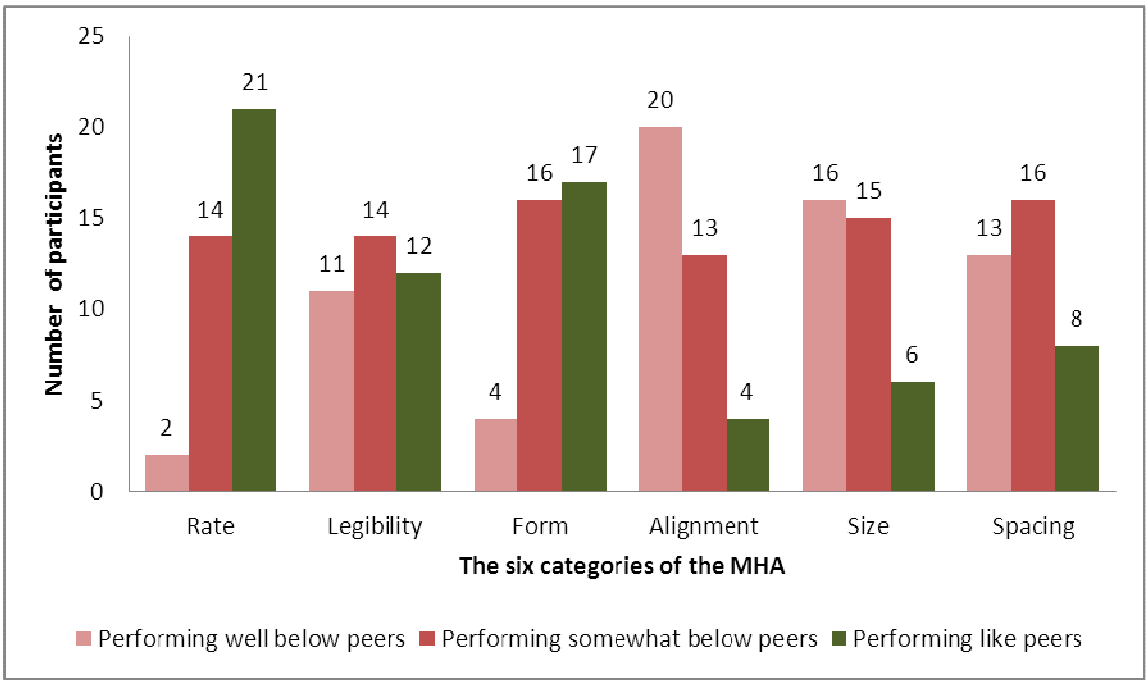

Figure 4.9: Chart on the development of hand skills in the five-year-old group (n=37) on the categories for rate, legibility, alignment, size and spacing in the MHA

a) Rate

In the rate category in the **five-year-old group** (n=2 [5.41%]) participants performed well below their peers. This was followed by (n=14 [37.84%]) participants performing somewhat below peers. The largest number of participants performed like their peers (n=21 [56.76%]).

In the **six-year-old group** there were no participants in the rate category who performed well below their peers. Nine (n=9 [25.00%]) participants performed somewhat below their peer group with the highest number (n=27 [75.00%]) performed like their peers.

b) Legibility

In the legibility category 11 (n=11 [29.73%]) participants in the **five-year-old group** performed well below their peer group. This was followed by 14 (n=14 [37.84%])

participants performing somewhat below their peers and, lastly, 12 participants (n=12 [32.43%]) performed like their peers.

In the legibility category in the **six-year-old group** three (n=3 [8.33%]) participants performed well below peers; six (n=6 [16.67%]) performed somewhat below the peer group. The majority of participants (n=27 [75%] performed like their peers.

c) Form

In the form category four (5.48%) participants in the **five-year-old group** performed well below peers. This was followed by 16 (n=16 [43.24%]) who performed somewhat below their peers with 17 (n=17 [45.95%]) performed like their peers.

In the **six-year-old group** there were no participants in the form category who performed well below peers but seven (n=7 [19.44%]) of the participants performed somewhat below peers. Twenty-nine (n=29 [80.56%]) constituted the highest number and they performed like their peers.

d) Alignment

In the alignment category, in the **five-year-old group**, the largest number of participants performed well below their peers (n=20 [54.05%]). This was followed by 13 (n=13 [35.14%]) participants performing somewhat below peers and lastly four (n=4 [10.81%]) participants performing like peers.

In the alignment category, in the **six-year-old group**, nine participants (n=9 [25.00%]) performed well below their peers. This was followed by 12 (n=12 [33.33%]) participants performing somewhat below peers with 15 (n=15 [41.67%]) participants performing like peers.

e) Size

In the size category of the **five-year-old group** 16 (n=16 [43.24%]) of the participants performed well below their peer group. This was followed by 15 participants (n=15 [40.54%] who performed only somewhat below their peers. Lastly, six (n=6 [16.22%]) participants' performance was similar to that of their peers.

In the size category in the **six-year-old group** six (n=6 [16.67%]) participants performed well below peers; 13 (n=13 [36.11%]) performed somewhat below their peer group and 17 (n=17 [47.22%]) participants performed like peers.

f) Spacing

In the spacing category 13 (n=13 [35.14]) participants in the **five-year-old group** performed well below peers. This was followed by 16 (n=16 [43.24%]) participants performing somewhat below peers. Eight participants (n=8 [21.62%]) performed like their peers.

Also in the spacing category in the **six-year-old group**, three (n=3 [8,33%]) performed well below peers while nine participants' (n=9 [25.00%]) performance was somewhat below that of their peer group. The majority, namely 24 (n=24 [66.675]) performed like their peers.

Refer to Figure 4.10 for the development of hand skills in the six-year-old group on the six categories of the MHA.

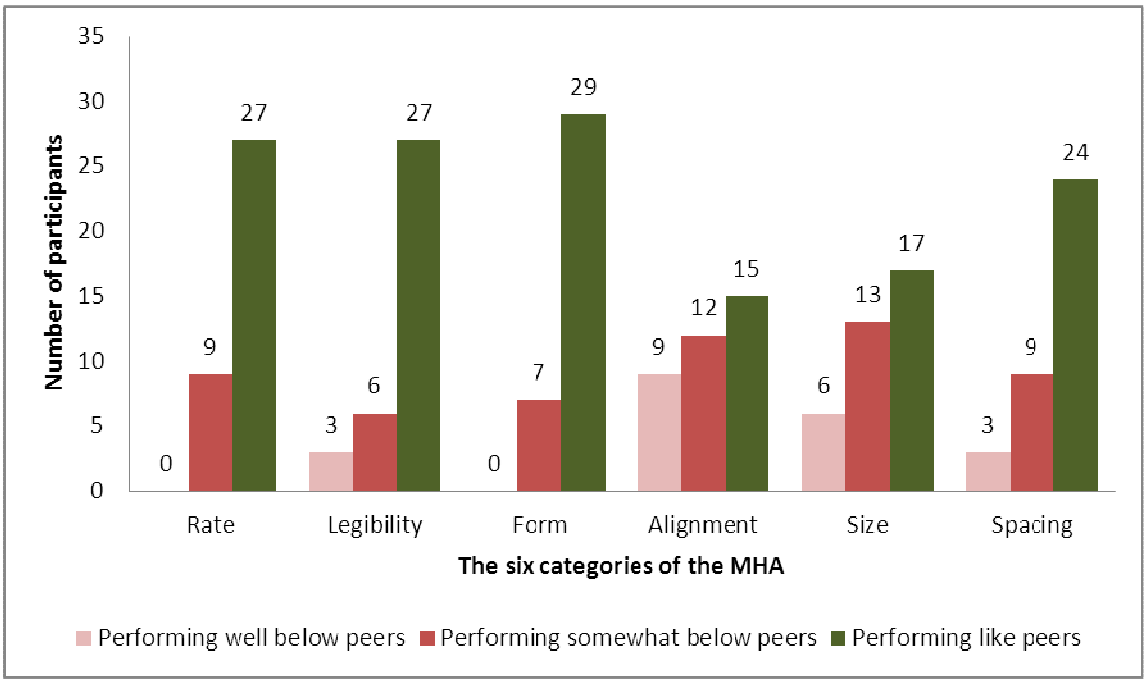

Figure 4.10: Chart on the development of hand skills in the six-year-old group (N=36) on the categories for rate, legibility, alignment, size and spacing in the MHA

4.3.1.4 Summary

The five-year-old group performed well in the categories of rate and form. In each of the other categories, namely legibility, alignment, size and spacing it was found that there was a higher number of participants in the "performing somewhat below peers" and "performing well below peers" than in the "performing like peers" range. In contrast to the five-year-old group, the six-year-old group did well in all the six categories as presented by the number of participants in the "performing like peers" range.

4.3.2 Results related to Objective 2

The second objective was *to compare the level of development of visual-motor integration, fine motor coordination and handwriting skills in groups of five- and six-year-old children on standardised tests.*

Objective 1 provided the researcher with levels of development regarding visual-motor integration, fine motor coordination and handwriting skills between the two age groups. Through **Objective 2** the researcher compared the levels of development in order to determine whether it influenced the two groups' readiness to acquire handwriting skills.

4.3.2.1 Visual-motor integration (VMI)

There was a statistically meaningful difference ($p=0.0049$), when working on a significance level of $p<0.05$, between the scaled scores obtained by the five- and six-year-old groups. Although both groups functioned within the norm regarding VMI, the six-year-old group was positioned well with regard to their level of readiness with VMI.

4.3.2.2 Fine motor coordination (FMC)

There was not a meaningful difference ($p=0.1899$), when working on a significance level of $p<0.05$, when comparing the scaled score of the five-year-old group was compared with the scaled score of the six-year-old group. This indicated that their level of readiness related to FMC is similar.

4.3.2.3 Handwriting skills

Objective 1 also provided the researcher with information regarding the level of development of handwriting skills between the five-year-old group and the six-year-old group.

The levels of development were firstly compared by referring to the performance of the two age groups on the three levels of the MHA.

a) "Performing well below peers" level

In comparison to the six-year-old group, the five-year-old group had a higher number of participants on the "performing well below peers" level in the six categories of the MHA. Refer to Figure 4.11 for a representation of the performance of the two age groups on the "performing well below peers" level.

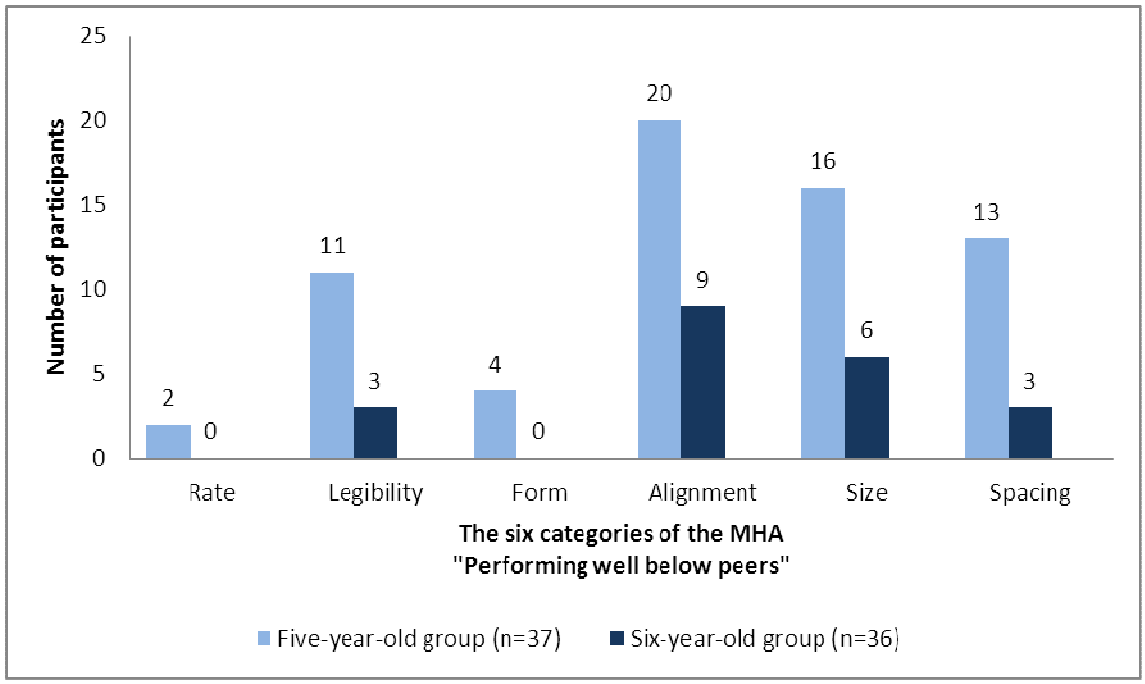

Figure 4.11: Comparison of five- and six-year-old participants who presented with scores on the "performing well below peers" level

b) "Performing somewhat below peers" level

The six-year-old group had a number of children in all six categories on the level of "performing somewhat below peers". Despite this representation, there were a higher number of participants from the five-year-old group in all six categories. Refer to Figure 4.12 for a representation of the two age groups on the performing somewhat below peers level.

c) "Performing like peers" level

The level of "performing like peers" was the only level of the MHA on which the six-year-old group had a higher number of participants in all six categories when compared to the five-year-old group. Refer to Figure 4.13 for a representation of the performance of the two groups on the 'performing like peers' level.

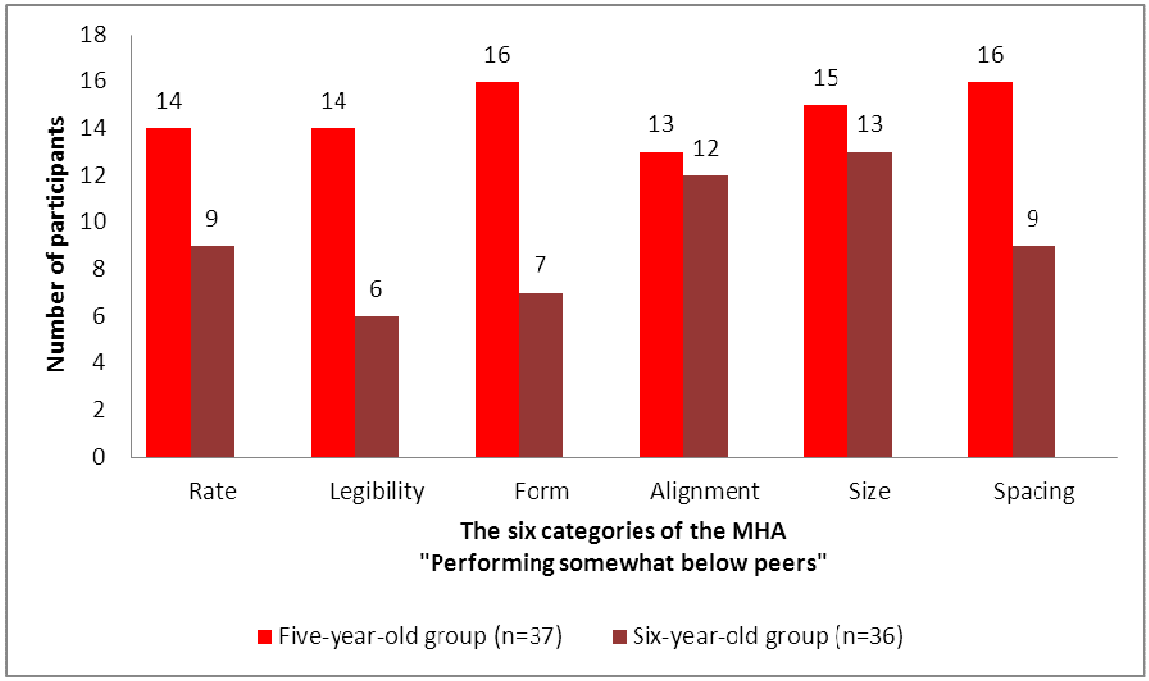

Figure 4.12: Comparison of five- and six-year-old participants who presented with scores on the "performing somewhat below peers" level

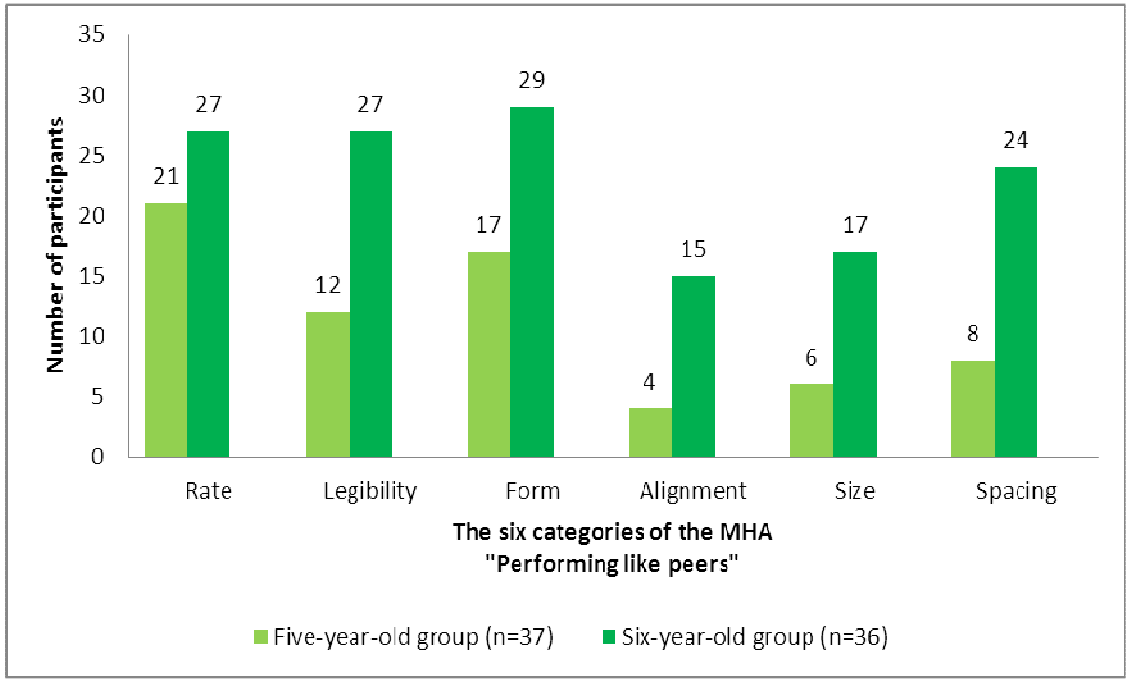

Figure 4.13: Comparison of five-and six-year-old participants who presented with scores on the "performing like peers" level

Secondly, the level of handwriting development of the two age groups was compared by referring to the median in each of the six categories of the MHA. Refer to Table 4.7 where the p-values which indicated a meaningful difference are in bold type. The significance level was at p 0.05.

Table 4.7: Comparison of the level of handwriting development between the two groups

MHA	Five-year-old children Median	Six-year-old children Median	p value
Rate	1 (1-2)	1 (1-1.5)	0.0818
Legibility	2 (1-3)	1 (1-1.5)	0.0003
Form	2 (1-2)	1	0.0015
Alignment	3 (2-3)	2 (1-2.5)	0.0017

Size	2 (2-3)	2 (1-2)	0.0018
Spacing	2 (2-3)	1 (1-2)	0.0001

Table 4.7 reflects the six categories as discussed under Section 4.3.1, **Objective 1.** When comparing the five-year-old group to the six-year-old group at a significance level of $p<0.05$ the following results emerged.

In the **rate** category there was no meaningful difference ($p=0.0818$) between the two groups. This implies that when the two groups were compared regarding the rate at which they copied the letters in the MHA, the six-year-old group did not perform significantly better than the five-year-old group. In the **other five categories** namely legibility ($p=0.0003$), form ($p=0.0015$), alignment ($p=0.0017$), size ($p=0.0018$) and spacing ($p=0.0001$) there were statistically meaningful differences between the two age groups. These five categories influence the quality of handwriting and eventually what a child's written work will look like. The quality of written work is related to the speed at which the task is completed. When a child therefore completes written work quickly it might not be of good quality; conversely, if a child works slower the quality will improve. It is important to note that the criteria for scoring in the MHA relate strongly to visual-perceptual abilities. This implies that a child who struggles with visual perception may not be able to obtain a good score in the six categories. If visual perceptual problems were present it would influence the rate at which the child finished the task as well as the quality.

4.4 DATA INDICATING A CORRELATION

In the process of comparing the readiness to acquire handwriting skills it was important to establish whether a correlation existed between the scores obtained in the MHA and the scores obtained in the VMI and FMC subtests of the M-FUN (2006). This aspect was addressed in **Objective 3 and 4** of the study.

4.4.1 Results related to Objective 3

The third objective was *to determine whether a correlation existed between the level of visual-motor integration and acquiring handwriting skills of five- and six-year-old children on a criterion-related test.*

Spearman's rho was applied to determine whether a correlation existed between the VMI scaled scores and the six categories of the handwriting assessment in the MHA. It must be noted that, according to De Vos, Strydom, Fouché and Delport (2011:274) coefficients between ± 0,35 and ± 0,59 are considered moderate. The correlation coefficients between the six categories of the MHA and the visual-motor scaled score of the two age groups are presented in Table 4.8.

Table 4.8: Correlation coefficients between the six categories of the MHA and the visual-motor scaled score of the two age groups

	VISUAL-MOTOR SCALED SCORE			
	Five-year-old participants (r)	**Five-year-old participants (p)**	**Six-year-old participants (r)**	**Six-year-old participants (p)**
Rate	-0.1149	0.4981	-0.3930	0.0177
Legibility	-0.4029	0.0134	-0.1257	0.5061
Form	-0.4300	0.0079	-0.0482	0.7803
Alignment	-0.0672	0.6926	-0.1145	0.5061
Size	-0.4087	0.0120	-0.1375	0.4239
Spacing	-0.3832	0.0192	-0.1792	0.2957

The values in the second and fourth column indicate a negative or inverse relationship between the six categories of the MHA and the VMI scaled score of the two groups of participants.

In the case of the **five-year-old group** a moderate correlation existed between four out of the six categories and the VMI scaled score. These categories are legibility, form, size and spacing. The coefficients in the categories of rate (r=-0.1149) and alignment (r=-0.0672) indicated weak associations. These moderate correlation

coefficients were confirmed by significant levels of $p<0.05$, as seen in the categories of legibility, form, size and spacing in the five-year-old group. The moderate negative correlations indicated that, should the performance in VMI increase, the performance in the categories of legibility, form, size and spacing would decrease. The opposite could then also be applicable: if the performance in the four categories of legibility, form, size and spacing should increase, the performance in VMI would decrease.

In the case of the **six-year-old group** there was only one coefficient which indicated a moderate negative correlation, namely between the rate and the VMI scaled score. This coefficient was confirmed by a significant level of $p=0.0177$. Therefore, if the performance in VMI increased, the performance in rate would decrease and if the performance in VMI decreased the performance in rate would increase. This statement will be clarified in the discussion in Chapter 5. Five out of the six categories indicated weak negative correlation.

4.4.2 Results related to Objective 4

The fourth objective was *to determine whether a correlation existed between the level of fine motor co-ordination and acquiring handwriting skills of five- and six-year-old children on a criterion-related test.*

The same process as in **Objective 3** was used to determine whether there was a correlation between the six categories of the MHA and the FMC scaled score. These results are depicted in Table 4.9.

Table 4.9: Correlations coefficients between the six categories of the MHA and the fine motor coordination scaled score of the two age groups

	FINE MOTOR SCALED SCORE			
	Five-year-old participants (r)	**Five-year- old participants (p)**	**Six-year-old participants (r)**	**Six-year-old participants (p)**
Rate	0.2822	0.0905	-0.1358	0.4297
Legibility	-0.3850	0.0186	0.0096	0.9555
Form	-0.2695	0.1068	-0.2695	0.1120
Alignment	-0.2556	0.1268	-0.1557	0.3645
Size	-0.2994	0.0718	-0.1882	0.2716
Spacing	-0.4697	0.0034	-0.0890	0.6056

The values in the second and fourth column indicate a negative or inverse correlation between the six categories of the MHA and the FMC scaled score of the five-year and six-year groups.

In the case of the **five-year-old group** a moderate correlation existed between two out of the six categories and the FMC scaled score. These categories were legibility and spacing. The latter was confirmed by significant levels of $p<0.05$ in the categories of legibility ($p=0.0186$) and spacing ($p=0.0034$).This indicated that if there was an increase in the performance of FMC, there would be a decrease in the performance of legibility and spacing. The opposite also applied: if there was a decrease in the performance of FMC there would be an increase in the performance of legibility and spacing. This statement will be clarified in the discussion in Chapter 5. The coefficients in the categories of rate, form, alignment and size indicated weak associations with the FMC scaled score.

In the case of the **six-year-old group** there were weak correlations between the six categories of the MHA and the scaled score for FMC.

4.5 SUMMARY

In Chapter 4 the composition of the sample was discussed. The differences between the two groups were highlighted. This was followed by a presentation of the research results and data analysis as it related to each of the four research objectives. The data analysis was done in such a manner as to indicate the levels of performance of the two age groups, compare the levels of performance and lastly determining whether a correlation existed between VMI and acquiring handwriting skills as well as FMC and acquiring handwriting skills. In Chapter 5 the study results are discussed in detail.

CHAPTER 5
DISCUSSION OF RESULTS

5.1 INTRODUCTION

In this chapter the researcher provides possible explanations for the results of the study as they were presented in Chapter 4 according to the four research objectives.

Against the background of the composition of the sample, attention is given to the differences between the five- and the six-year-old groups. The differences between the two age groups are highlighted and explained under the following two headings: data relating to the level of performance and the data indicating a correlation.

The limitations of the study will be discussed and recommendations for future studies are made.

5.2 DISCUSSION OF THE COMPOSITION OF THE SAMPLE

In Chapter 4 Section 4.2 the biographical factors which impacted on the differences between the two age groups were addressed. Some of these factors will prove to be significant in providing possible explanations for the findings of the research.

Despite the fact that data collection took place over two years, the ***number of five- and six-year-old participants*** from 2009 and 2010 were similar. The similarity in the number of participants indicated that the number of children who were enrolled in Grade 1 at the age of five-and-a-half-years did not differ substantially between 2009 and 2010. This resulted in two closely matched groups regarding the number of participants. It is important to note that the researcher selected participants for this study as typically developing children. The researcher attempted to control variables such as the use of medication, the presence of neurological and neuro-

psychological conditions and the ability of the participants to follow instructions in the medium language. Oliver (1990:111) states “children with learning or neurological disabilities often have an irregular academic readiness profile with a delay of one or more of the perceptual-motor skill components.” None of the participants in the two age groups were identified as possibly presenting with developmental delay or learning disabilities.

Gender was the second biographical factor to be considered. In this study the two age groups were not matched for gender. Table 4.2 in Chapter 4 Section 4.2.2 indicated that females were better presented than males in both the five- and the six-year-old groups. From clinical experience the researcher observed that society tends to assume, if not proven otherwise, that females are better at certain tasks – or then acquire certain skills – quicker than males of the same age at various stages of their growth and development. Society would be inclined to say that a girl of a young age would be more ready for certain tasks compared to a boy of the same age. This opinion is supported by literature when it comes to fine motor tasks and specifically handwriting (Judd et al. 1986:311; Spear 1989:272-274; Hartley 1991:141-143; Feder et al. 2007:56; Junaid and Fellowes 2006:8; Temur 2011:2204 and Schwellnus et al. 2012:723). All these authors agree that differences were observed between boys and girls with regard to fine motor activities and handwriting, with girls often showing more mastery than boys. Hartley (1991:143) comments that these differences emerge at a very young age and continue through life. Feder et al. (2007:56), on the other hand, state differences may not be that apparent at a very young age. If the researcher was to agree with the fact that girls perform better than boys, the seven female participants in the five-year-old group could have influenced the results of the five-year-old group significantly.

Clear differences were subsequently observed with the ***cultural distribution*** between the two age groups. (Refer to Table 4.3 in Chapter 4 Section 4.2.3). Although black and white cultures were represented in both age groups there was a pronounced difference in the representations in the groups. The black participants formed a large percentage (91.89%) of the five-year-old group while

the white participants formed a larger percentage (72.22%) of the six-year-old group. The differences in the representation of cultures between the two age groups suggest that the demographics of Grade 1 students in traditional Afrikaans and English schools have changed. This raised the question as to why there was a higher concentration of black children in the five-year-old group when compared to the six-year-old group.

Firstly, the area of Tshwane District North included schools easily accessible to black parents because of their geographical location, as some of the schools were closer to their work place and homes. The difference in representation between the two groups secondly possibly indicated that there was an inclination among black parents (within the sample) to send their child to school at the age of five. The latter could also be due to financial considerations since it is cheaper in South Africa for parents to enroll their child in a primary school than a nursery school. Thirdly, traditional Afrikaans schools provided the option of additional English classes which immediately increased the option for parents to select a school where English formed part of the child's learning.

Cultural distribution is closely associated with ***different mother tongue languages***. As the sample included participants from three different ethnic groups, the researcher expected differences among the participants regarding mother tongue language, irrespective of the medium language (the language of instruction) at the participants' school. Ten of the 11 official languages in South Africa were represented in the sample. Considering the distribution of culture between the two age groups, it was not surprising to note that Tswana and Sesotho were spoken most in the five-year-old group and Afrikaans in the six-year-old group. The black five-year-old participants were all taught in English at school. English was not their mother tongue language but a second and, in some cases, a third language. Dalvit, Murray and Terzoli (2009:36) found in their study when black parents were given the option of choosing the language of learning and instruction for their child, they preferred English. It was believed that this decision would empower their children with better opportunities in education and later employment.

In Chapter 2 Section 2.1.4 language was not identified as one of the factors that play a role in school readiness. The composition of this sample did, however, indicate that the language of instruction and the child's mother tongue language should be seen as vital in the process of learning. Through clinical experience the researcher has learnt that a good foundation in the mother tongue language is of critical importance when introducing a second language. Children are not always adequately prepared for a second language, especially when it is the language of instruction at school. Auditory processing and determining the richness and quality of a child's mother tongue language does not fall within the researcher's scope of practice. It does, however, not only influence the manner in which a child will follow instructions in class but also the quality of writing, reading and learning at school.

The distribution of culture and languages were closely related to ***the distribution of the participants among the primary schools.*** Table 4.4 in Chapter 4 Section 4.2 provided information on the distribution among the participating schools. It was interesting to note that the highest percentage of 72.97% (27 out of 37 participants) in the five-year-old group was in the three traditional Afrikaans primary schools where English classes had been formed. The six-year-old group was more evenly spread between 12 of the 15 primary schools. The parents had to indicate their address on the background information form. Not all parents were specific in indicating the area where they resided. The researcher did not record this information as part of the data collection; however, in noting the different areas which were indicated by the parents of the children in the five-year-old group, it was clear that some parents/children travelled a considerable distance to school. The participants in the six-year-old group came primarily from the areas surrounding the primary schools.

Since not all the families seemed to live close to the schools included in the sample, the researcher postulates that the following could possibly be reasons for the distribution of participants among the primary schools. Firstly, the school of choice might be close to where the parents work and possibly offered aftercare facilities which might have not been the case if the child was in a school closer to home. Secondly, the parents might have truly believed that they are providing their

child with better quality education if they chose a school where English was the medium language. Thirdly, the lower teacher/pupil ratio could be the motivation behind choosing a school further from home. Lastly, the parents might not have had other options in the area they lived and/or wanted to provide their child with another opportunity for education.

The importance of ***completing a Grade R*** year before entering into Grade 1 was highlighted in the literature review (Refer to Chapter 2 Section 2.1.4.3). Information on how many of the participants attended a Grade R was presented in Table 4.5 in Chapter 4 Section 4.2.5. Although there was not a significant difference between the two groups regarding their attendance of Grade R, a higher percentage of the six-year-old group was reported to have attended a Grade R when compared to the five-year-old group.

As stated previously, Grade R is not yet compulsory in South Africa. Consequently, no uniform learning programme exists to which nursery schools have to adhere. The researcher could not assume that all the participants had the same or even similar pre-school experiences. In an article in the Rapport newspaper (10 July 2011) it was reported that Prof. Eric Atmore from the department of Social Development at the University of Cape Town and the director of the Centre of Early Childhood Development, said that research proved the importance of a Grade R year in determining later achievement. According to Prof. Atmore, the South African Department of Education would only reach its target of including all pre-school children in a Grade R class by 2017 or 2018. According to the latest statistics 836 000 children were accommodated in 19 500 ECD centres nationwide in March 2012, while 767 865 children enrolled for Grade R in September 2012 (Atmore, Van Niekerk & Cooper 2012:82).

Hence, in the light of the aforementioned, the researcher was unable to unequivocally state that parents knew exactly what a Grade R entailed as well as knowing whether their child had in fact been accommodated in a typical Grade R class.

The composition of the sample was lastly affected by the ***results from the visual screening***. The results from the visual screening were indicated in Figure 4.6 in Chapter 4 Section 4.2.6. The number of five- and six-year-old participants referred to optometrists was on account of deficits on the eye movement item. This meant that the participants, who presented with deficits on the eye movement item, were still able to take part in the assessment as they did not present with deficits in the three items listed in Section 4.2.6.

5.2.1 Summary

The factors discussed above namely the number of five- and six-year-old participants, gender, cultural distribution, mother tongue language, distribution of participants among primary schools, completing a Grade R and the results from the visual screening, contributed to the differences between the five- and the six-year-old age groups. The demands placed on the five- and the six-year-old participants in Grade 1 were the same but the identified differences undoubtedly had an influence on their experience of the demands.

5.3 DATA REGARDING THE LEVEL OF PERFORMANCE/DEVELOPMENT

Within normal development children display characteristics and skills specific to their age. An example of these differences between five- and six-year-old children is found in Appendix A. Using the M-FUN normative data were collected on the development of visual-motor integration and fine motor abilities among five- and six-year-old participants. The researcher was able to conclude that a group functioned within the norm when a scaled score of 7-13 was attained. Each of the two age groups was compared to norms specific to their age, as determined during the standardisation process of the M-FUN. The discussion on the level of performance in the two age groups and the comparison thereof is presented in this section.

5.3.1 Interpretation of findings related to Objective 1 and Objective 2

The results from the first and the second objective of this study are discussed together because not only was the level of development of VMI, FMC and handwriting skills determined, but the different levels of development were also compared.

The first objective of the study was *to determine the level of development of visual-motor integration, fine motor coordination and handwriting skills in groups of five- and six-year-old children on standardised tests.*

The second objective of the study was *to compare the level of development of visual-motor integration, fine motor coordination and handwriting skills in groups of five- and six-year-old children on standardised tests.*

Table 4.6 in Section 4.3.1 provided information regarding the level of development of visual-motor integration and fine-motor coordination in the five- and six-year-old groups. An interpretation of these results is given below.

5.3.1.1 Visual-motor integration

The median of 9 and the range reflected that the **five-year-old group** overall presented with age appropriate visual-motor integration abilities. The seven five-year-old children participants who presented with scaled scores of 5 and 6 was concerning as it indicated that these participants' VMI abilities were not on par. The scaled scores from the seven participants together with the four participants who obtained a scaled score of 7 could have had certain implications. Firstly, these participants influenced the range of the scaled scores for the five-year-old age group. Secondly, the group of 11 participants who scored at the lower end of the range (scaled score=7) to below the norm (scaled score=5 and 6) would have had more of an effect on the correlation of VMI and the development of handwriting.

This indicated a strong average group of participants in the **six-year-old group**. Only two participants obtained a scaled score lower than 7 which indicated poor VMI abilities. Since the six-year-old group consisted of 36 participants, it was

unlikely that the low scaled scores of these two participants would have a meaningful impact when correlating VMI abilities with the development of handwriting.

The level of visual-motor integration in development and specifically at school-going age is of the utmost importance. Because perceptual and motor skills are very important when children learn to write, visual-motor integration would therefore be a strong indicator of writing skills (Bara & Gentaz 2010:747). Despite the few five- and six-year-old participants whose performance regarding VMI was not within the norm, both age groups presented with age appropriate VMI functioning.

5.3.1.2 Fine motor coordination

A mean of 8 and the range indicated that FMC functioning in the **five-year-old group** was within the norm. It is clear that although the five-year-old group attained a lower scaled score median for FMC than for VMI, the scaled scores for FMC were more evenly distributed (refer to Table 4.8, Chapter 4 Section 4.3.1). Six participants obtained scaled scores lower than 7 which indicated poor integration of FMC. Although the six participants who obtained a scaled score of 7 were still within the norm, they fell in the lower end of the range. As in the case of VMI this group of 12 participants would have had more of an effect on the correlation of FMC and the development of handwriting.

A mean of 8 and the range indicated that the functioning of the **six-year-old group** was within the norm. According to Figure 4.8 in Chapter 4 Section 4.3.1, only three participants in this group attained a scaled score lower than 7 which indicated poor integration of FMC. These three participants together with the six participants, who obtained a scaled score of 7, formed a group of 9 participants which could have influenced the correlation between FMC and the development of handwriting.

Although fine motor coordination has been identified as a pre-requisite for handwriting development (refer to Table 2.1, Chapter 2, Section 2.1.2.2), its role

has not been clearly demonstrated and defined (Bara & Gentaz 2010:746). The age groups had a similar level of readiness regarding fine motor coordination, presumably because of the nature of the fine motor activities in the M-FUN.

5.3.1.3 Handwriting skills

Within the six categories of the MHA each participant was placed on one of three levels namely “performing well below peers”, “performing somewhat below peers” and “performing like peers”. Figure 4.9 in Chapter 4 Section 4.3.1.3 indicated that the **five-year-old group** did best in the *rate* category. The five-year-old age group did worst in the *alignment* category.

According to Figure 4.10 in Chapter 4 Section 4.3.1.3, the participants in the **six-year-old group** performed like their peers in all six categories of the MHA. The strongest performance was in *form* followed by *rate* and *legibility*.

Feder et al. (2007:55) report that levels of maturity and age can play a role in the variability of handwriting skills in Grade 1.

5.3.2 Comparison between the two age groups regarding VMI, FMC and handwriting skills

Section 5.3.1 addressed the level of development of VMI, FMC and handwriting skills between the two age groups. A discussion on the comparison of the levels of development in the areas mentioned above follows.

5.3.2.1 Visual-motor integration

Table 4.6 in Chapter 4 Section 4.3.1 indicated that there was a significant difference (p=0.0049) between the scaled scores of the five- and the six-year-old groups. This was confirmed by the difference in the distribution of the ranges of scaled scores between the two age groups. The superior performance by the six-year-old group demonstrated an enhanced readiness for acquiring handwriting

skills. The following were considered to be possible explanations why there was a difference in the performance of the two age groups.

- There were six participants in the five-year-old group who attained a scaled score of less than 7 compared to three participants in the six-year-old group who attained a scaled score lower than 7.

- Although the M-FUN assessed the participants' level of development regarding VMI and FMC, it is important to remember that the M-FUN also provided the underlying neurological foundations for VMI and FMC. (Refer to Table 2.2 in Chapter 2 Section 2.1.2.3). Each activity under VMI and FMC provided the researcher with different possibilities as to why that particular activity was difficult for the participant. An example of this would be the following. In the activities *Amazing mazes, Race car, Find the puppies, Draw a kid, Writing* and *Go fishing* motor accuracy played an important role. If a participant had difficulty with motor accuracy the raw scores of all the abovementioned activities would be affected. The lower raw scores would then influence the scaled score for visual-motor integration. If each participant's responses on the different activities were to be analysed, they might have provided insight into why six participants got scaled scores lower than 7.

- The combination of a reception year together with being more mature could have resulted in some of the six-year-old participants having an advantage.

- In Chapter 1 and Chapter 2 the researcher emphasised the complexity of the process of handwriting. The importance of a child being ready for handwriting instruction was highlighted. Because of this information the researcher could assume that some of the participants in the five-year-old group were not ready for written activities because of age, insufficient exposure to pre-writing activities and preparation for Grade 1. This assumption would be a contributing factor to the difference in VMI between the two age groups. Exposure to pre-writing activities and the preparation for Grade 1 is also emphasised by Prior, Bavin and Ong (2010:14). Table 4.5, Chapter 4, Section 4.2.5, indicated that more

participants from the six-year-old group attended Grade R when compared to the five-year-old group. Although the researcher did not obtain background information regarding the socio-economic status of the families, this aspect cannot be excluded as a variable influencing the development of visual-motor integration. This opinion is strengthened by a study done by Lotz, Loxton and Naidoo (2009:66) in which they found that children who grow up in poor and disadvantaged communities might have significant difficulties with visual-motor integration when they enter Grade 1.

- All eight of the subtests for VMI expected a motor response from the participant in the form of writing.

5.3.2.2 Fine motor coordination

There was no significant difference (p=0.1899) between the scaled scores of the five- and the six-year-old groups. This was echoed by a more even distribution of scaled scores as seen in Figure 4.8 in Chapter 4 Section 4.3.1.2. The following serve as possible explanations for the performance in FMC of the two age groups being similar.

- Cornhill and Case-Smith (1996:733-735) highlight the importance of fine-motor control in the development of handwriting. These authors stress the role that in-hand manipulation, bilateral integration and motor planning play in fine-motor control. The activities through which fine motor coordination was assessed in the M-FUN included elements of in-hand manipulation skills, bilateral integration and motor planning. The five subtests which form part of FMC include actions such as cutting, posting, folding, rolling and opening a bottle and container. Each of these actions is familiar, functional and practiced often during a child's daily living activities. Bilateral integration is the one body function which forms part of all the mentioned actions. When compared to the VMI activities, it was easier for participants from both age groups to obtain a good raw score in the FMC activities than in the VMI activities. This could be because of the familiarity of the activities as well as the fact that there are no written activities included in FMC.

- All the participants in the study obtained high scores in the *snack time* activity. This activity required from the participant to open a bottle, pour water into a cup and get biscuits from a container. This activity formed part of FMC and contributed to good scaled scores by the majority of participants.

5.3.2.3 Handwriting skills

Table 4.7 in Chapter 4 Section 4.3.2.3 indicated the comparison between the performances of the two age groups on the six categories of the MHA. Significant differences were observed between five of the six categories if the significance level was p=<0.05. The five- and six-year-old age groups demonstrated similar performances in the *rate* category, but in the *quality* categories of the MHA the six-year-old group was superior. The six-year-old group presented with a more mature handwriting skill profile when compared to the five-year-old group.

5.3.2.4 Factors which influenced handwriting skills in the two age groups and the comparison thereof

Various research studies have been conducted to investigate the relationship between visual-motor integration, fine motor coordination and visual perception and the components of handwriting such as legibility, size and spacing (Parush, Lifshitz, Tochman & Weintraub 2010:45-46; Kaiser, Albaret & Doudin 2009:92-93; Feder et al. 2007:54-59; Daly, Kelley & Krauss 2003:461-462). Yet, in spite of this valuable work it must be noted that other factors such as rates of maturity and age could also influence performance when assessing legibility, form, alignment, size and spacing. (Ziviani 1995:189-191). Lazlo (1986) (in Dunsmuir and Blatchford (2004:462), states one third of all five year old children do not have sufficient perceptual-motor skills to have writing in size and quality that adults will expect.

The categories rate and legibility have been identified as the two most important aspects to be considered when assessing and/or remediating handwriting. (Feder & Majnemer 2007:315). On the contrary, previous studies did not state

unequivocally that there was a relationship between legibility and rate. However, in clinical practice the researcher has often seen that when a child wrote fast the handwriting was not legible; but when he or she wrote slowly the legibility of the handwriting sample was much better. If this is true it could explain the **five-year-old group's** poor performance in the *legibility* category despite doing well in the *rate* category. Dixon, Kurzman and Friesen (1993:368) hold that familiarity of the task can influence the speed/rate at which the task is completed. In the current study, when the researcher assessed the participants in mid-year, all of them had had exposure to the letters of the alphabet which added an element of familiarity. This could therefore explain the better performances by both groups in the rate category

In the **six-year-old group** 27 participants (out of 36) "performed like peers" in the *rate* and 27 participants (out of 36) "performed like peers" in the *legibility* categories. This could indicate that there was a close relationship between rate and legibility. The importance of readiness and a reception year (Grade R) have been highlighted throughout this report. On account of this the researcher could assume that the difference between the two age groups could be related to the six-year-old group having been more developmentally mature, more ready and better prepared for Grade 1 than the five-year-old group.

Legibility, form, alignment, size and *spacing* form part of the quality categories in the MHA (Reisman 1999:1). Form is the one other category that is also associated with legibility. Form was scored according to the variations in personal writing styles. The score in the form category could therefore also influence legibility. The other three categories namely alignment, size and spacing did not influence legibility, because the way in which the letter is formed had not changed and the letters were still recognisable.

In the administration of the MHA and during the analysis of the data, the researcher again realised the importance of visual-perceptual functions in handwriting. Table 2.1 in Chapter 2 Section 2.1.2.3 presented the views of different authors on the pre-requisites for handwriting. Visual perception, visual figure-

ground and spatial orientation was identified as some of the pre-requisites. It was not within the scope of this study to identify the specific visual-perceptual functions contributing to handwriting; however, the scoring criteria of the MHA relates strongly to visual-perceptual functions such as spatial relations, position in space, form constancy, figure-ground, visual discrimination, analysis and synthesis and visual closure. As early as 1981 Tan-Lin found that aspects such as size, quantity, proportion and spacing improved with age. Tan-Lin's (1981) (cited in Schneck & Amundson 2010:556) findings related well to Kramer and Hinojosa's (2010:353) statement that visual perception starts developing at a very young age and matures as a child gets older. This could be a valid reason for the poorer response of the five-year-old group in all the categories of the MHA except the category of rate, as their visual perception might not have matured yet.

Dunsmuir and Blatchford (2004:462) identified possible predictors for writing competence in children between the ages of four to seven years. Some of these predictors could be relevant to this study in that it foregrounds the differences between the two age groups. Firstly, under home variables the authors identified specifically the mother's educational level, the size of the family and writing at home. Secondly, they referred to child characteristics, which included when the child started school and whether there was a reception year before to entering primary school. Lastly they referred to school factors which pertain to the ability of a child to write his or her name before going to school.

The researcher did not inquire about the level of education of the mother or both parents, the size of the family or whether the child was able to observe writing at home. However, it was previously stated that the largest percentage (98.89%) of the five-year-old group were black participants. A large part of the black population is regarded as previously disadvantaged. This aspect could have lead to the grandparents and some older parents of some of the participants not having the opportunity to get an education. This could also be linked to how much or how little the child was exposed to writing at home. Dunsmuir and Blatchford (2004:475-477) posit that a child who has no siblings would be better prepared for writing, because of the level of attention and interaction with the parents. On the other hand, the

researcher suggests it also cannot simply be assumed that a child who comes from a family where there are other siblings will necessarily be better prepared for writing.

The child characteristics identified by Dunsmuir and Blatchford (2004:475-480) were significantly relevant to this study. The information made available in their article was similar to the discussion in the literature review. In the case of this research study it was hypothesised that there would be a difference between the five-year-old age group compared to the six-year-old age group, because both age groups were found in Grade 1 in the South African context. The researcher has discussed the importance of a reception year or Grade R before entering primary school. In South Africa this remains a problem because Grade R is not compulsory and there is no uniform syllabus between different nursery schools. Dunsmuir and Blatchford (2004:475-477) also referred to the child's ability to write her or his name. In the case of the current study this would depend on what happened in every child's home and also whether the child attended a reception year (Grade R).

5.3.3 Summary

Through Objective 1 the researcher could establish a baseline of development for VMI, FMC and handwriting skills in the two different age groups. The baseline of VMI and FMC was measured against what was considered to be the norm of VMI and FMC in the M-FUN. Measured against the norm, it was clear that the largest part of the two age groups functioned within the norm for VMI and FMC. The scaled score distribution was more even in the case of FMC when compared to VMI. Handwriting skills were assessed according to the six categories of the MHA.

From the discussion it was clear that the differences in VMI, FMC and handwriting skills between the two age groups were not only based on the differences in the scores. The importance of visual-perceptual body functions in the development of VMI should not be underestimated. Although the M-FUN addressed figure-ground and discrimination, the roles of other visual-perceptual body functions were not addressed. Literature indicated that aspects of handwriting such as size,

quantity/rate and so forth improve with age. Although the effects of visual-perceptual body functions on the abovementioned aspects of handwriting have not been researched sufficiently, it should still be considered as a reason for the differences in VMI between the two age groups.

The manner in which FMC was assessed through the M-FUN appealed to all the participants as they were familiar everyday activities. The participants were more relaxed during this part of the assessment and less attention was directed towards written tasks. It was important to note that a participant could have been functional in an activity but not necessarily skilled at it.

It can be stated with a fair degree of certainty that handwriting skills are influenced by various other factors, some of which have been researched previously. Authors such as Dunsmuir and Blatchford (2004:475-480) explained these factors very well. Factors highlighted in Chapter 4 such as age, culture and the attendance of a Grade R could have attributed to the readiness of the participants in the two age groups in acquiring handwriting skills. The null hypothesis, that there would be no difference between the two age groups regarding VMI, was rejected. The null hypothesis regarding the comparison of the six categories of the MHA between the two age groups was also rejected for five of the six categories namely *legibility, form, alignment, size* and *spacing.* The null hypothesis was accepted for the comparison of the two age groups on in the category of *rate.*

5.3.4 Interpretation of findings related to Objective 3

The third objective of the study was *to determine whether a correlation exists between the level of visual-motor integration and acquiring handwriting skills, in five- and six-year-old children on a criterion-related test.*

The researcher demonstrated in Chapter 1 and Chapter 2 that handwriting is a very complex skill with different pre-requisites playing a role. Visual-motor integration was one of these pre-requisites.

Bonney (1992:11) states handwriting is a visual-motor task and therefore a relationship exists between good visual-motor control and good handwriting. Various authors wrote about the relationship between handwriting and visual-motor integration (Daly, Kelley & Krause 2003:461-462; Weil & Cunningham Amundson 1994:986-987, Cornhill & Case-Smith 1996:737; Maeland 1992:1215). The extent to which visual-motor integration affects the development of handwriting and the quality of handwriting proves to be an ongoing discussion.

Table 4.8 in Chapter 4 Section 4.4.1 provided information regarding the correlation between the visual-motor integration scaled scores and the six categories of the MHA.

In the **five-year-old group** strong significant negative correlations were identified between the VMI scaled score and the categories of *legibility, form, size* and *spacing.* The categories for *rate* and *alignment* showed weak insignificant negative correlations.

In the **six-year-old group** a strong significant negative correlation was identified between the VMI scaled score and the category of *rate*. In the categories of *legibility, form, alignment, size* and *spacing* weak insignificant negative correlations were detected.

The negative correlations implied that when VMI tested low the specific category of handwriting was not a problem, or when VMI tested high the specific category of handwriting was problematic.

5.3.4.1 Discussion of correlation coefficients related to Objective 3

The correlation coefficients presented in Table 4.8 in Chapter 4 Section 4.4.1 confirmed the relationship previously reported in literature between VMI and acquiring handwriting skills. From clinical experience and as verified in literature the researcher expected a positive correlation rather than a negative correlation. The conclusions drawn by the researcher are outlined next.

5.3.4.2 VMI scaled scores and scaled score ranges

The correlation between VMI and handwriting was calculated for each group and not individually. The five-year-old group had 11 participants who obtained a scaled score in the lower end of the range or below the norm. As the number of five-year-old participants was only 37, these 11 outliers formed a considerable portion of the group and could have affected the correlation between VMI and acquiring handwriting skills. Within the six-year-old group there were only three participants who scored at the lower end of the range or below the norm. They therefore formed a smaller portion of the 36 participants in the six-year-old group.

5.3.4.3 The Minnesota Handwriting Assessment

The MHA was confirmed to be a valid and reliable instrument when used to assess handwriting in typical first and second graders from general education classes (Roston, Hinojosa & Kaplan 2008:108). Despite this, one should reconsider the validity of the MHA for five-year-old children. Reisman (1990) points out that in the development of the MHA the Grade 1 children in her sample were *generally* between the ages of six to seven years. This does not exclude the possibility of a few younger children being included as part of that original sample, and leaves room for interpretation.

Keeping the abovementioned in mind, it is important to note that in the five-year-old-group the number of participants who “performed well below peers” and “performed somewhat below” their peer group was higher than the number of participants who “performed like peers” in all of the six categories of the MHA. In the six-year old-group, the number of participants who “performed well below” and

"somewhat below their peers" was considerably less than the number of participants who "performed like their peers" on four of the six categories, namely *rate, legibility*, *form* and *spacing.* In the categories for *alignment* and *size* there were four and two children respectively, who "performed well below" and "somewhat below their peers".

The incidence of a higher number of participants in the five-year-old group who "performed well below" and "somewhat below their peers" when compared to that of the six-year-old group, could possibly be related to the following. Firstly, one could argue that the participants who "performed below their peers" could present with learning disability or developmental delay, but this would imply that the incidence of developmental delay or learning disability was higher in the five- year-old group. This could not be stated unequivocally, due to it being unlikely.

Secondly, the option of the five-year-old group being less ready for handwriting than the six-year-old group should definitely be considered. Literature indicated that handwriting readiness referred to certain factors that a child should have command over (refer to Chapter 2 Section 2.1.3). One of these factors was a mental age of 6-6 to 7-0. Karldottir and Stefansson (2002) confirm that quality of handwriting improves through the first grade, whereas permanent handwriting skill develops in the second grade. This could explain the difference in the performance in the five quality categories of the MHA between the five- and six- year-old groups.

5.3.4.4 Sensorimotor impairments

Another factor which could influence the correlation between VMI and the six categories of the MHA is that sensorimotor impairments could lead to handwriting difficulties (Tseng & Cermak 1993: 924). These authors identify the following as examples of sensorimotor components: visual perception, kinesthesia, in-hand manipulation and visual-motor integration. The current study focused on visual-motor integration and fine motor coordination and its relationship with handwriting. No specific assessment was done to determine pre-existing sensorimotor impairments.

The role of good visual-perceptual abilities in the development of handwriting was discussed in this chapter in Section 5.3.1.1. The categories of legibility, form, size and spacing are required of a participant to have good visual-perceptual abilities. Except for figure-ground abilities and discrimination abilities which formed part of the M-FUN, no other visual-perceptual abilities were assessed. The young participants of the five-year-old group could have lacked good visual-motor abilities for reasons such as immaturity or insufficient stimulation.

5.3.5 Summary

The discussion of the results pertaining to Objective 3 confirmed what has been previously stated in literature. There is a correlation between VMI and acquiring handwriting skills, although the correlation was negative. The two age groups and the assessment tools used in this study put a different slant to the information presently available on the correlation between VMI and handwriting skills. Although researchers agree that a relationship exists between VMI and handwriting skills, the nature of this relationship has not been agreed upon. The null hypothesis could be rejected for the correlation between VMI and handwriting skills, regarding *legibility, form, size* and *spacing* in the five-year-old group. The null hypothesis was rejected for the correlation between VMI and handwriting skills in the six-year-old group, regarding the category of *rate.*

5.3.6 Interpretation of findings related to Objective 4

The fourth objective of the study was *to determine whether a correlation exists, between the level of fine motor co-ordination and acquiring handwriting skills, in five- and six-year-old children on a criterion-related test.*

Handwriting is the most important fine motor activity in which children take part in while at school. (Peterson & Nelson 2003:153). Cornhill and Case-Smith (1996: 737-738) perceived fine motor control as one of the factors which might influence

handwriting performance. According to these authors, fine motor control included in-hand manipulation, bilateral integration and motor planning. This agrees with the neurological foundations of FMC abilities in the M-FUN (Miller 2006).

Table 4.9 in Chapter 4 Section 4.4.2 provided information regarding a correlation between the FMC scaled scores and the six categories of the MHA.

In the five-year-old group two significant negative correlations were identified between the FMC scaled score and the categories of *legibility* and *spacing.* The categories for *form, alignment* and *size* showed insignificant negative correlations. An insignificant positive correlation was found between rate and FMC.

In the six-year-old group no significant correlations were detected between the FMC scaled score and the six categories of the MHA. In the five categories of rate, form, alignment, size and spacing, slight insignificant negative correlations were detected. A slight insignificant positive correlation was found between legibility and FMC.

The negative correlations implied that when FMC tested low, the specific category of handwriting was not a problem; when FMC tested high, the specific category of handwriting was problematic. However, in the case of the positive correlations a good score in FMC yielded a good score with the specific category of the MHA.

Although literature mentions FMC as a pre-requisite for handwriting, studies which indicate a correlation between FMC and the different aspects of handwriting are scares. The following studies examined the correlation between FMC and handwriting quality. Tseng and Chow (1999:86) indicate that fine motor skills correlated with handwriting speed in two groups of normal speed hand writers and slow hand writers, though another analysis of the data indicate that FMC only correlate with handwriting speed in the normal speed hand writer group. Results from a study by Smits-Engelsman, Niemeijer and Van Galen (2001:177) indicate that a group of poor writers was characterized by low performance in fine motor coordination. A study by Jongmans, Van Schendel and Volman (2006:458)

confirmed that fine motor coordination, measured as unimanual dexterity, correlated significantly with quality of handwriting in a group of children with handwriting difficulties. Unimanual dexterity was the only significant predictor of handwriting quality in the control group. The three above mentioned studies yield different results, as fine motor coordination can be associated with poor or good hand writers. McHale and Cermak (1992:898) stated years ago that 30-60% of an elementary child's school day is spend on fine motor activities. Undoubtedly this percentage must have changed over the last few years but considering that pen and paper tasks still form a large part of the school day in the South African context, the effect of fine motor coordination on handwriting should not be underestimated.

5.3.6.1 Discussion of correlation coefficients related to Objective 4

The correlation between FMC and the six categories of the MHA presented differently from the correlation between VMI and the six categories of the MHA. The performances of the two age groups were very similar regarding the correlation between FMC and handwriting skills despite the difference in age. The researcher provides possible explanations for the latter in the following section.

5.3.6.2 FMC scaled scores and scaled score ranges

The distribution of the FMC scaled scores of the two age groups was more even when compared to the VMI scaled scores. (Refer to Chapter 4 Figure 4.8). There were no clusters of scaled scores to either side of the chart, but instead the largest percentages of scores for both groups were in 7-10. Despite the fact that there were not many outliers in the two age groups for FMC, the individual differences within the two age groups could have influenced the correlations as depicted in Table 4.9 in Chapter 4 Section 4.4.2.

5.3.6.3 The nature of the FMC activities in the M-FUN

In Section 5.3.2.2 the researcher discussed the nature of the FMC activities of the M-FUN. The researcher is of the opinion that the functionality of the activities included in the FMC abilities contributed to the very similar FMC abilities between the two groups. Secondly, no written response was expected from any participant during FMC and, thirdly, all the participants excelled in the *snack time* activity.

5.3.6.4 The Minnesota Handwriting Assessment

The categories for *legibility* and *spacing* required of the participants to apply and integrate their visual-perceptual body functions. According to the researcher, the requirements in the criteria for marking legibility and spacing are strongly related to visual-perceptual functioning as opposed to FMC. The following are examples in the legibility category:

- "A letter is not rotated or reversed." (Reisman 1990:10). Reversals in written work such as the 'b' and the'd' are caused by poor position in space.

- "All parts of the letter are complete." (Reisman 1990:10). The example in the manual refers to the 'j' and 'l' which should be dotted. When letters are incomplete it refers to poor visual closure.

The following are examples in the spacing category:

- "Letters within words may not touch…" and "A letter within a word written more than one fourth of an inch from the preceding letter earns an error point for spacing." (Reisman 1990:18). Spatial relations and perceptual constancy are important when knowing how big the spaces between letters in a word or the spaces between words should be.

5.3.7 Summary

Fine motor coordination has traditionally been associated with handwriting development. This was confirmed by the results from this study. The null hypothesis regarding the correlation between FMC and handwriting skills was rejected for legibility and spacing in the five-year-old group.

The discussions on the findings of this study firstly led the researcher to appreciate the crucial role that the characteristics of a sample could play.

Secondly, the level of development for VMI and FMC in the two age groups indicated that both groups were within the norm with individual participants to the lower and higher ends of the range. The level of development regarding handwriting was also determined. Despite the fact that both groups did well in the category of rate, compared to six-year-old group the five-year-old group did not perform well in the categories of legibility, alignment, form, size and spacing.

Finally, the researcher determined whether correlations existed between VMI and the six categories of the MHA as well as FMC and the six categories of the MHA. Negative correlations were identified between VMI and *legibility, form*, *size* and *spacing* in the five-year-old group and between VMI and *rate* in the six-year-old group. Negative correlations were identified between FMC and legibility and spacing in the five-year-old group.

It could be unequivocally stated that a relationship exists between VMI, FMC and the development of handwriting skills. Although this study contributed to existing research literature in this field, the mentioned relationships still require further investigation.

5.4 LIMITATIONS

This study added to the existing body of knowledge on school readiness as well as school-going age within the South African context. The results from this study will not only assist occupational therapists, but also other professionals, such as psychologists and teachers, when working with children in Grade R and Grade 1.

During the initial planning and subsequent execution of the study, methods and measures were applied in order for this study to be scientific and well executed. Despite insightful findings, the following factors were identified as limitations in the research process.

5.4.1 Population and setting

Tshwane North District was selected as the area from which the researcher collected the sample. This district included Soshanguve, Themba and City. The researcher collected the sample for City without including Soshanguve and Themba. The researcher acknowledges the fact that if Soshanguve and Themba had been included it could have resulted in a larger sample with more variables and more complicated comparisons because of demographical and socio-economical differences. Data from areas such as Soshanguve and Themba are profoundly important in the South African context as it could add to information that already exists regarding a child's maturity, academic readiness and acquiring handwriting.

5.4.2 Sampling

The sampling was done to the best of the researcher's knowledge and ability. The researcher did not match the two age groups regarding gender, ethnicity and handedness. But matching the groups for ethnicity would have been difficult within this specific population because of the traditional Afrikaans and English schools included in the sample.

5.4.3 The background information form

At the onset of this study the researcher compiled the background information form to obtain important information about the participants. In hindsight it was clear that some of the questions were not clear and formulated well enough. Each of these questions is discussed separately below.

5.4.3.1 Questions regarding medication and conditions

The researcher did not include a comprehensive list of possible medications that a participant could have been taking at the time of the research. The medications mentioned in Question 1 were selected on account of the researcher's clinical experience (Refer to Appendix G). Therefore, a more comprehensive list of medications could have been included.

Attention deficit hyperactivity disorder, cerebral palsy and depression were included as parents would have been aware if their child had been diagnosed with one of these conditions. After reviewing the results the researcher realised that learning disability/disorder or developmental delay could have impacted on the participants' readiness for the expectations in Grade 1 and should have been included in the background information form. Developmental delay can be diagnosed by a professional in any child from a young age. Learning disability/disorder is not necessarily diagnosed before the child enters Grade 1.

In retrospect, including learning disability/disorder and developmental delay in the background information form could have added some value to the background information and sampling. However, the researcher's stance is that parents still might not have been able to give accurate information on existing conditions in their child. Depending on the parents' circumstances and their frame of reference, they might only seek help for their child in the case of life-threatening conditions.

5.4.3.2 The question on the child's ability to understand instructions in the academic language

Afrikaans and English were in some cases the participants' second or third language. From clinical experience the researcher knew that most families spoke their mother tongue at home and that it could not be assumed that the medium language was spoken at home. The participants' ability to understand instructions in the medium language was part of the inclusion and exclusion criteria. All the parents/caregivers of participants indicated that their child was able to understand instructions in the language of instruction. As parents do not always speak Afrikaans or English to their children at home, the researcher questions the reliability of the responses to this question.

5.4.3.3 Questions related to the pre-school year

The question on where the participant spent his or her pre-school year provided sufficient information. The researcher followed up on this question by asking if the child completed a Grade R before entering into Grade1. In some cases parents/cargivers indicated that the child did complete Grade R whereas in the previous question they indicated that the child had spent his or her pre-school year with grandparents. The response in the question about Grade R did not match with the response in the question on where the child spent his or her pre-school year.

In South Africa the attendance of a Grade R is not compulsory. Although a suggested format for Grade R was provided in the RNCS, not all nursery schools followed this format. Because of this parents/caregivers might not have known whether their child actually attended a Grade R. The responses obtained in the abovementioned questions were not reliable mainly because of two reasons. Firstly, the researcher did not formulate the questions in such a way that accurate information could be provided by the parents or caregivers. Secondly, the parents/caregivers might not have had sufficient knowledge about the curriculum followed at their child's nursery school. One of the questions was related to whether the participant underwent a screening test prior to entering Grade 1. A

screening test could be done by different professionals such as an occupational therapist, a speech therapist or a psychologist. This term should have been defined for clarification.

5.4.3.4 Education level of parents

Research has shown that the education level of parents or caregivers plays an important part in establishing a child's readiness profile. The researcher did not include this question on the parents'/caregivers' education in the background information form. This could have shed some light on the parents'/caregivers' approach to preparing their child for Grade 1.

5.4.3.5 Socio-economic background of parents

As with the education level of parents, socio-economic background can contribute to the development of a child's readiness profile. Information related to the parents' socio-economic background should have been considered as another variable between the two age groups in the sample.

5.4.3.6 Measurement tools

In South Africa occupational therapists make use of standardised assessments from other countries such as the USA. None of the assessments used frequently have been standardised to fit the South African population profile. The researcher had to use what was available and searched for assessment tools which would address the elements of readiness to acquire handwriting skills.

a) Translation of instructions of the two standardised assessments

The researcher translated the instructions of the M-FUN from English to Afrikaans, as the participants were assessed in one of these two languages. This is not the correct procedure.

b) The M-FUN

Another limitation in this study was related to the fairly new test namely the Miller Function and Participation Scales (M-FUN) (2006). No research has been published about the test at the time of the study. This test included functional and familiar activities. Although this test mainly addressed visual-motor integration, fine motor coordination and gross motor abilities, there were underlying neurological foundations that influenced the raw score obtained in each activity. The raw score was then converted to a scaled score. The M-FUN therefore met the researcher's demand to obtain a VMI and FMC profile for each participant. The possible limitation did not lie within the test per se but rather in the way in which the information was analysed. Each activity done as part of VMI and FMC also included some underlying neurological foundations, for example, bilateral integration and motor planning.

c) The MHA

The Minnesota Handwriting Assessment (1998) provided the researcher with data on handwriting according to six different categories. This assessment was designed to assess Grade 1 and Grade 2 learners at different times during the year. A participant could through his or her raw score be plotted on one of the following levels: "performing somewhat below peers", "performing well below peers" and "performing like peers". Not all of these levels provide the assessor with a specific raw score in each of the six categories.

In this study the participants' raw scores fell within range, for example, 33-34, 22-34 and 29-34. These ranges were then interpreted as "performing like peers", "performing somewhat below peers" and "performing well below peers". When these raw scores were correlated with VMI and FMC it might not have been accurate. An example would be a participant having a raw score of 22 and another participant having a raw score of 33, yet they still fell into the range of "performing like peers". It would have been possible to compare the raw scores of individual participants, but it was not done in this study.

5.5 RECOMMENDATIONS FOR FUTURE STUDIES

The researcher encountered certain limitations during the execution of this study as mentioned in Section 5.4. The following serve as suggestions for prospective researchers in the area of pre-writing skills and handwriting.

5.5.1 Population and setting

The selected population provided a sample with a large enough number of participants to deliver statistically meaningful data. Because South Africa has such diverse populations, it would be worthwhile to obtain data from other populations, which might include schools other than just traditionally Afrikaans and English schools. Existing literature provides us with information on development and readiness profiles in different age groups. Within the South African context, there is a lack of research related to the characteristics of the five-and-a-half-year old group. Professionals know what to expect in terms of normal development in this age group, but there is insufficient evidence on the five-year-old group's ability to live up to the demands of Grade 1. It would be very valuable to do a similar study to this one with a group of children who had similar pre-school experiences. Grade R is not compulsory and it was not possible to accurately determine whether the participants in this study had the same pre-school stimulation. This was an important variable in this study and should be considered by future researchers.

5.5.2 Sampling

Future researchers might consider having two matched groups regarding gender, ethnicity and handedness when embarking on a similar study as this. Depending on the area or district where the research takes place, achieving two matched groups might pose a challenge because of the diversity aspect.

Language will always remain a very important factor when assessing through verbal instructions. When a child does not understand the instructions in an assessment, his or her responses will not be a true reflection of his or her abilities.

One would expect that a child should be able to follow instructions in the language of instruction at school. This, however, does not always happen. Making use of a translator could enlarge the potential sample size in future studies, although it might be time consuming and have certain financial implications. Instructions could be translated into the children's mother tongue languages. Practically this could be difficult as there are 11 national languages in South Africa. The latter would indicate if language is the deciding factor in the child's performance at school.

5.5.3 Background information form

5.5.3.1 Questions regarding medication and conditions

A more comprehensive list of neurological and neuro-psychological conditions would be beneficial in the background information form as part of the inclusion and exclusion criteria. However, then the answer to the question must be 'Yes'. A 'No' would not necessarily indicate that the condition is not present. The same principle applies to the use of medication.

Learning disability/disorder and developmental delay should preferably be added to the list, despite the fact that the parents might not know this information. In fact, having learning disability/disorder and developmental delay on the list pertaining to a child's background information might create awareness among parents about it.

5.5.3.2 The question on the child's ability to understand instructions in the medium language

The researcher suggests that enquiring about which languages are spoken at home would provide more accurate information on the use of different languages in a specific family. In this study some of the teachers were able to provide information regarding the child's ability to understand instructions in the language of instruction.

The researcher consulted an optometrist for a visual screening before each of the participants was assessed. A language and auditory screening compiled by a qualified speech and language therapist might in future studies assist with identifying potential participants with language or auditory processing difficulties.

5.5.3.3 Questions related to the pre-school year

The effect of a quality pre-school year should never be underestimated. It is suggested that a question regarding the participant's attendance of a Grade R should be included in future forms. It would be beneficial to establish a baseline of what Grade R should entail or which syllabus is used in different nursery schools as this could have an effect on the exposure of a participant to learning.

Another way of controlling the variable of Grade R attendance might be by defining the potential population better. Selecting nursery schools that follow the same curriculum or of which the outcomes for the pre-school children are similar will address the variable of Grade R attendance. If future researchers were to include a question on screening tests, a definition or clarification should be provided to prevent confusion or misinterpretation.

5.5.3.4 Education level of parents

Not only does literature emphasise the role that the parents' education level could play in the process of acquiring handwriting skills, but in some cases it can influence the parents' ability to provide background information on their child and complete questionnaires properly. Information on the education level of the parents/caregivers can also add to the profile of research participants.

5.5.3.5 Socio-economic background of parents

This can impact on the parents' ability to provide their child with learning opportunities such as attending a Grade R or providing additional learning activities. Information regarding parents' socio-economic background could provide

future researchers with an additional variable through which participants could be matched or grouped.

5.5.3.6 Measurement tools

a) Translation of instructions of the two standardised assessments

A copy of the translated instructions for the M-FUN can be found in Appendix M. It is suggested that future researchers follow the correct procedure in translating the instructions as suggested in Section 5.4.3.6 a).

b) The M-FUN

The M-FUN is according to the researcher, a user friendly test. It includes functional activities which address children's level of development at different ages. It would be ideal to use this test again in a similar study with a different population to see whether it yields similar results. It would be extremely valuable to determine to what extent each of the underlying neurological foundations play a role in establishing a raw score for visual-motor-, fine motor- and gross-motor abilities. Each of the activities in the three different areas should be analysed separately from the others.
Handedness is not recorded in the M-FUN and should be noted by researchers. Handedness is important for future studies as a factor through which two groups could be matched.

In the M-FUN the different neurological foundations were not defined. These are all terms well known to qualified occupational therapists, but if not defined within the context of the test, it leaves room for interpretation. An example of these is as follows: crossing of the midline. In the test it entails moving one hand over to the opposite side of the body during FMC. A child can, however, avoid crossing of the midline by making postural adaptations during written activities, but crossing the midline is within these activities not considered as a neurological function.

Mature grasp is another neurological function which could be interpreted differently. According to Schneck and Amundson (in Case-Smith 2010) there are four possibilities for pencil grasps which could be considered normal/mature. As the term 'mature grasp' is not well defined in the test, the assessor is left to interpret it by him- or herself.

The two examples mentioned should therefore carefully be considered when using the M-FUN in future studies. The M-FUN is a valuable tool to use not only for assessment but also in future research studies.

c) The MHA

It is the researcher's opinion that the MHA was appropriate for the Afrikaans and English speaking participants as far as the sentence used on the stimulus sheet was concerned. The raw score which was obtained sometimes fell within a range which could have affected the data analysis. (Refer to Section 5.4.3.5). If the MHA were to be used again care should be taken to analyse the participant's response within the range. This would indicate whether the particular child's score was towards the lower or upper end of the range.

5.6 CONCLUSION

In conclusion: "What is the difference in the readiness to acquire handwriting skills between five-and six-year-old children in Grade 1 when comparing the level of visual-motor integration and fine motor coordination?"
The results from this study added to the available literature on handwriting, visual-motor integration and fine motor coordination. Significant results were found when the level of VMI development was compared between the five- and six-year-old groups, whereas the comparison of FMC between the five- and six-year-old groups did not yield the same results. Mixed results were seen in correlating VMI and FMC with the six categories of the MHA. Therefore the answer to the extent of the relationship between VMI, FMC and handwriting skills still eludes researchers.

Although the findings of this study do relate to literature, the South African context creates a different dimension. The differences in socio-economic backgrounds, the availability of resources, cultural differences and the variety of national languages among communities are challenges within the educational system that may not be easily obviated. Yet, knowing the complexity of normal development and specifically an activity such as handwriting highlights the importance of preparing children optimally for Grade 1. Although age has always been the indicator as to whether a child is ready for school, it can no longer be considered the only or paramount guideline.

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APPENDIX A
MILLER FUNCTION AND PARTICIPATION SCALES: RECORD FORM

MILLER
FUNCTION & PARTICIPATION
SCALES

Record Form

Ages 4:0–7:11

Name: _____

Address: _____

Age: _____ ☐ M ☐ F Examiner: _____

School: _____ Teacher: _____

Score Summary

Performance Scores

	Visual Motor	Fine Motor	Gross Motor
Raw Score (p. 2)			
Scaled Score			
Scaled Score Confidence Interval (% level)	to	to	to

	Year	Month	Day
Test Date			
Birth Date			
Chronological Age			

Participation Scores

Checklist	Total Points	Results		
Home Observations	/195	☐ Average	☐ Below Avg.	☐ Far Below Avg.
Classroom Observations	/138	☐ Average	☐ Below Avg.	☐ Far Below Avg.
Test Observations*	/75	☐ Average	☐ Below Avg.	☐ Far Below Avg.

* See page 4 of this Record Form.

Performance Score Chart

Score	Visual Motor	Fine Motor	Gross Motor
19	•	•	•
18	•	•	•
17	•	•	•
16	•	•	•
15	•	•	•
14	•	•	•
13	•	•	•
12	•	•	•
11	•	•	•
10	•	•	•
9	•	•	•
8	•	•	•
7	•	•	•
6	•	•	•
5	•	•	•
4	•	•	•
3	•	•	•
2	•	•	•
1	•	•	•

Progress Scores

	First Test Date	Second Test Date	Third Test Date
	Age:	Age:	Age:
Visual Motor			
Raw Score			
Progress Score			
Fine Motor			
Raw Score			
Progress Score			
Gross Motor			
Raw Score			
Progress Score			

Progress Score Chart

Score	Visual Motor	Fine Motor	Gross Motor
900	•	•	•
875	•	•	•
850	•	•	•
825	•	•	•
800	•	•	•
775	•	•	•
750	•	•	•
725	•	•	•
700	•	•	•
675	•	•	•
650	•	•	•
625	•	•	•
600	•	•	•
575	•	•	•
550	•	•	•
525	•	•	•
500	•	•	•
475	•	•	•
450	•	•	•
425	•	•	•
400	•	•	•
375	•	•	•
350	•	•	•
325	•	•	•
300	•	•	•
275	•	•	•
250	•	•	•
225	•	•	•
200	•	•	•
175	•	•	•
150	•	•	•
125	•	•	•
100	•	•	•

Performance and Participation Skills Analysis

Performance Raw Score Total

Visual Motor (VM)	Total	Fine Motor (FM)	Total	Gross Motor (GM)	Total Ages 4:0 to 5:11	Total Ages 6:0 to 7:11
Amazing Mazes	/18	Go Fishing (Items 5–7)	/14	Statue	/24	/24
Race Car	/5	Clay Play	/24	Ball Balance	/18	/18
Hidden Forks	/9	Penny Bank	/30	Bouncing Ball		/42
Find the Puppies	/9	Origami	/24	Soccer	/43	/43
Draw a Kid	/15	Snack Time	/21	Jumping	/30	/30
Writing	/14	FM Behavior Rating	/9	GM Behavior Rating	/9	/9
Go Fishing (Items 1–4)	/16					
VM Behavior Rating	/9					
VM Raw Score	/95	**FM Raw Score**	/122	**GM Raw Score**	/124	/166

Norm-Referenced Performance Scores

	Visual Motor	Fine Motor	Gross Motor
Scaled Score			
Scaled Score Points +/-			
Confidence Interval % Level	to	to	to
Percentile Rank			
Percentile Rank Confidence Interval	to	to	to
Age Equivalent			

Performance Score Differences

Test Comparisons	Score 1	Score 2	Difference
VM and FM		–	
VM and GM		–	
FM and GM		–	

Difference Required to be Significant (.15/.05)*	Significant Difference?
VM and FM	☐ Yes ☐ No
VM and GM	☐ Yes ☐ No
FM and GM	☐ Yes ☐ No

Frequency in Standardization Sample*		≤5% in Standardization Sample?
VM > FM	VM < FM	☐ Yes ☐ No
VM > GM	VM < GM	☐ Yes ☐ No
FM > GM	FM < GM	☐ Yes ☐ No

*See chapter 3 in the Manual.

Participation: Observations Checklist Summary

	Observations Checklists		
	Home	Classroom	Test
Mobility	1*	1	1
	2, 3, 4, 5, 6, 7, 8, 9, 10		
Posture and Stability	11	2	2, 3
Regulation		3	4
		4	5
		5	6
		6	7
Self-Esteem		7	8
		8	9
		9	10
		10	11
Social Skills (in Structured Settings)		11, 12	12
		13	13
		14	14
		15	15
		34	16
Communication		16	17
		17	18
		18	19
Organization		19	20
	18, 20, 21, 22		
	19	20	21
			22
Speed		35	23
Participation Over Time			24, 25
Sensory Discrimination		21, 22, 23	
Play Skills/Social Skills (in Leisure Activities)	12, 13, 14	24, 25	
	15	29	
	16	30	
	17	31	
Handling Objects	23, 24, 25, 26		
Writing	27, 28, 29		
Daily Routines	30, 31, 32		
Computer Keyboarding	33, 34	36, 37	
Behavior and Self-Control	41, 43	26	
	35, 36, 37, 38	27, 28, 29	
	39	33	
	40	34	
	42, 44, 45	32, 33	
Emotions	46, 47, 48, 49		
	50, 51		
Eating/Drinking	52	39	
	53	40	
	54	42	
	55	38, 41	
Dressing/Grooming/Toileting	63	44	
	64	46	
	56, 57, 58, 59	43, 45	
	60, 61, 62, 65		

*Bold numbers on the same line indicate similar Checklist behaviors

Neurological Foundations Profile

This profile shows the neurological foundations that are scored for each item*. The numbers in the columns are M–FUN item numbers, not item scores. Circle the item numbers that were scored 1 or 0.

	Hand Function								Non-Motor: Visual Perception			Postural Abilities									Executive Function and Participation				
	Hand strength	Pincer grasp	Release	In-hand manipulation	Mature grasp	Motor accuracy	Motor planning	Crossing midline	Figure-ground	Scanning/Sust. Attn.	Visual discrimination	Bilateral coordination	Unilateral coordination	Motor accuracy	Motor planning	Body awareness	Strength	Stability	Balance and equilibrium	Coordination and timing	Weight-shifting	Sustained attention	Regulation and control	Motor planning	Socialization	Sharing/Turn-taking
Visual Motor																										
Amazing Mazes					1	1, 2, 3	1, 2, 3																			
Race Car						1																				
Hidden Forks									1	1	1															
Find the Puppies						1				1	1															
Draw a Kid						1										1										
Writing						1–3, 4–9, 10–12, 13–15, 16																					
Go Fishing (Items 1–4)						1, 2, 3, 4						1, 2, 3, 4														
Behavior Rating																						1	2	3		
Fine Motor																										
Go Fishing (Items 5–7)						5, 6, 7						5, 6, 7														
Clay Play	2, 3, 4, 5											1, 3	2, 4, 5													
Penny Bank		1, 2, 3, 4		3, 4		1, 2, 3, 4		1, 2																		
Origami						1, 2	1, 2					1, 2														
Snack Time												1, 2		2, 3			1								3	3
Behavior Rating																						1	2	3		
Gross Motor																										
Statue																		1, 2, 3, 4	1, 2, 3, 4							
Ball Balance															1, 2, 3				1, 2, 3							
Bouncing Ball												3, 4	1, 2, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5											
Soccer														5	1, 2, 3, 4, 5			1, 2, 3, 4, 5			1, 2, 3, 4, 5					
Jumping														1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6											
Behavior Rating																						1	2	3		

*Keep in mind that the complex activities assessed in M–FUN may require neurological foundations not scored in this test.

Test Observations Checklist

Date: _____

Directions

Rate the child's participation during the administration of the *Miller Function and Participation Scales* by placing a "1" in the box that corresponds to the appropriate rating for each item.

		Almost Always Successful (75–100%)	Frequently Successful (50–74%)	Occasionally Successful (25–49%)	Seldom Successful (0–24%)	Not Observed	Comments: Task modifications, adaptive equipment, other observations related to the child's participation
Mobility	1. Maneuvers around obstacles such as furniture in the room						
Posture/ Stability	2. Demonstrates stable posture when sitting during table top activities and good muscle tone when moving body around to complete tasks						
	3. Automatically uses nondominant hand to assist with tasks						
Regulation/ Sensory Modulation	4. Demonstrates appropriate responses to sensory stimulation (does not seek, avoid, or seem unaware of sensation)						
	5. Reacts appropriately to external noises and distractions						
	6. Maintains appropriate level of arousal						
	7. Transitions smoothly between tasks						
Self-Esteem	8. Is confident and assured during tasks (not anxious, nervous, agitated)						
	9. Shows pleasure in task mastery and accomplishments						
	10. Exhibits an appropriate level of persistence when performing tasks						
	11. Is satisfied with own performance						
Social Skills	12. Is interactive and alert; forms alliance with examiner						
	13. Cooperates when performing tasks; tries to perform well to please others						
	14. Initiates and takes turns in conversations						
	15. Uses personal space appropriately; does not intrude on space of others						
	16. Controls emotions such as frustration and anger appropriately						
Communication	17. Understands directions; does not need directions repeated						
	18. Has speech that is understandable (good voice quality, few articulation errors, good rate of speech)						
	19. Expresses self appropriately for age (uses sentences appropriate for age; no word finding difficulties)						
Organization	20. Initiates tasks with minimal encouragement						
	21. Completes multi-step task as appropriate for age						
	22. Organizes use of space on a page (sizing, spacing)						
Speed	23. Completes tasks at a rate that is age-appropriate						
Participation Over Time	24. Maintains same focus and enthusiasm as test progresses						
	25. Demonstrates consistent level of engagement and skill as test progresses						
	Totals						Test Observations Total Points
	Multiply by	x3	x2	x1			
	Sum	+	+				/75

Visual Motor

The Amazing Mazes Game

Workbook Pages	Materials	Time Limit
1–4	Red felt-tipped pen and stopwatch	30 seconds

Items	Mature Grasp	P	Motor Accuracy	P	Motor Planning	P
Item 1 Mother dog/ Puppy			Number of lines crossed _____			
	Mature grasp of pen	3	0 lines crossed	3		
	Holds pen with fingers, but not mature grasp	2	1 line crossed	2	Draws a line that approximates the maze from start to end	2
	Holds pen with whole hand	1	2 or more lines crossed	1	Attempts to draw line from start to end	1
	Unable to hold pen for entire task; holds and lets go	0	Could not draw a path	0	Does not attempt to draw line from start to end of maze; may scribble on maze	0
Item 2 Girl/Soccer ball			Number of lines crossed _____			
			0 lines crossed	3		
			1 line crossed	2	Draws a line that approximates the maze from start to end	2
			2 or more lines crossed	1	Attempts to draw line from start to end of maze	1
			Could not draw a path	0	Does not attempt to draw line from start to end of maze; may scribble on maze	0
Item 3 Boy/Treasure			Number of lines crossed _____			
			0 lines crossed	3		
			1 line crossed	2	Draws a line that approximates the maze from start to end	2
			2 or more lines crossed	1	Attempts to draw line from start to end of maze	1
			Could not draw a path	0	Does not attempt to draw line from start to end of maze; may scribble on maze	0
	Mature Grasp total	/3	Motor Accuracy total	/9	Motor Planning total	/6
					The Amazing Mazes Game total	/18

The Race Car Game (Spiral)

Workbook Page	Materials	Time Limit
5	Red felt-tipped pen and stopwatch	60 seconds

	Motor Accuracy	P
Item 1 Spiral	Number of segments in which the line is drawn within the black borders of the spiral (no errors) _____ (0–14)	
	11–14 segments drawn within borders	5
	8–10 segments drawn within borders	2
	6–7 segments drawn within borders	1
	0–5 segments drawn within borders	0
	Motor Accuracy total	/5
	The Race Car Game total	/5

The Hidden Forks Game

Workbook Page	Materials	Time Limit	Note
6	Red felt-tipped pen and stopwatch	30 seconds	There are 12 forks in the picture, 3 in each quadrant.

	Visual Discrimination	P	Figure-ground	P	Scanning/Sustained Attention	P
Item 1 Marks forks	Number of spoons marked _____ (0–8)		Number of forks marked _____ (0–12)			
	Number of knives marked _____ (0–8)					
	0 spoons or knives marked	3	11–12 forks marked	3	Searches for forks in all four quadrants	3
			8–10 forks marked	2	Search limited to two or three quadrants	2
			6–7 forks marked	1	Search limited to one quadrant	1
	1 or more spoons or knives marked	0	0–5 forks marked or is unable to mark page	0	Does not search page	0
	Visual Discrimination total	/3	Figure-ground total	/3	Scanning/Sustained Attention total	/3
					The Hidden Forks Game total	/9

The Find the Puppies Game

Workbook Page	Materials	Time Limit	Note
7	Red felt-tipped pen and stopwatch	30 seconds	There are 20 puppies on the page.

	Visual Discrimination	P	Figure-ground/Motor Accuracy	P	Scanning/Sustained Attention	P
Item 1 Marks puppies			Number of puppies marked _____ (0–20)			
	Marks puppies and does not mark other animals	3	16–20 puppies marked	3	Searches for puppies in all four quadrants	3
	Marks puppies and marks 1–2 other animals	2	14–15 puppies marked	2	Search limited to two or three quadrants	2
	Randomly marks animals in the picture	1	12–13 puppies marked	1	Search limited to one quadrant	1
	Unable to mark any animals in the picture	0	0–11 puppies marked	0	Does not search page	0
	Visual Discrimination total	/3	Figure-ground/ Motor Accuracy total	/3	Scanning/Sustained Attention	/3
					The Find the Puppies Game total	/9

The Draw A Kid Game

Workbook Pages	Materials	Time Limit	Note
8–9	Red felt-tipped pen and stopwatch	60 seconds	Each check mark counts as one body part or clothing item.

Body Awareness		Motor Accuracy	
Mark a check if the child draws a body part or clothing item on the page.		Mark a check if the child draws the body part in the appropriate place relative to the whole body.	
Torso		Torso	
Arms		Arms	
Legs		Legs	
Head		Head	
Hands		Hands	
Feet		Feet	
Fingers		Fingers	
Toes		Toes	
Nose		Nose	
Ears		Ears	
Mouth		Mouth	
Hair		Hair	
Teeth		Teeth	
Eyes		Eyes	
Pupils		Pupils	
Eyebrows		Eyebrows	
Eyelashes		Eyelashes	
Other on head: _____		Other on head: _____	
Neck		Neck	
Shoes		Shoulders indicated	
Collar		Elbows indicated	
Pants		Knees indicated	
Shirt		Body longer than arms	
Skirt			
Other clothing: _____			
Total checks for Body Awareness		Total checks for Motor Accuracy	

Continued

	Body Awareness	?	Motor Accuracy	?
Item 1 Number of parts	Child draws body part or clothing on the page. Total number of checks from previous page _____		Child draws body part in the appropriate place relative to the whole body. Total number of checks from previous page _____	
	11–23 body parts/clothing items	3	11–23 body parts/clothing items	5
	7–10 body parts/clothing items	2	7–10 body parts/clothing items	3
	3–6 body parts/clothing items	1	4–6 body parts/clothing items	1
	0–2 body parts/clothing items	0	0–3 body parts/clothing items	0
Overall Impression			The lines of the body of the person do not overlap, are the right shape, and are attached at the right place	4
	Drawing has two arms, two legs, a body, a head, and most facial features	3	The lines of the body of the person sometimes overlap, are generally the right shape and attached at the right place	3
	Drawing is recognizable as a person	2	The lines of the body of the person overlap a great deal, are poorly shaped, and may not attach at the right place	2
	Attempts to draw a person	1	The body parts are not attached; the sides of the body are strikingly dissimilar	1
	Drawing is not recognizable as a person	0	Shapes of parts are unrecognizable or grossly distorted, sideways, or upside down	0
	Body Awareness total	/6	Motor Accuracy total	/9
			The Draw a Kid Game total	/15

The Writing Game

Weighted Ages	Materials	Time Limit	Note
10–14	Red felt-tipped pen	Items 1–15: 10 seconds Item 16: 120 seconds	If the child scores 0 on Item 1, do not administer Items 2–16.

Tracing Letters	Resembles letter	Does not resemble letter	Does not trace
Item 1 Trace *A*	2	1	0
Item 2 Trace *T*	2	1	0
Item 3 Trace *X*	2	1	0
Sum of Tracing Letters points			/6

Tracing Letters Motor Accuracy Score	
5–6 points	2
2–4 points	1
0–1 points	0
Tracing Letters Motor Accuracy subtotal	/2

Copying Letters	Resembles letter	Does not resemble letter	Does not copy
Item 4 Copy *W*	2	1	0
Item 5 Copy *S*	2	1	0
Item 6 Copy *G*	2	1	0
Item 7 Copy *d*	2	1	0
Item 8 Copy *f*	2	1	0
Item 9 Copy *y*	2	1	0
Sum of Copying Letters points			/12

8–12 points	3
6–7 points	2
2–5 points	1
0–1 points	0
Copying Letters Motor Accuracy subtotal	/3

Writing Letters	Resembles letter	Does not resemble letter	Does not write
Item 10 Write *H*	2	1	0
Item 11 Write *M*	2	1	0
Item 12 Write *J*	2	1	0
Sum of Writing Letters points			/6

6 points	3
4–5 points	2
2–3 points	1
0–1 points	0
Writing Letters Motor Accuracy subtotal	/3

Copying Words	Resembles word	Does not resemble word	Does not copy
Item 13 Write *cat*	2	1	0
Item 14 Write *fox*	2	1	0
Item 15 Write *sky*	2	1	0
Sum of Copying Words points			/6

6 points	3
4–5 points	2
2–3 points	1
0–1 points	0
Copying Words Motor Accuracy subtotal	/3

Copying a Sentence
Item 16 Total number of seconds required to complete sentence

1–90 seconds	3
91–120 seconds	0
Copying a Sentence Motor Accuracy subtotal	/3

Continued

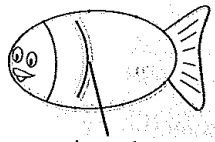
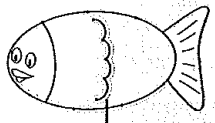
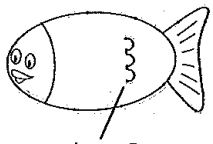
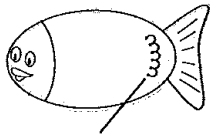
Tracing Letters subtotal	/2
Copying Letters subtotal	/3
Writing Letters subtotal	/3
Copying Words subtotal	/3
Copying a Sentence subtotal	/3
The Writing Game total	/14

Visual Motor Behavior Rating (Amazing Mazes to Go Fishing Game Items 1–4 [next page]) Rate the child's behavior during the Workbook activities.	Circle the score that indicates how frequently the child exhibited each behavior.			
	Almost Always	Frequently	Rarely	Almost Never
1. Paid attention to instructions and details in tasks; sustained concentration.	3	2	1	0
2. Planned before beginning; inhibited unnecessary talking and touching materials and examiner; was not impulsive.	3	2	1	0
3. Performed without fidgeting, restlessness; remained controlled during games; appropriate activity level (not hypo- or hyperactive).	3	2	1	0
Visual Motor Behavior Rating				/9

The Go Fishing Game

Workbook Page	Materials	Time Limit	Note
15	Red felt-tipped pen, scissors, adhesive tape (3/4"), string (18"), pencil ("fishing pole"), and stopwatch	Items 1–4: 10 seconds Items 5–7: 90 seconds	The Teaching and Practice Items and Items 1–4 are presented from left to right on the fish's tail.

Go Fishing: Visual Motor Items 1–4

Visual Motor Items	Motor Accuracy	P	Bilateral Coordination/Automatic Assist	P
Item 1 Tracing curved line; wide shaded area  Item 1	Number of segments in which line is traced within the shaded area _____ (0–2)			
	2 segments traced	2	Uses both hands: one to write, one to hold paper	2
	1 segment traced	1	Slow to use both hands; holds paper ineffectively with nondominant hand	1
	0 segments traced or unable to trace	0	Does not attempt task	0
Item 2 Tracing line with 4 curves; wide shaded area  Item 2	Number of segments in which line is traced within the shaded area _____ (0–4)			
	4 segments traced	2	Uses both hands: one to write, one to hold paper	2
			Slow to use both hands; holds paper ineffectively with nondominant hand	1
	0–3 segments traced or unable to trace	0	Does not attempt task	0
Item 3 Tracing line with 3 bumps/ narrow shaded area  Item 3	Number of segments in which line is traced within the shaded area _____ (0–3)			
	3 segments traced	2	Uses both hands: one to write, one to hold paper	2
			Slow to use both hands; holds paper ineffectively with nondominant hand	1
	0–2 segments traced or unable to trace	0	Does not attempt task	0
Item 4 Tracing line with 5 bumps/ narrow shaded area  Item 4	Number of segments in which line is traced within the shaded area _____ (0–5)			
	3–5 segments traced	2	Uses both hands: one to write, one to hold paper	2
			Slow to use both hands; holds paper ineffectively with nondominant hand	1
	0–2 segments traced or unable to trace	0	Does not attempt task	0
	Motor Accuracy total Visual Motor Items 1–4	/8	Bilateral Coordination/Automatic Assist total Visual Motor Items 1–4	/8
			Visual Motor Go Fishing total	/16

Continued

Fine Motor

Go Fishing: Fine Motor Items 5–7

Fine Motor Items	Motor Accuracy	P	Bilateral Coordination/Automatic Assist	P
Item 5 Cutting out fish	Number of segments in which line is cut within the shaded area _____ (0–12)			
	11–12 segments cut	3		
	7–10 segments cut	2	Uses both hands: one to cut, one to hold paper	2
	3–6 segment cut	1	Slow to use both hands; holds paper ineffectively with nondominant hand	1
	0–2 segments cut or unable to use scissors to cut	0	Unable to use scissors to cut	0
Item 6 Taping string to mouth of fish	Places tape on string; places string on fish's mouth	2	Holds tape dispenser with one hand and tears off tape with the other	2
	Attempts to place tape on string and/or string on fish's mouth inaccurately	1	Attempts to hold tape dispenser or tear off tape but ineffective with one hand	1
	Unable to place tape on string and/or place string on fish's mouth	0	Does not try to hold tape dispenser while tearing off tape	0
Item 7 Reeling in fish	Winds string neatly around pencil	3		
	Winds string loosely 3 to 10 times	2	Uses both hands to reel in fish; one hand to hold pencil; the other hand to wind string	2
	Attempts to wind string; string loosely wound around pencil 1 or 2 times	1	Difficulty holding pencil and winding string	1
	Unable to wind string to reel in fish	0	Unable to wind string to reel in fish	0
	Motor Accuracy total Fine Motor Items 5–7	/8	Bilateral Coordination/Automatic Assist total Fine Motor Items 5–7	/6
			Fine Motor Go Fishing total	/14

The Clay Play Game

Materials	Time Limit
Four balls of colored modeling clay (ping-pong ball size) and a stopwatch	10 seconds

	Hand Strength	P	Bilateral Coordination	P	Unilateral Coordination	P
Item 1 Makes a ball			Moves both hands in a smooth, circular motion to produce round ball	3		
			Moves both hands in a circular motion, but movement is jerky	2		
			Attempts to make ball by moving both hands back and forth but not in circular motion	1		
			Unable to roll chunk of clay into a ball	0		
Item 2 Makes a cookie	Flattens ball into disc that is mostly 1/4" thick	3			Able to form an almost evenly rounded flat shape using heel of one hand	3
	Flattens ball into disc with some part of it at least 1/4" thick	2			Approximates a rounded shape of uneven thickness (not flat)	2
	Flattens ball into disc more than 1/4" thick	1			Flattens ball but thickness and edges are uneven	1
	Unable to flatten ball	0			Unable to flatten ball	0
Item 3 Makes worm with both hands	Worm is a mostly smooth tube that is approximately 1/2" in diameter	3				
	Worm is a mostly smooth tube, some of which is 1/2" in diameter	2	Moves hands bilaterally and smoothly to make first worm (smooth, rhythmic motion of hands)	2		
	Worm is a mostly lumpy tube or is bigger than 1/2" in diameter	1	Attempts to roll with both hands but tends to roll with one hand more than the other; poor coordination	1		
	Result does not resemble a worm	0	Unable to use both hands to produce a worm	0		
Item 4 Makes worm with dominant hand	Worm is a mostly smooth tube that is approximately 1/2" in diameter	3				
	Worm is a mostly smooth tube, some of which is 1/2" in diameter	2			Moves dominant hand smoothly on table to make second worm	2
	Worm is a mostly lumpy tube or is bigger than 1/2" in diameter	1			Uses dominant hand but movement is choppy (not smooth and continuous)	1
	Result does not resemble a worm	0			Unable to make worm with dominant hand	0
Item 5 Makes worm with nondominant hand	Worm is a mostly smooth tube that is approximately 1/2" in diameter	3				
	Worm is a smooth tube, some of which is 1/2" in diameter	2			Moves nondominant hand smoothly on table to make second worm	2
	Worm is a mostly lumpy tube or is bigger than 1/2" in diameter	1			Uses nondominant hand but movement is choppy (not smooth and continuous)	1
	Result does not resemble a worm	0			Unable to make worm with nondominant hand	0
	Hand Strength total Items 2, 3, 4, & 5 only	/12	Bilateral Coordination total Items 1 & 3 only	/5	Unilateral Coordination total Items 2, 4, & 5 only	/7
					The Clay Play Game total	/24

The Penny Bank Game

Materials	Time Limit
Bank, 10 pennies, and stopwatch	60 seconds

	Crossing Midline (1 & 2)	P	Pincer Grasp	P	Motor Accuracy	P
Item 1 Pennies in slot, dominant hand	Crosses midline automatically to pick up 5 pennies	3			Number of pennies placed in slot accurately without dropping _____ (0–10)	
	Crosses midline automatically to pick up 1–4 pennies	2	Uses pincer grasp consistently to pick up pennies	2	10 pennies in slot	2
	Crosses midline with a verbal prompt to pick up 1–5 pennies	1	Inconsistently uses pincer grasp to pick up pennies	1	9 pennies in slot	1
	Does not cross midline with a verbal prompt	0	Does not use pincer grasp to pick up pennies	0	0–8 pennies in slot	0
Item 2 Pennies in slot, nondominant hand	Crosses midline automatically to pick up 5 pennies	3			Number of pennies placed in slot accurately without dropping _____ (0–10)	
	Crosses midline automatically to pick up 1–4 pennies	2	Uses pincer grasp consistently to pick up pennies	2	10 pennies in slot	2
	Crosses midline with a verbal prompt to pick up 1–5 pennies	1	Inconsistently uses pincer grasp to pick up pennies	1	9 pennies in slot	1
	Does not cross midline with a verbal prompt	0	Does not use pincer grasp to pick up pennies	0	0–8 pennies in slot	0
	In-Hand Manipulation (3 & 4)					
Item 3 In-hand manipulation, dominant hand	Smooth, linear movement of pennies from palm to finger pads with penny held solely in one hand and good control of thumb	3			Number of pennies placed into the slot _____ (0–5)	
	Is able to move pennies from palm to finger pads but movements are awkward, thumb is not used well; poor finger coordination	2	Consistently uses pincer grasp to place pennies in slot	2	5 pennies in slot	3
	Is able to move pennies to finger pads but uses assist, either bracing penny on table top or on body, or placing it in finger pads with other hand or drops and picks up penny	1	Inconsistently uses pincer grasp to place pennies in slot	1		
	Tries but is unable to get any pennies to finger pads	0	Does not use pincer grasp to place pennies in slot	0	0–4 pennies in slot	0
Item 4 In-hand manipulation, nondominant hand	Smooth, linear movement of pennies from palm to finger pads with penny held solely in one hand and good control of thumb	3			Number of pennies placed into the slot _____ (0–5)	
	Is able to move pennies from palm to finger pads but movements are awkward, thumb is not used well; poor finger coordination	2	Consistently uses pincer grasp to place pennies in slot	2	5 pennies in slot	3
	Is able to move pennies to finger pads but uses assist, either bracing penny on table top or on body, or placing it in finger pads with other hand or drops and picks up penny	1	Inconsistently uses pincer grasp to place pennies in slot	1		
	Tries but is unable to get any pennies to finger pads	0	Does not use pincer grasp to place pennies in slot	0	0–4 pennies in slot	0
Crossing Midline + In-Hand Manipulation total		/12	Pincer Grasp total	/8	Motor Accuracy total	/10
					The Penny Bank Game total	/30

The Origami Game

Workbook Pages	Materials	Time Limit	Note
Center sheet in Workbook	Two washcloths, dog and fish origami templates for both examner and child (prepared before administration), and stopwatch	30 seconds	Accurate alignment = within 1/8 of an inch

	Motor Accuracy	P	Bilateral Coordination	P	Motor Planning	P
Item 1 Folds dog	All 4 folds aligned accurately	5				
	3 folds aligned accurately	4				
	2 folds aligned accurately	3	Folds paper using both hands actively	3	Completes all steps in folding sequence	3
	1 fold aligned accurately	2	Folds paper using second hand only to stabilize paper	2	Completes 2 or 3 steps in folding sequence	2
	1 fold but not accurately aligned	1	Ineffective attempts to stabilize paper with second hand	1	Initiates the folding task by making at least one fold with the paper, but can't figure out how to make the dog	1
	Able to manipulate paper, but doesn't make folds	0	Does not attempt to stabilize paper with second hand	0	Does not attempt to initiate the folding task	0
Item 2 Folds fish	All 6 folds aligned accurately	7				
	4–5 folds aligned accurately	3	Folds paper using both hands actively	3	Completes all steps in folding sequence	3
	2–3 folds aligned accurately	2	Folds paper using second hand only to stabilize paper	2	Completes 2 or 3 steps in folding sequence	2
	1 fold aligned accurately	1	Ineffective attempts to stabilize paper with second hand	1	Initiates the folding task by making at least one fold with the paper, but can't figure out how to make the fish	1
	Able to manipulate paper, but folds not aligned accurately	0	Does not attempt to stabilize paper with second hand	0	Does not attempt to initiate the folding task	0
	Motor Accuracy total	/12	Bilateral Coordination total	/6	Motor Planning total	/6
					The Origami Game total	/24

Snack Time

Materials	Time Limit	Note
20 oz. bottle of water (half full), two napkins, three 8 oz. plastic cups, and bite-size snack crackers placed in one of the cups	None	Verify with the parent or caregiver that the child does not have food allergies or food sensitivities that can be aggravated by the crackers. The bottle of water should be half full. Open the bottle prior to the test session and screw the cap back on securely, but not tightly. Sit across the table from the child so that you can maintain eye contact.

	Motor Accuracy	P	Bilateral Coordination	P	Strength	P
Item 1 Opens bottle			Automatically uses both hands; one to hold bottle and one to twist cap	3	Twists the cap off upright bottle	3
			Tries to twist cap, then uses alternate hand to assist	2	Unable to twist the cap off upright bottle, but able to remove it if examiner starts to untwist it	2
			Tries to use alternate hand but it is an ineffective helper	1	Drops bottle or turns bottle on side while trying to twist cap	1
			Examiner holds bottle while child twists cap off	0	Unable to twist cap from bottle	0
Item 2 Pours water	Pours water into both cups without spilling	3	Uses both hands to pour water into cups OR pours with one hand and stabilizes cup with other hand automatically	3		
	Pours water into both cups with a little spilling	2	Has difficulty pouring with one hand; awkward use of second hand to correct for difficulty	2		
	Needs assistance to pour water into cup and/or spills a lot	1	Does not automatically use second hand; examiner must cue to use second hand	1		
	Unable to pour any water into cup	0	Unable to hold bottle and pour with two hands OR unable to hold with one hand and pour with the other	0		
			Socialization for entire snack time	P	Sharing/turn-taking for entire snack time	P
Item 3 Puts crackers on napkins	Gently pours from cup so crackers land on both napkins neatly OR uses pincer grasp to place crackers on both napkins	3	Consistently demonstrates appropriate cooperation and attention	3	Consistently interacts, takes turns, maintains eye contact, and communicates (verbally or nonverbally)	3
	Pours from cup or takes out with fingers so that most of the crackers land on the napkins	2	Sometimes cooperates and attends	2	Sometimes interacts, takes turns, maintains eye contact, and communicates (verbally or nonverbally)	2
	Aims for the napkins but most of the crackers land off of the napkins	1	Infrequently cooperates and attends	1	Infrequently interacts, takes turns, maintains eye contact, and communicates (verbally or nonverbally)	1
	Unable to place crackers on both napkins	0	Does not cooperate or attend	0	Does not interact, take turns, maintain eye contact, or communicate (verbally or nonverbally)	0
			Bilateral Coordination total Items 1 & 2 only	/6	Strength total Item 1 only	/3
	Motor Accuracy total Items 2 & 3 only	/6	Socialization total Item 3 only	/3	Sharing/turn-taking total Item 3 only	/3
					Snack Time total	/21

Fine Motor Behavior Rating (Go Fishing Items 5–7 to Snack Time Games) Rate the child's behavior during the Fine Motor tabletop activities.	Circle the score that indicates how frequently the child exhibited each behavior.			
	Almost Always	Frequently	Rarely	Almost Never
1. Paid attention to instructions and details in tasks; sustained concentration.	3	2	1	0
2. Planned before beginning; inhibited unnecessary talking and touching materials and examiner; was not impulsive.	3	2	1	0
3. Performed without fidgeting, restlessness; remained controlled during games; appropriate activity level (not hypo- or hyperactive).	3	2	1	0
			Fine Motor Behavior Rating	/9

Gross Motor

The Statue Game

Materials	Time Limit
Stopwatch	Items 1 & 2: 10 seconds Items 3 & 4: 5 seconds

	Body Stability	P	Balance and Equilibrium When feet move, stop timing and end task	P
Item 1 Balances on right foot; eyes open			Number of seconds position is held _____ (0–10)	
	Balances on right foot without moving body or arms for at least 2 seconds; right foot stationary on ground	3	8–10 seconds	3
	Right foot remains in place for at least 2 seconds but arms flail or body is moving	2	6–7 seconds	2
	Can assume position for 1 second but right foot moves to maintain balance or left foot immediately touches floor	1	4–5 seconds	1
	Unable to assume position	0	0–3 seconds	0
Item 2 Balances on left foot; eyes open			Number of seconds position is held _____ (0–10)	
	Balances on left foot without moving body or arms for at least 2 seconds; left foot stationary on ground	3	8–10 seconds	3
	Left foot remains in place for at least 2 seconds but arms flail or body is moving	2	6–7 seconds	2
	Can assume position for 1 second but left foot moves to maintain balance or right foot immediately touches floor	1	4–5 seconds	1
	Unable to assume position	0	0–3 seconds	0
Item 3 Balances on right foot; eyes closed			Number of seconds position is held _____ (0–5)	
	Balances on right foot without moving body or arms for at least 2 seconds; right foot stationary on ground; eyes remain closed	3	4–5 seconds	3
	Right foot remains in place for at least 2 seconds but arms flail or body is moving; or maintains balance but eyes are open	2	3 seconds	2
	Can assume position for 1 second but right foot moves to maintain balance or left foot immediately touches floor	1	2 seconds	1
	Unable to assume position	0	0–1 seconds	0
Item 4 Balances on left foot; eyes closed			Number of seconds position is held _____ (0–5)	
	Balances on left foot without moving body or arms for at least 2 seconds; left foot stationary on ground; eyes remain closed	3	4–5 seconds	3
	Left foot remains in place for at least 2 seconds but arms flail or body is moving; or maintains balance but eyes are open	2	3 seconds	2
	Can assume position for 1 second but left foot moves to maintain balance or right foot immediately touches floor	1	2 seconds	1
	Unable to assume position	0	0–1 seconds	0
	Body Stability total	/12	+ Balance and Equilibrium total	/12
			The Statue Game total	/24

The Ball Balance Game

Materials	Time Limit	Note
Ball, two 4" × 4" mats, two 4' strips of masking tape, spoon, wall, and stopwatch	Item 1: 30 seconds Items 2 & 3: 60 seconds	Space required: Cleared space at least 12' from wall. For all items, if the child drops the ball before the time limit is reached, tell the child to pick up the ball and put it back on the spoon.

	Motor Planning	P	Balance	P
Item 1 First mat to second mat	Coordinated walking while carrying ball from mat to mat	3	Completes path without dropping ball	3
	Stumbles or walks off path one time	2	Balances ball on spoon for 2–4 seconds several times	2
	Stumbles or walks off path two or more times	1	Attempts to walk and balance ball	1
	Does not attempt or unable to walk and balance ball	0	Does not attempt or unable to walk and balance ball	0
Item 2 Around perimeter of two mats	Carries ball on spoon to and around second mat and back to first mat	3	Completes path without dropping ball	3
	Stumbles or walks off path one time	2	Balances ball on spoon for 2–4 seconds several times	2
	Stumbles or walks off path two or more times	1	Attempts to walk and balance ball	1
	Does not attempt or unable to walk and balance ball	0	Does not attempt or unable to walk and balance ball	0
Item 3 Figure 8	Carries ball on spoon in figure 8 pattern without dropping ball	3	Completes path without dropping ball	3
	Stumbles or walks off path one time	2	Balances ball on spoon for 2–4 seconds several times	2
	Stumbles or walks off path two or more times	1	Attempts to walk and balance ball	1
	Does not attempt or unable to walk and balance ball	0	Does not attempt or unable to walk and balance ball	0
	Motor Planning total	/9	Balance total	/9
			The Ball Balance Game total	/18

The Bouncing Ball Game (Ages 6:0–7:11 Only)

Materials	Time Limit	Note
Ball, one 4" × 4" mat, two 4' strips of masking tape, wall, and stopwatch	10 seconds	Space required: Cleared space at least 12' from a wall. For all items, if the child drops the ball before the time limit is reached, tell the child to pick up the ball and continue.

	Bilateral Coordination	P	Unilateral Coordination	P	Motor Accuracy	P	Motor Planning	P
Item 1 Bounces ball; catches with dominant hand Each catch = 1					Number of times child catches ball with dominant hand in 10 seconds _____			
					6 or more catches	3	Bounces and catches ball with no fumbling	3
			Bounces ball on floor and catches with dominant hand one time	2	4–5 catches	2	Bounces and catches ball with some fumbling	2
			Attempts to bounce and catch ball	1	2–3 catches	1	Attempts, but does not catch ball	1
			Unable to bounce and catch ball	0	0–1 catches	0	Unable to bounce and catch ball	0
Item 2 Bounces ball; catches with nondominant hand Each catch = 1					Number of times child catches ball with nondominant hand in 10 seconds _____			
					6 or more catches	3	Bounces and catches ball with no fumbling	3
			Bounces ball on floor and catches with nondominant hand one time	2	4–5 catches	2	Bounces and catches ball with some fumbling	2
			Attempts to bounce and catch ball	1	2–3 catches	1	Attempts, but does not catch ball	1
			Unable to bounce and catch ball	0	0–1 catches	0	Unable to bounce and catch ball	0
Item 3 Tosses ball from hand to hand Each toss = 1					Number of times child catches ball when tossing it from one hand to the other _____			
	Tosses ball from hand to hand multiple times	3			7 or more catches	3	Tosses ball from hand to hand with no fumbling	3
	Tosses ball from hand 1 to hand 2, then back to hand 1 one time	2			3–6 catches	2	Tosses ball from hand to hand with some fumbling	2
	Attempts to toss ball from hand to hand	1			1–2 catches	1	Attempts, but does not catch ball	1
	Unable to toss ball from hand to hand	0			0 catches	0	Unable to bounce and catch ball	0
Bilateral Coordination subtotal		/3	Unilateral Coordination subtotal	/4	Motor Accuracy subtotal	/9	Motor Planning subtotal	/9

Continued

	Bilateral Coordination	P	Unilateral Coordination	P	Motor Accuracy	P	Motor Planning	P
Item 4 Bounces ball with one hand and catches with the other Each catch = 1					Number of times child catches the ball with hand 2 _____			
	Bounces ball from hand to hand multiple times	3			8 or more catches	3	Bounces ball in one hand and catches it with the other with no fumbling	3
	Bounces ball from hand 1 to hand 2, then back to hand 1 one time	2			5–7 catches	2	Bounces ball in one hand and catches it with the other with some fumbling	2
	Attempts to bounce ball with one hand and catch with the other hand	1			1–4 catches	1	Attempts, but doesn't coordinate actions to bounce and catch ball	1
	Unable to bounce ball with one hand and catch with the other	0			0 catches	0	Unable to bounce and catch ball	0
Item 5 Bounces, catches ball while walking Each catch = 1					Number of times child catches ball while walking _____			
					6 or more catches	3	Bounces, then catches ball while walking with no fumbling	3
			Smoothly bounces and catches ball one time while walking	2	3–5 catches	2	Bounces, then catches ball while walking with some fumbling	2
			Attempts to bounce and catch ball but uses both hands	1	1–2 catches	1	Understands task; attempts task, but doesn't coordinate actions to bounce and catch ball and walk simultaneously	1
			Unable to bounce or catch ball.	0	0 catches	0	Unable to bounce or catch ball	0
Bilateral Coordination total Items 3 & 4 only		/6	Unilateral Coordination total Items 1, 2 & 5 only	/6	Motor Accuracy total	/15	Motor Planning total	/15
							The Bouncing Ball Game total	/42

The Soccer Game

Materials	Time Limit	Note
Ball, one 4" × 4" mat, two 4' strips of masking tape, wall, and stopwatch	Items 1–4: None Item 5: 20 seconds	Space required: Cleared space at least 12' from a wall. Use the same mat-and-masking tape setup as the Throw and Catch Game.

	Stability	P	Weight-shifting	P	Motor Planning	P
Item 1 Kicks stationary ball to 4' line; dominant leg Foot used to kick: ☐R ☐L	Kicks with sufficient force to reach line 4' away and does not lose balance	3			Foot connects with ball with no fumbling	3
	Has to catch balance by putting foot down immediately after kicking	2	Shifts weight to opposite leg when preparing to kick	2	Foot connects with ball with some fumbling	2
	Attempts, but falls or has to catch balance by putting foot down when trying to kick	1	Attempts, but falls or has to catch balance by putting foot down when attempting to shift weight to opposite leg	1	Attempts, but foot does not connect with ball	1
	Does not attempt or unable to kick	0	Does not attempt to shift weight	0	Does not attempt or unable to kick	0
Item 2 Kicks stationary ball to 4' line; nondominant leg	Kicks with sufficient force to reach line 4' away and does not lose balance	3			Foot connects with ball with no fumbling	3
	Has to catch balance by putting foot down immediately after kicking	2	Shifts weight to opposite leg when preparing to kick	2	Foot connects with ball with some fumbling	2
	Attempts, but falls or has to catch balance by putting foot down when trying to kick	1	Attempts, but falls or has to catch balance by putting foot down when attempting to shift weight to opposite leg	1	Attempts, but foot does not connect with ball	1
	Does not attempt or unable to kick	0	Does not attempt to shift weight	0	Does not attempt or unable to kick	0
Item 3 Kicks rolled ball to 8' line; dominant leg	Kicks with sufficient force to reach line 8' away and does not lose balance	3			Foot connects with ball with no fumbling	3
	Has to catch balance by putting foot down immediately after kicking	2	Shifts weight to opposite leg when preparing to kick	2	Foot connects with ball with some fumbling	2
	Attempts, but falls or has to catch balance by putting foot down when trying to kick	1	Attempts, but falls or has to catch balance by putting foot down when attempting to shift weight to opposite leg	1	Attempts, but foot does not connect with ball	1
	Does not attempt or unable to kick	0	Does not attempt to shift weight	0	Does not attempt or unable to kick	0
Item 4 Kicks rolled ball to 8' line; nondominant leg	Kicks with sufficient force to reach line 8' away and does not lose balance	3			Foot connects with ball with no fumbling	3
	Has to catch balance by putting foot down immediately after kicking	2	Shifts weight to opposite leg when preparing to kick	2	Foot connects with ball with some fumbling	2
	Attempts, but falls or has to catch balance by putting foot down when trying to kick	1	Attempts, but falls or has to catch balance by putting foot down when attempting to shift weight to opposite leg	1	Attempts, but foot does not connect with ball	1
	Does not attempt or unable to kick	0	Does not attempt to shift weight	0	Does not attempt or unable to kick	0
	Stability subtotal	/12	Weight-shifting subtotal	/8	Motor Planning subtotal	/12

Continued

	Stability	P	Weight-shifting	P	Motor Planning	P	Motor Accuracy	P
Item 5 Kicks ball against the wall Kicks that hit the wall and ricochet across the line = 1							Number of times child kicks ball against wall in 20 seconds _____ (0–15)	
	Kicks with sufficient force to reach wall; ball ricochets back behind the line more than 50% of the time	3			Usually anticipates when and where ball will come and moves body as needed to kick	3	4 or more kicks	3
	Kicks with sufficient force to reach wall; ball ricochets back behind the line less than 50% of the time	2	Shifts weight to opposite leg when preparing to kick	2	Sometimes anticipates when and where ball will come and sometimes moves body as needed to kick	2	2–3 kicks	2
	Attempts, but ball rarely hits the wall or rarely ricochets back across the line	1	Attempts, but falls or has to catch balance by putting foot down when attempting to shift weight to opposite leg	1	Attempts, but rarely anticipates where ball will go and is not there to receive it	1	1 kick	1
	Unable to kick ball to wall and back	0	Does not attempt to shift weight	0	Does not attempt or unable to kick	0	0 kicks	0
	Stability total	/15	Weight-shifting total	/10	Motor Planning total	/15	Motor Accuracy total Item 5 only	/3
							The Soccer Game total	/43

The Jumping Game

Materials	Time Limit	Note
Three 4"× 4" mats and stopwatch	Items 1–4: 10 seconds Items 5–6: 60 seconds	Space required: Cleared space about 10' × 10' Item 5 is to be administered only to ages 4:0–5:11. Ages 4:0–5:11 do not take Item 6. Item 6 is to be administered only to ages 6:0–7:11. Ages 6:0–7:11 do not take Item 5.

	Motor Accuracy	P	Motor Planning	P
Item 1 Jumps in together/ out together Counting jumps: feet out = 1 feet in =1	Number of jumps completed in 10 seconds _____			
	20 or more jumps	3	Continuous, smooth jumping with no stumbling for the first 10 seconds	3
	8–19 jumps	2	Interrupted or jerky jumping; does not stumble	2
	6–7 jumps	1	Attempts task; jumping is interrupted or jerky with frequent stumbling	1
	0–5 jumps	0	Unable to jump with both feet leaving the floor simultaneously	0
Item 2 Jumps side to side Counting jumps: left to right = 1 right to left = 1	Number of jumps completed in 10 seconds _____			
	21 or more jumps	3	Continuous, smooth jumping with no stumbling for the first 10 seconds	3
	13–20 jumps	2	Interrupted or jerky jumping; does not stumble	2
	5–12 jumps	1	Attempts task; jumping is interrupted or jerky with frequent stumbling	1
	0–4 jumps	0	Unable to jump with both feet leaving the floor simultaneously	0
Item 3 Jumps forward and backward Counting jumps: forward over mat = 1 backward over mat = 1	Number of jumps completed in 10 seconds _____			
	12 or more jumps	3	Continuous, smooth jumping with no stumbling for the first 10 seconds	3
	6–11 jumps	2	Interrupted or jerky jumping; does not stumble	2
	4–5 jumps	1	Attempts task; jumping is interrupted or jerky with frequent stumbling	1
	0–3 jumps	0	Unable to jump with both feet leaving the floor simultaneously	0
Item 4 Jumps in triangle pattern 3 jumps in triangle pattern = 1 sequence	Number of jump sequences completed in 10 seconds _____			
	7 or more jumps	3	Continuous, smooth jumping with no stumbling for the first 10 seconds	3
	4–6 jumps	2	Interrupted or jerky jumping; does not stumble	2
	2–3 jumps	1	Attempts task; jumping is interrupted or jerky with frequent stumbling	1
	0–1 jumps	0	Unable to jump with both feet leaving the floor simultaneously	0
	Motor Accuracy subtotal	/12	Motor Planning subtotal	/12

Continued

	Motor Accuracy	T-	Motor Planning	T-
Item 5 Ages 4:0–5:11 only Jumps for 60 seconds Both feet leave the ground simultaneously = 1	Number of jumps in 60 seconds _____			
	100 or more jumps	3	Continuous, smooth jumping with no stumbling for the first 10 seconds	3
	50–99 jumps	2	Interrupted or jerky jumping; does not stumble	2
	16–49 jumps	1	Attempts task; jumping is interrupted or jerky with frequent stumbling	1
	0–15 jumps	0	Unable to jump with both feet leaving the floor simultaneously	0
Item 6 Ages 6:0–7:11 only Jumping jacks	Number of accurate jumping jacks in first 10 seconds _____			
	13 or more jumps	3	Continuous, smooth jumping with no stumbling for the first 10 seconds	3
	4–12 jumps	2	Interrupted or jerky jumping; does not stumble	2
	3 jumps	1	Attempts task; jumping is interrupted or jerky with frequent stumbling	1
	0–2 jumps	0	Unable to complete a jumping jack	0
	Motor Accuracy total	/15	Motor Planning total	/15
			The Jumping Game total	/30

Gross Motor Behavior Rating (Statue to Jumping Games) Rate the child's behavior during the Gross Motor activities.	Circle the score that indicates how frequently the child exhibited each behavior.			
	Almost Always	Frequently	Rarely	Almost Never
1. Paid attention to instructions and details in tasks; sustained concentration	3	2	1	0
2. Planned before beginning; inhibited unnecessary talking and touching materials and examiner; not impulsive	3	2	1	0
3. Performed without fidgeting, restlessness; remained controlled during games; appropriate activity level (not hypo- or hyperactive)	3	2	1	0
	Gross Motor Behavior Rating			/9

APPENDIX B

NORMAL DEVELOPMENT OF THE FIVE- AND SIX-YEAR-OLD CHILD

NORMAL DEVELOPMENT OF THE FIVE-YEAR-OLD-CHILD

MOTOR SKILLS

Gross motor skills

He can walk across a balancing beam without losing his balance.
He can walk on a straight line (heel-touching-toes) without losing his balance.
He can walk and run on tiptoe.
He can stand on tiptoe for 10 seconds.
He can jump with two feet together.
He can stand on one leg for up to 10 seconds, keeping his eyes open and using his arms to help him balance.
He can jump on one leg, at least 3 to 5 times.
He can gallop rhythmically.
He can skip, using his feet alternately.
He can march.
Smooth eye movements are expected from his age, onwards.
He starts to ride a bicycle.
He can catch and throw a ball.
He can catch a bouncing ball with both hands.
He can bounce a ball on the floor with both hands.
He can throw a ball overhead.
He can kick a ball up in the air.
He can run to a ball and kick.

Fine motor skills

It is expected of a 5 year old to perform desk activities by making sufficient postural adjustments.
He can draw a detailed picture.
He can cross his midline.
He can copy the following shapes on paper, if you draw and example for him.
He can write his own name if his was taught how.

He can colour in fairly neatly within the lines of a picture.
He has a dynamic three-pointed grip like an adult. He uses his thumb, index and middle finger to hold his pencil with.
He uses mostly finger movements when drawing. Thus, he keeps his shoulder and elbow joint as well as his wrist, relatively still while moving his fingers to write.
He can cut circles and difficult corners, quality might still be insufficient.
He can manipulate the scissors more or less like an adult would.
Hand, eye and foot dominance should be fixed at this age.
He can sharpen a pencil.
He can use an eraser.
He can glue a picture fairly accurately.
He can touch his thumb with each of the other fingers individually in 8 seconds.
He can throw 12 coins through an opening in the lid of a container in 20 seconds.
He can tear a form from paper by tearing the paper carefully on the lines of the picture, using both hands.
He can thread cotton through a thick needle. He can do simple sewing activities, making stitches with a needle and wool through little holes.
He can snap his fingers slowly.

PERCEPTUAL DEVELOPMENT

Body awareness

He can point to all of the basic body parts if asked to.
He can name all the basic body parts.
He knows the functions of all the basic body parts.
He can identify body parts on somebody else.
He can name the positions of the different body parts.
He realizes that his body is smaller than those of his parents.
Drawing-of-a-man: he draws all the basic body parts as well as clothes for the man.

Concepts

He can identify the following 10 shapes on request.

He can distinguish between the rectangle and the square.
He can distinguish between the kite and the diamond.
He can give the name of the following shapes on request.
He can point to all the colours on request.
He can give the names of at least 5 to 6 colours if you point to the colours.
He can organize shades of the same colour from light to dark.
He can count from 1 to 13 or more.
He can count 10 objects.
He can copy the first 5 numbers on a paper, if taught how.
He can calculate within 5 numbers.
He can find the middle size object between three sizes.
He can identify the thick and the thin block.
He can identify the short and the tall person.
He can identify the bigger and the smaller object between objects of different sizes.
He can sort objects according to size.
He can organize 5 objects from small to big.
He realizes that his body consists of two halves, a left and a right side. He will still get confused though, about which side is which.

Visual perception

He can follow instructions where he has to orientate one object in relation to another in the following ways: in front of, behind, next to, under, inside, on top and diagonally.
He can respond correctly to instructions like: “Jump forwards, jump backwards.”
He knows where he lives: the street name, residential area and city.
He can compare the speed of two moving objects in terms of the following: “fastest slowest, fast-slow.”
He can copy a train, a bridge, a gate, stairs and a dubble gate with blocks.
He can copy simple patterns built with 6 blocks or less, when you build him an example.
He can copy simple patterns build with a ten-piece-pegboard.
He can copy complex patterns with Brainy Blocks, each individual shape is

indicated on the picture.
He can differentiate between days of the week, cars, animals etc.
He can identify small differences between similar objects or pictures.
He can find a hidden object between other objects.
He can play “snap.”
He can complete a 20-piece puzzle or more.
He can build one object with its parts.
He can copy a pattern made from beads.
He can copy a three-dimensional pattern with blocks and shapes, when you build and example for him.

(Witthaus, S, Enhancing your child’s development. You can make a difference’, pp. 81-88)

NORMAL DEVELOPMENT OF THE SIX-YEAR-OLD CHILD

MOTOR SKILLS

Gross motor skills

He can walk heel-toe on a balancing beam without losing his balance.
He can walk heel-toe backwards on a straight line.
He can jump over a distance keeping his feet together.
He can stand on 1 leg for 19 seconds, keeping his eyes open and using his arms to help him keep his balance.
He can stand on 1 leg for 5 seconds with his eyes closed. He nay use his arms to help him balance.
He can stand on 1 leg for 5 seconds, eyes open, arms crossed.
He can jump on 1 leg with his arms on his hips.
He can make star jumps.
He can gallop.
He can skip; he can change direction while skipping.
He can skip with s skipping rope.
He can clap his hands rhythmically.

He can ride a bicycle without the side-wheels attached.
He can make two somersaults, one after the other.
He can do 10 push-ups.
He can catch a beanbag with his hands only. He doesn't catch it against his chest anymore.
He can catch a ball with his hands only.
He can throw a ball up in the air and catch it again.
He can bounce a big ball on the floor with one hand.
He can hit a ball with a bat or racket.

Fine motor skills

He can copy each of the following if you draw him an example.
He can colour in well within the lines of a picture.
He uses a dynamic adult three pointed grip-thumb, index and middle finger.
He uses mostly finger movements when writing. Thus, he holds his shoulder and elbow joint as well as his wrist relatively still while his fingers moves when drawing.
He can cut on straight lines and corners.
He can cut around curves and more difficult corners.
Dominance of the hands, feet and eyes are established.
Dominance of the hands, feet and eyes should correlate at the age of 6 years.
He can cross his midline.
His eyes can follow a moving abject fluently. He can write his own name.
He can touch his thumb with each of the other fingers in 5 seconds.
He can thread 8 beads on a string in 25 seconds.

PERCEPTUAL DEVELOPMENT

Body awareness

He can point to all body parts on request.
He can give the names of all body parts, the functions and their positions on request.
Drawing-of-a-man: He can draw a detailed picture with all the basic body parts as

well as clothes for the man.

Concepts

He can point to all the basic shapes if you ask him to.
He knows the names of all the basic geometrical shapes.
He knows the difference between the circle and the oval, the kite and the diamond, the square and the rectangle.
He can point to all the colours, if asked to.
He can give the names of all the colours, on request.
He uses the appropriate colours when colouring in.
He can organize different shades of one colour from light to dark.
He can count from 1 to 30.
He can count 13 to 20 objects.
He can do simple mathematics with numbers 1 to 10.
He knows the numbers 1 to 10, he can identify each individually as well as in the correct sequence.
He understands that an object further away looks smaller because of the distance.
He knows the left and right side of his body.

Visual Perception

He can follow instructions where he has to orientate two objects in relation to one another on a two-dimensional level in the following ways: behind, under, in front of, next to, on top, diagonally.
He can copy patterns built with 10 blocks without demonstration.
He can copy steps with blocks, if you build him an example.
He can copy complex ten-hole-pegboard-patterns, from your example.
He can complete complex Brainy Blocks patterns with only the outlines of the picture indicated.
He can indicate “higher” and “lower” on his own body.
He can copy patterns on a two-dimensional level.
He can copy patterns from a three dimensional to a two dimensional level.

He can identify small differences between letters and numbers.
He enjoys complex “find-the-difference” pictures.
He can complete a complicated 30-piece puzzle or more.
He understands the concepts of “a half” and “a quarter.”
He knows that one can make a circle with two circles and a square with four smaller squares.
He can organize a series of pictures in the correct sequence.
He can thread beads according to a complex two dimensional pattern given to him.
He can copy patterns from a two dimensional level to a two dimensional level.

(Witthaus, S, Enhancing your child’s development. You can make a difference’, pp. 93-98)

APPENDIX C
LEARNING OUTCOMES IN THE RNCS FOR GRADE R AND GRADE 1

LERNING OUTCOMES IN THE RNCS FOR GRADE R AND GRADE 1

(Meij & Sullivan 2007:5-6)(Best Books Panel, 2003:5-6)

GRADE R	GRADE 1
Languages (Home Language) – Learning Outcome 4 Writing	Languages (Home Language) – Learning Outcome 4 Writing
The learner is able to write different kinds of factual and imaginative texts for a range of purposes	The learner will be able to write different kinds of factual and imaginative texts for a wide range of purposes
Assessment standards We know this when the learner:	Assessment standards We know this when the learner:
1. Experiments with writing	1. Writes with increasing legibility: • Manipulates writing tools like crayons and pencils effectively • Develops letter formation and handwriting skills, drawing patterns, tracing and copying words • Forms letters of the alphabet successfully
• Creates and uses drawings to convey a message, and as a starting point for their writing	2. Does pre-writing: • Creates and uses drawings as a focus for writing • Responds to a picture by writing simple sentences • Discusses with classmates (in pairs or groups) topics and ideas for writing
• Forms their letters in various ways (e.g. by using own body to show the shapes, writing in the sand)	3. Writes for different purposes: • Compiles lists • Writes simple labels or captions for drawings • Creates simple texts such as birthday cards (with written and visual text) • Uses simple strategies for getting and recording information, such as carrying

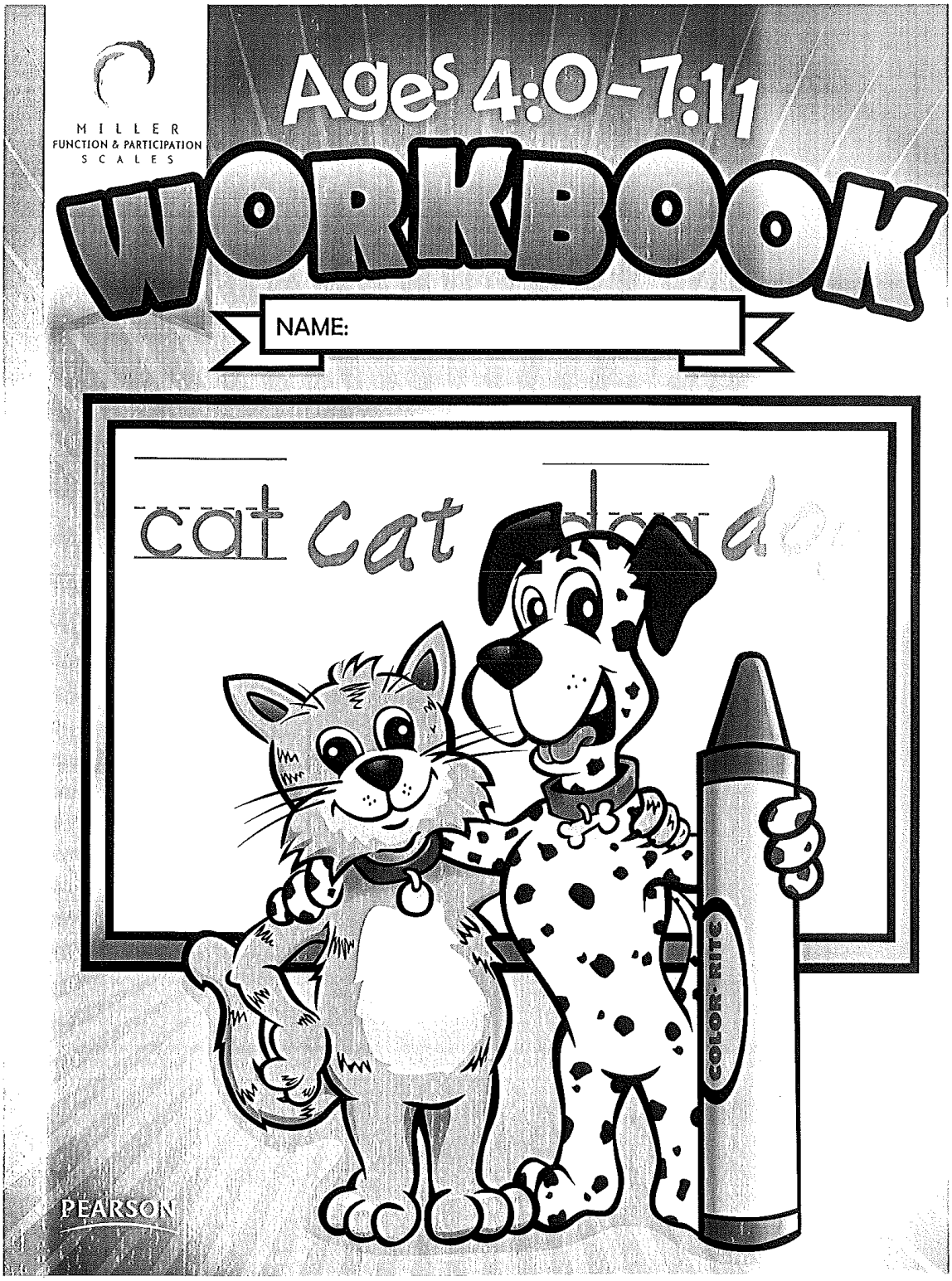
GRADE R	GRADE 1
Languages (Home Language) – Learning Outcome 4 Writing	Languages (Home Language) – Learning Outcome 4 Writing
	out a survey of how many languages are spoken in a group • Organises information in simple graphical forms, such as a chart or roster • Collects suitable pictures and graphics to illustrate text
• Understands that writing and drawing are different	4. Drafts and revises: • Contributes ideas to a group writing a story (initially with teacher as scribe) • Revises a draft of the group's story to be clearer and more interesting • Writes and reads own draft to teacher and classmates, and starts to make revisions
• 'Writes and asks others to give the meaning of what has been written	5. Writes so that others can understand, using writing conventions: • Uses letters to form simple words and short sentences • Leaves space between words • Uses left and right, top to bottom orientation to print • Writes own sentences, with the support of writing frames where necessary • Starts to use basic punctuation (e.g. capital letters and full stops)
• Talks about own drawing and 'writing'	6. Begins to build vocabulary and starts to spell words so that they can be read and understood by others: • Writes words that represent familiar people, places and things • Spells common words correctly

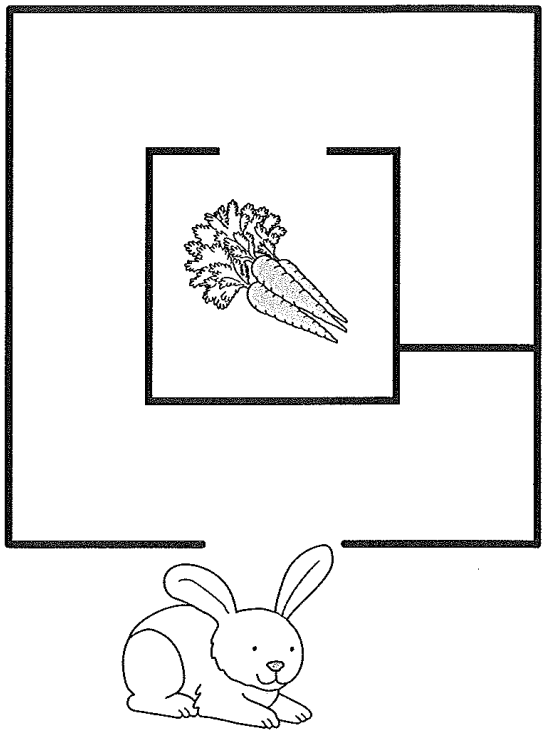
GRADE R	GRADE 1
Languages (Home Language) – Learning Outcome 4 Writing	Languages (Home Language) – Learning Outcome 4 Writing
	• Attempts to spell unfamiliar words using knowledge of phonics (emergent spelling) • Builds own word bank and personal dictionary
• Role-plays 'writing' for a purpose (e.g. telephone message, shopping list)	
• Uses known letters and numerals (or approximations) to represent written language, especially letters from own name and age	
• 'Reads own emerging writing when asked to do so	
• Shows in own writing attempts, beginning awareness of directionality (e.g. starting from left to right, top to bottom)	
• Copies print from the environment (e.g. labels on household items, Advertisements)	
• Make attempts at familiar forms of writing, using known letters (e.g. in lists, messages or letters)	
• Manipulates writing tools like crayons and pencils	
Languages(Additional Language) Learning Outcome 4 Writing	First additional language Learning Outcome 4 Writing
The learner will be able to write different kinds of factual and imaginative texts for a wide range of purposes	The learner will be able to write different kinds of factual and imaginative texts for a wide range of purposes
Assessment standards We know this when the learner:	Assessment standards We know this when the learner:

GRADE R	GRADE 1
Languages (Home Language) – Learning Outcome 4 Writing	Languages (Home Language) – Learning Outcome 4 Writing
1. Draws pictures on which the teacher writes labels	1. Copies familiar words and short sentences (e.g. labels or titles for own drawings)
2. Understands that writing and Drawing are different	2. Uses simple, familiar words to complete sentence 'frames' (e.g. 'My name is….; 'I like….)
3. Understands the purpose of writing – That it carries meaning	3. Writes lists with titles (e.g. 'My Friends')
4. Copies simple words already known Orally	
5. Makes attempts at writing such as trying to write own name	

APPENDIX D

MILLER FUNCTION AND PARTICIPATION SCALES WORKBOOK





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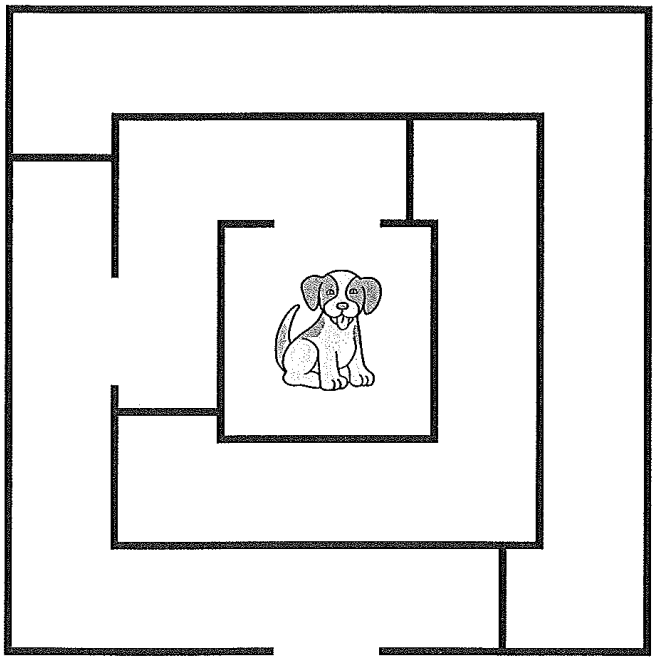

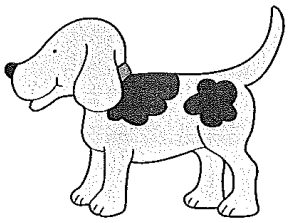

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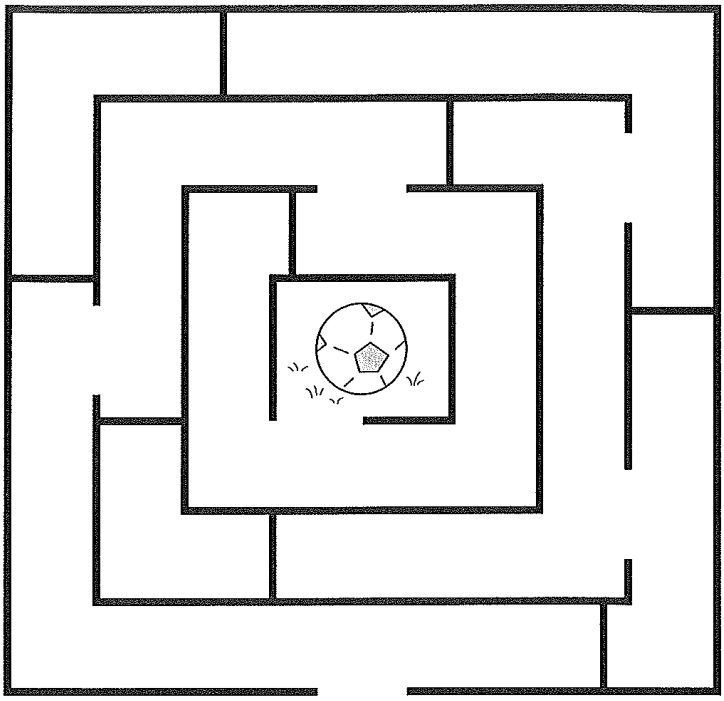

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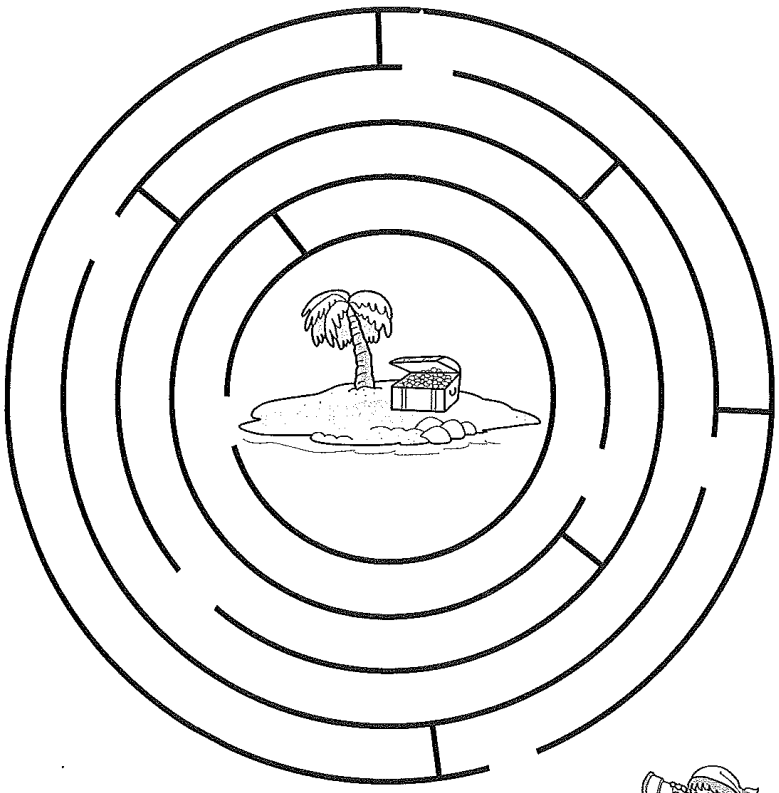

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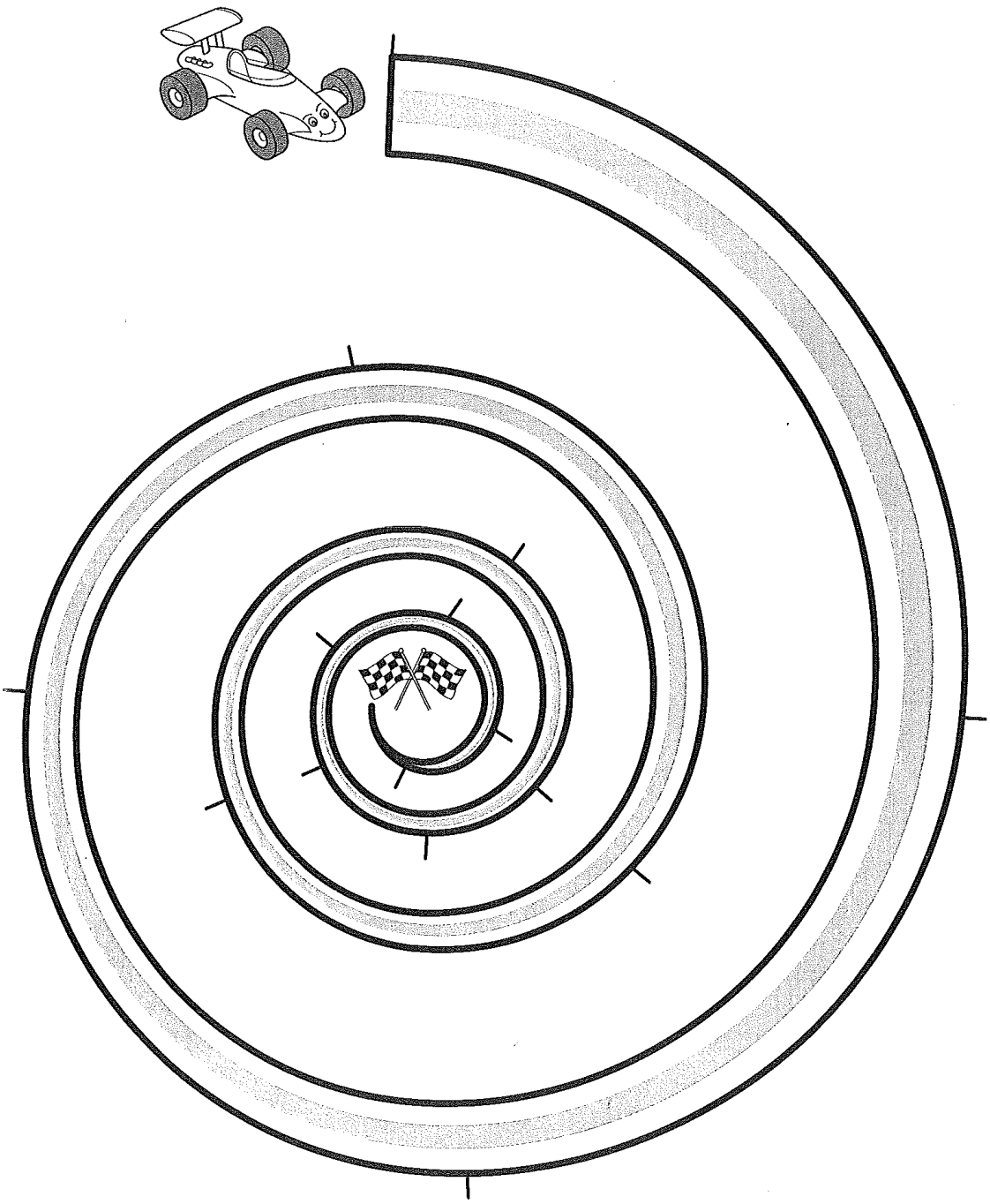

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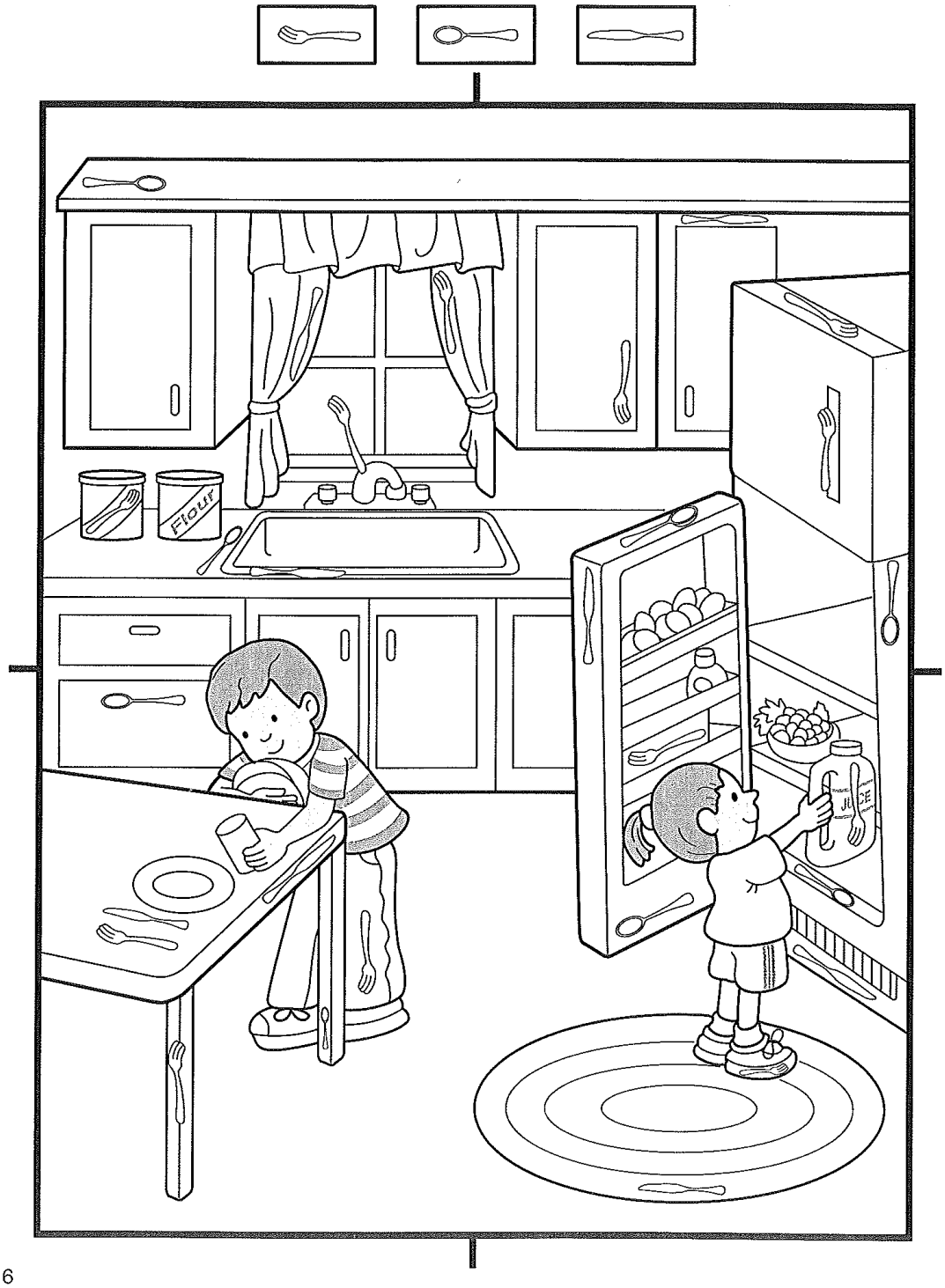

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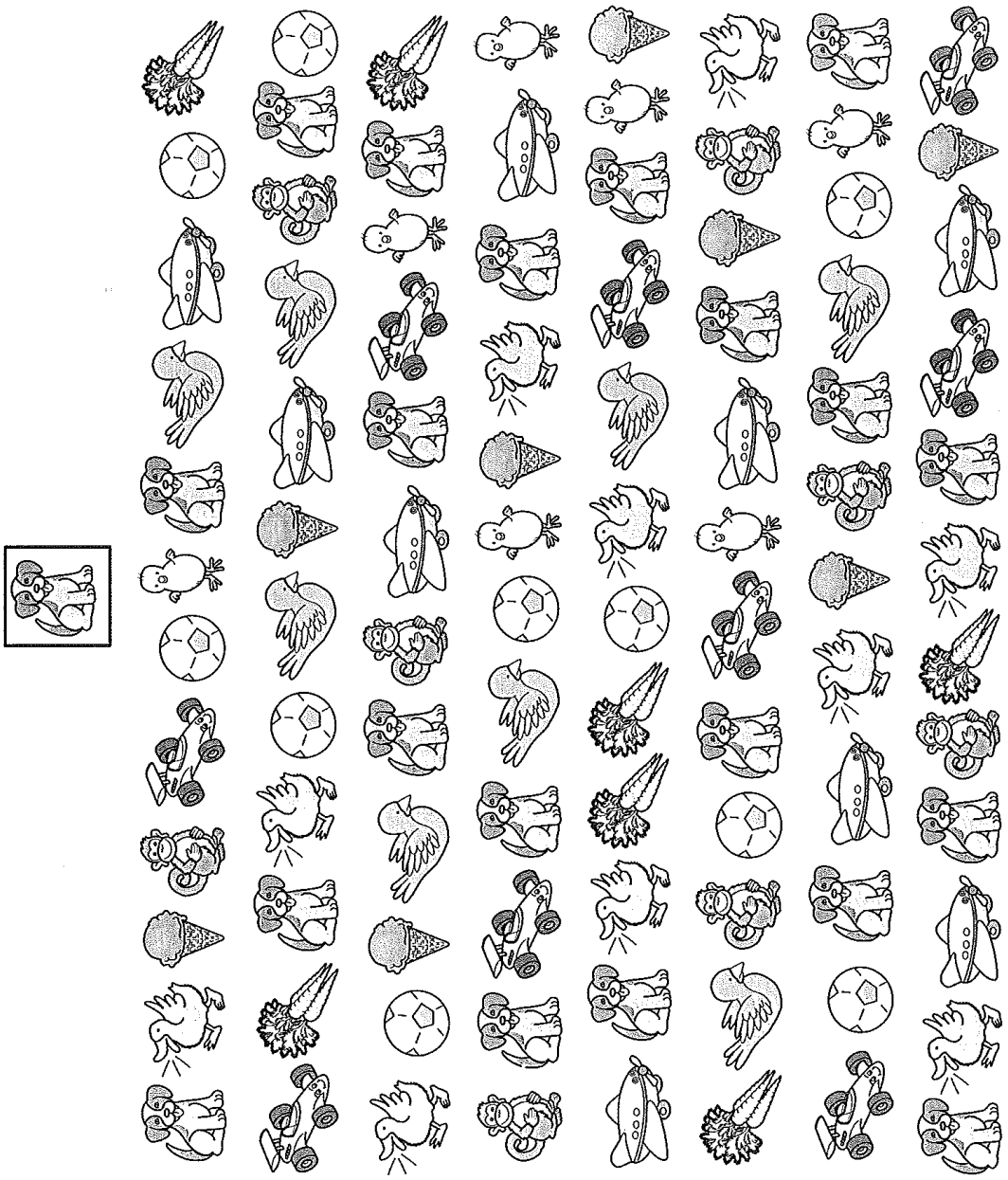

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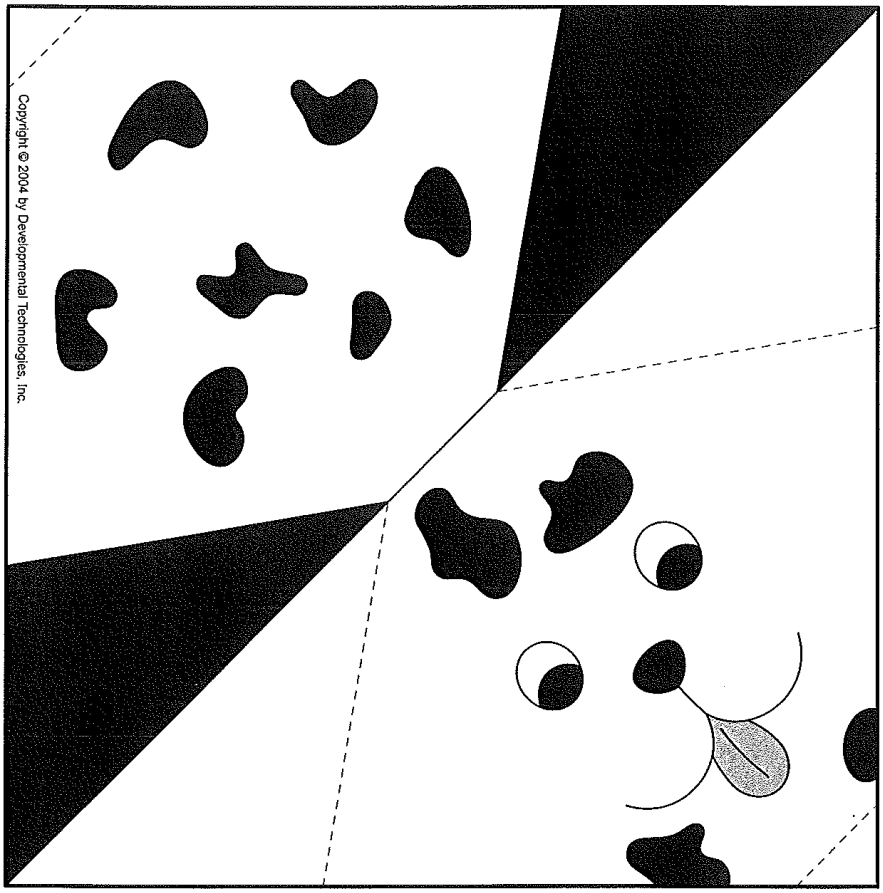

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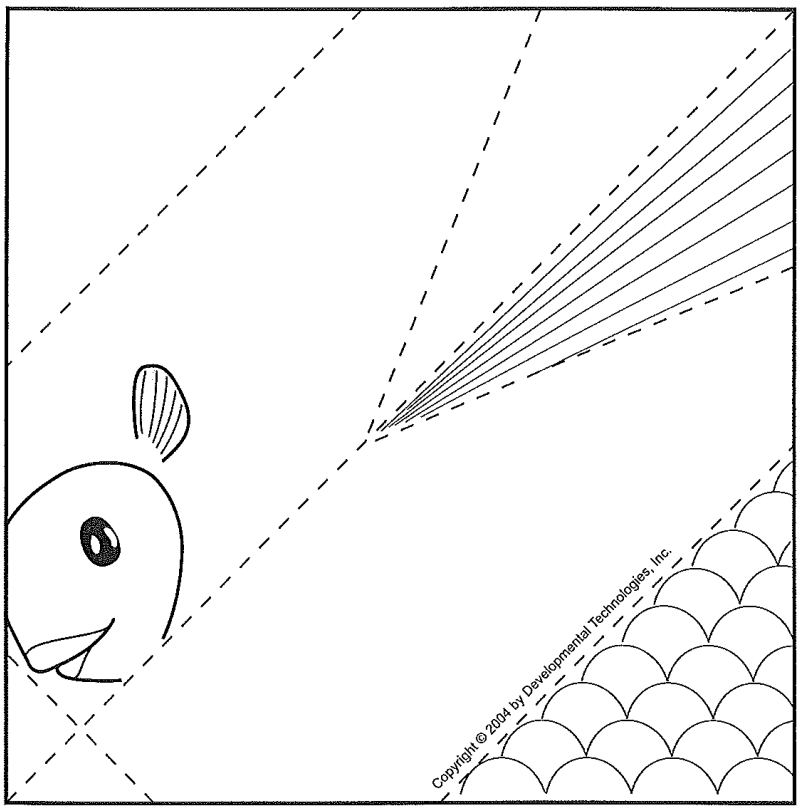

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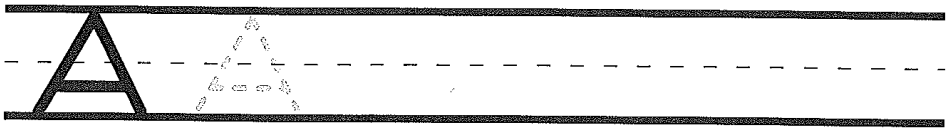

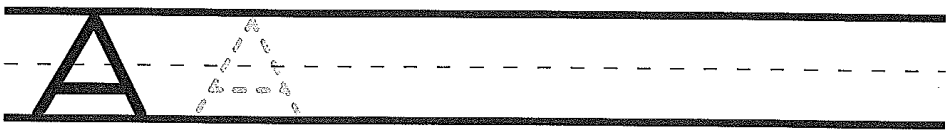

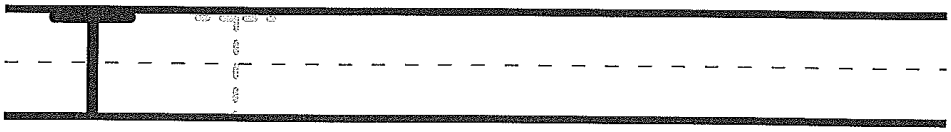

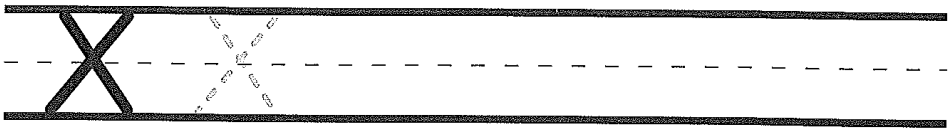

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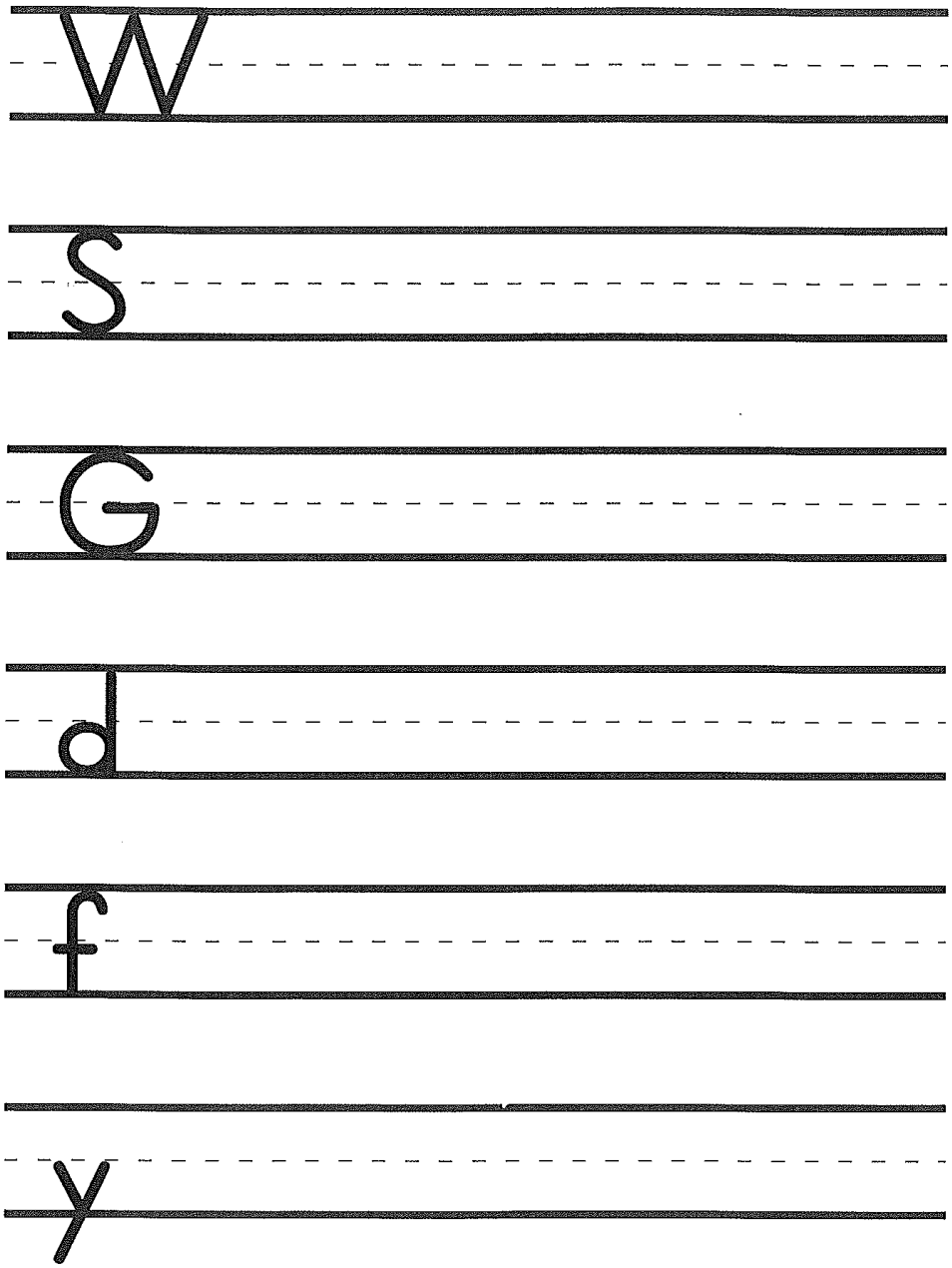

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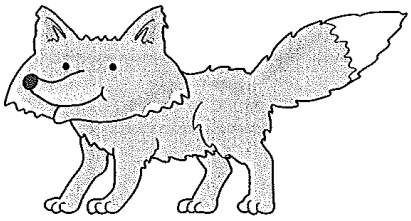
cat

cat

fox

sky



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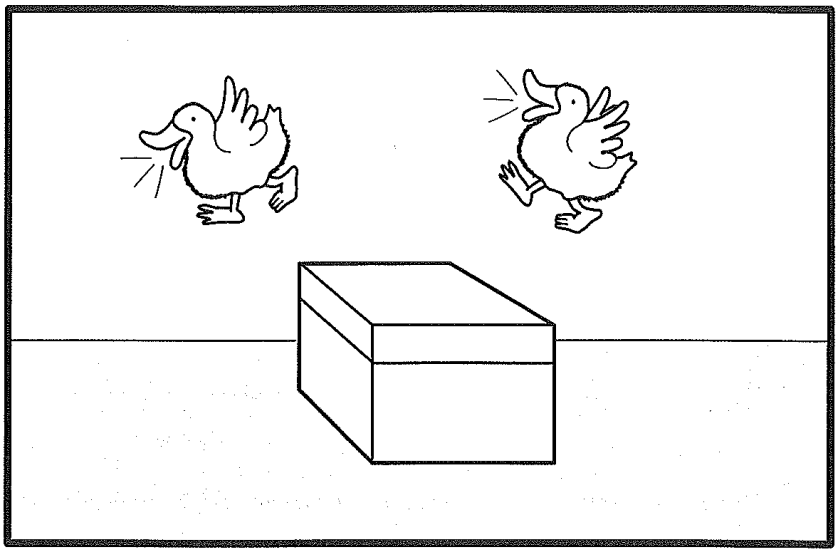
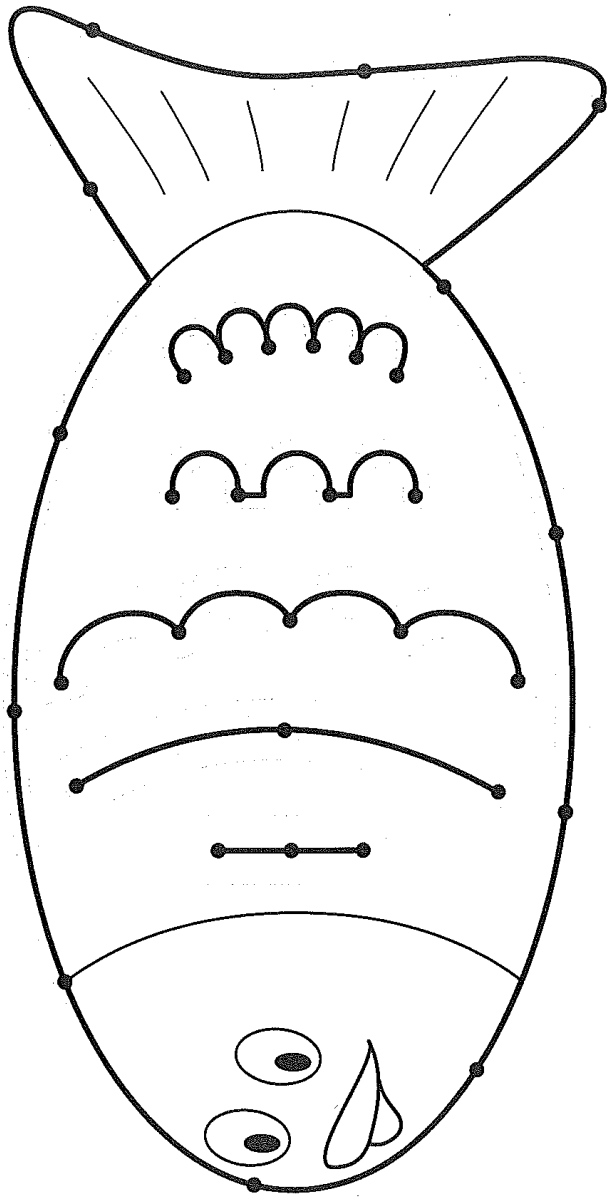


Fuzzy ducks jump over the white box.

14



15

APPENDIX E

MILLER FUNCTION AND PARTICIPATION SCALES: HOME OBSERVATION CHECKLIST

Home Observations Checklist

Child's Name: _____

Respondent: _____

MILLER
FUNCTION & PARTICIPATION
SCALES

Date: _____

Directions

Rate your child's participation at home by placing a "1" in the box that corresponds to the appropriate rating for each item.

		Rating				
		Almost Always Successful	Frequently Successful	Successful Some of the Time	Seldom/ Never Successful	Not Seen/Don't Know
During Homework, Weekends, & After School						
Moving Around	1. Maneuvers around furniture and people					
	2. Obtains materials on high and low shelves					
	3. Opens and closes doors as needed					
	4. Moves around home environment easily					
	5. Has good balance					
	6. Has good coordination					
	7. Moves through grocery store or department store without bumping into people or things					
	8. Boards and rides bus or other transportation without reported difficulties; buckles seat belt and uses car seat if necessary					
	9. Enjoys moving around in play					
	10. Climbs on play equipment in yard or park					
Posture	11. Stands up straight					
Getting Along With Others	12. Starts conversations and play with other children					
	13. Plays with other children for a while					
	14. Shares possessions					
	15. Seeks your help if he/she gets into a conflict					
	16. Does not intrude on other children's space					
	17. Takes turns					
Organizing	18. Gets materials needed for tasks					
	19. Does a 3–4 step activity					
	20. Organizes his/her own things					
	21. Cleans up room					
	22. Helps keep house neat					
Handling Objects	23. Holds small objects					
	24. Folds and handles paper					
	25. Cuts with scissors					
	26. Uses hobby or art supplies					
Writing	27. Colors in pictures as expected for age					
	28. Holds and uses pencil					
	29. Writes as expected for age					
Daily Routines	30. Follows routines (puts dirty clothes in special place)					
	31. Pulls out and pushes chair to the table					
	32. Locks and unlocks doors					
	Subtotals Page 1:					

(continued)

PEARSON

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PsychCorp

Product Number: 015401592X

		Rating				
		Almost Always Successful	Frequently Successful	Successful Some of the Time	Seldom/ Never Successful	Not Seen/Don't Know
Computer Keyboarding	33. Uses a computer keyboard	☐	☐	☐	☐	☐
	34. Uses a computer mouse	☐	☐	☐	☐	☐
Behavior and Self-Control	35. Asks to use the bathroom when necessary when in public					
	36. Stays seated during meals					
	37. Follows household rules					
	38. Follows directions					
	39. Manages emotions appropriately					
	40. Controls emotions such as frustration and anger appropriately					
	41. Keeps hands to self when moving through crowded stores or other places					
	42. Exhibits appropriate behavior in noisy environments (sports arena, mall)					
	43. Controls behavior in large groups (birthday party, family gathering)					
	44. Exhibits appropriate behavior in quiet public places (library, church)					
	45. Exhibits appropriate volume of voice for different situations					
Emotions	46. Shows caring or consideration of others	☐	☐	☐	☐	☐
	47. Has good energy level	☐	☐	☐	☐	☐
	48. Has good attention span	☐	☐	☐	☐	☐
	49. Is motivated	☐	☐	☐	☐	☐
	50. Handles unexpected changes	☐	☐	☐	☐	☐
	51. Respects the feelings of others	☐	☐	☐	☐	☐
Daily Activities or Routines						
Eating/ Drinking	52. Drinks from glass					
	53. Opens containers and cartons (pudding, chips, cookies)					
	54. Uses fork and spoon					
	55. Obtains own snacks					
Dressing/ Grooming/ Toileting	56. Dresses self, excluding fasteners	☐	☐	☐	☐	☐
	57. Washes face and mouth	☐	☐	☐	☐	☐
	58. Brushes teeth	☐	☐	☐	☐	☐
	59. Blows nose	☐	☐	☐	☐	☐
	60. Buttons and unbuttons clothing	☐	☐	☐	☐	☐
	61. Zips and unzips clothing	☐	☐	☐	☐	☐
	62. Puts shoes and socks on	☐	☐	☐	☐	☐
	63. Ties shoes	☐	☐	☐	☐	☐
	64. Maintains toileting control during day (no accidents)	☐	☐	☐	☐	☐
	65. Bathes or showers independently	☐	☐	☐	☐	☐
	Subtotals Page 1/Subtotals Page 2:					
	Totals Pages 1 + 2:					
	Multiply by	x3	x2	x1		
	Sum		+	+		/195

Please list any additional abilities or behaviors with which your child has difficulties: _____

_____

_____

_____

APPENDIX F

MILLER FUNCTION AND PARTICIPATION SCALES: CLASSROOM OBSERVATIONS CHECKLIST

Classroom Observations Checklist

Child's Name: _____

Respondent: _____

MILLER FUNCTION & PARTICIPATION SCALES

Date: _____

Directions

Rate the child's participation at school by placing a "1" in the box that corresponds to the appropriate rating for each item.

Classroom Activities		Rating					Comments
		Almost Always Successful (75–100%)	Frequently Successful (50–74%)	Occasionally Successful (25–49%)	Seldom Successful (0–24%)	Not Observed	Task modifications, adaptive equipment, other observations related to the child's participation
Mobility	1. Maneuvers around obstacles such as furniture in the room						
Posture/Stability	2. Demonstrates stable posture when sitting during tabletop activities and good muscle tone when moving body around to complete tasks						
Regulation/ Sensory Modulation	3. Demonstrates appropriate responses to sensory stimulation (does not seek, avoid, or seem unaware of sensation)						
	4. Reacts appropriately to external noises and distractions						
	5. Maintains appropriate level of arousal throughout the day						
	6. Transitions smoothly between tasks						
Self-Esteem	7. Is confident and assured during tasks (not anxious, nervous, agitated)						
	8. Shows pleasure in task mastery and accomplishments						
	9. Exhibits an appropriate level of persistence when performing tasks						
	10. Is satisfied with own performance						
Social Skills (in Structured Settings)	11. Follows classroom and school rules						
	12. Interacts with school peers						
	13. Cooperates when performing tasks; tries to perform well to please others						
	14. Initiates and takes turns in conversations						
	15. Uses personal space appropriately; does not intrude on space of others						
Communication	16. Understands directions; does not need directions repeated						
	17. Has speech that is understandable (good voice quality, few articulation errors, good rate of speech)						
	18. Expresses self appropriately for age (uses sentences appropriate for age; no word-finding difficulties)						
Organization	19. Initiates tasks independently or with minimal cueing						
	20. Completes multi-step tasks as appropriate for age						
Sensory Discrimination	21. Appears to recognize objects by touch; manages small objects such as buttons						
	22. Appears to sense where head and body are in space; can move easily through space without falling or running into objects or people.						
	23. Maintains positions (sitting or standing without slumping, moving around restlessly, or bouncing)						
	Subtotals Page 1						

(continued)

		Rating					Comments
		Almost Always Successful (75–100%)	Frequently Successful (50–74%)	Occasionally Successful (25–49%)	Seldom Successful (0–24%)	Not Observed	Task modifications, adaptive equipment, other observations related to the child's participation
At Recess or Other Play Times							
Play Skills	24. Initiates play with peers and engages others in activity						
	25. Plays age-appropriate games with peers; has fun						
Self-Control	26. Demonstrates self-control (stands in line without touching or bumping others, maintains self-control in large group activities)						
	27. Shows safety awareness						
	28. Transitions calmly between activities and classrooms						
	29. Seeks assistance from adults when needed						
Social Skills (in Leisure Activities)	30. Uses personal space appropriately; does not intrude on space of others						
	31. Takes turns during games and activities						
	32. Does not get over-aroused; maintains controlled behavior						
	33. Manages emotions appropriately throughout day						
	34. Controls emotions such as frustration and anger appropriately						
Speed	35. Completes classroom tasks at a rate that is age-appropriate						
Computer Keyboarding	36. Uses a computer keyboard at an age-appropriate level						
	37. Uses a computer mouse at an age-appropriate level						
Eating/ Drinking	38. Carries tray in cafeteria						
	39. Drinks from glass						
	40. Opens containers and cartons (pudding, chips, milk)						
	41. Eats a sandwich						
	42. Uses fork and spoon						
Dressing/ Grooming/ Toileting	43. Manages clothing including buttons and zippers						
	44. Ties shoes						
	45. Maintains age-appropriate grooming						
	46. Maintains toileting control during school day (no accidents)						
	Subtotals Page 1/Subtotals Page 2:						
	Totals Pages 1 + 2:						
	Multiply by	x3	x2	x1			
	Sum		+	+		/138	

Please list any additional abilities or behaviors with which the child has difficulties:_____

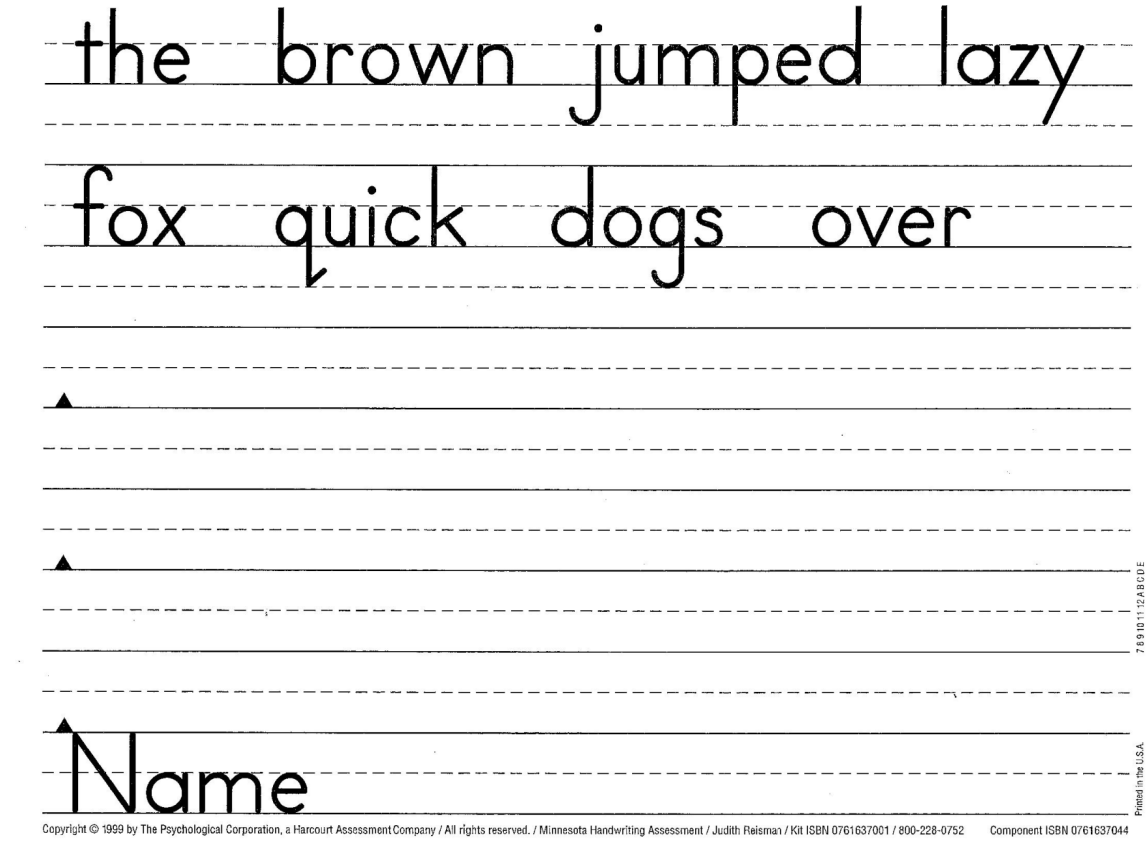
_____

_____

_____

APPENDIX G

MINNESOTA HANDWRITING ASSESSMENT: MANUSCRIPT STIMULUS SHEET



APPENDIX H

MINNESOTA HANDWRITING ASSESSMENT: RECORD FORM

Minnesota Handwriting Assessment Record Form

Name _____ Date _____

School _____

Teacher _____ Examiner _____

Grade *Circle the marking period that most closely matches the assessment date.*

1st Grade January | 1st Grade April | 2nd Grade October | 2nd Grade January | 2nd Grade April

1st Grade	Rate Score		Legibility Score	Form Score	Alignment Score		Size Score	Spacing Score
	January	April	January–April	January–April	January	April	January–April	January–April
Performing Like Peers	18–34 ○	22–34 ○	33–34 ○	30–34 ○	29–34 ○	29–34 ○	27–34 ○	30–34 ○
Performing Somewhat Below Peers	11–17 ○	13–21 ○	32 ○	25–29 ○	20–28 ○	22–28 ○	15–26 ○	26–29 ○
Performing Well Below Peers	10 or fewer ○	12 or fewer ○	31 or fewer ○	24 or fewer ○	19 or fewer ○	21 or fewer ○	14 or fewer ○	25 or fewer ○

2nd Grade	Rate Score			Legibility Score	Form Score	Alignment Score	Size Score	Spacing Score
	October	January	April	October–April	October–April	October–April	October–April	October–April
Performing Like Peers	26–34 ○	29–34 ○	33–34 ○	34 ○	31–34 ○	31–34 ○	27–34 ○	32–34 ○
Performing Somewhat Below Peers	15–25 ○	17–28 ○	20–32 ○	32–33 ○	28–30 ○	26–30 ○	19–26 ○	29–31 ○
Performing Well Below Peers	14 or fewer ○	16 or fewer ○	19 or fewer ○	31 or fewer ○	27 or fewer ○	25 or fewer ○	18 or fewer ○	28 or fewer ○

APPENDIX I

LETTER OF INVITATION TO PRINCIPLES TO BE PART OF THE STUDY

Dear _____

Invitation to be part of a research study

I am a master student in Occupational Therapy at the University of Pretoria. The title of my study is:

A comparison between five and six year old Grade 1 children regarding their readiness for acquiring handwriting skills

I plan on assessing 80 five- and six-year-old Grade 1 children in the Tshwane District North at the end of the second term of 2009. Afrikaans and English Primary schools will be included. Two standardized tests will be used. The one test will involve fine-motor and copying tasks, and the other will be copying of words from a near point example.

I have applied for approval of the study from the Department of Education, the Ethical Committee of the Faculty of Health Sciences, the Research and Postgraduate Committee of the School of Healthcare Sciences and the Academic Advisory Committee.

If you do provisionally agree to be part of this study, please complete the attached form and fax it to 012-3541329.

I will then make an appointment with you at the beginning of 2009 to explain the study in detail and provide you with the consent forms.

Please contact me if you have any queries.

Your consideration is greatly appreciated!

Yours sincerely

Maretha Bekker
Student number: 8729891
0739467435
012-354 1466

I, _____, principal of _____, provisionally agree to be part of the research study to be conducted by

Maretha Bekker.

Signature: _____

Date: _____

APPENDIX J

LETTER OF CONSENT TO THE PRINCIPAL AND THE TEACHER

A comparison between five and six year old Grade 1 children regarding their readiness for acquiring handwriting skills

Dear Sir/Madam

You are hereby cordially invited to be part of research study.

This letter contains information to assist you in deciding to be part of this study. If you do have any questions, after reading this letter, please contact the investigator. It is of the utmost importance that you only agree to be part of this study, if you understand all the procedures involved. You are requested to discuss this decision with the governing body of the school, as well as the teachers involved.

Purpose of the study

The investigator will do a comparative study between children that enter into grade 1 at the age of 5½ years, as to children that enter grade 1 at the age of 6½ years. These two groups of children will be compared regarding pre-writing skills (skills that develop before writing) and also how they form letters.

Afrikaans and English Schools from the Tshwane North District will be randomly sampled. This is why your school is approached. Boys and girls from different ethnical groups will be included. They must be 5½ and 6½ years old upon entering grade 1 in January 2009.

Unfortunately there are some exclusion criteria. They are as follows:

- the children must not use any medication such as stimulants or non-stimulants
- the children must not have been assessed during the past six months by an occupational therapist or be involved in an occupational therapy programme at the time of the study.
- children that suffer from a neurological and neuropsychological condition.

- children who experience difficulty in understanding instructions in their academic language (English or Afrikaans).
- children should not have visual problems.
- children should not have undergone a screening test prior to enrollment into grade 1.

The abovementioned information will also be reflected in the consent form to the parent/guardian. Should they indicate that any of these criteria are present; the child will be excluded from the study.

Time frame

The investigator will do the study during the second term of 2009, in April and May. If a child or children from the school are randomly selected and the parent or guardian gives his/her consent, you will be informed of the date when the investigator will visit the school to do the assessment. The assessment will take place at the school, during school hours, as previously arranged with yourself and the relevant teacher/s.

Procedures

In the study the researcher will make use of two standardized tests, namely the Miller Function and Participation Scales and the Minnesota Handwriting Assessment. Both of these standardized tests involve pen and paper activities. It is preferable that the child is assessed in a room with sufficient light and without any disturbances. The child will be assessed individually. The child will be provided with a break between the two tests.

Ethical Approval

The protocol was submitted to the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria. Written approval has been granted by that committee.

The protocol was also submitted to the Department of Education. Written approval has been granted by the Department of Education.

Your rights as a participant in the trial

Your participation in this trial is voluntary and you have the right to refuse to take part without providing a reason. The investigator retains the right to withdraw children from the study, when any of the exclusion criteria apply.

Risks

As far as the investigator is concerned, there are no risks involved for the children or the school, when agreeing on taking part in this study.

The investigator will monitor the child's responses and the child will be in the investigator's care for the duration of the assessment.

No unrealistic expectations will be set for the child.

There will be no costs involved for the school or the parent/guardian of the child.

Possible benefits

Although you will not benefit directly from the study, the results of the study may in future add to the knowledge base on the school entry age within the South African context. Professionals like you, occupational therapists, speech therapists, psychologists and psychiatrists may use the results in the process of determining whether a child is school ready.

Confidentiality

All the information obtained during the course of the study will remain confidential. Data that may be reported in journals will not make the school's or children's identities known.

As headmaster of the school you may indicate whether the school will benefit from knowing the results of the study. It will then be made available to the school in due time.

No individual results of children will be made available to the school.

Contact person

Please contact the investigator at 012-3541466 or 0739467435, if you have any questions regarding the study.

Please complete the attached informed consent, together with the teachers of the selected children. The investigator will collect it.

Thank you very much for your time.

Yours sincerely

Maretha Bekker
Student number: 8729891

Informed consent

I,_____, principal of _____
confirm that the investigator, Mrs. M. Bekker, has informed me regarding the nature, conduct, benefits and risks of the abovementioned study.

I have received, read and understood the written information regarding the study.

I am aware that the results of the study, including the children's personal detail, may be anonymously processed into a report or article.

I understand that I may, without prejudice, withdraw my consent and participation in the trial. The investigator provided me with ample opportunity to ask questions and I am willing to participate in this study.

Headmaster's name: _____

Headmaster's signature: _____ Date: _____

Teachers names: _____ Date: _____

_____Date: _____

I would like to be informed about the results of the study
Yes / No

APPENDIX K

LETTER OF CONSENT TO THE PARENT/CAREGIVER

A comparison between five and six year old Grade 1 children regarding their readiness for acquiring handwriting skills.

Dear Parent/Guardian

You are hereby kindly invited to be part of a research study.

This letter has information to help you to decide to be part of this study. If you do have any questions, after reading this letter, please contact the investigator, Mrs. Maretha Bekker. It is very important that you only agree to be part of this study, if you understand what is involved.

Purpose of the study

The investigator will do a study, in which she compares children that enter into grade 1 at the age of five-and-a-half years, to children that enter Grade 1 at the age of six-and-a-half years. These two groups of children will be compared regarding pre-writing skills (skills that develop before writing) and also how they form letters when they start writing.

Some Afrikaans and English Schools from the Tshwane North District will be chosen. Boys and girls from different ethnical groups will be included. They must be five-and-a-half and six-and-a-half years old upon entering Grade 1 in January 2009.

The principal of your child's school has granted permission that the study might be done at the school.

However, if you agree to your child taking part in the study, none of the following must apply to your child:

- your child must not use any medication such as Ritalin, Wellbutrin,

Stratera, Tofranil, Concerta, Risperdal or Serequel.

- your child must not have been assessed during the past six months by an occupational therapist or be involved in an occupational therapy programme at the time of the study.
- your child must not suffer from a neurological and neuropsychological condition.
- your child should not have difficulty understanding instructions in their academic language (English or Afrikaans).
- your child should not present with any visual problems.

Time frame

The investigator will do the study during the second term of 2009, in April and May. If your child is selected and you give your consent, you will be informed of the date when the researcher will visit the school to do the assessment. The assessment will take place at the school, during school hours. It will take approximately 60 minutes (1 hour) to complete the tests. The researcher does therefore not expect from you to transport your child anywhere or to be present on the day of the assessment.

Procedures

In the study the investigator will use two standardized tests, namely the Miller Function and Participation Scales and the Minnesota Handwriting Assessment. Both of these standardized tests involve activities where your child will write and do fine coordination activities. Your child will be assessed in a room with sufficient light and without any disturbances. Your child will be assessed individually. A visual screening will be done prior to the two standardized tests. Your child will be provided with a break between the two tests.

Ethical Approval

The protocol was submitted to the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria. Written approval has been granted by that committee.

The protocol was also submitted to the Department of Education. Written approval has been granted by the Department of Education.

Your child's rights as a participant in the trial

You and your child's participation in this trial is voluntary and you and you're your child have the right to refuse to take part, or withdraw without giving a reason. The investigator has the right to withdraw children from the study, when any one of the exclusion criteria applies.

Risks

There are no risks involved for you or your child, when you agree to take part in this study.

The investigator will monitor your child's responses and your child will be in the investigator's care for the duration of the assessment.

The investigator will not ask your child to do things that he/she cannot do.

There will be no costs involved for you.

Possible benefits

You as parent/guardian can make an appointment with the investigator to get your child's test results. This will explain some of your child's strengths and

weaknesses, and may help you to decide if your child must see somebody to help with his/her school work.

Confidentiality

All the information obtained during the course of the study will remain confidential. If the results of the study will be reported in a journal, it will not make the school's or your child's identities known.

No individual results of children will be made available to the school.

Contact person

The contact person/investigator for this study is Mrs. Maretha Bekker. If you have any questions regarding the study, please contact her at 0739467435 or 012-3541466.

Please complete the attached informed consent form, the assent form of your child, the demographical questionnaire and the observational checklist and return them to your child's teacher.

Thank you for your time and effort!

Kind Regards

Maretha Bekker
Student number: 8729891

Informed consent

I,_____, parent/guardian of _____
confirm that the investigator, Mrs. M. Bekker, has told me about the study, it's benefits and risks. I have received, read and understood the written information regarding the study.

I am aware that the results of the study, including my child's personal detail, may be anonymously processed into a report or article.

I understand that I may withdraw my consent and my child's participation in the study. The investigator gave me enough time to ask questions and my child is willing to participate in this study.

Parent/Guardian's name: _____

Parent/Guardian's signature: _____

Date: _____

I do agree that my child may take part in this study:
Yes/No

APPENDIX L

BACKGROUND INFORMATION FORM

BACKGROUND INFORMATION FORM

Please complete this form. This information will be treated confidentially. Your answers to questions 1-4 will assist me in knowing if your child fits the criteria for the study.

Name of the child: _____

Date of birth of the child: _____

Address: _____

The child's mother tongue language: _____

Question 1

Make a cross in the block next to the correct answer.

Does your child take any medication such as Ritalin, Wellbutrin, Stratera, Tofranil, Concerta, Risperdal or Serequel?

Yes	
No	

If yes, what kind of medicine: _____

Question 2

Was your child tested by an occupational therapist in the last 6 months?

Yes	
No	

Is he/she presently seeing an occupational therapist?

Yes	
No	

Question 3

Does your child suffer from conditions such as Attention Deficit Hyperactivity Disorder, Cerebral Palsy or Depression?

Yes	
No	

Question 4

Does your child understand when a person gives him/her instructions in his/her academic language?

Yes	
No	

Question 5

Where did the child stay during the day of the year before he/she went to school?
Make a cross in the block next to the correct answer.

At home, with mother, father, grandparents etc.	
At a nursery school.	
At a playgroup.	
At a friend's house.	

Did your child complete a Grade R year before entering into grade 1?

Yes	
No	

Please return this form together with the checklist, consent form and assent form to the school.

Thank you for your cooperation!

Maretha Bekker

APPENDIX M

MILLER FUNCTION AND PARTICIPATION SCALES.

INSTRUCTIONS FOR VMI AND FMC IN ENGLISH AND AFRIKAANS

VISUAL-MOTOR ACTIVITIES AGES 4:0-7:11

The Amazing Mazes Game

Teaching and practicing item

This bunny wants her carrot. Let's help her find it. When I say go, start here.

Now draw a line so the bunny can get her carrot. Don't cross the lines. Find the way to the carrot.

Here is the carrot. We want to get from here to here. We can go through this opening. From here we can get to the next opening. Here is the carrot!

Hierdie hasie wil haar wortel hê. Kom ons help haar om dit te kry. As ek sê gaan, begin hier.

Trek nou 'n lyn sodat die hasie haar wortel kan kry. Moenie die lyne kruis nie. Kry die pad na die wortel.

Hier is die wortel. Ons wil van hier na hier gaan. Ons kan deur hierdie opening gaan. Van hier kan ons tot by die volgende opening kom. Hier is die wortel.

Item 1 (Mother dog/Puppy)

This dog has lost her puppy. When I say go, start here.

Now draw a line to show how the mother dog can get to her puppy. Don't cross the lines! Try to go as fast as you can.

Hierdie mamma hond het haar baba hondjie verloor. As ek sê gaan, begin hier.

Trek nou 'n lyn om te wys hoe die mamma hond by haar baba hondjie kan kom. Moenie die lyne kruis nie! Probeer om so vining te gaan as wat jy kan.

Item 2 (Girl/Soccer ball)

This girl wants her soccer ball. When I say go, start here.
Now draw a line to show how the girl can get to her soccer ball.
Don't cross the lines! Try to go as fast as you can.

Hierdie dogtertjie wil haar sokkerbal hê. As ek sê gaan, begin hier.
Trek nou 'n lyn om te wys hoe die dogtertjie haar sokkerbal kan kry.
Moenie die lyne kruis nie! Probeer om so vining te gaan as wat jy kan.

Item 3 (Boy/Treasure)

This boy wants the treasure on the island. When I say go, start here.
Now draw a line to show how the boy can get to the treasure.
Don't cross the lines! Try to go as fast as you can.

Hierdie seuntjie wil die skat op die eiland hê. As ek sê gaan, begin hier.
Trek nou 'n lyn om te wys hoe die seuntjie by die skat gaan kom.
Moenie die lyne kruis nie! Gaan so vinnig as wat jy kan.

The Race Car Game (Spiral)
Teaching and Practice Item

This car wants to drive all the way to the flags at the finish line.
Put your finger here and follow this line.
Go all the way to the flags.

Hierdie motor wil al die pad ry tot by die vlae by die eindstreep.
Sit jou vinger hier en volg hierdie lyn.
Gaan al die pad tot by die vlae.

Item 1

Good! Now try it with the pen, Stay on the gray path in the middle and go as fast as you can. Ready? Go!

Goed! Nou probeer dit met die pen. Bly op die grys paadjie in die middel en gaan so vinnig as wat jy kan. Gereed? Gaan!

The Hidden Forks Game

Teaching and Practice Item

See the fork right here? Mark this fork with your pen.
Use your pen to make a slash mark over the fork.
Here is a spoon. Here is a knife. Do not mark any spoons or knives

Sien jy die vurk hier? Merk die vurk met jou pen.
Gebruik jou pen en trek 'n lyn oor die vurk.
Hier is 'n lepel. Hier is 'n mes.
Moenie enige lepels of messe merk nie.

Item 1 (Marks forks)

This picture has forks, spoons, and knives hidden in the picture. Mark just the forks. I'll count the forks that you marked when you've done.
Don't mark the knives or spoons. Just find the forks.
Find some more!

Hierdie prentjie het vurke, lepels, en messe weggesteek in die prentjie. Merk net die vurke. Ek sal die vurke tel wat jy gemerk het as jy klaar is.
Moenie die messe en lepels merk nie. Vind slegs die vurke.
Vind nog!

The Find the Puppies Game

See this puppy? Mark the puppy.

Sien jy die hondjie? Merk die hondjie.

Item 1

Look! This page has lots of puppies! Mark all the puppies. Go as fast as you can!

Kyk! Hierdie bladsy het baie hondjies! Merk al die hondjies. Maak so vinnig as wat jy kan!

The Draw a Kid Game
Teaching and Practice Item

I'm going to draw a picture of me! I'll draw my picture here and you copy it here.

Ek gaan 'n prentjie van myself teken! Ek gaan myself hier teken en jy teken dit hier.

Item 1

Now use this page to draw a boy (or girl).
Draw the best boy (or girl) you can. You have one minute to finish. Ready? Go!

Gebruik nou hierdie bladsy om 'n seuntjie (of dogtertjie) te teken.
Teken die beste seuntjie (of dogtertjie) wat jy kan. Jy het een minuut om klaar te maak. Gereed? Gaan!

The Writing Game

Teaching and Practice item

Let's do some writing. Write your name here.
Now you're going to trace some letters. Trace this letter A.

Kom ons skryf. Skryf jou naam hier!
Nou gaan jy 'n paar letters natrek. Trek die letter A na.

Item 1 (Traces A)

Now trace these letters. Let's do the first one.
Trace the A.

Nou trek hierdie letters na. Kom ons DoEn die eerste een.
Trek die A na.

Item 2 (Traces T)

Trace the T.

Trek die T na.

Item 3 (Trace X)

Now this one.
Trace the X.

Nou hierdie een.
Trek die X na.

Items 4-9 (Copies letters)

Now copy these letters all by yourself.

Teken/kopieër al die letters op jou eie.

Item 10-12 (Writes letters)

Now you are going to write the letters I say. I'm going to time you. Write neatly and use capital letters.

Start here. Use as many lines as you need. Ready? Write.

Nou gaan jy die letters skryf wat ek sê. Ek gaan jou tyd neem. Skryf netjies en gebruik hoofletters.

Begin hier. Gebruik soveel lyntjies as wat jy nodig het. Gereed? Skryf.

Teaching and Practice Item

Now you will write words. Copy the word cat just like it looks here.

Nou gaan jy woorde skryf. Skryf die word 'cat' oor net soos dit hier lyk.

Items 13-15 (Copies words)

Now write the word cat all by yourself.

Nou skryf die woord 'cat' op jou eie.

Item 16 (Copies a sentence)

Look at this page. This sentence says 'Fuzzy ducks jump over the white box'.
When I say go, copy this sentence on these lines. Remember to write neatly. Ready? Go!

Kyk na hierdie bladsy. Hierdie sin sê 'Fuzzy ducks jump over the white box'.

As ek sê gaan, skryf die sin op hierdie lyne. Onthou om netjies te skryf. Gereed? Gaan!

The Go Fishing Game

Teaching and Practice Item

Let's trace the scales on the fish! Trace this line like this. Try to stay right on this black line.

Kom ons trek die skubbe van die vis na! Trek hierdie lyn so na. Probeer om op die swart lyn te bly.

Item 1-4 (Traces scales)

Here are some more scales on the fish. Trace the scales. Start here. Now trace all the rest of the scales of the fish. Try to stay right on the black line.

Hier is nog meer skubbe op die vis. Trek die skubbe na. Begin hier. Trek nou al die ander skubbe van die vis na. Probeer om op die swart lyn te bly.

FINE-MOTOR GAMES AGES 4:0-7:11

Item 5 (Cuts on line)

Cut around the fish. Try to stay on this black line.
Knip om die vis. Probeer om op die swart lyn te bly.

Item 6 (Tapes string)

Now we are going to catch the fish with this fishing line. Tape this string to the fish's mouth.

Nou gaan ons die vis vang met die vislyn. Bind hierdie tou vas aan die vis se bek.

Item 7 (Winds string)

Here's the last thing we will do. Reel in the fish by wrapping the string around the fishing pole. Now it's your turn! You finish reeling the fish.

Hier is die laaste ding wat ons gaan DoEn. Katrol die vis in deur die tou om die visstok te draai. Nou is dit jou beurt! Jy katrol die vis klaar.

The Clay Play Game

Teaching and Practice Game

We are going to hammer this ball flat. Hammer the ball. Hammer it like this. Now it's your turn. You do it!

Ons gaan die bal plat slaan. Slaan die bal. Slaan dit so. Nou is dit jou beurt. DoEn jy dit!

Item 1 (Makes ball)

Now let's make it a ball again. Make it round!

Kom ons maak dit nou weer 'n bal. Maak dit rond.

Now make a flat cookie, like this. Press it flat!

Maak nou 'n plat koekie, soos dit. Druk dit plat.

Item 3 (Makes worm with both hands)

Now let's make some worms! Do this.

Make s skinny worm! Now it's your turn. You do it. Good! Let's let this worm rest here.

Kom ons maak wurms! DoEn dit.

Maak 'n maer wurm! Nou is dit jou beurt. DoEn jy dit. Goed! Kom laat ons die wurm hier rus.

Item 4 (Makes worm with dominant hand)

Now let's make another worm. Use one hand, like this. Now you do it. Use one hand. Good! Put that worm here.

Kom ons maak 'n ander wurm. Gebruik een hand soos dit. Nou DoEn jy dit. Gebruik een hand. Goed! Sit daardie wurm hier.

Item 5 (Makes worm with non-dominant hand)

One more. Use the other hand now. Now you do it. Use one hand. Good! Look at all those worms you made! Let's squish them up and put them back.

Nog een. Gebruik nou die ander hand. Nou DoEn jy dit.Gebruik een hand. Goed! Kyk na al die wurms wat jy gemaak het! Kom ons druk hulle saam en sit hulle weg.

The Penny Bank Game

Teaching and Practice Item

Here are some pennies. Let's put them in the bank. Now you do it. Pick up this penny. Now out it in the bank. Get another penny. Just use this hand.

Hier is 'n paar sente. Kom ons sit hulle in die bank. DoEn jy dit nou. Tel hierdie sent op. Nou sit dit in die bank. Kry 'n ander sent. Gebruik net hierdie hand.

Item 1 (Pennies in slot, dominant hand)

Put the pennies in the bank one at a time. Pick up all the pennies. Just use this hand. Go fast!

Sit die sente in die bank een op 'n slag. Tel al die sente op. Gebruik net hierdie hand. Gaan vinnig!

Item 2 (Pennies in slot, non-dominant hand)

Let's do this again. Now use only this. Start here. Put all the pennies in the bank. Ready? Go.

Kom ons DoEn dit weer. Gebruik nou net hierdie hand. Begin hier. Sit al die sente in die bank. Gereed? Gaan.

Item 3 (In-hand manipulation, dominant hand)

Now hold the pennies in this hand. Put them in the slot one at a time like this. Don't use your other hand to help. Ready? Go.

Hou nou die sente in hierdie hand. Sit hulle een vir een in die gleuf soos dit. Moenie jou ander hand gebruik om te help nie. Gereed? Gaan.

Item 4 (In-hand manipulation, non-dominant hand)

Do it with this hand now. Remember to put in one penny at a time. Ready? Go.

Doen dit nou met hierdie hand. Onthou om een sent op 'n slag in te sit. Gereed? Gaan.

The Origami Game

Teaching and Practice Item

Let's fold this towel. Watch me. Did you see how I folded it? Now you do it. Good! Make the corners touch. Very good! Now fold the washcloth into a square like this. Now it's your turn.

Kom ons vou die waslap. Hou my dop. Het jy gesien hoe ek dit gevou het? Nou Doen jy dit. Baie goed. Vou nou die waslap in 'n vierkant soos dit. Nou is dit jou beurt.

Item 1 (Dog)

We are going to fold this paper to make a paper dog. When we are all done you can take the dog home. Start with the paper like this.

Watch how I make the dog's face. Now it's your turn. Make a dog like I did!

Ons gaan hierdie papier vou om 'n papier hond te maak. As ons klaar is kan jy die hond huistoe vat. Begin met die papier so. Kyk hoe maak ek die hond se gesig. Nou is dit jou beurt. Maak 'n hond soos ek gemaak het.

Item 2 (Fish)

We are going to fold this paper to make a paper fish. When we are done you can take the fish home too. Start with the paper like this. Watch how I make the fish!

Ons gaan hierdie papier vou om 'n papier vis te vorm. As ons klaar is kan jy die vis huistoe neem. Begin met die papier so. Kyk hoe maak ek die vis.

Snack Time

Item 1 (Opens bottle)

Let's have a snack! Here is something to drink. Open the bottle.

Kom ons geniet 'n versnapering! Hier is iets om te drink. Maak die bottel oop.

Item 2 (Pours water)

Here is my cup and here is your cup. pour some water into the cups for both of us.

Hier is my koppie en hier is jou koppie. Gooi van die water in die koppies vir albei van ons.

Item 3 (Puts crackers on napkins)

Put some crackers on the napkins. Give me some crackers please. Thank you! Now you get some crackers.

APPENDIX N
VISUAL SCREENING

VISUAL SCREENING

Name: _____ Date: _____

1) Visual acuity

L: R: Both:

2) 3 Dot Lustre Test

_____

3) Eye movements

L: R: Both:

Convergence:

Divergence:

Accommodation:

4) Unilateral cover test

L: R:

Comments: _____

APPENDIX O
LETTER TO PRINCIPAL REGARDING THE LOGISTICS OF THE ASSESSMENT

Beste _____

Baie dankie dat u en die skool se beheerliggaam ingestem het dat ek my navorsing by _____ kan doen. Dit word opreg waardeer!

Vind hierby toestemmingvorms vir die _____ leerlinge soos aangedui op u faks. Ek wil graag vra dat die betrokke onderwyseres die vorms vir die leerling se ouers sal huistoe stuur. In die brief aan die ouers het ek gevra dat die ouers die vorms sal terugstuur teen_____. Ek sluit ook ‘n vraelys in wat asseblief deur elke kind se onderwyseres voltooi moet word.

As dit in orde is sou ek graag die volgende kinders op _____ by die skool kom evalueer.

1. _____
2. _____
3. _____
4. _____
5. _____

Ek sal daardie oggend reeds 7h30 by die skool wees en ek behoort teen 13h00 klaar te wees, indien al die ouers toestemming verleen.

Nogmaals dankie vir u samewerking.

Vriendelike groete
Maretha Bekker

APPENDIX P

LETTER OF APPROVAL FROM DEPARTMENT OF EDUCATION

UMnyango WezeMfundo
Department of Education

Lefapha la Thuto
Departement van Onderwys

Enquiries : Shadrack Phele MIRMSA

Tel. No. : [+2711] 355 0285

Monday, 27 October 2008

Mrs. Bekker Maretha
PO Box 1220
MONTANA RARK
0159

Dear Mrs. Bekker Maretha

PERMISSION TO CONDUCT RESEARCH: PROJECT

The Gauteng Department of Education hereby grants permission to conduct research in its institutions as per application.

Topic of research	: "A comparison between 5 and 6 year old children in Grade 1 regarding their readiness for acquiring handwriting skills."
Nature of qualification	: M. Occ. Ther. [School of Health Care Sciences]
Name of institution	: University of Pretoria

Upon completion of the research project the researcher is obliged to furnish the Department with copy of the research report (electronic or hard copy).

The Department wishes you success in your academic pursuit.

Yours in Tirisano,

p.p. Shadrack Phele [MIRMSA]
TOM WASPE
CHIEF INFORMATION OFFICER
Gauteng Department of Education

Office of the DDG: IS & KM (CIO)
Room 1807, 111 Commissioner Street, Johannesburg, 2001 P.O.Box 7710, Johannesburg, 2000
Tel: (011) 355-1514/1507 Fax: (011) 355-0734/0833 E-mail: tomw@gpg.gov.za or elridar@gpg.gov.za

APPENDIX Q

LETTER OF APPROVAL FROM FACULTY OF HEALTH SCIENCES RESEARCH ETHICS COMMITTEE

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

* FWA 00002567, Approved dd 22 May 2002 and Expires 13 Jan 2012.
* IRB 0000 2235 IORG0001762 Approved dd Jan 2006 and Expires 13 Aug 2011.

100 1908 - 2008

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Committee
Fakulteit Gesondheidswetenskappe Navorsingsetiekkomitee

DATE: 6/04/2009

PROTOCOL NO.	**211/2008**
PROTOCOL TITLE	A comparison between 5 and 6 year old grade 1 children regarding their readiness for acquiring handwriting skills.
INVESTIGATOR	**Principle Investigator:** Mev M Bekker
SUBINVESTIGATOR	N/A
SUPERVISOR	Ms. Aronstam
DEPARTMENT	**Dept:** Occupational Therapy maretha.bekker@up.ac.za
STUDY DEGREE	MOcc.Ther
CONTACT DEATAILS	**Phone:** 012-3541466 **Fax:**012-3541329 **Cell:** 0739467435
VAT NO.	N/A
MEETING DATE OF THIS STUDY	19/11/2008

This **Protocol** and **Informed Consent** have been considered by the Faculty of Health Sciences Research Ethics Committee, University of Pretoria on 25/03/2009 and found to be acceptable

* *Members attended & Feedback at the meeting .*

*Prof A Nienaber	(female) BA (Hons) (Wits); LLB; LLM (UP); PhD; Dipl.Datametrics (UNISA)
*Prof V.O.L. Karusseit	MBChB; MFGP (SA); MMed (Chir); FCS (SA)
*Prof M Kruger	(female) MB.ChB. (Pta); MMed. Paed. (Pret); M.Phil (Stellenboch) cum laude; PhD. (Leuven)
Dr N K Likibi	MB.BCh; Med.Adviser (Gauteng Dept.of Health)
Dr T S Marcus	(female) BSc (LSE), PhD (University of Lodz, Poland)
*Snr Sr J. Phatoli	(female) BCur (Eet.A) BTec (Oncology Nursing Science)
*Dr L Schoeman	(female) B.Pharm, BA Hons (PSy), PhD
*Dr R Sommers	(female) MBChB; MMed (Int); MPharMed;
Mr Y Sikweyiya	MPH; SARETI Fellowship in Research Ethics; SARETI ERCTP; BSC (Health Promotion) Postgraduate Dip in Health Promotion
*Prof TJP Swart	BChD, MSc (Odont), MChD (Oral Path), PGCHE
*Dr A P van Der Walt	BChD, DGA (Pret) Director: Clinical Services of the Steve Biko Academic Hospital
Prof C W van Staden	MBChB; MMed (Psych); MD; FCPsych; FTCL; UPLM; Dept of Psychiatry

DR R SOMMERS; MBChB; MMed (Int), MPharMed.
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

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MS: dd 2013/10/28: C:\Users\User\Documents\Protokolle\2~Grade briewe\Letters 2008\211.doc