ASSESSMENT OF
VISUAL-MOTOR INTEGRATION FUNCTIONING IN
A SELECTED SOUTH AFRICAN MIDDLE CHILDHOOD SAMPLE

LESLIE LOTZ

Supervisor: HS Loxton

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DECLARATION

I, the undersigned, hereby declare the work contained in this assignment consists of my own original work, and that I have not previously in its entirety, or in part, submitted it at any university for a degree.

Signature Date

SUMMARY

During middle childhood, cognitive, social, emotional and self-concept development is of importance, and prepares the child for the adaptation and challenges awaiting the child in adolescence. *Visual-motor integration* is described by various sources as playing an important role in the development of a child. Visual-motor integration is the child's ability to integrate visual perceptual skills with fine motor coordination. In order to assess visual-motor integration functioning, the *Developmental Test of Visual-Motor Integration* (*VMI*) (Beery, 1989) is often applied. Considering visual-motor integration functioning as an integral part of the drawing task (Harris, 1963), the *Goodenough-Harris Drawing Test* (*GHD*) may also convey important information of a child's visual-motor integration functioning.

The *primary aim* of the present study was to determine the status of visual-motor integration functioning of the selected group of middle childhood children within the South African context, in order to identify possible delays. Visual-motor integration functioning was determined by the children's performance on GHD and the VMI. Academic achievement results were also reviewed to determine the chosen sample's status in this regard. The obtained results were analyzed and summarized in order to obtain information leading to the fulfillment of the primary aim.

The *secondary aim* of the present study flows parallel to the primary aim, and was motivated by the need to discover an effective, child-friendly measurement tool of visual-motor integration, applicable at a young age, as to gain accurate knowledge of a child's visual-motor integration functioning. The secondary aim consisted of exploring a) the correlations (if any) between the results of the *Goodenough-Harris Drawing Test* (GHD) and the biographical variables of *gender*, *chronological age* and *socioeconomic status*, b) the correlations (if any) between the results of the *Beery Developmental test of Visual-Motor Integration* (VMI) and the above-mentioned variables, c) the correlations (if any) between *academic achievement* and the above-mentioned variables and test results, and d) the correlations (if any) between the *VMI* and *GHD* results, in order to compare different tests of visual-motor integration.

Three hundred and thirty nine participants attending grade one to four in a specific primary school, took part in this study. The study resulted in various *conclusions regarding the status of visual-motor*

integration functioning, the most relevant being that the selected sample presents with functioning levels lower than that which is expected for children their age, in their achievement on both the VMI and the GHD, implying possible visual-motor integration functioning challenges. This finding implies the need to implement effective intervention programmes in order to address this seemingly evident delay.

Conclusions regarding the various relationships between the test results and certain biographical variables include the following: It was found that the relationship between socioeconomic status and childhood development, as reflected by the correlation between *socioeconomic status* and the GHD, seems very important in the South African context. When considering *gender* differences, females achieved lower scores on both tests applied in the present study than males. *Chronological age* correlated significantly with scores on the VMI. It was further shown that visual-motor integration functioning could have a significant impact on *academic achievement*.

The VMI and GHD results were compared, in order to compare different tests of visual-motor integration. High scores on the GHD related significantly to high scores on the VMI. Although the present study was unable to confirm the superiority of one test, various considerations were discussed leading to the identification of a child-friendly test of visual-motor integration. The present study highlights the importance of identifying and addressing developmental delays in general, and visual-motor integration functioning in specific, in order to ensure the development of middle childhood children to their complete potential in the South African context. It also underlines the need for effective, child-friendly assessment tools of visual-motor integration that will ensure the effective identification of developmental delays.

OPSOMMING

Gedurende middelkinderjare is kognitiewe-, emosionele- en selfbeeldontwikkeling van belang, omdat dit die kind voorberei vir die verwagte aanpassings en uitdagings tydens adolessensie. *Visueel-motoriese integrasie* speel 'n sentrale rol in kinderontwikkeling. Visueel-motoriese integrasie word beskryf as die kind se vermoë om visueel-perseptuele vaardighede te integreer met fyn-motoriese koördinasie. Die VMI *(Developmental Test of Visual-Motor Integration,* Beery (1989)) word gereeld as meetinstrument gebruik vir visueel-motoriese integrasie. Omdat visueel-motoriese integrasie 'n sentrale deel van 'n kind se tekenvaardighede is, is die *GHD (Goodenough-Harris Drawing Test)* ook toepaslik om informasie rakende 'n kind se visueel-motoriese integrasie funksionering te bepaal.

Die *primêre doel* van die huidige studie was om die status van visueel-motoriese integrasie funksionering van 'n gekose groep kinders in die middelkinderjare binne die Suid-Afrikaanse konteks, te bepaal. Hierdie doel is bereik deur die toepassing van die VMI en die GHD. Akademiese resultate is verder in ag geneem. Die analisering van die finale resultate en data het gelei tot belangrike afleidings rakende die status van die geselekteerde steekproef.

Die *sekondêre doel* was gemotiveer deur die behoefte om 'n effektiewe, kindervriendelike meetinstrument van visueel-motoriese integrasie te identifiseer, wat toepaslik is op 'n jong ouderdom, en akkurate kennis rakende 'n kind se visueel-motoriese integrasie funksionering tot gevolg het. Om die sekondêre doel aan te spreek, is die volgende ondersoek: a) die korrelasies (indien enige) tussen die resultate van die GHD en sekere biografiese veranderlikes, naamlik *geslag, chronologiese ouderdom en sosio-ekonomiese status*; b) die korrelasies (indien enige) tussen die resultate van die VMI en die bogenoemde biografiese veranderlikes; c) die korrelasies (indien enige) tussen *akademiese resultate* en die bogenoemde veranderlikes en toets resultate; en d) die korrelasies (indien enige) tussen die GHD en die VMI resultate, ten einde verskillende toetse van visueel-motoriese integrasie te vergelyk.

Die huidige studie dui op vele gevolgtrekkings rakende die status van visueel-motoriese integrasie funksionering in die geselekteerde steekproef; die mees relevante dat die steekproef funksioneer op 'n vlak wat laer is as dit wat verwag word vir kinders van hul ouderdom. Hierdie gevolgtrekking is

gebaseer op die resultate van beide die GHD en die VMI, en impliseer moontlike visueel-motoriese integrasie agterstande. Hierdie bevinding dui op 'n behoefte vir effektiewe intervensie programme wat hierdie oënskynlike agterstande sal aanspreek.

Gevolgtrekkings rakende die vele verwantskappe tussen die toetsresultate en sekere biografiese veranderlikes, sluit die volgende in: kinderfunksionering, soos gereflekteer deur die resultate van die GHD, is beduidend verwant aan *sosio-ekonomiese status*. Hierdie verskynsel blyk belangrik te wees in die Suid-Afrikaanse konteks. Met in agneming van *geslagsverskille,* het vroulike deelnemers beduidend swakker resultate in beide die GHD en die VMI as manlike deelnemers getoon. *Chronologiese ouderdom* het beduidend met VMI resultate gekorreleer. Laastens het dit ook gevolg dat visueel-motoriese integrasie, soos reflekteer deur die resultate van beide die VMI en die GHD, 'n beduidende verwantskap tot *akademiese funksionering* toon.

'n Vergelyking tussen die resultate van die VMI en die GHD het gelei tot die gevolgtrekking dat hierdie twee toetse beduidend positief verwant is. Hoë tellings op die GHD het verband gehou met hoë tellings op die VMI. Alhoewel die resultate van die huidige studie nie die superioriteit van die gebruik van die een toets bo die van die ander kon bevestig nie, is verskeie oorwegings verder bespreek wat in ag geneem behoort te word tydens die seleksie van 'n kindervriendelike meetinstrument van visueel-motoriese integrasie. Die huidige studie is van waarde in die beklemtoning van die belangrikheid om ontwikkelingsagterstande in die algemeen, en spesifiek in visueel-motoriese integrasie funksionering, spoedig te identifiseer en aan te spreek. Die uitvoering hiervan mag 'n bydra lewer tot die ontwikkeling van kinders se potensiaal in die Suid-Afrikaanse konteks. Die studie beklemtoon verder die belangrikheid van effektiewe, kindervriendelike meetinstrumente van visueel-motoriese integrasie, wat die identifisering van hierdie ontwikkelingsagterstande sal verseker.

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1. INTRODUCTION

1.1 General Introduction

During middle childhood, cognitive, social, emotional and self-concept development is of importance, and prepares the child for the adaptation and challenges awaiting the child in adolescence (Louw, Van Ede & Louw, 1998). *Visual-motor integration* is described by various sources as playing an important role in the development of a child. In order to assess visual-motor integration functioning, the *Developmental Test of Visual-Motor Integration* (*VMI*) (Beery, 1989) is often applied. Considering visual-motor integration functioning as an integral part of the drawing task (Harris, 1963), the *Goodenough-Harris Drawing Test* (*GHD*) may also convey important information of a child's visual-motor integration functioning.

The **social relevancy** of the present study was grounded in the need for an intervention programme for certain observed difficulties regarding visual-motor integration, brought to light by the teachers of the selected school. Considering the findings of the present study, it seemed eminent to embark on an endeavour to address this need by gaining further knowledge and understanding pertaining to the status of visual-motor integration functioning of the selected sample of middle childhood children in the South African context.

Assessment of children, with the aim to identify problems at an early enough stage for intervention, lies parallel with the South African government's criteria of fostering children's physical, mental, emotional, moral and social development (Draft White Paper, 1996). Failure to identify and treat inadequate visual-motor integration abilities may, in some instances, lead to the development of certain challenges, one of which could be learning disabilities (Aylward & Schmidt, 1986; Dunn, 2001; Schlodder, 1986). Most guidelines for establishing a learning disability include, amongst other criteria, a significant weakness or lag in the area of fine-motor development (Breen, 1982; Breen, Carlson, & Lehman, 1985). This opinion highlights the central role visual-motor integration may play in academic difficulties, although Schlodder (1986) warned that it would be erroneous to conclude that all children with visual-motor integration difficulties will develop learning disabilities. This concern would gain from further research before any conclusions are drawn. Many researchers agree that the inclusion of a visual-motor integration assessment tool in any test battery would be advisable (Beery, 1997; Breen et al., 1985; Schlodder, 1986).

In order to develop and implement an intervention programme aimed to support the identified needs in the selected sample, information is firstly needed to define the status surrounding the visual-motor integration functioning in the selected sample. In order to obtain this information, reliable

tests are needed to assess the children. **Scientific motivation** for the present study was thus to find a child-friendly, easy applicable test of visual-motor integration, which reflects the abilities and skills of these children most accurately across chronological age, gender and socioeconomic groups. The identification of such a test should provide a better tool for understanding visual-motor integration functioning of the middle childhood child, leading to more applicable, effective intervention programmes in the future. As Kastner, May, and Hildman (2001) postulated, once at risk children are identified, they clearly benefit from soundly structured educational programmes. This notion is supported by the work of De Wet, Falkson, Richter, and Griesel (1989).

The **primary aim** of the present study was explorative in nature. The researcher wished to determine the status of visual-motor integration functioning of the selected group of middle childhood children within the South African context, in order to identify and address identified delays. Visual-motor integration functioning was determined by the children's performance on the Developmental Test of Visual-Motor Integration (VMI) and the Goodenough-Harris Drawing Test (GHD). Academic achievement results were also reviewed to determine the chosen sample's status in this regard. The obtained results were analyzed and summarized in order to obtain information leading to the fulfillment of the primary aim.

The **secondary aim** of the present study flows parallel to the primary aim, and was motivated by the need to discover an effective, child-friendly measurement tool of visual-motor integration, applicable at a young age, as to gain accurate knowledge of a child's visual-motor integration functioning. The researcher wished to obtain information indicating the existence of significant correlations between the test results and certain biographical variables, and, if such correlations existed, what the nature of these correlations was.

Tennant (1986) identified five factors able to influence the visual-motor integration functioning of children. These are chronological age, gender, intelligence, environment and culture. The biographical variables that were attended to in the present study are gender, chronological age and socioeconomic status. Academic achievement was also considered.

In summary, the secondary aim consisted of exploring:

(a) the correlations (if any) between the results of the *Beery Developmental test of Visual-Motor Integration* (VMI) and the biographical variables of *gender*, *chronological age* and *socioeconomic status*,

(b) the correlations (if any) between the results of the *Goodenough-Harris Drawing Test* (GHD) and the above-mentioned variables,

(c) the correlations (if any) between *academic achievement (ACACH)* and the above-mentioned variables and test results, and

(d) the correlations (if any) between the *VMI* and *GHD* results, in order to compare different tests of visual-motor integration.

It is not yet clear if there is one visual-motor integration test that is most effective (Breen et al., 1985). Aylward and Schmidt (1986) could not conclude the superiority of one test, but suggested certain criteria that need to be taken into consideration when choosing a specific test. These include 1) the easiness of following test instructions, when used by inexperienced testers, 2) the nature of the population to be tested, 3) practical and time considerations, 4) gender bias, and 5) predictive validity. These criteria were taken into consideration in assessing the selected tests.

1.2 Defining Key Constructs

1.2.1 Middle Childhood Children

The target group of the present study was children ranging from the age of 6-years 5-months to 13-years 4-months currently attending an identified primary school in the Stellenbosch region of South Africa. According to developmental literature the life stage of middle childhood includes all children ranging from 6- to 12-years, while a child is considered an adolescent when entering the age of 13 (Craig, 1996; Louw et al., 1998; Newman & Newman, 1999). This implies that the current sample includes children of both the middle childhood and adolescent life stages. Normally the age range of 6-years to 13-years would include children attending *grade 1* throughout *grade 7*. In the present study all children attending *grade 1* to *grade 4* were assessed, independent of their chronological age. The sample therefore consisted of a few children older than that which is expected, possibly because of failing at least one academic year or late school entry. For the sake of uniformity in the present study, the children older than 12 will be considered as middle childhood children, as they are expected to function on the same school level as children who are currently in middle childhood.

1.2.2 Visual-Motor Integration

The term *visual-motor integration*[1] was introduced and conceptually developed by Keith E. Beery in 1967, when the Beery-Buktenica test was first published (Dunn, 2001). Aylward and Schmidt

[1] For the purpose of the present study, the terms 'visual-motor' and 'sensory- or perceptual-motor' will be used interchangeably

(1986) described visual-motor integration as the child's ability to integrate visual perceptual skills with fine motor coordination. The fine motor skills require the use of the hand and fingers to produce precision movements, and rely on hand-eye coordination for the task to be completed successfully (Baard, 1998; Beery, 1997). Tennant (1986) defined visual-motor integration as the reaction to visually observed stimuli by means of motoric behaviour appropriate to the specific task, implying it consists of behaviours such as visual perception and motor coordination, involving the effective co-working of eyes and body muscles. For the purpose of this study, the definition of Aylward and Schmidt (1986) will be used.

1.3 Literature Review

Developmental psychologists advocated that the development of finer motor functions during middle childhood may contribute to adaptation later in life (Louw et al., 1998). Piaget's theory (cited in Schlodder, 1986) is of importance when describing visual-motor integration development, as he acknowledges the importance of various perceptual-motor abilities during childhood development. Although his focus is very much on cognitive development, Piaget also stressed the importance of sensory-motor intelligence as a prerequisite for further development. When discussing the stages of development, Piaget (cited in Schlodder, 1986) described the first stage as the sensory-motor stage, during which children develop the ability to coordinate simple motor actions with incoming visual information. This developmental stage serves as the basis for further progress in the pre-operational, concrete-operational and formal-operational stages. Schlodder (1986) highlighted the significance of Piaget's view, by stating the interesting notion that sensory-motor development seems to be the foundation of the maturation process. Visual-motor development could thus be seen as one of the most crucial aspects of the child's overall development.

Several important developmental qualities depend on the child's visual-motor integration abilities. Intact perceptual modalities are a prerequisite for *advancement with formal learning activities* (*inter alia* Brand, Graf, & Hinton, cited in Dunn, 2001; Vorster, 1994). Visual-motor integration is an important factor of *school readiness* (Hanekom, 1991). Furthermore, visual-motor integration functioning influences a child's mastering of *reading, writing and arithmetic skills* at school entrance level (De Jager & Hanekom, cited in Dunn, 2001).

Breen et al. (1985) and Chan (2000) illustrated the importance of visual-motor integration functioning, by postulating that interference with these abilities may restrict interaction with the environment and have far-reaching consequences for the child's *physical and psychological well*

being. Sullivan (cited in Dunn, 2001) stressed this point further by explaining that a transient immaturity in visual-motor functioning may "delay the acquisition of pre-school letter cognition, consequently [affecting] the child's transactions with his environment long after the motor immaturity has reached age appropriate norms" (pp. 5). Visual-motor integration functioning could therefore not only impinge on the child's academic and school performance, but also on his/her emotional and interactional contact with his/her environment.

From the above discussion it seems evident that the early detection of visual-motor integration difficulties is important during child assessment, preventing later psychological and physical developmental delays, as well as relational and learning difficulties. Kitay (cited in Fuller & Vance, 1995), as well as Mazzeschi and Lis (2000), strongly supported the notion that perceptual-motor tests (such as the tests used in the present study) should be used as part of any test battery. This is postulated because of the information it provides about a child's perceptual-motor functioning, expressive style and possible maladjustment. Gredler (2000) also underlined the importance of early childhood education, assessment and intervention. Early detection may lead to the timely implementation of intervention programmes, reducing the overall incidence of scholastic problems and equipping the child for better future development (Dunn, 2001; Schlodder, 1986).

1.3.1 **The Developmental Test of Visual-Motor Integration**

The test devices that were used in the present study can be described as assessment tools of visual-motor integration functioning. The Developmental Test of Visual-Motor Integration (Beery, 1989) is also known as the VMI or the Beery. Psychologists, occupational therapists and remedial teachers often use the *American* standardized VMI for the evaluation of visual-motor integration functioning in the *South African* context (Vorster, 1994). Concha (cited in Vorster, 1994) and Dunn (2001) also supported the applicability of the VMI as a valid measurement tool of visual-motor integration functioning in South Africa. Effectively explained, the VMI is designed to measure the hyphen in the term visual-motor integration (Beery, 1997). This is done on the premise that the whole is greater than the sum of its parts, implying that effective functioning of the parts in isolation (in this case either visual or motor functioning) may not imply effective functioning of the whole. This is therefore the focus of the VMI.

1.3.2 **The Goodenough-Harris Drawing Test**

The *Goodenough-Harris Drawing Test* (GHD) was initially developed by Florence Goodenough (1926) to evaluate empirically qualitative aspects of human figure drawings. It became the first test to use human figure drawings in an empirically, scientific based test (Harris, 1963). The test was

developed in order to assess the developmental and cognitive maturity of 3- to 15- year old children. Piaget (cited in Reynolds & Kamphaus, 1990) colours this concept by stating that the child's cognitive perspective of his or her world and a person within that world should significantly determine a) how a child will complete a drawing in the GHD, b) what details will be in the drawing, and c) to what degree it compares with drawings of same-aged peers. Although this test is generally described as a test of intelligence (Abell, Von Briesen, & Watz, 1996), it can also be considered applicable in the measurement of visual-motor integration functioning, as it consists of drawing tasks (Goodenough, 1926; Harris, 1963).

By stating that drawing requires sensory stimulation, perception, conceptualization, thinking and visual-motor coordination, Harris (1963) supported the applicability of drawings as a measurement of visual-motor integration. Dunn (1967) further underscored this view be postulating that the GHD might reflect the ability to develop and utilize concrete functional-motoric concepts, as contrasted with abstract-verbal concepts. When reviewing the format of the GHD, it is noteworthy to observe that the test has included in its scoring system (Harris, 1963), items specifically assessing the visual-motor qualities portrayed in the drawing.

1.3.3 **Influences on Visual-Motor Integration Functioning, the VMI and the GHD**

Various factors have been identified to influence visual-motor integration. Tennant (1986) postulated that **gender** affects most visual-motor skills. It has been found by some that girls in kindergarten have more mature visual-motor integration abilities than boys (Koppitz, cited in Aylward & Schmidt, 1986). Harris (1963) stated that girls show better fine-motor coordination and a slight, but consistent acceleration in general development and superior drawing performance. Brown (1990) also found that girls ages 5, 6 and 9 were developmentally ahead of boys of the same age, in their ability and willingness to include more characteristics in their drawings of the head in the GHD. However, various studies did not find evidence to support these findings (Dunn, 2001; Frey, 1996; Scott, 1981). Kerschensteiner and Ivanhoff (cited in Goodenough, 1926) was in favour of boys as superior to girls.

When reviewing functioning according to the VMI, it has been proposed that the VMI is biased in favour of girls, although this could not be supported by various studies (Beery, 1982; Frey, 1996; Schlodder, 1986; Scott, 1981). Baard (1998) and Schlodder (1986) concluded that the effect of gender on visual-motor integration is a subject of disagreement amongst researchers. Due to contradictory findings the influence of gender on visual-motor integration needs to be researched further in future.

Another factor thought to influence visual-motor integration, is **chronological age**. In the view of earlier theories of development (Piaget & Kephart, cited in Schlodder, 1986) it seems superfluous to state that visual-motor integration develops over time, hence concluding that age is related to visual-motor integration. Piaget and Inhelder (cited in Chappell & Steitz, 1993) postulated that the drawings of children on the GHD are connected to their age. According to Piaget (Craig, 1996), the 7- to 10- year old child is in the cognitive developmental stage of concrete operations. During this phase, the child acquires the abilities of conservation, class inclusion, serialization and the ability to think in relational terms (Schlodder, 1986). The child also reaches visual realism, where the drawing of a human figure should be in proportion and in proper perspective with the background. Schlodder (1986) explained this phenomenon by stating that the child starts to make sense of his/her environment by actively dealing with objects and people. The child slowly progresses through time from these primitive motor-coordination encounters, to higher functions, such as abstract reasoning, hypothesizing, reasoning, and organizing. Chappell and Steitz (1993) found that there is a definite correlation between children's cognitive developmental stage and drawings: as cognitive abilities increase, the level of drawing increases as well. Harris (1963) cautioned that individual scoring points on the GHD cease to show an age increment in the early teens. In some instances it even shows an age decrement at the age of fifteen.

Dunn (2001) found that performance on the VMI correlates with the chronological age of the South African child. Tennant (1986) concluded that because development implies change, the visual-motor integration functioning of a child will be influenced by age.

A third influencing factor is that of **socioeconomic status**. The present study focuses on how different factors in this particular environment influence the child's development in general and visual-motor integration abilities in particular. Socioeconomic status is a contributory factor to a child's environment. Baard (1998) identified visual-motor integration as a particularly sensitive predictor of socioeconomic status. Kagitcibasi (1979) found clear evidence suggesting that socioeconomic development influence the perceptual-cognitive functioning of children, in the sense that the weaker the quality of drawings produced by the child on the GHD, the lower the level of socioeconomic status. Dunn (2001) and Beery (cited in Vorster, 1994) provided evidence suggesting that a correlation exists between the performance on the VMI and the child's socioeconomic status. The environment in which the child is brought up should therefore be taken into account.

Concerning the estimation of socioeconomic status in the South African context, the numerical occupation classification scale, used by Riordan (cited in Tennant, 1986) and adapted by Dunn (2001), was used (See Addendum A). The numerical occupation classification scale uses the occupation and educational level of the father or guardian to determine the level of socioeconomic status, by assigning numerical values to different educational and occupational levels. In this study the primary school from which the sample was drawn provided the information regarding the occupation and educational level of the father or guardian. Addendum B contains a summary of the specific careers included into the various levels of the numerical occupation scale, as determined by the researcher.

Lastly, **academic achievement** seems to be indicated as related to visual-motor integration. Duffey, Ritter, and Fedner (1976) found the GHD and VMI, amongst other tests, of little value when predicting academic achievement, while Dunn (2001), Reynolds, Wright, and Wilkinson (1980), and Schlodder (1986) concluded that VMI scores were significant predictors of academic development. Frostig and Horne (cited in Dunn, 2001) identified visual-motor integration functioning as one of the visual-perceptual abilities that seems to have the greatest relevance to academic achievement. Other abilities include *visual-spatial ability* (which consists of (a) the perception of position in space and (b) spatial relations), *perceptual constancy* and *figure-ground perception*. Schlodder (1986) supported this notion, by stating that intelligence and achievement have a sensory-motor basis, therefore implying higher cognitive reasoning and behaviour as in need of integration amongst visual input and motor actions.

In contrast Eaves, Williams, Winchester, and Darch (1994) viewed another test of visual-motor integration functioning, the Bender-Gestalt, as quite effective. Chan (2000) asserted that the Bender-Gestalt test has been widely used to screen for learning difficulties and to predict academic performance, therefore implying academic achievement as related to visual-motor integration. Research regarding the Bender-Gestalt test in relation to the VMI and GHD are recommended for further insight into these findings.

1.4 Theoretical Context

The present study takes the environment in which the child is brought up into account, and focuses on how different factors in this particular environment influences the child's development in general and visual-motor integration abilities in particular. For this purpose the ecological systems theory (Bronfenbrenner, 1986) is most effective in describing all the factors influencing the child. Bronfenbrenner (1979) explained the ecology of human development as:

> ...the study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by the relations between these settings, and by the larger contexts in which the setting are embedded (pp. 21).

Effectively explained, the environment a child grows up in, is not limited to a single, immediate setting, but to a variety of interconnected settings, as well as external influences from the larger surroundings. The structures within the ecological environment (seen as concentric circles nested in one another) are referred to as the *micro-*, *meso-*, *exo-* and *macrosystems* (Bronfenbrenner, 1979). The various structures will be shortly discussed, based on the work of Bronfenbrenner (1979; 1986).

The *microsystem* is described as "a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting" (Bronfenbrenner, 1979, pp. 22). When viewing the selected sample, possible microsystems include the child's home, the day care centre, the playground, or the classroom. The *mesosystem* is a system of microsystems, indicating the interrelatedness amongst two or more settings in which the child is actively involved. Examples of the mesosystem include the relations amongst home, school and the neighbourhood peer group. Settings that do not involve the developing child as an active participant, but in which events occur that affect the child and his/her setting, is referred to as the *exosystem*. This might include the parent's place of work, the local school board, the parents' friends, or a school class attended by an older sibling. Lastly, the *macrosystem* includes all possible "consistencies [between the micro-, meso-, and exosystems] that exist at the subculture or culture level as a whole, along with any belief system or ideology underlying such consistencies" (Bronfenbrenner, 1979, pp. 26). For example, within a given society, such as the society from which the current sample was drawn, similar school classrooms (microsystems), similar relations between home and school (mesosystems), and similar school boards (exosystems) exist in various locations, that all differ from their counterparts in another society. This implies that the developing child is also influenced by factors such as the political views and legislation of a society.

In applying the ecological theory to the South African child in the selected sample, the need to consider the wide range of systems that impact on the child is realized. Craig (1996) supported this notion by stating that physical-motor development could be slowed when children live in limited and restricted environments. It is further stated that children who are restricted from using creativity to learn (e.g. few objects to play with, places to explore and tools to use) may have

trouble developing their motor skills. Thus, it can be seen that various factors in the child's environment can influence visual-motor integration development.

2. METHOD

2.1 Participants

In order to address the aims of the present study, the total group of children that attended grade one to four in the selected primary school in the Stellenbosch region was assessed. The final participants consisted of 339 coloured[2] children, 95 attending grade one, 76 attending grade two, 70 attending grade three and 98 attending grade four. The participants consisted of 171 males and 168 females, and ranged from 6-years 5-months to 13-years 4-months of age, with a mean chronological age of 8- years and 10- months. According to Riordan's index of socioeconomic status (Tennant, 1986), the sample in the present study consisted of upper (n = 9), middle (n = 92) and lower (n = 238) socioeconomic families. The majority of the participants (70.2%) come from lower socioeconomic backgrounds.

The participants were tested either in Afrikaans or English, according to their preference. The independent variables, namely gender, chronological age and socioeconomic status, were taken into consideration. Written consent was obtained from the Western Cape Education Department (See Addendum C), the selected primary school (See Addendum D), the participants (See Addendum E) and their parents (See Addenda F and G).

2.2 Research Design

The research was conducted in order to address the primary and secondary aims of the present study. In order to accomplish this, the present study was divided into two design areas. An *explorative research design* was followed to find specific information regarding the status of visual-motor integration functioning of the selected sample of middle childhood children, thereby addressing the primary aim of the present study. This was done by administering the chosen test devices to the selected sample, leading to quantitative information regarding the status of visual-motor integration functioning of the sample, as reflected by the VMI and the GHD.

The secondary aim of the present study was fulfilled by following a *correlational research design*. This was done by determining (a) the correlations (if any) between the results of the *Beery Developmental test of Visual-Motor Integration* (VMI) and the biographical variables of *gender*,

[2] The use of the term "coloured" could be viewed as controversial. The term will be used descriptively and in the context as explained.

chronological age and *socioeconomic status*; (b) the correlations (if any) between the results of the *Goodenough-Harris Drawing Test* (GHD) and the above-mentioned variables; (c) the correlations (if any) between *academic achievement* and the above-mentioned variables and test results, and (d) the correlations (if any) between the *VMI* and *GHD* results, in order to compare different tests of visual-motor integration. Factors that may contribute to a child friendly assessment tool, as cited earlier (Aylward & Schmidt, 1986), were kept in mind.

2.3 Measuring Instruments

Data were firstly generated by informative questionnaires completed by the teachers of the selected primary school, and secondly through assessment of the selected sample. The teachers supplied the researcher with all necessary information regarding the occupational and educational levels of the selected sample's parents or caretakers, in order to enable the researcher to arrive at a numerical representation of each participant's current socioeconomic status level, using the numerical occupational classification scale of Riordan (Dunn, 2001; Tennant, 1986). Care was taken to instruct the teachers concerning the importance of the correct detailed completion of the data of all participants. The researcher was further given access to the academic achievement results of the participants, in the form of their report cards, at the time of testing, enabling the researcher to generate data representative of the current status of academic achievement results of the selected sample.

The psychometric assessment tools consisted of the Developmental Test of Visual-Motor Integration (VMI, 1989) and the Goodenough-Harris Drawing Test (GHD). A brief discussion of each measuring instrument follows.

2.3.1 The Developmental Test of Visual-Motor Integration

The VMI is designed for preschool and early grade level children (Aylward & Schmidt, 1986), measuring fine motor coordination and visual perception of abstract stimuli (Demsky, Carone, Burns, & Sellers, 2000; Graf & Hinton, 1997). The VMI is said to be *structured*, *non-verbal* and therefore *culture-fair*. Other advantages are the *simple, quick and inexpensive* applicability of the VMI in a group context (Dunn, 2001).

There are four versions in total of the VMI (Dunn, 2001). The 1989 version of the VMI was applied in the present study. Dunn (2001) underlined a strength of this version as being its *sensitivity to individual differences* due to the added 26 marks used for scoring. In the VMI (Beery, 1989) the child is asked to copy 24 geometric designs, increasing in difficulty and complexity

(Dunn, 2001), in space provided under the design. There are three designs per page. Each item is scored 'failed' or 'passed'. The child continues to draw until he/she fails three consecutive drawings (Aylward & Schmidt, 1986).

Some considered the VMI a somewhat better measurement of normal development of visual-motor integration functioning than the Bender-Gestalt test (Demsky et al., 2000). Aylward and Schmidt (1986) found the VMI to produce less ambiguous scores than the Bender-Gestalt. Armstrong and Knopf (1982) conducted research similar to the present study. The results obtained on the VMI and the Bender-Gestalt tests were compared, by administering the selected tests to two groups of 40 children, ranging from 7- to 10-years of age. The selection was done according to learning disabilities for the first group, and normal class enrollment for the second group. A high correlation of r = .74 was found between the VMI and the Bender-Gestalt for the learning-disabled group, while a low correlation of r = .36 was obtained for the regular students. The results suggested that the groups performed differently on the tests, and postulated that both the VMI and the Bender-Gestalt is of more worth for *assessment of learning disabled children*, while normal students performed varyingly on the tests.

Dunn (2001) supported the VMI for its *predictive validity* as well as it being a *valid indication of visual-motor integration functioning in the South African context*. Vorster (1994) viewed the VMI as a reliable test of visual-motor integration for certain South African groups, but recommended further research done on different culture groups in South Africa.

2.3.2 **The Goodenough-Harris Drawing Test**

In considering a suitable subject for her test, Goodenough (1926) believed it must be something with which all children are equally familiar. The GHD is based on Goodenough's belief that more intellectually developed children would convey more details in a human figure drawing (Abell et al., 1996). The test consists of 73 items for the scoring of the drawing of a man, and 71 items for the drawing of a woman, and results in a non-verbal measure of mental ability (Aikman, Belter, & Finch, 1992). As mentioned earlier, the results of this test may also provide useful information regarding visual-motor integration functioning.

The GHD has been identified as a useful test for children, because of its *predictive ability* and *independence towards language* (Carroll & Ryan-Wenger, 1999; Kagitcibasi, 1979). Reynolds et al. (1990) highlighted that children are often unable to express themselves, because of insufficient language skills, and therefore resort to "more primitive means of *motoric expression*" (pp. 58),

making drawing a useful method of assessing children's emotions, as well as their visual-motor functioning. Goodenough (1926) stated that drawing serves primarily as a language for the child, a *form of expression*. She described her test as (a) utilizing only the drawings of the child, (b) non-verbal, (c) time effective in testing groups, (d) applicable to children with the mental age of 4 to 10, and (e) reliable (r = .80 to .90). Van der Host (cited in Harris, 1963, pp. 182) explained the mediums of expression used by children as follows:

> As the child's inner life becomes richer, more complicated and more abstract, drawing becomes a less adequate means of expression. Being a concrete activity, drawing is less adequate than is language for the expression of abstract ideas. Drawing activity declines in late childhood and early adolescence, not so much because it is inadequate for expressing new ideas and feelings, as because more adequate modes of expression have become available.

Drawing therefore seems an appropriate tool for assessing the younger child. The applicability and appropriateness of drawing tests with young children can further be stressed by bringing it into context with the child's age and developmental stage. Goodenough (1926, pp. 13) stated that "up to about the age of ten years children draw the human figure in preference to any other subject".

Richter, Griesel, and Wortley (1989) applied the test to a group of black South African children, and compared the results with drawings done by similar children in 1938 and 1988. Their results indicated no significant changes in the drawings over the past 50 years, thus portraying the test as producing *stable results over time*. The conclusion was drawn that the test might underestimate cognitive abilities of children older than the age of 8 years. Aikman et al. (1992) supported these findings, describing the GHD as a *promising screening device for children of below-average intelligence*, but of less value for children of normal or above average intelligence.

2.3.3 **Academic Achievement and Teacher Ratings**

Eaves et al. (1994) viewed teacher rating as one of the most commonly used methods to estimate pupil's academic performance. Two South African studies, done by Dunn (2001) and Vorster (1994), portray a definite correlation between teacher ratings of a group of South African children, and their results on the VMI. Goshi, Demura, Kasuga, Sato, and Minami (2000) conducted a study on observation of child behavior, and identified a number of items that can be assessed in terms of observed behavior, making it easy to assess the abilities of the young schoolchild. These items included categories for locomotion, manipulation and stability. It was found that young children's

motor play reflects their motor skills. Therefore, by observation alone, information can be gathered regarding the visual-motor integration abilities of the child. As Goshi et al. (2000, pp. 216) asserted, "estimation based on observation is an effective method with young children, considering their mental and physical characteristics." For the purpose of the present study, the teacher ratings done in the form of the child's report card were used. The researcher awarded each child with a score out of 10, based on the participants' average mid-term marks which were derived from their various subject marks. For example, a participant with an average of 60 percent would be awarded a score of 6 out of 10.

2.4 **Procedure**

Prior to all procedures, permission to conduct the research was obtained from the Western Cape Education Department. Once the primary school was identified, the relevant teachers and caregivers were contacted. The research was discussed and permission was obtained to do the research on the school's premises during school hours. The assessment was planned, and the teachers were informed as to the nature and details of the assessment. Consent was asked from the parents or caregivers where possible, and from the selected primary school, in order to have access to the information needed regarding occupational and educational levels of the father or guardian, as well as the participants' academic results.

Several assistants (psychology honours students with a psychometric background) were recruited and trained to assist the researcher in conducting the various assessments. The researcher and the assistants familiarized themselves with the test environment and the participants before testing was initiated. The assistants were further prepared for possible difficulties within the setting.

The participants were tested in groups of between 30 and 40 children (according to the class sizes), in their familiar environment, in the presence of their particular teacher. Research assistants were present to provide sufficient support and supervision for the children. Each assistant was responsible for approximately 10 children. The GHD and the VMI were administered in one session, given in a counterbalancing design to minimize the practice effect. The standardized instructions of the psychometric tests were given in Afrikaans or English, according to the preferences of the participants. Precautions were taken to ensure that the children were unable to view each other's work. The duration of testing did not exceed that of one class period (40 minutes).

After all the data were collected, the researcher scored the tests, each according to its own instructions provided in the test manuals. Feedback concerning the individual children's visual-motor integration functioning and recommendations regarding the further development thereof was given to the parents. Deficits were identified and communicated to the parents and teachers (see Addendum H and I). Lastly, recommendations regarding the betterment of visual-motor integration functioning were made available to the teachers, while parents were advised to contact the school or the researcher for further assistance.

2.5 Statistical Techniques and Methods of Analysis

The *primary aim* of the present study was to determine the status of visual-motor integration functioning of a selected group of middle childhood children, through explorative analysis of the data. For this, it was necessary to conduct a descriptive analysis after categorizing the total scores of all the variables. This was done as a basis for forming an adequate conceptualization of the status of the selected sample's visual-motor integration functioning, in order to identify at risk children.

The *secondary aim* was correlational in nature, and implied the application of statistical techniques suitable for attaining information regarding the relationships between the different test results, academic achievement and certain biographical variables of the sample. Therefore, most of the data analyses were done in the form of correlations. Analyses of Variance (ANOVA) were applied where necessary. The Statistical Package for Social Science (SPSS) (George & Mallery, 1999) was used.

3. RESULTS

3.1 Introduction

The results of the statistical analyses conducted are presented in this section. The raw scores obtained were used for data reduction purposes. As some of the tests were not completed correctly, this was taken into account during the statistical analyses.

3.2 Descriptive Analyses

For the purpose of this section, the focus is on the exploration of the descriptive analyses of the data, in order to address the *primary aim* of the present study.

3.2.1 The VMI, GHD and Academic Achievement Results of the Sample

The means and standard deviations of the VMI results (test age), the GHD results (intelligence coefficient) and the academic achievement results (as a score out of 10) of the selected sample, are presented in Table 1.

Table 1

The Means and Standard Deviations of the VMI, GHD and Academic Achievement

	N	M	SD
VMI	339	90.09	23.24
GHD	339	93.86	15.68
ACACH	339	6.11	1.71

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement

Dunn (2001) described the standard scores of the **VMI** as having a mean of M = 100 and a standard deviation of SD = 15 for all age groups, based on the means of raw score distributions. As reflected in Table 1, *the mean VMI score of the selected sample (M = 90.09) is below that which is expected for children of this particular age.* The children in the present sample therefore seem to have a mean level of visual-motor integration equivalent to children of 7-years 6-months.

Figure 1 portrays the distribution of the standard scores of the VMI as slightly negatively skewed, with the most test age scores lying between 70 and 80 months. The mean is 90.09 months, with a standard deviation of 23.24 (as seen in Table 1). Compared to the mean chronological age of 106 months, *the test age lies 16 months below the chronological age.*

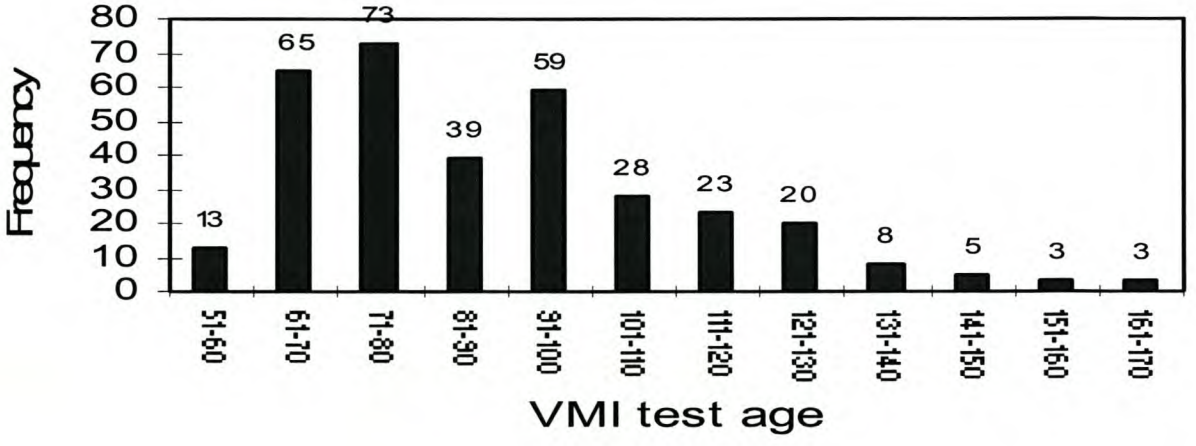

Figure 1. The frequencies of the VMI test age scores

When viewing Figure 2, illustrating the **GHD** standard score frequencies, it seems that the GHD scores form a curve with a modus of scores above 85 and below 90, a mean of 93.86 and a standard deviation of 15 (as seen in Table 1). As said earlier, the score of a participant represents the child's relative standing on the test in relation to his/her own age and gender group, in terms of a mean of 100 and a standard deviation of 15 (Harris, 1963). *Therefore the average score (M = 93.86) of the current sample, is approximately one half a standard deviation below the average of their age and gender groups.*

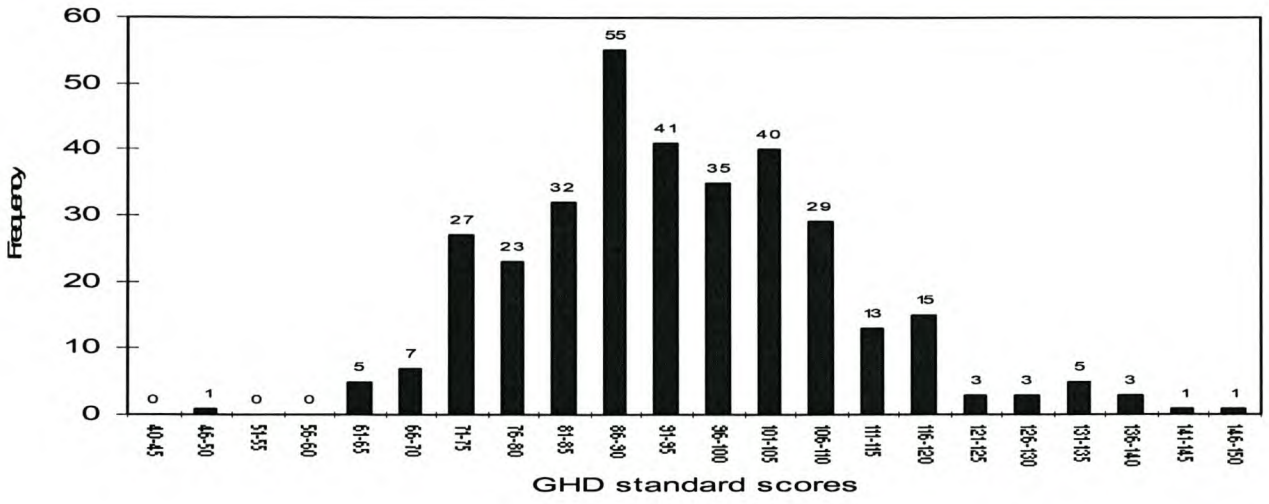

Figure 2. The frequencies of the standard scores of the GHD

3.2.2 **Gender**

The overall mean scores were calculated for respectively the male and female participants, with regard to their functioning in the VMI (test age), the GHD (intelligence coefficient), and academic achievement (as a score out of 10). The results are reported in Table 2.

Table 2

The Means of the VMI, GHD and Academic Achievement of Male and Female Participants

GENDER	n	VMI	GHD	ACACH
Male	171	94.40	96.40	5.91
Female	168	85.71	91.49	6.31

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement

As seen in Table 2, males achieved higher scores on both the test age score of the VMI (m = 94.40 months), and the intelligence coefficient score of the GHD (m = 96.40), while achieving lower academic results, reflected as a score out of 10 (m = 5.91).

3.2.3 **Chronological age**

The overall mean scores were calculated for the different age groups, with regard to their functioning in the VMI (test age), the GHD (intelligence coefficient), and academic achievement (score out of 10). The results are reported in Table 3.

Table 3

The Means of the VMI, GHD and Academic Achievement of Participants in Certain Age Groups

Age (years)	Range	n	VMI	GHD	ACACH
7	6y5m – 7y4m	63	75.49	93.61	7.21
8	7y5m – 8y4m	84	84.55	95.28	6.31
9	8y5m – 9y4m	80	94.23	93.89	5.78
10	9y5m – 10y4m	74	101.41	94.28	5.98
11	10y5m – 11y4m	28	96.89	91.10	4.91
12	11y5m – 12y4m	7	91.29	88.93	4.38
13	12y5m – 13y4m	3	96.33	85.17	4.33

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement

The results, as seen in Table 3, are clarified in Figures 3, 4 and 5 that describe the flow of VMI, GHD and academic achievement scores across different age groups.

Figure 3. VMI test ages (months) of different age groups

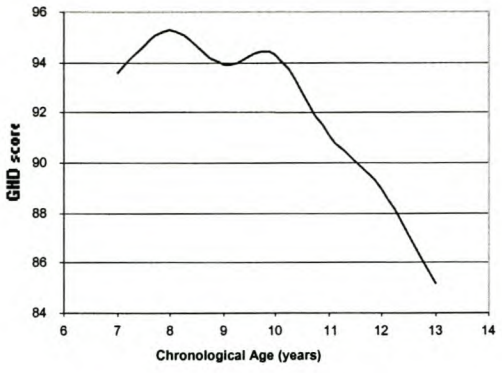

Figure 4. GHD test scores (intelligence coefficients) of different age groups

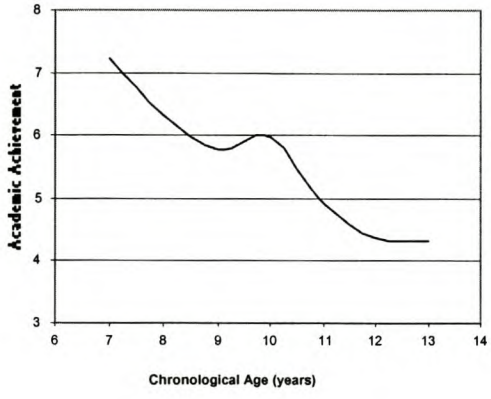

Figure 5. Academic achievement results (as a score out of 10) of different age groups

When viewing Figure 3, in seems that the VMI test age increases steadily until the age of 10. The test ages of children older than 10 seems unstable. Figure 4 illustrates the present sample's range of GHD scores as varying between 85.17 and 95.28. Again, the scores do not seem to increase with age, there seems to be a decrease in intelligence coefficients as age increases. The data presented in Figure 5 indicate a decrease in academic achievement results as age increases. When viewing Table 3 and Figure 5, it seems that a rapid decrease in academic achievement results occur in children older than 10-years. It seems that the academic achievement results of participants in the age group of 11- to 13-years are below average. The older children are therefore possibly under-achievers, explaining the existence of older children in lower grades.

3.2.4 **Socioeconomic Status**

The overall mean scores of the sample's functioning in the VMI (test age), the GHD (intelligence coefficient), and academic achievement (score out of 10), were calculated for the different socioeconomic levels (lower, middle and upper). The results are reported in Table 4.

Table 4

The Means of the VMI, GHD and Academic Achievement in Lower, Middle and Upper Socioeconomic Status Levels

SES	n	VMI	GHD	ACACH
Lower	238	88.84	91.69	5.69
Middle	92	92.11	98.89	7.02
Upper	9	102.67	99.83	7.66

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement

As reflected in Table 4, the scores on the VMI, GHD and academic achievement results increase as socioeconomic status increases.

3.3 **Correlational Analyses**

The focus of the following section is correlational in nature, aiming to address the *secondary aim* of the present study.

The current study hypothesizes that certain biographical variables, namely gender, chronological age and socioeconomic status, are related to the visual-motor integration functioning of the child in the middle childhood phase of development, and therefore will be related to the results of the VMI and the GHD. To test this hypothesis, data were collected by administering two tests aimed at measuring visual-motor integration functioning, as well as by collecting the academic results of the participants through teacher ratings. The results, as presented in Table 1, were applied to correlational analyses of the data.

The Pearson correlations between the mean VMI scores, the mean GHD scores and the mean academic achievement results, as well as the biographical variables (gender, chronological age and socioeconomic status) were calculated for the total group. The results are reported in Table 5.

Table 5

Pearson Correlation Coefficient Results between Scores on the VMI, GHD, Academic Achievement and Certain Biographical Variables

	VMI	GHD	ACACH	GENDER	AGE
GHD	.45**				
ACACH	.22**	.35**			
GENDER	-.19**	-.15**	.12*		
AGE	.33**	-.09	-.38**	-.034	
SES	.10	.21**	.37**	.028	-.14**

* Correlation is significant at the 0.05 level (2-tailed); p<0,05
**Correlation is significant at the 0.01 level (2-tailed); p<0,01

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achivement; SES = Socioeconomic Status

The results seen in Table 5 will be separately discussed in the following section.

3.3.1 **Biographical Variables**

3.3.1.1 **Gender**

The hypothesis was made that gender is related to visual-motor integration functioning, and will therefore be related to the results of the VMI and the GHD, as well as the academic achievement results. To investigate the relationship of gender with visual-motor integration functioning, an analysis of variance was applied to compare the means of the VMI, the GHD and academic achievement of different gender groups. The results are reported in Table 6.

Table 6

The Analysis of Variance Results for Gender

		SS	*df*	MS	F	*p*
VMI	Between groups	6398.50	1	6398.50	12.25	.001
	Within groups	176089.67	337	522.52		
	Total	182488.17	338			
GHD	Between groups	1861.87	1	1861.87	7.73	.006
	Within groups	81203.55	337	240.96		
	Total	83065.42	338			
ACACH	Between groups	13.37	1	13.37	4.64	.032
	Within groups	985.37	337	2.88		
	Total	972.00	338			

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement

The results show a significant difference in the means of the gender groups, when considering the results of the **VMI** [F (1, 337) = 12.25; p< .05], with the *male participants showing significantly better visual-motor integration development than females*. When the results of the **GHD** are investigated, similar results are found. Again, a significant difference between the means of the groups are found, with *male GHD scores being significantly higher than female scores* [F (1, 337) = 7.73; p< .05]. The mean **academic achievement** results of females and males, also indicate a significant difference [F (1, 337) = 4.64; p< .05], with *female participants* achieving significantly better than males.

3.3.1.2 **Chronological Age**

The hypothesis was made that chronological age will be related to the level of visual-motor integration functioning, and will therefore be related to the results of the VMI and the GHD, as well as academic achievement. To test this hypothesis, the mean scores, as presented in Table 3, were used in the calculation of the Pearson correlation coefficients between the mean VMI and GHD scores, academic achievement, and chronological age. The results are presented in Table 7.

Table 7

Pearson Correlation Results of the Mean VMI scores, GHD scores, Academic Achievement and Chronological Age for the Total group (n = 339)

	VMI	GHD	ACACH
Chronological age	.33**	-.09	-.38**

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

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement

The correlation between mean chronological age and the mean **VMI** test age, as seen in Table 7, is significant, with r (337) = .33, p< .01. Contrary to these findings chronological age has an insignificant negative relationship to the mean **GHD** scores, with r (337) = - .09, p> .01.

Figure 6 portrays the comparison between the *VMI test age and chronological age* (in months) of each participant. It seems that VMI test age fluctuates above and below the true chronological age of the participants, therefore creating an overlap between the two variables. It might be an indication that test age is related to other factors except chronological age, explaining the weak correlation between the two variables.

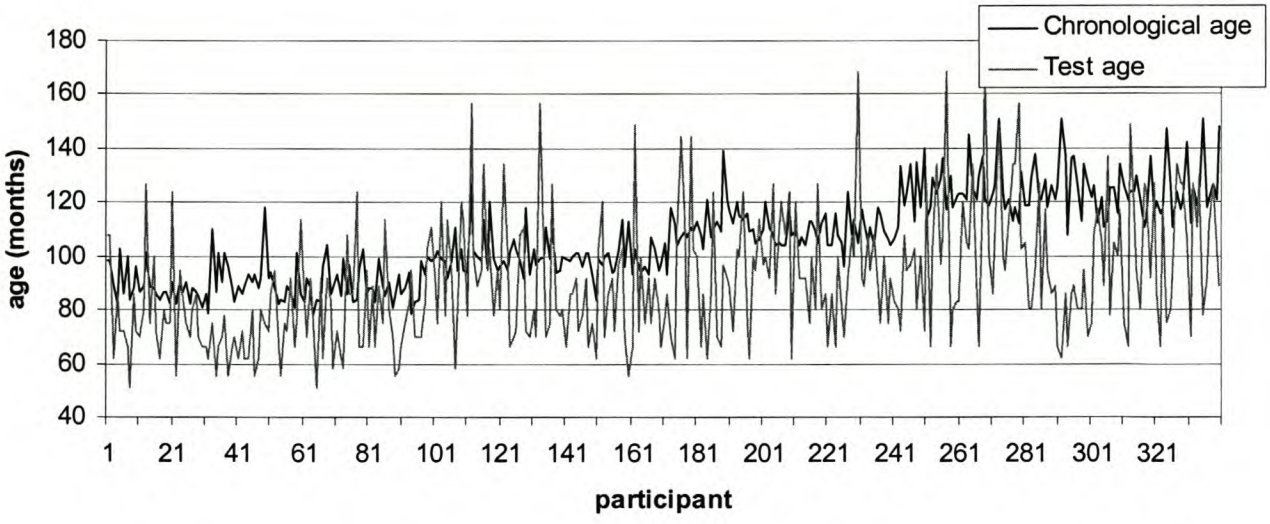

Figure 6. A comparison between chronological age (months) and VMI test age (months)

3.3.1.3 Socioeconomic Status

The hypothesis was made that socioeconomic status will be related to the level of visual-motor integration functioning, and will therefore be related to the results of the VMI and the GHD, as well as academic achievement. To test this hypothesis, the overall mean scores, as presented in Table 4, were used to calculate the correlations between the results of the VMI, the GHD, academic achievement and the biographical variable socioeconomic status. The results are presented in Table 8.

Table 8

Correlation between Scores on the VMI, GHD, Academic Achievement and Socioeconomic Status (n = 339)

	VMI	GHD	ACACH
Socioeconomic Status	0.10	0.21**	0.37**

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

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement

The Pearson correlation between socioeconomic status and mean **GHD** scores are significant, with r (337) = .21, p< .01. Socioeconomic status also correlates significantly with mean **academic achievement**, with r (337) = .37, p< .01.

In a further attempt to investigate the role of socioeconomic status in visual-motor integration functioning, an analysis of variance was run to compare the means of the GHD, the VMI and academic achievement. The results are reported in Table 9 on the next page.

The results show a significant difference in the means of the socioeconomic groups, when considering the results of the **GHD** test [F (1, 337) = 7.99; p< .05], with *lower socioeconomic groups achieving lower scores on the GHD.*

Table 9

Analysis of Variance for the Variable Socioeconomic Status

		SS	*df*	MS	F	*p*
VMI	Between groups	2172.64	2	1086.32	2.02	.134
	Within groups	180315.50	336	536.65		
	Total	182488.20	338			
GHD	Between groups	3771.00	2	1885.50	7.99	.000
	Within groups	79294.42	336	236.00		
	Total	83065.42	338			
ACACH	Between groups	138.97	2	69.49	27.58	.000
	Within groups	846.40	336	2.52		
	Total	985.37	338			

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement

When the results of the **VMI** are investigated, the differences between the means of the different socioeconomic status groups are portrayed to not be big enough to exclude a difference due to chance [F (1, 337) = 2.02; p> .05]. Still, when reviewing the results, lower socioeconomic groups portray lower scores on the VMI. This phenomenon is illustrated in Figure 7.

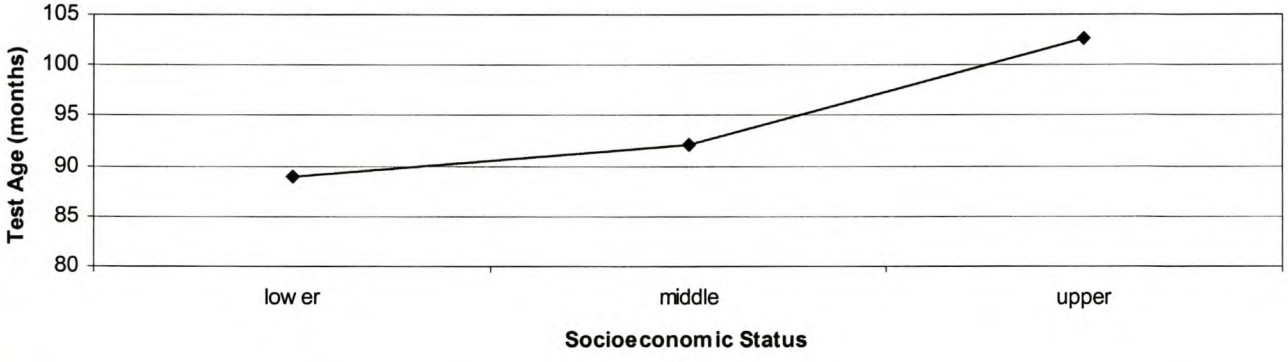

Figure 7. Mean test age for results on the VMI of participants of lower, middle and upper socioeconomic status groups

The mean **academic achievement** results of lower, middle and upper socioeconomic status groups, differed significantly [F (1, 337) = 27.58; p< .05]. Therefore, *participants of lower socioeconomic status achieved lower results on the VMI, the GHD as well as academic achievement*, when compared to participants of middle socioeconomic status, while the latter achieved lower scores on the VMI, the GHD and academic achievement than the participants of upper socioeconomic status.

3.3.1.4 Academic Achievement

The hypothesis was made that academic achievement, according to the mid-year report cards of the participants, will have a relationship with the level of visual-motor integration functioning, and will therefore relate to the results of the VMI and the GHD, as well as to certain biographical variables. To test this hypothesis, the overall mean scores were calculated for academic achievement with regard to their functioning in the VMI (test age), the GHD (intelligence coefficient), and certain biographical variables. These mean scores were used in the calculation of the relation between these variables. The results are reported in Table 10.

Table 10

The Pearson Correlation Coefficient Results for Academic Achievement, the Mean VMI and GHD Scores, as well as the Biographical Variables of Gender, Chronological Age and Socioeconomic Status

	VMI	GHD	GENDER	SES	AGE
ACACH	.22**	.35**	.12*	.37**	- .38**

* Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test; ACACH = Academic Achievement; SES = Socioeconomic Status

Mean academic achievement scores correlate significantly with both the mean scores of the **VMI**, with r (337) = .22, p< .01, and the **GHD**, with r (337) = .35, p< .01. From these results it seems that academic achievement do vary to some degree with scores on the VMI and the GHD, with *higher levels of academic achievement having higher scores on the VMI and the GHD*, and therefore better visual-motor integration functioning.

Academic achievement is also significantly correlated to **gender** with r (337) = .116, p< .05, with *girls achieving better than boys*. Lastly, mean academic achievement has a significant negative

relationship with **chronological age**, with r (337) = - .376, p< .01. From this it seems that *younger children in the present sample achieve slightly better academically than older children.*

3.3.2 The correlation between the VMI and GHD tests

The hypothesis was made that the mean test results of the VMI will be related to the mean test results of the GHD, implying the GHD to be helpful in determining a child's visual-motor integration functioning. To test this hypothesis, the correlation was calculated between the mean scores of the VMI (test age) and the GHD (intelligence coefficient). The results are reported in Table 11.

Table 11

The Pearson Correlation Coefficient Results for the Relation between the VMI and the GHD

	GHD
VMI	.45**

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

Note: VMI = Developmental Test of Visual-Motor Integration; GHD = Goodenough-Harris Drawing Test

As can be seen, the Pearson correlation between the mean scores on the VMI and the GHD is r (337) = .45, and this correlation is statistically significant at $\alpha = .01$. From these results it can be concluded that *VMI scores do vary with GHD scores*, with higher scores on the VMI implying higher scores on the GHD.

4. DISCUSSION

4.1 General Discussion

The *primary aim* of the present study was to determine the status of visual-motor integration functioning of a selected group of middle childhood children within the South African context. The *secondary aim* was to obtain information indicating the existence of significant correlations between the test results and certain biographical variables, and, if such correlations existed, what the nature of these correlations was. Therefore the secondary aim consisted of exploring the correlations (if any) between the results of the *Developmental test of Visual-Motor Integration* (VMI) and the biographical variables of *gender*, *chronological age* and *socioeconomic status*; secondly exploring the correlations (if any) between the results of the *Goodenough-Harris Drawing Test* (GHD) and the biographical variables; thirdly exploring the correlation (if any) between *academic achievement* and the above-mentioned variables and test results; and lastly the

correlations (if any) between the *VMI* and *GHD* results, in order to compare different tests of visual-motor integration.

4.2 The Status of Visual-Motor Integration in the Selected Sample

The current study gathered information regarding the status of visual-motor integration functioning of the selected sample of middle childhood children, in an attempt to address the *primary aim* of the present study. It is postulated that the selected sample's scores on the VMI and the GHD would be helpful in identifying children with challenges in this area of functioning. The exploratory findings will be further discussed in this section.

4.2.1 The Developmental Test of Visual-Motor Integration

According to the results of the VMI (as seen in Table 1), the sample presented with an average *test age* of M = 90.09 months, therefore approximately 7- years and 6- months, and a *standard deviation* of SD = 23.24. The mean *chronological age* of the sample was 8- years and 10- months. The selected sample therefore displays a mean test age 1- year and 4- months lower than their true chronological age. *It may be concluded that the visual-motor integration functioning of the participants is lower than what is expected for children their age.* Acknowledging the danger of making definitive conclusions based on only one test of visual-motor integration, it does not seem prudent to draw conclusions regarding this sample's status of visual-motor integration functioning. It seems of noteworthy that the current sample includes children older than that which is expected for grade 4 children, and that these participants achieve below average academic achievement results, as well as unstable VMI scores and GHD scores lower than participants in the age group of 7- to 10-years (as reflected in Table 3, as well as Figure 3, 4 and 5). It seems therefore that these children (aged 11-years to 13-years) are weak achievers who have possibly failed at least one academic year. This might serve as one explanation for the higher mean chronological age of the current sample, while the VMI scores are lower than expected.

A more helpful application of this tendency is the identification of children who function below the average of their peer group in terms of visual-motor integration. Therefore, although one is not able to conclude with surety whether the selected sample's functioning is below what is expected, based on the data of one test, one may still identify children in the identified primary school who function below the norms of their own group. Research aimed at standardizing the VMI for other racial groups could be beneficial, as this could lead to adequate conclusions of a sample's functioning.

4.2.2 The Goodenough-Harris Drawing Test

According to the results of the GHD, as reflected in Table 1, the sample presented with a *mean estimation of intellectual maturity* of M = 93.86 and a standard deviation of SD = 15.68. It therefore seems that the majority of the participants are of *average intellectual maturity*. As highlighted earlier, this score reflects the sample's abilities according to a mean of 100 and a standard deviation of 15. It may therefore be concluded that, based on the sample's mean score on the GHD, the sample reflects an estimation of intellectual maturity *lower than that which is expected for their age- and peer group*.

Viewing the above findings, pertaining to fulfillment of the *primary aim* of the present study, it is useful to conclude that a need exists in the present sample to address the evident delays in visual-motor integration functioning.

4.2.3 Academic Achievement

As stated earlier, the researcher wished to explore the current sample's status in the area of academic achievement, as further assistance to the fulfillment of the primary aim of the present study. As this is also contained in the secondary aim of the present study, and therefore consists of correlational information, it will be discussed in the following section. The relationships between academic achievement and the biographical variables of chronological age, gender and socioeconomic status, will be discussed throughout the following section, where applicable.

4.3 Correlations between the VMI, the GHD, Academic Achievement and certain Biographical Variables

The *secondary aim* of the present study was to obtain information indicating the existence of significant correlations between the test results and certain biographical variables, and, if such correlations existed, what the nature of these correlations was. The results that were obtained will be discussed in this section.

4.3.1 Gender

The results in Table 6 shows a significant difference in the means of the gender groups, when considering the results of the **VMI** and the **GHD**. *Therefore it seems that a significant correlation exists between both the VMI and the GHD scores, and gender.* Male participants obtained significantly higher scores on both the *VMI* and *GHD* tests, and therefore show better visual-motor integration development than females. These findings are supported by Kerschensteiner and Ivanhoff (cited in Goodenough, 1926) who found similar results, while being contradicted by Beery

and Buktenica (1967) who found that girls were superior to boys in visual motor integration functioning, reflected in the results of the VMI, and by Harris (1963), stating that girls achieve superior to boys in the GHD. Other sources, cited earlier in the present study (Brown, 1990; Harris, 1963; Koppitz, cited in Aylward & Schmidt, 1986; Tennant, 1986) also supported the superiority of girls in their scores on these tests. Still other authors (Dunn, 2001; Schlodder, 1986) found gender to have no significant relationship with visual-motor integration functioning. Although the findings of the present study indicate males as performing significantly better than females in the GHD, the influence of gender on visual-motor integration functioning remains a topic of disagreement. Due to contradictory findings the influence of gender on visual-motor integration needs to be researched further in future.

Contrary to what is expected, females achieved significantly higher **academic** results than males, although they scored lower in terms of visual-motor integration functioning (Tables 2 and 3). The explanation for this is elusive. Therefore it can be concluded that middle childhood males *seem to be more developed in the area of visual-motor integration functioning, while achieving lower than females academically.*

4.3.2 **Chronological Age**

From the results obtained in Table 7, it seems evident that the **VMI** is significantly correlated with chronological age. This implies that *visual-motor integration functioning may be related to chronological age*, as scores on the VMI varies with chronological age. Older children exhibited significantly better developed levels of visual-motor integration functioning than younger children. This phenomenon is observable when viewing Table 3 and Figure 3. It is noteworthy that, when viewing Figure 3, the VMI scores of participants in the age range of 7- to 10-years increase uniformly as age increases, thus resulting in the correlation between VMI test age and chronological age. The VMI scores of participants older than 10 seem to decrease, implying the older children exhibits lower test scores than the younger participants. Keeping in mind the observation made earlier that participants older than 10-years seem to achieve below average academically (Table 3), and seem to be the children that have failed at least one academic year, this phenomenon is expected, implying that the weak participants in the group exhibits lower VMI scores than their younger counterparts.

These results are supported by Beery (cited in Dunn, 2001) as he stated that the VMI is specifically designed to measure changes in hand-eye-coordination as children grow older, therefore reflecting developmental age differences in the arena of visual-motor integration. VMI scores correlate as

high as r = .89 with chronological age (Beery, 1989; Beery, 1997), implying that 79% of variance in test scores are attributable to chronological age. This emphasizes the important influence that age has on visual-motor integration functioning. The present study explains only 11% (Table 7) of the variance in VMI test scores as attributable to chronological age. The reason for this is elusive, although one may consider a weakness of the present study being that too many uncontrolled variables may have impacted on the results, leading to weak correlations and unexplained observations.

It was further found that *VMI scores did not improve consistently with an increase in age.* This might indicate the VMI to be a better suitable assessment tool for younger children than older children. This is supported by a study done by Helm (1989), urging that the VMI must be used with younger children (younger than 11).

No significant correlation (Table 7) was found between chronological age and the results on the **GHD,** implying that some older children had lower scores on the GHD than younger children. The explanation of this observation is uncertain. It might imply that the GHD is not particularly sensitive to changes in chronological age, leading to support of the notion that the GHD is a better assessment tool for younger children, and that it results in unreliable scores of older children. Abell et al. (1996) confirmed this by stating that the GHD may be a more suitable assessment tool for children with lower intelligence coefficients, or younger children. The above findings might also imply the GHD to measure a function that is not age bound. This seems to contradict postulations made by Piaget (cited in Harris, 1963), stating that "with increased age the whole quality of drawings shows a progression, it is more detailed and at the same time more complexly organized" (pp. 163). Harris (1963) supported Piaget's view of the developmental nature of visual-motor integration by explaining that younger children depend much more on motor and kinesthetic experience than on visual experience, while older children become increasingly 'visual'. This is used as a way to explain the improvements seen in children's drawings, as they grow older. It seems therefore that the majority of literature reviewed by the researcher implies GHD results to increase as children grow older. Although the present study shows an increase in GHD scores across age (as seen in Table 3 and Figure 4), the findings are not significantly in favour of this phenomenon. The explanation for this is uncertain.

Academic achievement was found to have a negative relationship with chronological age (Table 10), implying that younger children achieved academically better than older children. The correlation was significant. Therefore the present study implies a *negative significant correlation between chronological age and academic achievement.*

4.3.3 Socioeconomic status

Tables 9 and 10 portray the correlations found between the VMI, GHD, academic achievement and socioeconomic status. *No significant correlation was found between the **VMI** and socioeconomic st*atus levels. Therefore the present study is unable to indicate a relationship between socioeconomic status and visual-motor integration functioning, and as a result contradicts Baard (1998), Beery (cited in Vorster, 1994), Dunn (2001), and Kagitcibasi (1979). While qualitative observations (according to Figure 7) lead to the conclusion that lower socioeconomic groups achieved lower than middle and upper socioeconomic groups, it was not significant. Janse van Rensburg (1992) and others (Schlodder, 1986) indicated that children of middle socioeconomic status backgrounds perform better on the VMI than lower status groups, supporting the findings of the current study. Contrary to this, Dunn (2001) stated that a *significant* correlation exists between the above mentioned variables. The present study illustrates that the difference between the scores of the lower class and the middle class are the most, with a small difference between the middle and higher socioeconomic status classes. This may support Beery (1989), Bray (1974) and Dunn (2001) in their notion that VMI is a particularly good predictor of achievement of lower socioeconomic status groups. Some studies (Schlodder, 1986) found no significant correlation between the performances of South African children on the VMI and socioeconomic status, therefore supporting the current findings.

As for **GHD** and **academic achievement**, *both correlated significantly with socioeconomic status.* Children from lower socioeconomic status classes appear to achieve lower scores on the GHD, as well as achieving inferior academically when compared with children from higher socioeconomic status levels. This may be an indication of the importance of a child's environment in general, and his/her socioeconomic status background in particular, for healthy development. According to Janse van Rensburg (1992), children from lower socioeconomic status backgrounds have less developed skills in visual perception. Dawes and Donald (cited in Dunn, 2001) estimated that there is a high risk of developmental problems among many South African children, due to their socioeconomic status. This might imply low socioeconomic status levels as a possible danger to healthy childhood development. Although causality is not indicated by the present study, it still seems important to keep this phenomenon in mind when working with children in South Africa.

4.3.4 **Academic Achievement**

Some authors, cited earlier, found the VMI of worth as an indicator of academic achievement results. The present study seems to verify this partly. A *small significant correlation* was found between academic achievement and the results of the **VMI** and the **GHD** (Table 3 and Table 10). This might imply that academic achievement do vary to some degree with scores on the VMI and the GHD, with higher levels of academic achievement occurring simultaneously with higher scores on the VMI and the GHD, and therefore better visual-motor integration functioning. This might be interpreted to imply that *visual-motor integration functioning, as well as other constructs measured by the VMI and GHD, have an effect on academic achievement.*

4.3.5 **The relationship between the VMI and the GHD**

Table 11 describes the correlation between the VMI and the GHD as positive and significant. From these results it may be concluded that *VMI scores do vary with GHD scores to some degree*, with higher scores on the VMI occurring simultaneously with higher scores on the GHD. The interpretation of this effect is unclear. It may be that the VMI and the GHD measures similar functions, implying the GHD to have at least some ability to measure visual-motor integration functioning, supporting the findings of the literature, such as Goodenough (1926), who described the GHD as containing some degree of motor ability assessment. But it is equally likely that the current findings might imply the functions measured by the VMI and the GHD as being two different constructs, the one having an impact on the other.

The present study did not aim to elucidate the causative factors related to visual-motor integration and test performance. Rather, the *primary aim* was to gain knowledge as to the status of visual-motor integration functioning of the selected sample. The *secondary aim* was to determine if any relationship existed between test results, academic achievement, and certain biographical variables, and if so, what these relationships were. It was further wished to determine the relationship of the VMI and the GHD, in order to compare different tests of visual-motor integration functioning. Thus, the present study is unable to indicate certain variables as causative. Further comparisons between different developmental assessment tools could be of worth to come to reliable conclusions.

Schlodder (1986) underlined the relationship between *motor-sensory development*, such as that which is measured by the VMI, and *intelligence*, such as traditionally measured by the GHD, in citing Beery's findings (1982) that children with retarded intellectual abilities experienced more visual-motor integration difficulties than did children with normal intellectual abilities. Although it seems viable to conclude the one causes the other, this would be erroneous merely on the basis of

the relationship between the two variables. What does seem possible, though, is Zagar and Mead's (1983) assumption that intelligence is a hierarchical organized structure with general factors and specific abilities, of which perceptual-motor ability (and therefore visual-motor integration) is one aspect. Other factors taken into account when viewing the structure of intelligence are verbal intelligence and academic achievement. The results of the current study may therefore be supportive of the notion that, to say the least, *visual-motor integration functioning is one of the constructs contained in the notion of intelligence.* Therefore, although the results of the relationship between the VMI and the GHD may not be indicative of cause-and-effect, it may be indicative of the Goodenough-Harris Drawing Test as containing elements that are also measured by the Developmental Test of Visual-Motor Integration.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions based on the Primary Aim of the Present Study

Dunn (2001) underlined the need in South Africa for appropriate diagnostic materials which can be utilized by child development- and health professions. Richter, Griesel, and Rose (1994) described this need as especially pertaining to the area of practical assessment of developmental status of African children. A similar need arose that led to the development of the aims of the present study. The primary aim was to determine the status of visual-motor integration functioning of a selected sample of middle childhood children, in order to identify at risk children. *According to the results obtained in the present study, it seems that the selected sample achieved below what is expected on both the VMI and the GHD, therefore implying that the sample have a visual-motor integration functioning level below that expected for children of their age.* This is further supported by the correlations between academic achievement results and scores on the VMI and the GHD. *Therefore it seems that children with lower VMI and/or GHD scores achieve lower academic achievement results.* The present study cannot confirm these findings solely based on these tests, but it seems plausible to argue that the present sample may benefit from intervention strategies aimed at strengthening visual-motor integration functioning. At risk children would gain from an intervention programme addressing this seemingly evident delay. The present study would have gained from further support of another test of visual-motor integration, such as the Bender-Gestalt. While this was considered, time- and resource constraints limited the researcher from carrying through such endeavours. The results of the present study led to the identification and support of children that functioned below average when compared to their own peer group.

The gained information presented in the present study may be helpful in developing effective intervention strategies and identifying children in need of such interventions. These interventions need to be implemented at an early enough stage in order to prevent future possible difficulties, as discussed earlier in the present study, due to visual-motor integration functioning delays. In summary, the present study concludes that the visual-motor integration functioning of the selected sample, as reflected through the VMI and GHD scores, seems to be lower than that which is optimal, indicating interventions in this area of functioning as advisable.

5.2 Conclusions based on the Secondary Aim of the Present Study

The secondary aim consisted of firstly exploring the correlations (if any) between the results of the *Developmental test of Visual-Motor Integration* (VMI) and the biographical variables of *gender*, *chronological age* and *socioeconomic status*; secondly exploring the correlations (if any) between the results of the *Goodenough-Harris Drawing Test* (GHD) and the biographical variables; thirdly exploring the correlation (if any) between *academic achievement* and the above-mentioned variables and test results; and lastly the correlations (if any) between the *VMI* and *GHD* results, in order to compare different tests of visual-motor integration. The conclusions and recommendations based on these findings will be discussed in this section.

5.2.1 The Developmental Test of Visual-Motor Integration

An analysis of the nature of the relationships between the mean results of the *Developmental Test of Visual-Motor Integration (VMI)* and the biographical variables of gender, chronological age and socioeconomic status, lead to the conclusions discussed below.

- **Gender**

A significant difference exists between the results of the VMI of the different gender groups. *Males achieved significantly better scores on the VMI than females*. Again it is unsure whether this phenomenon truly reflects higher visual-motor integration functioning of boys over girls, or whether the test results are biased or influenced by external factors. Considering boys as more active when in play (for example running, climbing, ball-play and play fighting), one may consider whether this exposure to more gross-motor activities does not serve as an advantage to later visual-motor integration development. As it was not the aim of the present study to identify factors leading to visual-motor integration development, one can only hypothesize as to these influences. Further research into natural, inexpensive ways to better visual-motor integration would be optimal for the South African context.

- **Chronological Age**

A significant correlation exists between the mean results of the VMI and the biographical variable of chronological age. It may thus be concluded that *older participants achieved higher scores on the VMI than younger children*, possibly implying older children to be more developed when considering visual-motor integration functioning. It seems therefore that visual-motor integration does improve over time.

- **Socioeconomic Status**

Although participants from higher socioeconomic status levels achieved higher mean scores on the VMI than participants from lower socioeconomic status levels, the difference between these results were not significant. It seems therefore that *visual-motor integration functioning, as measured by the VMI, is not influenced by the socioeconomic environment to the same extent to which the GHD results are influenced.*

5.2.2 The Goodenough-Harris Drawing Test

An analysis of the nature of the relationships between the mean results of the *Goodenough-Harris Drawing test (GHD)* and the biographical variables of gender, chronological age and socioeconomic status, lead to some conclusions. These are discussed below.

- **Gender**

When considering the biographical variable of gender, the present study led to the conclusion that a significant difference exists between the results of the different gender groups. *Males achieved significantly higher scores on the GHD than females*. The interpretation of this may be that the males of this specific sample are intellectually more mature than females. Considering that this possibility seems to contradict most of the prior findings, one may also consider whether the GHD is either biased toward boys, or that the test results are not a true reflection of their abilities, due to uncontrolled variables influencing the present study's outcome. Further research of this phenomenon is needed before any conclusions may be drawn.

- **Chronological Age**

When considering the biographical variable of chronological age, it is concluded that *no significant relationship exists between the sample's mean chronological age and their mean results on the GHD*. It seems that the findings of the present study imply that older children do not necessarily achieve higher scores on the GHD than younger children. Considering a weakness of the present

study to be the varying sizes of the different age groups, it might be that this phenomenon would come to the light more clearly with more evenly numbered groups.

- **Socioeconomic Status**

When considering the biographical variable of socioeconomic status, the present study concludes that a *significant difference existed between the GHD results of the lower, middle and upper socioeconomic status levels*. Therefore children from lower socioeconomic status backgrounds seem to achieve lower results on the GHD than higher socioeconomic status backgrounds. It may be concluded that lower socioeconomic status environments may in some instances lead to limited intellectual development of children. One reason may be limited resources and opportunities in their environment. Other reasons to explore are the factors connected to lower socioeconomic status backgrounds, such as poverty, violence and a shortage of work. These environmental factors have been said to lead to family violence and child abuse and neglect (Walters, 1975). A child exposed to such extreme circumstances may suffer the consequences.

5.2.3 Academic Achievement

An analysis of the nature of the relationships between the mean *academic achievement* results and the biographical variables of gender, chronological age and socioeconomic status, and the results of the VMI and the GHD, lead to the following conclusions:

- **Gender**

A small significant difference exists between the academic achievement results of males and females. Females achieved slightly better results than their male counterparts. The explanation for this is elusive.

- **Chronological Age**

A small negative correlation exists between academic achievement results and chronological age, implying that the older participants in the present study demonstrate lower academic results than the younger participants. Again, the present study is not able to clarify the reasons for this phenomenon. One plausible explanation seems to be the grade appropriateness of the older participants. As discussed earlier, it seems that the older participants, specifically the participants in the age group of 11- to 13-years, are the weaker students in their groups, causing them to fail at least one academic year. This partly explains the older participants' below average academic achievement results.

- **Socioeconomic Status**

Participants from lower socioeconomic status levels achieved lower academic results than participants from higher socioeconomic status backgrounds, implying that low socioeconomic status environments may lead to impairment in academic functioning. Further research into these findings will be advantageous for the South African context. The above might be interpreted to imply that *visual-motor integration functioning, as well as other constructs measured by the VMI and GHD, have an effect on academic achievement.* This indicates the urgency of addressing visual-motor integration delays at an early as possible age, in order to ensure healthy development of children academically. Baard (1998) and Vorster (1994) warned that impairments in visual-motor integration functioning can contribute to scholastic failure, which can mistakenly be attributed to laziness or lack of cooperation. Academic success may have an impact on the child's belief in him- or herself, and his/her attitude to growth and development. Identifying and addressing visual-motor integration and cognitive developmental delays may therefore be one way in which we can contribute to our children's healthy development of self-confidence.

In applying the ecological systems theory of Bronfenbrenner (1986) to the South African children in the present study, the need to consider the wide range of systems that impact on the child is realized. Limited socioeconomic resources might lead in some instances to limited and restricted environments wherein children are raised. As discussed earlier, Craig (1996) mentioned that physical-motor development could be slowed when children live in such environments. Thus, it can be seen that various factors in the child's environment, one of which is socioeconomic status, can influence visual-motor integration development.

The relationship between socioeconomic status levels and test performance is of particular importance for the selected sample of middle childhood children in the South African context. One implication of such a relationship is the use of holistic intervention methods when attempting to support and further childhood development. Attempts to address visual-motor integration functioning in isolation from the child's home environment may inhibit positive results, due to limiting effects of his/her environment out of school. It is thus recommended that any intervention programme aimed at the betterment of visual-motor integration functioning should contain elements addressing the child's social, familial and financial surroundings. Incorporating the involvement of the child's parents or caretakers in the application of any intervention programme seems to be advisable, as this may contribute to the transfer of the effects of an intervention to other contexts within his/her environment.

- **The VMI and GHD**

The mean academic achievement results show a *significant correlation with the mean results of both the VMI and GHD.* This might imply that academic achievement vary to some degree with the level of visual-motor integration functioning (as reflected by the results of the VMI) as well as the level of intellectual maturity (as reflected by the results of the GHD). It seems important to address challenges in the cognitive and visual-motor integration development of children, in order to ensure later adaptation and success in school and further training.

5.2.4 A Comparison between Different Tests of Visual-Motor Integration

The mean VMI results had a significant positive relation with the mean GHD results of the present sample of children in the developmental phase of middle childhood. If the proportion of the variance (r^2) of 20% (see Table 11) is taken into account, it seems that the results of these tests are a product of many factors other than the results of the other test in consideration. On the basis of this finding, it can not be concluded that the GHD is another test to be used to assess visual-motor integration. It seems, though, that the construct of visual-motor integration is one of the areas of functioning considered in the GHD. This is an observation that Harris (1963) confirmed.

In an attempt to further explore the relationship between the GHD and VMI, in order to compare different tests of visual-motor integration functioning, Aylward and Schmidt's (1986) suggestions were considered. As discussed, these included (1) the easiness of following test instructions, when used by inexperienced testers, (2) the nature of the population to be tested, (3) practical and time considerations, (4) gender bias, and (5) predictive validity. The following qualitative observations may serve as a vantage point for further scientific research, as well as a basis for further conclusions in the present study. These observations will now be discussed.

5.2.4.1 Administering and scoring of Tests

Both the VMI and the GHD seem to be *simple and easily applied*, both tests are *inexpensive*, and have several advantages as a diagnostic and prognostic assessment tool. *Inexperienced testers easily comprehend the test instructions* as described in the test-manuals.

Taking into consideration the nature of the population that needed to be tested, it was necessary to use assessment tools that could be applied in a *group context*, as this was more profitable regarding the time spent on testing. *Both* the VMI and the GHD seem to be effective assessment tools for large groups of children. This characteristic indicates both these tests as optimal in the South African context, especially when the need exists to assess large groups of individuals in a short

period of time. A drawback that needs to be taken into consideration is the fact that a group setting easily result in *competition and copying*. Although measures were taken to prevent these phenomena, it seems evident that is still influenced the children, possibly leading to results not representative of the sample's true abilities.

Scoring of the VMI is relatively simple and quick. The scoring of the GHD can be problematic in assessing large groups, as it is quite time consuming and reliant on the observation of minute detail. In scoring large amounts of drawings, detail might be overlooked.

5.2.4.2 **Behaviour during Testing**

With specific mention of the **VMI,** it seems that this test results in *competitive behaviour* such as rushing to complete the test. The attempt to finish before the other participants could possibly have resulted in the children not achieving to their full potential. Therefore, the test age acquired through this assessment may be an underestimation of the participants' true abilities.

The **GHD** seems not to have the same impact on the children than the VMI. Participants seemed to be much more aware of their *personal expression* in this test, than the performance of the participants around them. Great care was taken by the children to complete these pictures up to the most intricate detail before handing it to the researcher with great pride. One explanation for this may be the nature of the tests. The researcher experienced the VMI as representing an academic activity, such as the type of activities the children complete daily at school. Therefore it is expected that the VMI could have been experienced as a test with right and wrong responses. Contrary to this, drawing is often a luxury or fun activity afforded the children after the completion of their work, or as leisure activity. This might be a reason explaining the children's enjoyment of this test, paying much more attention to detail, while not being so attentive to time.

Both tests seemed to be equally accepted by *males and females*. A stumbling block experienced during testing, was the participants' *working tempo*. This resulted in some children having to wait for others, occasionally becoming restless, and therefore distracting their fellow students. On the contrary, it also resulted in some children becoming anxious to complete their tasks, even giving up before they are satisfied with the final product. This may have impacted on the children's' final results.

5.2.4.3 Qualitative value

Schlodder (1986) indicates the worth of *qualitative use* of the **VMI**, stating that "qualitative analysis can enhance the interpretation of the VMI" (pp. 53). Once again, this would only be possible in an individual setting. It seems realistic to conclude that, although the VMI may be administered in a group context, it stays optimal to administer this test individually.

When applying the **GHD** to a large group of children, the *individual meaning* and the opportunity to observe the style and process of the child while he/she draws are lost to a great extent. The GHD are often used as a diagnostic tool of emotional and self-concept development and status. In not being able to question children about their work, researchers and therapists stand a higher chance of misinterpreting the meaning of the drawing. While the above seems to be the ideal when applying the GHD, Abell et al. (1996) stated that the GHD is a convenient nonverbal measure of intelligence to classify large numbers of non-reading children for educational purposes. To conclude, while both the VMI and the GHD are applicable and valuable in a group context, much personal information of the child is lost. *Individual observation and application is optimal.*

5.2.4.4 Child-friendliness

When referring to Breen et al. (1985) in considering a child-friendly test, it is the researcher's opinion that the GHD seems to be more child-friendly than the VMI, especially in a group context where competition is unavoidable. The characteristics of the GHD, as discussed above, seem to make the GHD an excellent choice when assessing childhood development. Although the GHD seemed to be experienced more positively by the children, the present study is not able to indicate the superiority of one of the tests used in assessment. One reason is that, in order to indicate the superiority of one test above another, one needs to be sure that both tests measure exactly the same construct. The present study is unable to conclude that these tests are similar, therefore interchangeability is not optional.

5.3 Recommendations

Considering the overall results of this study, several observations could be made regarding the selected sample's status of visual-motor integration functioning, therefore addressing the *primary aim*. Several conclusions could further be drawn leading to the fulfillment of the *secondary aim*. The relationships between the VMI, the GHD, academic achievement, and the biographical variables of gender, chronological age and socioeconomic status were explored and conclusions were drawn. The current conclusions are limited in its generalizability, as it is not representative of the South African population at large.

It seems that both the VMI and the GHD have certain qualities that need to be taken into consideration when selecting an assessment tool. Because the present study is not able to conclude that a strong enough relationship exists between the results of the VMI and the GHD that may sufficiently indicate the two tests as interchangeable, it is advisable to include both these tests in any battery for assessing childhood development.

Given the findings and limitations of the present study, certain factors need to be considered for future research. It seems eminent in South Africa to assess the current influence of low *socioeconomic status* levels on childhood development, as this is a factor that many children and families are unfortunately presently exposed to. More than this, it seems important to assess the environment of the child as a whole, to gain knowledge of how the social- and familial circumstances of the child may impinge on healthy overall development.

Secondly, it would be advantageous to further the current findings, by applying similar studies to *racial groups* other than coloured children. A weakness of the present study is the inability to generalize to larger populations, due to a sample not representative of the larger community. Ensuring the sample of such studies to be representative of the South African population at large, may support effective conclusions to be drawn.

Thirdly, because the total group of children attending grades one to four in the selected primary school was tested, too many *extraneous variables* were not under the researcher's control. This might have lead to unreliable or weak results. Future studies aimed at understanding only a small, controlled portion of the current findings may lead to more confidence into factors influencing visual-motor integration development.

Lastly, the present study seems important in understanding the selected sample's status of visual-motor integration functioning, but this should only be the starting point for effectively understanding the circumstances necessary for healthy childhood development in general, and visual-motor integration in particular. Research leading to a deeper understanding in this regard, is not only valuable for effective psychological assessment and intervention, but also for the promotion of the elements which the children of South Africa need for healthy overall development.

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7. ADDENDA

ADDENDUM A

THE NUMERICAL OCCUPATIONAL CLASSIFICATION SCALE

(Tennant, 1986; Dunn, 2001)

Classification of Breadwinner's Occupation

Occupation Classification	**Score**
Highly qualified professional, executive, administrative and technical occupations	9
Professional, administrative and managerial work	8
Commercial independent	7
Lower qualified administrative, technical and clerical with limited supervisory responsibility	6
Skilled workers and artisans with trade qualifications	5
Routine clerical and administrative workers, service and sales workers	4
Semi-skilled production and manual workers	3
Unskilled production and manual workers	2
Not economically active or productive	1
No response or information	0

Classification of Breadwinner's Education

Father's Education	**Score**
Attended university	7
Trained at Post-matric level (not university)	6
Matric	5
Apprenticeship	4
Junior Certificate	3
Primary School	2
No education	1
No response or information	0

Classification of Socio-economic Status

Lower	**Middle**	**Upper**
2-6	7-10	11-16

ADDENDUM B

CAREERS CLASSIFIED ACCORDING TO THE NUMERICAL OCCUPATION SCALE

Classification	Occupation e.g.
1	*Not academically active or productive*: house-wife, pensioner, unemployed
2	*Unskilled production and manual workers*: Delivery, messengers, golf caddies, lawnmowers, packers, petrol station attendants, cleaners, vending stall workers, fishermen.
3	*Semi-skilled production and manual workers:* Baker, domestic worker, builder, bus driver, factory worker, repair work, cabinet maker, cellar assistant, tailor, clinic assistant, nursery assistant, carpet layer, mason, needlework, portrait framer, butcher assistant, taxi driver, typist, gardener, painter, truck driver.
4	*Routine clerical and administrative workers, service and sales workers*: Housing clerk, fireman, wood seller, office work, cashier, waitress, clerk, contractor, lab assistant, wage clerk, municipality work, museum assistant, receptionist, policeman, secretary, security guard, soldier, salesman, shop assistant.
5	*Skilled workers and artisans with trade qualifications*: Tradesman, electrician, hairdresser, chef, plumber, mechanic.
6	*Lower qualified administrative, technical and clerical with limited supervisory responsibility*: child supervisor, crèche, supervisor, and foreman.
7	*Commercially independent*: nurse.
8	*Professional, administrative and managerial workers*: Administrator, pastor.
9	*Highly qualified professional, executive, administrative and technical occupations*: Engineer

ADDENDUM C

WESTERN CAPE EDUCATION DEPARTMENT: INFORMATIVE LETTER

The Director: Curriculum Management
(Research Section)
Western Cape Education Department
Private Box 9114
Cape Town
8000

18 June 2002

RE: PERMISSION TO CARRY OUT THESIS RESEARCH

I am a psychology master student at the University of Stellenbosch and I am currently planning to conduct my mater degree thesis on the following topic:

Assessment of Visual-Motor Integration functioning
in a selected South African middle childhood sample.

The proposed study is a follow-up study of Dunn (2001), done on request of the identified Primary School. Visual-Motor Integration involves the child's ability to integrate visual perceptual skills with fine motor coordination, therefore involving the effective co-working of eyes and body muscles (Aylward & Schmidt, 1986). Visual-Motor Integration is involved in advancement with formal learning activities (Vorster, 1994); school readiness (Hanekom, 1991); reading, writing and arithmetic skills (De Jager & Hanekom, cited in Dunn, 2001); and the child's physical and psychological well-being (Breen, Carlson & Lehman, 1985). For this reason early detection of Visual-Motor Integration difficulties should be supported. As Kastner, May and Hildman (2001) postulated, once at risk children are identified, they clearly benefit from soundly structured educational programmes. Gaining information of the visual-motor integration functioning of the middle childhood child could therefore be of value in developing and implementing more effective intervention programmes, aimed at enhancing the functioning of the child.

Should the needed consent be obtained from the school, the parents/guardians, and the participants, the children will be asked to complete three tests of visual-motor integration, namely the

Goodenough-Harris Drawing Test, the Beery Test of Visual Motor Integration, and the Bender Visual-Motor Gestalt Test. The data obtained will be used to gain information regarding the current scenario of visual-motor integration functioning of the children in the selected school, by comparing test results with the biographical variables of age, gender, socio-economic status, and academic achievement, as well as comparing the results of the three chosen tests with each other, in order to discover an easy applicable and comprehensible, child-friendly test of visual-motor integration. The obtained information will further the knowledge of middle childhood visual-motor integration, and enhance the possibility of developing more effective intervention programs.

The following conditions will be met:

1. The principal/teachers/learners are under no obligation to assist in this investigation.
2. The principal/teachers/learners should not in any way be able to be identified from the results of this investigation.
3. All the arrangements concerning this investigation will be done personally.
4. The conditions, as stated in 1-3 above, will be submitted unamended to the school principal where the intended research is to be conducted.
5. A brief summary and completed thesis will be provided to the Director: Curriculum Management (Research Section).

Thank you for considering my application.

Regards

Ms L. Lotz
Counselling Master Student
Counselling Programme
University of Stellenbosch

Mrs. H. Loxton
Supervisor
Lecturer: Child Psychology
University of Stellenbosch

ADDENDUM D

PRIMARY SCHOOL: INFORMATIVE LETTER

I am currently doing research for my Master's Degree in Counselling Psychology at the University of Stellenbosch. The research is aimed at determining the scenario of Visual-Motor Integration functioning of children in the developmental stage of middle childhood. Visual-Motor Integration plays an important role in the development of a child. This involves the child's ability to integrate visual-perceptual skills with fine motor coordination, therefore involving the effective co-working of eyes and body muscles. Visual-Motor Integration is involved in advancement with formal learning activities; school readiness; reading, writing and arithmetic skills; and the child's physical and psychological well being. For this reason early detection of Visual-Motor Integration difficulties should be supported.

Three tests widely used as screening devices for visual-motor integration functioning, are the Goodenough-Harris Drawing Test, the Beery Developmental Test of Visual Motor Integration and the Bender Visual-Motor Gestalt Test. These tests are also included in school readiness testing. The application of these tests should give the researcher a clear indication of the children's current status of visual-motor integration functioning.

The information gathered from the research will be aimed at better understanding the scenario of visual-motor integration functioning of children currently attending grade one to 4, between the ages of 6 and 10, by comparing their test results with certain biographical variables, including age, gender, socio-economic status and academic achievement. The research further aims at identifying a child-friendly, easy-applicable test of visual-motor integration, which provides the tester with the most reliable test results, by comparing the different tests with each other. The final aim is to utilize this information to the benefit of the tested children, as well as to form a better understanding of children's visual-motor integration functioning in general. This information may lead to the development of effective assessment tools and intervention programs, implemented for the sake of helping the child currently struggling with difficulties surrounding this area of functioning.

Should the necessary consent be obtained, the child would be asked to complete the above-mentioned tests of visual-motor integration. The testing will be done during school hours on the school premises, in class format, and the whole session will not exceed the duration of one class period.

To this end, this letter is a friendly request to you as headmaster, to allow the children falling in the range of the proposed study, to participate in the research project. It is further a request for obtaining the needed biographical information of the parent/caregiver, specifically the occupation and level of education of the breadwinner, in order to estimate the level of socio-economic status of the child, as well as the academic records of the children. Complete confidentiality is assured, and in reporting the research results, the children and the school will only be referred to by such aspects as gender, age, socio-economic status and academic achievement.

Lastly it is suggested, that, should this study be completed, the obtained information should be kept in an information bank, possibly being of worth to the staff, should they need information of a specific child regarding his/her level of visual-motor integration functioning. The accessibility of this information may be of great value to help the child in need.

It would be preferable if you do not discuss anything regarding the research with the children prior to the research date. Should you be interested, arrangements can be made to discuss the findings of the group during a general feedback session.

It would be highly appreciated if arrangements with regard to a first visit from the researcher prior to the test date could be made in order to create rapport and finalize other logistics, at a meeting on _____2002, during which I will be happy to answer any questions that you may have.

Your assistance in the above regard will be highly appreciated and it is hoped that your participation in this research will be of benefit for both yourself and the children.

Should you at any time wish to contact me, I may be reached at:

I thank you in advance for your co-operation.

Yours sincerely

_____

Ms Leslie Lotz
Supervisor: Mrs Helene Loxton
Lecturer: Department of Psychology

ADDENDUM E

PARTICIPANTS: LETTER OF ASSENT

Hereby, I, _____, give my permission that I will participate voluntarily in the project. It has been explained to me that the information is confidential and that my name will not be published. I understand what the project is about.

ADDENDUM E

DEELNEMERS: TOESTEMMINGSBRIEF

Hiermee gee ek, _____, toestemming dat ek vrywillig sal deelneem aan die projek. Daar is aan my verduidelik dat die inligting vertroulik hanteer sal word en dat my naam nie bekend gemaak sal word nie. Ek verstaan waaroor die projek gaan.

ADDENDUM F

PARENTS/CAREGIVERS: INFORMATIVE LETTER

Dear Parent/Caregiver

I am currently doing research for my Master's Degree in Counselling Psychology at the University of Stellenbosch. The research is aimed at determining the scenario of Visual-Motor Integration functioning of primary school children currently attending grade 1 to 4. Visual-Motor Integration involves the effective co-working of eyes and body muscles. Visual-Motor Integration is involved in advancement with formal learning activities; school readiness; reading, writing and arithmetic skills; and the child's physical and psychological well being, and therefore plays an important role in the development of a child.

The information gathered from the research will be aimed at better understanding the visual-motor integration functioning of children in the age group of six to ten years. The final aim is to use this information to the benefit of your own child, as well as other children in South Africa, by obtaining valuable information that will assist in the development and implementation of effective assessment tools and preventive programmes.

To this end, this letter is a friendly request to you as a parent or caregiver, to allow your child to participate in the research project. Complete confidentiality is assured, and in reporting the research results, the children will only be referred to by such aspects as gender, age, socio-economic status and academic achievement.

Should you give your consent, your child will be asked to complete three brief child-friendly tests. The testing will be done during school hours on the school premises, in class format, and the whole session will not exceed the duration of one class period.

Arrangements for the specific day will be made with_____

It would be preferable if you do not discuss anything regarding the research with your child prior to the research date. Should you be interested, arrangements can be made to discuss the findings of the group during a general feedback session.

Yours sincerely

Leslie Lotz

Supervisor: Mrs. Helene Loxton
Department of Psychology, University of Stellenbosch
Private Bag X1
Matieland
7602
South Africa

ADDENDUM F

OUERS/VOOGDE: INLIGTINGSBRIEF

Geagte ouer/voog

Ek doen huidiglik navorsing vir my meestersgraad in Voorligting Sielkunde by die Universiteit van Stellenbosch. Die navorsing het ten doel die bepaling van omstandighede rakende die Visueel-Motoriese Integrasie funksionering van die laerskoolleerder, wat tans graad 1 tot 4 voltooi. Visueel-Motoriese Integrasie verwys na effektiewe koördinasie tussen oë en liggaamsspiere, en is betrokke by die vordering van die kind in formele leer aktiwiteite; skoolgereedheid; lees-, skryf- en wiskundige vaardighede; en die kind se fisiese- en sielkundige gesondheid. Vir hierdie redes speel visueel-motoriese integrasie 'n baie belangrike rol in die ontwikkeling van die kind.

Die informasie ingesamel deur die navorsing sal bydra tot 'n meer omvattende begryping van visueel-motoriese integrasie funksionering van die 6- to 10-jarige kind. Die finale mikpunt is om die informasie te benut tot die beste belange van u eie kind, asook ander kinders in Suid-Afrika, deur die ontwikkeling en toepassing van effektiewe asseserings-instrumente en voorkomings-programme.

Hiermee rig ek 'n vriendelike versoek tot u as ouer/voog om asseblief toestemming te gee vir die deelname van u kind aan hierdie studie. Die inligting wat ingewin word sal as vertroulik hanteer word, en geen inligting wat vir navorsingsdoeleindes gebruik word, sal op enige wyse direk aan u kind of die skool herlei kan word nie. In die rapportering van die navorsingsresultate word slegs verwys na groeperings van kinders op die grond van aspekte soos geslag, ouderdom, sosio-ekonomiese status en akademiese prestasie

Indien u, as ouers/voogde toestemming verleen, sal u kind gevra word om drie kort toetse te voltooi. Die hele sessie sal plaasvind gedurende skoolure en op die skool perseel, in groepsverband (volgens klasse), en die sessie sal nie langer duur as een klas periode nie.

Reëlings vir die spesifieke dag sal getref word met _____

Dit sal verkies word indien u nie vooraf enigiets aangaande die navorsing met die kind sal bespreek nie. Indien u dit verlang, kan reëlings getref wrd om na afloop van die projek 'n algemene terugvoersessie te hê oor die resultate van die groep.

Vriendelike groete

Leslie Lotz

Supervisor: Mev. Helene Loxton
Departement Sielkunde, Universiteit van Stellenbosch
Privaat sak X1
Matieland
7602
Suid-Afrika

ADDENDUM G

PARENTS/CAREGIVERS: PERMISSION

TITLE OF RESEARCH PROJECT:

Assessment of Visual-Motor Integration functioning
in a selected South African middle childhood sample

DECLARATION OF PARENTS/CAREGIVERS:

I, _____ the undersigned, in my capacity as parent/caregiver (delete which is not applicable) of _____ (child) from _____ (address) hereby give consent to my child's participation in the above-mentioned project.

Signed at _____ on _____ 2002

Signed (Parent/Caregiver)_____

ADDENDUM G

OUERS/VOOGDE: TOESTEMMING

TITEL VAN DIE NAVORSINGSPROJEK:

Assesering van Visueel-Motoriese Integrasie funksionering
in 'n geselekteerde steekproef van Suid-Afrikaanse kinders in die middel-kinderjare.

VERKLARING VAN OUER/VOOG:

Ek, _____ die ondergetekende, in my hoedanigheid as ouer/voog (skrap indien nie van toepassing) van _____ (kind) vanaf _____ (adres) gee hiermee vrywillig toestemming tot my kind se deelname aan bogenoemde projek.

Geteken te _____ op _____ 2002

Handtekening (Ouer/Voog)_____

ADDENDUM H

FEEDBACK: PARENTS

Geagte Ouer / Voog

Baie dankie vir u instemming dat ..... in Augustus en September 2002 aan my navorsing oor visueel-motoriese integrasie kon deelneem. Visueel-motoriese integrasie het onder andere te doen met die kind se oog-hand-koördinasie, wat weer 'n belangrike aspek is van lees- en skryfvaardighede in skoolwerk. Uit die toetse wat ek afgeneem het, het die volgende geblyk:

Die chronologiese ouderdom van u kind was ..... jaar en ..... maande tydens toetsing.
U kind
a) het volgens chronologiese ouderdom presteer,
b) het effens bo chronologiese ouderdom presteer,
c) het beduidend bo chronologiese ouderdom presteer,
d) het effens onder chronologiese ouderdom presteer, en sal baatvind by die program (sien *)
e) kan baat indien hy / sy vir volledige assessering verwys word,

Leiding is aan die onderwyseresse gegee met betrekking tot 'n program (*) vir die verbetering van visueel-motoriese integrasie. Indien u egter enige verdere navrae het, is u welkom om my te skakel by _____, of Mev. Loxton (Departement Sielkunde, Universiteit van Stellenbosch) by _____, *gedurende Januarie 2003.*

Baie dankie vir die voorreg om met u kind te kon werk!
Vriendelike groete

_____

Leslie Lotz
Voorligtingsielkundige in opleiding
Universiteit van Stellenbosch

ADDENDUM I

FEEDBACK: PRIMARY SCHOOL

TERUGVOERING: NAVORSING OOR VISUEEL-MOTORIESE-INTEGRASIE BY KINDERS IN MIDDEL KINDERJARE

Baie dankie dat u my ondersteun het in my navorsing rakende Visueel-Motoriese Integrasie by _____ gedurende Augustus en September 2002. Ek wil graag terugvoering in verband hiermee verskaf.

Visueel-motoriese integrasie het onder andere te doen met die kind se oog-hand-koördinasie, wat weer 'n belangrike aspek is van lees- en skryfvaardighede in skoolwerk. Uit die toetse wat ek afgeneem het, het sekere informasie geblyk rakende onder andere visueel-motoriese integrasie, en soos afgespreek, is terugvoering hieroor aan die betrokke ouers gegee. Dit is my hoop dat dit van nut sal wees vir elke ouer.

Vind aangeheg verdere voorstelle vir die verbetering van visueel-motoriese integrasie (met dank aan Munita Dunn, Somerset-Wes Skoolkliniek). Ek sal dit baie waardeer indien u hierdie inligting beskikbaar sal stel vir die onderwyseresse van Graad 1 to Graad 4. Dit sal verder voordelig wees indien u hierdie inligting beskikbaar stel aan ouers, of selfs integreer in die skoolprogram.

Laastens wil ek u bedank vir die gasvryheid en samewerking van elke individu betrokke gedurende hierdie tydperk. Ek waardeer dit opreg!

Indien u enige verdere navrae het, is u welkom om my te skakel by _____, of Mev. Loxton (Departement Sielkunde, Universiteit van Stellenbosch) by _____.

Vriendelike groete

_____

Leslie Lotz
Voorligtingsielkundige in opleiding
Universiteit van Stellenbosch