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THE VALIDITY AND RELIABILITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA

MONIQUE HARRIS

A dissertation submitted to the Faculty of Health Sciences, School of Therapeutic Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Science in Occupational Therapy.

Johannesburg, 2017

DECLARATION

I, **Monique Harris** hereby declare that this thesis is my own work. It is being submitted for the degree of Master of Science in Occupational Therapy of the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.



_____

5th Day of May, 2017.

DEDICATION

I would like dedicate this research to the occupational therapy profession of South Africa. May the research that we do advance our profession and help to make a difference in the children we assess and treat.

ACKNOWLEDGMENTS

I would like to express my gratitude to:

Parents/caregivers, for consenting to their children's participation in this study.

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Most importantly, to **Jesus,** for all His wisdom, favour and guidance. To You be all the praise and glory!

ABSTRACT

Occupational therapists routinely make use of the Test of Visual Perceptual Skills - Third Edition (TVPS-3), the Developmental Test of Visual Perception - Third Edition (DTVP-3) and the Developmental Test of Visual-Motor integration - Six Edition (Beery VMI-6) to determine visual perception and visual-motor integration (VMI) dysfunction. This study aimed to determine the validity and reliability of the TVPS-3, DTVP-3 and Beery VMI-6, on a sample of six to nine year old South African children. The scores for the typical children attending a mainstream school fell within the norms reported for children in the USA for all three tests. The DTVP-3, TVPS-3 and Beery VMI-6 were found to discriminate between children with and without a specific learning disability. All three assessments were found to have low levels of sensitivity, however were found to exhibit adequate levels of reliability. With the exception of the visual closure subtest on the TVPS-3 and DTVP-3, the tests cannot be used interchangeably but are all suitable for use with South African children from middle socio-economic backgrounds and can be used to identify visual perceptual and VMI dysfunction. This study was limited by a few factors such as that not all learners with a specific learning disability had visual perceptual problems, the participants used in this study only represented one region of Johannesburg and one province and lastly only learners aged six to nine years were included in this study. Further research on a more representative sample of South African learners is recommended as socio-economic status and environmental conditions have been shown to affect the performance on these tests.

TABLE OF CONTENTS

DECLARATION i
DEDICATION ii
ACKNOWLEDGMENTS iii
ABSTRACT iv
TABLE OF CONTENTS v
LIST OF FIGURES ix
LIST OF TABLES x
OPERATIONAL DEFINITIONS xi
ABBREVIATIONS xii

CHAPTER 1: INTRODUCTION 1

1.1 BACKGROUND: 1
1.2 STATEMENT OF THE PROBLEM: 2
1.3 PURPOSE OF THE STUDY: 3
1.4 RESEARCH QUESTION: 4
1.5 AIM OF THE STUDY: 4
1.6 OBJECTIVES: 4
1.7 NULL HYPOTHESIS: 5
1.8 JUSTIFICATION FOR THE STUDY: 5
1.9 OUTLINE OF STUDY: 6

CHAPTER 2: LITERATURE REVIEW 8

2.1 INTRODUCTION: 8
2.2 VISUAL PERCEPTION AND VISION: 8
2.2.1 VISUAL PERCEPTION 8
2.2.2 VISUAL-RECEPTIVE AND VISUAL-COGNITIVE FUNCTIONS 9
2.2.3 THE DEVELOPMENT OF VISION AND VISUAL PERCEPTION 11
2.3 THE IMPACT OF VISUAL PERCEPTUAL DYSFUNCTION ON 12
A CHILD'S AREAS OF OCCUPATION: 12
2.4 VISUAL PERCEPTION DYSFUNCTION AND SPECIFIC
LEARNING DISABILITIES: 14
2.4.1. VISUAL-PERCEPTUAL DYSFUNCTION AND SPECIFIC LEARNING DISABILITIES 14
2.4.2 DEFINITION OF A SPECIFIC LEARNING DISABILITY 15
2.4.3 THE DIAGNOSIS OF SPECIFIC LEANING DISABILITY 15
2.5 STANDARDISED TESTS IN PAEDIATRIC PRACTICE: 18
2.5.1 TYPES OF STANDARDISED TESTS 18
5.3.2 VALIDITY AND RELIABILITY 20
5.3.2.1 Validity 20
5.3.2.2 Reliability 22
2.5.2.3 Factors influencing the validity and reliability of standardised tests: 22
2.5.3 STANDARDISED TESTS OF VISUAL PERCEPTION AND VISUAL-MOTOR
INTEGRATION: 23
2.5.3.1 The Developmental Test of Visual Perception (DTVP) 25
2.5.3.2 Test of Visual-Perceptual Skills (TVPS) 29
2.5.3.3 The Developmental Test of Visual-Motor Integration (VMI) 32
2.6 SUMMARY: 33

CHAPTER 3: METHODOLOGY 35

3.1 INTRODUCTION: 35
3.2 RESEARCH DESIGN: 35
3.3 SAMPLE: 36
3.3.1 STUDY POPULATION 36
3.3.2 STUDY SAMPLE 36
3.3.3 STUDY SETTING 36
3.3.4 SAMPLE SELECTION 37
3.3.5 SAMPLE SIZE 37
3.4 MEASUREMENT INSTRUMENTS: 38
3.4.1 DEMOGRAPHIC QUESTIONNAIRE 38
3.4.2 DEVELOPMENTAL TEST OF VISUAL PERCEPTION – THIRD EDITION (DTVP-3) 38
3.4.2.1 Scoring 38
3.4.2.2 Reliability 41
3.4.2.3 Validity 41
3.4.3 TEST OF VISUAL PERCEPTUAL SKILLS – THIRD EDITION (TVPS-3) 42
3.4.3.1 Scoring 43
3.4.3.2 Reliability 43
3.4.3.3 Validity 44
3.4.4 BEERY-BUKTENICA: DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION - SIX EDITION (BEERY VMI-6) 45
3.4.4.1 Scoring 45
3.4.4.2 Reliability 46
3.4.4.3 Validity 46
3.5 ETHICAL CONSIDERATIONS: 47
3.6 RESEARCH PROCEDURE: 47
3.7 DATA COLLECTION: 48
3.8 DATA ANALYSIS: 50

CHAPTER 4: RESULTS 52

4.1 INTRODUCTION: 52
4.2 DEMOGRAPHICS OF THE PARTICIPANTS: 52
4.3 THE VALIDITY OF THE TVPS-3, DTVP-3 AND THE BEERY (VMI-6) FOR SOUTH AFRICAN LEARNERS: 53
4.3.1 THE TEST OF VISUAL PERCEPTUAL SKILLS - THIRD EDITION (TVPS-3) 53
4.3.2 THE DEVELOPMENTAL TEST OF VISUAL PERCEPTION – THIRD EDITION (DTVP-3) 55
4.3.3 THE DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION - SIX EDITION (BEERY VMI-6) 56
4.4 THE DISCRIMINATIVE VALIDITY OF THE TVPS-3, DTVP-3 AND THE BEERY (VMI-6): 57
4.4.1 THE TEST OF VISUAL PERCEPTUAL SKILLS - THIRD EDITION (TVPS-3) 57
4.4.1.1 Subtest scale scores of the Test of Visual Perceptual Skills - Third Edition (TVPS-3) for mainstream and LSEN groups 57
4.4.1.2 The Test of Visual Perceptual Skills - Third Edition (TVPS-3) subtest z scores for mainstream and LSEN groups 58
4.4.1.3 Composite and index scores for the LSEN and mainstream groups for the Test of Visual Perceptual Skills - Third Edition (TVPS-3) 60

4.4.2. THE DEVELOPMENTAL TEST OF VISUAL PERCEPTION - THIRD EDITION (DTVP-3) 62
4.4.2.1 Mean subtest scale scores of the Developmental Test of Visual Perception - Third Edition (DTVP-3) for mainstream and LSEN groups 62
4.4.2.2 Developmental Test of Visual Perception - Third Edition (DTVP-3) subtest z scores for mainstream and LSEN group 63
4.4.2.3 Composite scores for mainstream and LSEN groups of the Developmental Test of Visual Perceptual Skills - Third Edition (DTVP-3) 65
4.4.3. DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION – SIX EDITION (BEERY VMI-6) 68
4.4.3.1 Mean subtest scores for The Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) for mainstream and LSEN groups 68
4.4.3.2 The Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) z scores for mainstream and LSEN groups 69
4.5 THE CLINICAL ACCURACY (SENSITIVITY AND SPECIFICITY) OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6): 70
4.5.1 THE TEST OF VISUAL PERCEPTUAL SKILLS - THIRD EDITION (TVPS-3) 71
4.5.2. THE DEVELOPMENTAL TEST OF VISUAL PERCEPTION – THIRD EDITION (DTVP-3) 72
4.5.3 DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION - SIX EDITION (BEERY VMI-6) 72
4.6 THE INTERNAL CONSISTENCY RELIABILITY OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6): 73
4.7 THE CONCURRENT VALIDITY OF TVPS-3, DTVP-3 AND BEERY (VMI-6): 75
4.8 SUMMARY 77

CHAPTER 5: DISCUSSION 79

5.1 INTRODUCTION**:** 79
5.2 DEMOGRAPHICS: 79
5.3 VALIDITY OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6) FOR SOUTH AFRICAN LEARNERS: 80
5.3.1 LEARNERS WITHOUT SPECIFIC LEARNING DISABILITIES 80
5.3.2 LEARNERS WITH SPECIFIC LEARNING DISABILITIES 83
5.4 THE DISCRIMINATIVE VALIDITY OF THE TEST OF TVPS-3, DTVP-3 AND BEERY (VMI-6): 85
5.5 THE INTERNAL CONSISTENCY RELIABILITY OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6): 90
5.6 THE CONCURRENT VALIDITY OF TEST OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6): 92
5.7 LIMITATIONS OF THE STUDY: 94

CHAPTER 6: CONCLUSION 96

6.1 INTRODUCTION: 96
6.2 CLINICAL RECOMMENDATIONS: 98

REFERENCES 100

APPENDIX A1: Demographic Questionnaire 114

APPENDIX A2: DTVP- 3 Score Sheet 120
APPENDIX A3: TVPS- 3 Score Sheet..... 121
APPENDIX A4: Beery VMI-6 Score Sheet 122
APPENDIX B: Ethical Clearance..... 123
APPENDIX C: Permission Gauteng Education Department..... 124
..... 126
APPENDIX D1: Permission Letter – mainstream school principals..... 126
APPENDIX D3: Permission Letter – LSEN school principal..... 136
..... 140
APPENDIX E1: Information Sheet – Parents mainstream school (English) 140
APPENDIX E2: Information Sheets – Parents mainstream school (Afrikaans) .. 144
APPENDIX F1: Information Sheet – Parents LSEN school (English)..... 148
..... 152
APPENDIX F2: Information Sheet – Parents LSEN school (Afrikaans)..... 152
APPENDIX G: Verbal Assent 156

LIST OF FIGURES

Figure 4.1 The Test of Visual Perceptual Skills – Third Edition (TVPS-3) subtest z scores for mainstream group 59
Figure 4.2 The Test of Visual Perceptual Skills - Third Edition (TVPS-3) subtest z scores for LSEN group 60
Figure 4.3 Z scores obtained on the Test of Visual Perceptual Skills (TVPS-3) composite and indexes for mainstream group 61
Figure 4.4 Z scores obtained on the Test of Visual Perceptual Skills - Third Edition (TVPS -3) composite and indexes for LSEN group. 62
Figure 4.5 The Developmental Test of Visual Perception - Third Edition (DTVP-3) subtest z scores for mainstream group 64
Figure 4.6 The Developmental Test of Visual Perception - Third Edition (DTVP-3) subtest z scores for LSEN group 65
Figure 4.7 General composite scores for mainstream and LSEN groups for the Developmental Test of Visual Perceptual Skills - Third Edition (DTVP-3) 66
Figure 4.8 Visual-motor integration composite scores for mainstream and LSEN groups for the Developmental Test of Visual Perceptual Skills - Third Edition (DTVP-3) 67
Figure 4.9 Motor-reduced composite scores for mainstream and LSEN groups for the Developmental Test of Visual Perceptual Skills – Third Edition (DTVP-3) 68
Figure 4.10 Z scores for mainstream and LSEN groups for the Developmental Test of visual-motor integration - Six Edition 70
Figure 4.11 Bland Altman plot for the visual closure subtests of the Test of Visual Perceptual Skills – Third Edition (TVPS-3) and the Developmental Test of Visual Perception – Third Edition (DTVP-3) 76
Figure 4.12 Bland Altman plot for the form constancy subtests of the Test of Visual Perceptual Skills - Third Edition (TVPS-3) and the Developmental Test of Visual Perception – Third Edition (DTVP-3) 77

LIST OF TABLES

Table 3.1 Strength of correlations 51
Table 4.1 Demographics of the participants for the Mainstream and LSEN groups 53
Table 4.2 Mean subtest scale scores of the Test of Visual Perceptual Skills - Third Edition (TVPS-3) for mainstream group compared to American norms..... 54
Table 4.3 Mean subtest scale scores of the Developmental Test of Visual Perception - Third Edition (DTVP-3) for mainstream group compared to the American norms 55
Table 4.4 Mean subtest scale scores of the Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) for mainstream compared to the American norms 56
Table 4.5 Mean subtest scale scores of the Test of Visual Perceptual Skills - Third Edition (TVPS-3) for mainstream and LSEN groups 58
Table 4.6 Mean subtest scale scores of the Developmental Test of Visual Perception - Third Edition (DTVP-3) for mainstream and LSEN groups..... 63
Table 4.7 Mean subtest scores for mainstream and LSEN groups for Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) 69
Table 4.8: The sensitivity and specificity of the Test of Visual Perceptual Skills – Third Edition (TVPS-3) 71
Table 4.9 The sensitivity and specificity of the Developmental Test of Visual Perception - Third Edition (DTVP-3)..... 72
Table 4.10 The sensitivity and specificity of The Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6)..... 72
Table 4.11 Reliability scores for the Test of Visual Perceptual Skills - Third Edition (TVPS-3), the Developmental Test of Visual Perception – Third Edition (DTVP-3) and Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6) (n=92)..... 74
Table 4.12 Correlation between the Standard Scores of the three standardised tests..... 75

OPERATIONAL DEFINITIONS

Visual perception: Visual perception is the “total process responsible for the reception and cognition of visual stimuli” (Schneck, 2010, p. 373).

Visual-Motor Integration (VMI): Visual-motor integration (VMI) is the “degree to which a visual perception and finger-hand movements are well coordinated” (Beery & Beery, 2010, p. 13).

Specific learning disability: Specific learning disabilities incorporates a diversified group of disorders in which children commonly have an average intelligence but finds the processing of information or producing an output very challenging. A child’s neurocognitive processes may be influenced by a specific learning disability. It can hamper the ability to listen, speak, read, spell, write reason, solve mathematical problems and organize information. A motor coordination dysfunction is also typically present (Handler & Fierson, 2011).

A Standardised test: A standardised test has homogeneous procedures for administration and scoring (Richardson, 2010).

Reliability: Reliability is defined by Urbina, 2004 as ‘the consistency or stability of scores obtained by one individual when tested on two different occasions with different sets of items or under other variable examining conditions’ (Urbina, 2004).

Validity: Validity is defined as ‘the extent to which a test measures what it says it measures’ (Urbina, 2004).

ABBREVIATIONS

ADD : Attention Deficit Disorder

ADHD : Attention Deficit Hyperactivity Disorder

AUC : Area under the curve

CFA : Confirmatory factor analysis

DCD : Developmental Coordination Disorder

DIF : Differential Item Functioning

DTVP-2 : Developmental Test of Visual Perception - Second Edition

DTVP-3 : Developmental Test of Visual Perception – Third Edition

ICC : Intraclass Correlation Coefficient

LSEN : Learners with Special Educational Needs

PS : Position in Space

ROC : Receiver operating characteristic

RMM : The Rasch Models of Measurements

SIAS : The Screening, Identification, Assessment and Support (SIAS) policy document

SD : Standard Deviation

SEM : Standard error of measurement

SR : Spatial relations

TVPS-R : Test of Visual Perceptual Skills-Revised

TVPS-3 : Test of Visual Perceptual Skills-3rd edition

VMI : Visual-Motor Integration

Beery VMI-4 : Developmental Test of Visual-Motor Integration (Beery-Buktenica) - 4thedition

Beery VMI-5 : Developmental Test of Visual-Motor Integration (Beery-Buktenica) - 5thedition

Beery VMI-6 : Developmental Test of Visual-Motor Integration (Beery-Buktenica) - 6th edition

VMS : Visual Motor Speed

EWP-6 : White Paper Six *special needs education, building an inclusive education and training system*

USA : United States of America

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND:

Occupational therapists assist persons of all ages to participate in and enjoy activities that have meaning and purpose (American Occupational Therapy Association, 2004). The occupational therapist's role in a school setting is assisting learners to perform at their best in all occupations that comprises of typical school and academic activities by addressing fundamental constituents of function which involves motor, praxis and sensory–perceptual performance skills. These skills are needed to perform in the academic areas of reading, writing, mathematics and spelling (Vlok, et al., 2011; American Occupational Therapy Association, 2008). Dysfunction in motor, praxis and sensory–perceptual performance skills in school-aged children can therefore have an adverse influence on various aspects of a child's occupational performance (Brown, et al., 2008) (Schneck, 2005). Visual perception is the "total process responsible for the reception and cognition of visual stimuli" (Schneck, 2010, p. 373) and visual-motor integration (VMI) is the "degree to which a visual perception and finger-hand movements are well coordinated" (Beery & Beery, 2010, p. 13). The aforementioned two skills are often assessed and treated by paediatric occupational therapists in the school-aged child (Brown, et al., 2005; Burtner, et al., 2002).

Visual perception and visual-motor integration dysfunction appear in a high percentage of children with a specific learning disability in which children commonly have an average intelligence, but find the processing of information or producing an output very challenging. This disability can hamper the development of skills needed for academic achievement and the ability to organise information. A motor co-ordination dysfunction is also typically present (Handler & Fierson, 2011). These children usually present with normal visual acuity (Seiderman, 1976). Children with a specific learning disability may find it challenging to filter out

unimportant stimuli from the environment and therefore have irregular visual attention skills (Todd, 1999).

As part of the admission criteria to a school for learners with special education needs (LSEN) remedial stream, specifically for children identified with specific learning disabilities, assessments of visual perception and visual-motor integration skills are used to pinpoint possible causes for a child's noted achievement on school related tasks. As most of these children present with visual perception or visual-motor integration deficits ranging from mild to severe, an assessment of visual perceptual skills is beneficial as underlying factors can be revealed by the subtests for example visual discrimination or figure ground perceptual deficits (Martin, 2006; Stewart, 2010).

In the South African White Paper Six (EWP-6) *special needs education, building an inclusive education and training system* a recommendation was made that learners should only be subjected to standardised tests which have been proven to be useful in identifying barriers to learning thus the most appropriate assessments should be applied. (South African Department Eduction, 2001)

Health professions also play a significant role in the Department of Education's Screening, Identification, Assessment and Support (SIAS) policy document for learners who are facing barriers to learning (Department of Basic Education, 2014). The occupational therapist's role is to conduct more formal visual perception assessments with learners in determining possible underlying reasons for a child's lack of achievement in academic tasks (Department of Basic Education, 2014). Therefore, it is necessary for occupational therapists to use assessment tools which can provide the best results (Brown & Rodger, 2009).

1.2 STATEMENT OF THE PROBLEM:

Assessment for visual perception and visual-motor integration skills dysfunction in occupational therapy in LSEN schools is routinely undertaken using standardised tests such as the Developmental Test of Visual Perception - Second Edition (DTVP-2), the Beery-Buktenica: Developmental Test of Visual-Motor Integration – Fourth Edition (VMI-4) and the Test of Visual Perceptual Skills - Revised (TVPS-

R) (van der Merwe, et al., 2011). However, these tests are all standardised on samples of children from the United States of America (USA). In clinical practice these standardised visual perceptual test editions have been found to not clearly discriminate dysfunction and on some of the subtest items children either over- or underscore. Ceilings on the tests have also been experienced as being inadequate. This leads to false negatives where children with problems are often overlooked or false positives where children are identified with problems they do not have (Hammill, et al., 2014).

All three perceptual tests have been revised and the new editions of the tests - the Developmental Test of Visual Perception - Third Edition (DTVP-3), the Beery-Buktenica: Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6) and the Test of Visual Perception skills - Third Edition (TVPS-3) have recently become available in South Africa. As important decisions concerning therapy may be grounded on a part of the scores obtained from standardised tests, it would be preferable for South African occupational therapists to use visual perceptual tests which have been proven useful in the identification of visual perception and visual-motor integration dysfunction in South African children (Brown & Rodger, 2009). However, no research is available on the use of the new editions of the DTVP-3, Beery VMI-6 and TVPS-3 on children in South Africa and therefore it is not known if these assessment tests are more discriminative in identifying visual perception and visual-motor integration dysfunction in children in this country. Standardised visual perception tests have not been extensively researched on a South African population. According to literature no comparative studies have been published on South African children (Richmond & Holland, 2011). This is concerning as therapists' confidence is usually founded on the evidence from different types of validity and reliability studies (Martin, 2006).

1.3 PURPOSE OF THE STUDY:

The purpose of the study is to determine if the new editions of the standardised visual perception tests – the DTVP-3, Beery VMI-6 and TVPS-3 are valid, discriminative and reliable in identifying visual perceptual and visual-motor integration dysfunction in children with a specific learning disability. The study will

also be used to determine which one the aforementioned tests best identify dysfunction in visual perception and visual-motor integration skills when assessing children in South Africa, Gauteng according to the sensitivity and specificity of the tests.

1.4 RESEARCH QUESTION:

Are the new versions of the standardised tests (DTVP-3, Beery VMI-6 and TVPS-3) valid and reliable in identifying visual perceptual and visual-motor integration dysfunction in children between six and nine years in Gauteng, South Africa?

1.5 AIM OF THE STUDY:

The aim of the study is to determine the validity and accuracy in terms of discriminative validity, specificity and sensitivity as well as the internal consistency of the DTVP-3, Beery VMI-6 and TVPS-3 in identifying visual perceptual and visual-motor integration dysfunction in children with a specific learning disability.

1.6 OBJECTIVES:

1. To determine the validity of the TVPS-3, DTVP-3 and Beery VMI-6 by comparing the normative scores in the manuals for a sample of learners aged six to nine years, without a specific learning disability from the Gauteng Province, South Africa.

2. To determine the discriminative validity of the TVPS-3, DTVP-3 and Beery VMI-6 for learners, aged six to nine years, from the Gauteng Province, South Africa, with a specific learning disability compared to those without a specific learning disability.

3. To determine the concurrent validity of the TVPS-3, DTVP-3 and Beery VMI-6 and visual perceptual dysfunction for a sample of learners, aged six to nine years, from the Gauteng Province, South Africa.

4. To determine the clinical accuracy (sensitivity and specificity) of the TVPS-3, DTVP-3 and Beery VMI-6 for a sample of learners aged six to nine years, from the Gauteng province, South Africa.

5. To determine the reliability of the tests in terms of internal consistency of the constituent items on the TVPS-3, DTVP-3 and Beery VMI-6 for a sample of learners aged six to nine years, from the Gauteng province, South Africa.

1.7 NULL HYPOTHESIS:

Objective 1: There will be no difference between the normative scores reported in the manuals of the TVPS-3, DTVP-3 and Beery VMI-6 for a sample of USA learners and a sample of mainstream South African learners from the Gauteng province without a learning disability aged six to nine years.

Objective 2: There will be no difference between the scaled scores for learners, aged six to nine years, from the Gauteng Province, South Africa, with a specific learning disability and those without a specific learning disability.

Objective 3: There will be no correlation in the scaled scores between the subtests of the TVPS-3, DTVP-3 and Beery VMI-6 for a sample of learners, aged six to nine years, from the Gauteng Province, South Africa.

1.8 JUSTIFICATION FOR THE STUDY:

The results of this study will provide South African occupational therapists with evidence regarding the validity and reliability of the DTVP-3, TVPS-3 and Beery VMI-6 for a sample of learners, aged six to nine years, from the Gauteng Province, South Africa. Results gained in this study will therefore contribute to evidence-based practice which is important to substantiate the proficiency of occupational services.

The DTVP-3, Beery VMI-6 and TVPS-3 are all new editions of the standardised visual perceptual tests. Although some international research has been done on the new editions of these tests no research is available on the use of the revised

test editions on a South African population. International researchers such as Brown and Murdolo (2015), have suggested that standardised tests such as the DTVP-3 needs to be validated in certain cultural settings and with particular diagnosed groups before attempting to generalise the acquired results (Brown & Murdolo, 2015).

1.9 OUTLINE OF STUDY:

Chapter 1: Introduction

This chapter introduces the rationale for this research study, followed by the problem statement, purpose of the study, research question, aim, objectives and the justification of the study. Lastly, this chapter concludes with an outline of the study.

Chapter 2: Literature review

This chapter reviews the literature and addresses components of visual perception, the development of visual perception and the effect of visual perceptual dysfunction on a child's occupations especially academic functioning. Specific learning disabilities and visual perceptual dysfunction will also be considered. Furthermore, standardised tests in paediatric practice will be explored and elaborated on. Lastly, the assessments of visual perception and visual-motor integration dysfunction as well as the standardised assessment tools that are utilised by paediatric occupational therapists will be included.

Chapter 3: Methodology

This chapter gives a detailed account of the method of research used and the ethical principles adhered to as well as considered for this cross-sectional, comparative, quantitative design. The study sample consisted of 48 mainstream participants and 44 LSEN participants from a middle class, urban setting. Participants completed the TVPS-3, DTVP-3 and Beery VMI-6 according to the prescribed methods set out in the various test-manuals. Data was analysed and is described in chapter five.

Chapter 4: Results

This chapter presents the results of the study. Results regarding the demographic information of the study sample, validity, discriminative validity, sensitivity and specificity as well as the reliability of the DTVP-3, Beery VMI-6 and TVPS-3 are presented in terms of tables and graphs.

Chapter 5: Discussion

In this chapter the findings of the study are discussed according to the demographics of the participants as well as the objectives of the study in terms of the validity of the TVPS-3, DTVP-3 and Beery VMI-6 for mainstream learners six to nine years as well as the diagnostic value of the TVPS-3, DTVP-3 and Beery VMI-6 by determining the discriminative validity of the tests for a sample of participants with a specific learning disability compared to those without a specific learning disability. The sensitivity and specificity of the TVPS-3, DTVP-3 and Beery VMI-6 and the reliability of the tests in terms of the internal consistency as well as whether the tests can be used interchangeably in determining visual perceptual dysfunction will also be considered.

Chapter 6: Conclusion

This is the last chapter of the study and describes the conclusions drawn from this study and clinical recommendations made.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION:

The review in this chapter starts by addressing components of visual perception, the development of visual perception and the effect of visual perceptual dysfunction on a child's occupations especially academic functioning. Reference has been made to some of the original research on visual perception and test development reported in the 1960s to the 1990s as well as more recent studies. Specific learning disabilities and visual perceptual dysfunction will also be considered.

Furthermore, standardised tests in paediatric practice will be explored and elaborated on. Lastly, the assessments of visual perception and visual-motor integration dysfunction as well as the standardised assessment tools that are utilised by paediatric occupational therapists will be included. The previous assessment editions of the tests evaluated in this study will briefly be reviewed and literature which has assisted in the revision and updating of the assessment editions will be considered. The changes between the old and the new assessment editions will be highlighted. The new editions will be reviewed and described and literature available on the new assessment editions will be discussed. An overview will be given on research in visual perceptual tests conducted on various populations.

2.2 VISUAL PERCEPTION AND VISION:

2.2.1 Visual perception

Visual perception can be described as the capability of a human being's brain to make meaning of and comprehend what the eyes see (Martin, 2006). It involves the ability to perceive and notice forms, objects, colours and additional attributes as well as the precise judgment of objects based on the length, breadth, shape

and orientation in space (American Occupational Therapy Association, 2008). Visual perception is reliant on the central nervous system's superior levels of capability to transform unprocessed visual inputs into information that is relevant (Brown, 2012). It is reasoned that motor-reduced and motor-enhanced visual perception are two associated processes concerned with visual perception. Motor reduced visual perception is concerned with the assimilation of visual input with previous knowledge. Motor enhanced visual perception is generally mentioned as visual-motor integration which requires the co-ordination of visual perception with body movements and motor actions (Schneck, 2010; Dankert, et al., 2003; Hammill, et al., 2014).

2.2.2 Visual-receptive and visual-cognitive functions

Visual perception has a visual-receptive component and the visual-cognitive component which jointly allow an individual to see and to comprehend what they see. Both are essential for practical and useful vision (Schneck, 2010). The visual-receptive component is the means by which information is obtained and arranged from our surroundings while the visual-cognitive component comprises of particular brain functions. The aforementioned components make it possible for an individual to arrange and order visual input as well as make sense of what is seen (Optometric Extension Program Foundation, 2006).

The visual-receptive component is related to the oculomotor system which allows visual input to be received. An essential skill required for all other oculomotor responses is visual fixation on a non-moving object that includes tracking and scanning. Six extra-ocular muscles ensure that the eye moves in a coordinated action. To gain information from the surroundings two kinds of eye movements are utilised; namely, pursuit eye movements or tracking and saccadic eye movements or scanning.

Visual pursuit or tracking is the firm continued focus on a target that is moving to make sure the image is kept sustained on the fovea. Pursuit movements need to be slow and smooth. The fast change of fixation from one specific location in the visual field to another is known as saccadic eye movements or scanning. The vestibulo-ocular pathways regulate combined eye movements reflexively in reaction to the head movement and position in space (Gentile, 1997). Additionally,

visual-receptive components also incorporate acuity, accommodation, binocular fusion, stereopsis, convergence and divergence. Acuity involves the ability to distinguish the intricate features of objects found in the visual field. Accommodation is the process for acquiring clear vision and the capacity for each eye to make amends for an image that is blurred. Binocular fusion makes it possible for two eyes to mentally merge the images into a single percept. Stereopsis can be described as three-dimensional vision or binocular depth perception and lastly convergence and divergence makes it possible for both eyes to turn inwards and outwards from the medial plane (Gentile, 1997).

Visual-cognitive components incorporate the following: visual attention, visual memory, visual discrimination and visual imagery. Visual attention includes visual input that is carefully chosen. Visual-perceptual processing occurs when visual attention supplies a suitable time period through which information flows past the eye to the primary visual cortex of the cerebrum. There are four constituents of visual attention namely alertness, selective attention, visual vigilance and divided attention. Secondly, visual memory includes visual information that is combined with former experiences (Hyvarinen, 1994).

The capability to observe characteristics of stimuli for identification, pairing and classification is known as visual discrimination. A visual stimulus is assisted by visual-receptive capabilities for visual discrimination (Todd, 1999). Visual perceptual skills are defined by various terms and classifications. Object (form) vision and spatial vision differs from each other (Gulyas, et al., 1994; Kosslyn, et al., 1992). Object vision involves the identification of objects through vision by colour, texture, shape and size. Spatial vision is concerned with the position of objects in an area and reacts to information from a motor capacity (Hyvarinen, 1995). The aforementioned categories of function are interposed by individual neural systems. For both object vision and spatial vision the cortical tracts are directed to the primary visual cortex, however the route for object vision goes to the temporal lobe while the route for spatial vision goes to the inferior parietal lobe of the cerebrum (Goodale, 2000; Goodale & Milner, 1992). Lastly visual imagery is an essential constituent in visual cognition and also alludes to the capability to

visualise a person, designs and items in one's imagination even when the pictures are not actually present (Schneck, 2010).

2.2.3 The development of vision and visual perception

In the unborn foetus, the visual-receptive process and capacities already starts developing. As a new-born, the baby has very immature visual fixation capability as well as short reflexive tracking capacity (Glass, 1993). At the age of two months, stereopsis is apparent while accommodation, convergence and oculomotor subsystems are fixed shortly before the end of the second month (Bouska, et al., 2006). At the age of five years, the greatest amount of accommodation is achieved (Westheimer & Levi, 1987). Regulated tracking skills proceed according to a developmental sequence. Horizontal eye-movements are first to develop followed by eye movements in a vertical, diagonal and circular direction. The eyes of a child in preschool should have the ability to move with smooth control and co-ordination in all directions. At the age of eighteen years, visual acuity is optimal, but thereafter starts to decrease (Schneck, 2010).

At birth, a few visual-cognitive component abilities are present, however higher visual-cognitive capacities are not completely developed until the early teens (Schneck, 2010). Visual-perceptual capabilities (pattern recognition, form constancy and depth perception) appear to be well-developed in babies. A discriminatory response to patterns is shown by babies from as young as one week old. Visual information is arranged by infants in three ways. At two months of age, perception of brightness appears first. Babies can put objects that belong together according to shape and proximity at about four months of age (Farran & Cole, 2008). Visual perception advances with the greater part of developmental changes occurring at age nine. The pace at which children obtain perceptual abilities, functionally use and apply these functions accurately and with comfort appears to differ for each child (Levine, 1987). Children first gain an understanding of how to identify an item dependent upon its common aspects and not by distinct features. They are only able to derive the characteristics that make the item a constituent of a group, as they learn to group objects into categories and varieties (Quinn, 1998). Figure-ground perception development peeks between the ages three to five years with growth settling at around six to seven years of age. Form

constancy has a significant advance between the ages of six and seven years with less development from ages eight to nine years (Williams, 1983).

The developmental procedure of spatial perception and the process of organising space differ from that of form (object) perception. Children first obtain a notion of vertical proportions followed by the concepts of horizontal proportions. The more complex oblique and diagonal proportions require more integration and mature later. Vertical lines can be discriminated from horizontal lines at three to four years of age; however only from about, six years of age are children able to discriminate oblique lines (Cratty, 1970). The capacity to distinguish between mirror or reverse numbers and letters is not fully developed until around seven years of age in a few children (Schneck, 2010). Position in space substantially develops between the ages of six to seven years with further refinement taking place up until the ages of eight to nine years. Spatial relationships develop most favourably at the age of seven to nine years, and advances until the age of ten years (Williams, 1983).

2.3 THE IMPACT OF VISUAL PERCEPTUAL DYSFUNCTION ON A CHILD'S AREAS OF OCCUPATION:

Visual perception is considered a primary component in the development of cognition, acquiring new skills and many daily tasks (Kattouf & Steele, 2000). Visual perceptual and visual-motor integration dysfunction have been found to hinder a child's ability and independence in areas of occupation such as personal management, education, work, play, leisure and social skills (Sortor & Kulp, 2003; Schneck, 2010; Coallier & Rouleou, 2014). The most curial period for the development of visual perception is between four and a half and seven years, which coincide with the first years of school (Hanneford, 1995). Therefore learners with visual-perceptual dysfunctions can have various challenges with scholastic tasks such as reading, spelling, writing and mathematics (Schneck, 2010). Various research studies have all highlighted the impact of visual perception and visual-motor integration dysfunction on a child's scholastic skills; namely, handwriting, mathematics and reading skills. In a study conducted by Sortor and Kulp (2003), it was found that visual perceptual skills are an important component

related to performance in mathematics and reading skills (Sortor & Kulp, 2003). Chan (2000), also concluded that there is a connection between visual-motor integration skills and academic performance in children aged four to eight years (Chan, 2000). In a study conducted with Grade 0 South African learners on the VMI-4, a noteworthy link was found between visual-motor integration and letter formation but not legibility of handwriting (Naidoo, et al., 2002). Inadequate visual-motor skills have also been found to be related to problems with spatial organisation during the execution of written and maths activities (Barnhardt, et al., 2005).

The important link between visual perception and academic performance seems to indicate that visual perceptual motor skills are a factor in various basic learning skills related with typical educational development (Willows, 1998). Furthermore, the school learner must have the ability to isolate objects from their environment in the visual field, for example when reading or writing letters and words must be isolated from the rest of the page. Visual perception is also crucial in the planning of motor actions as in the visual representation of a sequence of letters or numbers when reading, writing or doing maths (Brown, et al., 2003; Mäki, et al., 2001; Parush, et al., 1998).

Visual perceptual and visual-motor integration dysfunction does not just impact on a child's education; it also has an impact on other occupational performance areas. With tasks that have to be completed on daily basis, children may find it challenging to eat independently using a fork, knife and spoon or find it difficult when having to dress themselves- doing buttons, zips and tying shoelaces. In the area of recreation and leisure, the child may find competing in games and sport, building puzzles as well as constructing challenging (Schneck, 2010).

Visual perception is a performance skill that may frequently be dysfunctional in children with a specific learning disability and the above-mentioned deficits are often observed in these children. (Kimball, 1993). Learners with a specific learning disability also find the interpretation and utilisation of visual information challenging despite having normal visual acuity (Todd, 1993). Therefore visual perceptual difficulties in learners with a specific learning disability could be a contributing

factor to their poor scholastic performance and hence the reason why they attend a LSEN remedial stream school.

2.4 VISUAL PERCEPTION DYSFUNCTION AND SPECIFIC LEARNING DISABILITIES:

2.4.1. Visual-perceptual dysfunction and specific learning disabilities

Literature links visual–perceptual dysfunction with specific learning disabilities. Various investigators have proposed that visual-perceptual dysfunctions are typical of learners with a specific learning disability (Gershwind & Galaburda, 1985). However, as individuals with a specific learning disability form a diverse group, not all children with a specific learning disability may present with a visual-perceptual dysfunction (Rourke, 1985; Hung, et al., 1987). According to some specialists, visual processing difficulties could be risk factors for learning disabilities such as dyslexia, however according to an extensive report by the American Academy of Paediatrics, visual processing difficulties are a consequence of a learning disability and not the cause (Handler & Fierson, Pediatrics 127.3 (2011): E818–856) (Arky, 2014-2017). In their study, using the scores on all subtests of the general score of the DTVP-2, Moryosef-Ittah and Hinojosa in 1996 found that the children diagnosed with a specific learning disability do have lower scores when compared to the normative sample (Moryosef-Ittah & Hinojosa, 1996). More errors were made by learners with specific learning disabilities on the Test of Visual Perceptual Skills (TVPS) and they took more time to finish the assessment as compared to the group without specific learning disabilities (Hung, et al., 1987). Mattison et al. (1986) examined visual-motor problems in learners with a specific learning disability and established that these learners found design-copy tasks involving visual-motor components challenging (Mattison, et al., 1986) confirming the higher frequency of visual-motor skill disorders in a learning-disabled population when compared to with a non-learning-disabled control group (Rosner & Rosner, 1987). In a research study conducted by Waldron and Saphire in 1992, it was found that the specific learning disabled learners were notably weaker in spelling, in nearly all areas of maths and decoding skills as compared to the control group. It was also established that

these learners were notably weaker in memory, visual discrimination, sequencing, spatial abilities and auditory discrimination. The researchers conclude that underlying perceptual and memory deficits could be linked to learner's academic difficulties (Waldron & Saphire, 1992).

2.4.2 Definition of a specific learning disability

Specific learning disability influences learning in children who display normal levels of intellectual functioning. The commencement, identification and recognition of specific learning disabilities commonly appear in the course of the foundational school years when it is mandatory for children to acquire the capacity to read, spell, write and do mathematics (National Joint Committee on Learning Disabilities, March 2011). The US Federal law defines specific learning disability as a disorder of mental and thought processes involved in the comprehension of language usage, verbal and non-verbal that can present in the inaccurate and effortful capability to speak, read, write, spell and do mathematics (International Joint Committee on Learning Disabilities, 2001). Furthermore, it is the lack of success in fulfilling the academic requirements for an age-appropriate grade in the areas of oral and written expression, listening and reading comprehension, basic reading skills, and fluency of reading and lastly doing mathematic calculations and problem solving, notwithstanding that opportunities to learn and remediate on age-level was provided (Tannock, 2012)..

2.4.3 The diagnosis of specific leaning disability

The Diagnostic and Statistical Manual of Mental Disorders- V, (DSM-V) (American Psychiatric Association, 2013) uses the term specific learning disorders. The terms specific learning disability and specific learning disorder are often used interchangeably.

In the DSM-V, the diagnostic criteria for specific learning disabilities are set out and four diagnostic criteria are given.

A. Finding learning and utilising academic skills challenging as determined by the existence of at least one of the following symptoms that have lingered for at least 6 months, regardless of the interventions provided to address those difficulties:

1. Word reading is inaccurate, slow and effortful.
2. Difficulty comprehending the meaning of what is read.
3. Struggles with spelling.
4. Written expression is found difficult.
5. The ability to master number sense, number facts, or calculation is challenging.
6. Difficulties with mathematical reasoning.

B. The academic skills affected are considerably and quantifiably below what is anticipated for the child's chronological age and can critically interfere with academic and occupational performance as well as with activities of daily living. This is substantiated by the administration of individual standardised assessments and a complete clinical assessment.

C. The learning challenges start during school age years, however it may not fully be revealed until the demands for academic skills affected surpass the child's limited academic loads abilities.

D. A key diagnostic feature is that the learning difficulties are regarded "specific," for four reasons. First the learning difficulties is not as a result of intellectual disabilities, global developmental delay, undetected and uncorrected visual or auditory acuity, other mental, neurological or motor disorders. (American Psychiatric Association, 2013).

A diagnosis is made by thoroughly reviewing a learner's developmental, medical, educational and family history as well as conducting individual standardised tests. The teacher also plays an important role in this review by presenting classroom observations, scores on tests and reaction to academic remediation. (American Psychiatric Association, 2013).

From a South African education perceptive, emphasis has largely been on inclusive education. The Education White paper six (EWP-6) *special needs education, building an inclusive education and training system* (South African Department Eduction, 2001) was initiated in 2001, as a policy providing guidelines in the carrying out of inclusive education practices (Nel & Grosser, 2016). Previously, a medical model was put into effect requiring diagnosis and treatment (Department of Basic Education, 2014) (Nel, M., 2013). Currently a

multidisciplinary perceptive with regards to the diagnosis of a specific learning disability within a social–ecological model is fostered. The social-ecological model encourages the schooling of learners together and the implementation of teaching to allow for individual differences. Various stakeholders which include health care professionals, teachers, parents and even learners should collaborate in contributing valuable knowledge and skills and work towards giving the most suitable support for a learner facing barriers (Department of Basic Education, 2014) (Nel, et al., 2014). The Screening, Identification, Assessment and Support (SIAS) policy document (Department of Basic Education, 2008) for learners who are facing barriers to learning was developed and implemented in 2008. The purpose of this policy was to serve as a guideline providing procedures and processes to follow with learners who most likely have a learning barrier. In 2014, the aforementioned document was revised, specifying more comprehensible guidelines (Department of Basic Education, 2014) (Nel & Grosser, 2016).

The SIAS policy document (Department of Basic Education, 2014) gives a general description of the process towards the assessment of the degree of support needed in schools and in the classroom to ensure the maximal engagement of learners in the learning process. The policy document sets out a protocol according to a set of forms that needs to be adhered to when a learner who encounters barriers to learning has been identified to facilitate a suitable decision making process with regards to the most appropriate support. The key aspect of this document is the importance of teamwork between all stakeholders (such as teachers, health professions, the school based support team, parents etc.) right through the identification, assessment and support process.

As stated in the SIAS policy document, (Department of Basic Education, 2014) assessment involves a multifaceted approach and necessitates that an assortment of assessments which includes diagnostic and curriculum-based tests, rendering different viewpoints be used. The DSM-V necessitates clinical assessment by means of standardised tests for the diagnosis of a learning disability; however the SAIS policy document states that the standardised tests need to be part of a variety procedures which includes observations and interviews utilised in the

assessment procedure (Department of Basic Education, 2014) (Nel & Grosser, 2016) (American Psychiatric Association, 2013).

The policy, indicates that standardised tests can be used in the assessment process, however these should not be culturally biased (Department of Basic Education, 2014). It is therefore essential that therapists use standardised tests with well-founded psychometric properties (validity, reliability, sensitivity to change and clinical usefulness– cost and time efficient tests) (Asher, 1996; Chu & Hong, 1997; Law, et al., 2001).

2.5 STANDARDISED TESTS IN PAEDIATRIC PRACTICE:

A standardised test has unvarying procedures for administration and scoring (Urbina, 2004). That means that the same guidelines, components and methods must be utilised by examiners each time they conduct the test and scoring needs to be conducted according to the criteria specified in the test booklet (Richardson, 2010). Standardised tests have certain features; namely, the inclusion of a test booklet, a set number of items and lastly, standardised tests have a protocol for administration and a guideline for scoring which is set (Richardson, 2010).

2.5.1 Types of standardised tests

Norm-referenced tests and criterion referenced tests are two kind of primary standardised tests often utilised. (Richardson, 2010).

A criterion-referenced test is devised to supply information on how children achieve on specific tasks instead of comparing their achievement with that of his or her age group. These tests also deduce which skills a child can and cannot achieve (Richardson, 2010).

In this study norm-referenced tests were utilised. The intent of a norm-referenced test is to ascertain how a child achieves in correlation to the average achievement of the normative sample, therefore allowing peers to be compared to peers. It allows clinicians to choose and analyse suitable standardised assessment tools corresponding to the child's age, functionality and the reason for assessment. (Richardson, 2010).

On most norm-referenced assessment tools, the order of achievement follows the normal Gaussian curve which is representative of various human features, for example weight, height, intellect, etc. There are two kinds of descriptive statistics; namely, the measure of central tendency and the measure of variability. The centre point of the distribution for a specific group is indicated by the measure of central tendency. The mean is the central measure of tendency most often utilised and is the sum of all scores for a specific group divided by the sum of scores. The median is a further measure of central tendency, which is the middle score of a distribution. The measure of variability decides how much the achievement of an entire group deviates for the mean. It is utilised to calculate the standard scores made use of in standardised assessment tools and is also derived from the normal Gaussian curve. The average of the squared deviations of the scores forms the mean and is known as the variance. Therefore, it is a measure of how much a score of an average person in a sample deviates from the group mean. The standard deviation (SD) is the square root of the variance (Richardson, 2010).

Norm-referenced standardised tests have a standardised procedure for administration and scoring and can be scored in various ways. Methods for scoring include z scores of the number of SD below the mean, Standard Scores (calculated by deducting the mean obtained in the test from a person's score and dividing it by the SD), Scaled Scores (in a distribution with a mean of 10 with a SD of 3), t scores (in a distribution with a mean is 50 with a SD of 10), percentiles (the percentage of individuals in the standardisation sample whose score is at or below a particular raw score is known as a percentile score) and age-equivalent scores (the age equivalent score is the age at which the raw score is at the 50^{th} percentile) are also all used and reported. Lastly developmental index scores may also be used in standardised tests (Richardson, 2010).

It is therefore the property of standardisation that makes norm-referenced standardised tools useful. Furthermore, utilising standardised tests in clinical practice provides necessary outcome measures that are deemed an essential component in the therapeutic process assisting occupational therapists in the identifying of problem areas, recording of a child's progress in therapy, assisting with preparing programs for intervention and the prioritising of therapy aims and

lastly to aid with obtaining data for research purposes. Furthermore, outcome measures are also crucial for evidence-based practice as this is important to substantiate the proficiency of occupational services (Unsworth, 2000; Richardson, 2010).

Standardised tests should not be the only tests used in the assessment process. There are other crucial parts of the assessment procedure; namely, making use of clinical judgement, formal and informal observation, interviews with caregivers, and obtaining data from other sources. An assessment session only provides the therapist with a "glimpse" of how a child behaves and what their abilities are. It also needs to be taken into consideration that certain factors such as illness, fatigue, anxiety as well as the unfamiliarity with the therapist, area and assessment materials can hamper a child's performance. Standardised tests have fixed testing procedures. Therefore standardised tests clearly and definitely identify the specific ways of administering test items. This can be of a disadvantage to a child who has difficulty understanding verbal instructions or have insufficient motor control (Richardson, 2010).

5.3.2 Validity and Reliability

Standardised tests need to have two important measurement properties; namely, validity and reliability. Therapists rely on these two measurement properties for significant indicators of test accuracy, consistency and precision (Salvia, et al., 2007).

5.3.2.1 Validity

Validity is the extent to which an assessment battery accurately measures what it purposes to measure (Urbina, 2004) (Kielhofner & Fossey, 2006). The purpose for validating a test is to give information that indicates whether suitable and meaningful conclusions can be made from a test (Messick, 1989). A standardised test can demonstrate various types of validity including face, content, criterion-related, construct, concurrent, predictive and discriminative validity (Kielhofner & Fossey, 2006). The two types of validity that is the focus of this study are discriminative and concurrent validity.

Discriminative validity is inherent to the process of construct validity which is the extent to which a test measures an exact theoretic framework (Richardson, 2010). Discriminative validity is the capability of a standardised test to discriminate with precision between two or more groups that are known to be different. For instance, a test demonstrates discriminative validity if a group of patients attains notably different scores from that of the healthy group (Crowley, et al., 2003). Independent t-tests are utilised to evaluate if there are statistic differences of note between the participants of two groups (Brown, et al., 2011). Therefore as differences between the learners with a specific learning disability and learners without a specific learning disability are anticipated, the discriminative validity of the three tests – DTVP-3, TVPS-3 and Beery VMI-6 can be investigated. The discriminative validity can be quantified by a measure of clinical accuracy such as sensitivity and specificity. The sensitivity of an assessment is the degree to which the assessment determines what children have a visual perceptual deficit, whereas specificity of an assessment is the degree to which the assessment is successful in eliminating those children without a visual perceptual deficits (Domholdt, 2005) (Hammill, et al., 2014).

The second type of validity used in this study is concurrent validity. Concurrent validity is a subtype of criterion related validity. Concurrent validity demonstrates that the results acquired on one standardised assessment tool correlate with the results acquired when utilising another standardised assessment tool constructed to measure the exact or equivalent variable such as visual perception (Kielhofner & Fossey, 2006). In order to establish criterion-related validity, the test score is examined against a criterion, a separate measure of what the test is planned to predict. Concurrent validly reports how well test scores demonstrate current achievement. The correlation coefficient depicts the extent of the relationship between the test and the criterion. Most validity correlation coefficients range from 0.40 to 0.80. A coefficient of 0.70 or above would imply that achievement on one test can anticipate achievement on a second test (Richardson, 2010). In this study the concurrent validity of three visual perceptual tools; the DTVP-3, TVPS-3 and Beery VMI-6 will be analysed though correlation to establish whether these newly developed editions are equal in value in measuring the visual perceptual abilities of children.

5.3.2.2 Reliability

Reliability is the lack of change or stability of scores acquired by one person when evaluated on two separate instances with varying sets of items or under other variable testing circumstances (Urbina, 2004). The three subtypes of reliability most frequently used in paediatric assessments are test-retest reliability, inter-rater reliability and standard error of measurement (SEM). This study will focus on the internal consistency of the constituent items on the TVPS-3, DTVP-3 and Beery VMI-6. Internal consistency measures "the degree of agreement or commonality between items in an assessment that measures a single concept or skill" (Crist, 2010, P191). A Cronbach's alpha coefficient is used to measure the internal consistency. Cronbach's alpha coefficients at or above 0.80 are satisfactory, while those of 0.90 and above are most wanted (Anastasi & Urbina, 2007).

2.5.2.3 Factors influencing the validity and reliability of standardised tests:

All the assessments used by South African occupational therapists are standardised on samples of children from the USA a country of many cultural and environmental differences to South Africa. According to literature there appears to be a link between how cultural differences influence visual perception. Assessment tools developed in one cultural setting can vary from other cross-cultural contexts and can affect a child's achievement. Therefore it is essential to be certain that assessment tools administered are suitable for a specific cultural group (Cheung, et al., 2005). Furthermore, the development of children from different cultural backgrounds might take place at a different rate; therefore the development of a child can be misunderstood by applying norms from one culture to another (Schneider, et al., 1995).

Although South Africa is described as a middle income state, there are moderate to severe socio-economic differences (Zere & McIntyre, 2003). Children growing up in impoverished settings are more vulnerable to various stressors from their environment putting them at a higher risk for developing delays and failing at school (Goodway & Branta, 2010) (Robinson & Goodway, 2009) Furthermore, children from impoverished settings have poor access to learning resources and often come from homes where stimulation is limited. This appears to be detrimental to the development of perceptual-motor skills (Huston, 1994). South

Africa has 11 official languages. The reliability of a test can be influenced by the translation of instructions. This is especially of concern in a country such as South Africa that is multilingual (Koch, et al., 2015). The collaboration between socio-economic inequalities and multiple languages also appear to influence a child's scholastic achievement especially in literacy (Völkel, et al., 2016).

From the literature reviewed on the assessment tools most utilised by South African paediatric occupational therapists to assess visual perception and visual-motor integration dysfunction in children, it was found that data collected from South African children differed from that of children from the USA. This is substantiated in a study conducted by Dunn et al in 2006 where noteworthy ethnic differences on visual-motor integration achievement in a South African preschool sample were identified (Dunn, et al., 2006). In a different study, results obtained by South African children on the Beery VMI-4 tend to differ from the normative data established on children in the USA. Furthermore research conducted by Rens in 2008 on the Beery VMI-4 and Beery VMI-5 found that South African children performed better than the USA participants on the supplemental test for motor co-ordination (STMC). According to the researcher this result needs to be interpreted with care as the small sample size could have resulted in a false negative where children with problems could have been missed (Rens, 2008).

2.5.3 Standardised tests of visual perception and visual-motor integration:

Theoretically five visual perceptual constructs have been described, namely: spatial relations, visual discrimination, figure-ground, visual closure and visual memory (Colarusso & Hammilll, 2003; Martin, 2006). Various writers have also identified a sixth construct, form constancy. The aforementioned first five skills, comprise of the capability to orient the body in space and discern the relative position of objects (spatial relations), to distinguish the characteristics of different items such as colour and shape (visual discrimination), to differentiate objects in the foreground from the background (figure-ground), recognise the entire shape when only segments of the object is presented (visual closure) and lastly identify an object following a short interim (visual memory). Form constancy is a visual perceptual skill that involves the capability to identify the main features of forms

even though the forms may be darker, lighter, larger, smaller, rotated, shaded or textured (Chalfant & Scheffelin, 1969; Gardner, 1996; Unsworth, 1999).

In the design of visual perceptual tests the constructs obtained from factor analysis can be utilised as the foundation for evolving subtests, however it should not accepted that the results from subtests carefully measure the construct (Hammill, et al., 2014).

Although separate visual perceptual abilities may be identified from a theoretical point of view, visual perceptual abilities do not seem to be unrelated of one another. Investigators have identified visual functioning, visual perception and visual-motor integration capabilities as essential benefactors to an effective visual-perceptual system (Scheiman, 2007). Many everyday activities require the concurrent use of various visual perceptual actions (Martin, 2006). The first DTVP was criticised for stating that visual perceptual skills were unrelated of each other and that the subtests measured separate abilities. However, various factor analysis studies conducted did not support this notion (Boyd, et al., 1970) (Olson, 1968). Various researchers, especially the work of Frostig et al.(1961), has demonstrated a connection between the scores of the different visual perceptual subtests emphasising that various visual perceptual constructs are interdependent on one another (Frostig, et al., 1961). Since subtests are so highly intercorrelated it should be acknowledged that one subtest may not just measure one perceptual capability with discretion. For instance; with a subtest that is intended to measure figure-ground capability; a person is guided to find figures hidden within a background of distracting shapes, however in order to do so, the person must also rely on other visual perceptual capabilities such as visual discrimination, spatial relationship and form constancy. Therefore it could be claimed that visual discrimination is the elementary capability that underpins all of the different types of visual perceptual activities (Parush, et al., 1998). The authors of the DTVP-2 therefore come up with separate composite scores for motor-reduced visual perception and visual-motor integration on the DTVP-2 in an attempt to refrain from constructing subtests measuring separate visual perceptual capacities. Hence, the designers of the DTVP-3 suggested the utilisation of the composite scores when a child’s visual-perceptual skills are explained (Hammill, et al., 2014).

There are various standardised tests which are at the disposal of occupational therapists to evaluate children's visual perceptual and visual-motor integration skills (Schneck, 2010). This is routinely undertaken using standardised tests such as the DTVP-2, Beery VMI-4 and TVPS-R which are available in South Africa. Various changes have been made to the new editions of the tests which will be reviewed below.

2.5.3.1 The Developmental Test of Visual Perception (DTVP)

The first edition Developmental Test of Visual Perception was developed in 1961 by Frostig, Lefever and Whittlesey (Frostig, et al., 1961). It comprised of five subscales namely; eye-hand coordination, figure ground, form constancy, position in space and spatial relationships. This test battery was standardised and normed on 2100 children with normal development from the USA. The minority of the children were from middle class backgrounds and their ages ranged from three to nine years (Frostig, et al., 1966). Various research studies revealed that the DTVP had serious flaws. Overall the test lacked sound psychometric properties (Salvia, et al., 2007; Luftig, 1989; Goh & Swerdlik, 1985).

The Developmental Test of Visual Perception- Second Edition (DTVP-2) is the 1993 revised version of Frostig's Developmental Test of Visual Perception (Frostig, et al., 1961). Notable changes were made to the DTVP-2 amongst other things the improvement of the test battery's psychometric properties (reliability and validity); the introduction of two new composite scores and the age span for which the DTVP-2 was suitable for was expanded to include 10 year olds. A sample of children between the ages of four and ten years representative of the USA was used in the norming process of the test battery. Most importantly, the subscales of the DTVP-2 measured interconnected features of visual perceptual abilities. Furthermore, the DTVP-2 was comprised of eight subscales namely; eye-hand coordination, position in space, copying, figure-ground, spatial relations, visual closure, visual-motor speed and form constancy (Hammill, et al., 1993). Overall the DTVP-2 received a lot of commending appraisals. The test-booklet of the DTVP-2 described the specifics of good internal reliability, inter-rater reliability, content validity, convergent validity and construct validity (Pierangelo & Giuliani, 2006; Salvia, et al., 2007)

The DTVP-2 also had its flaws and in a critique by Bologna and Tindal (1995) they suggested that the clinical demand of the DTVP-2 might be limited as its results do not strongly correlate with academic achievement and therefore contribute minimally to diagnosing specific learning disabilities. (Bologna, 1995; Tindal, 1995). Literature also indicated that the DTVP-2 has no significant relationship to handwriting ability and therefore the DTVP-2 is not the most effective assessment to be used for handwriting referrals (Yost & Lesiak, 2010).

The DTVP-2 was found to be biased in regards to different cultures and ethnicity. According to research conducted by Feder et al (2000) and Rodger et al (2005) the DTVP-2 seems to be used more frequently for the measurement of visual perceptual skills in South Africa than in Canada or Australia (Feder, et al., 2000; Rodger, et al., 2005). This is of concern as research using the DTVP-2 on a South African sample, showed that the DTVP-2 is not a valid tool for measuring visual closure abilities (van Romburgh, 2006; Visser, et al., 2012). In a study conducted by Cheung et al in 2005, it was established that the results gained from the research did offer a prefatory picture of how children in Hong Kong perform on visual perception. Results further indicated that the performance of children from Hong Kong differed from that of the American population on which the test was standardised as ceiling effects were reached on various subtests. (Cheung, et al., 2005). Similarly, Lai et al (2012) found in their study of the DTVP-2 with Chinese children that the findings did not totally conform to the American norms as these children achieved higher scores on the visual-motor integration items as compared to the motor-reduced items (Lai & Leung, 2012). Thai children in the age bands four to five years and eight to 11 years received higher scores on the visual-motor speed subtest of the DTVP-2 as compared to that of children from the USA (Guntayuong, et al., 2013). In research conducted by Brown and Hockey in 2013 with primary school children aged six to 12 years in Australia it was established that the DTVP-2 had Cronbach's alpha coefficients less than 0.80 for the figure-ground, spatial relations and visual-motor speed subscales, therefore, demonstrating moderate levels of internal consistency for the DTVP-2. Brown and Hockey therefore state that it is a suitable assessment for its intended use, however they do recommend that more research is required (Brown & Hockey, 2013).

Furthermore, the four motor-free subscales of the DTVP-2 were found to be unsuccessful in coming together to measure a one-dimensional construct which is a weakness associated with the DTVP-2's construct validity. The four motor free DTVP-2 scales can be utilised by clinicians to gain a general study of an individual's visual-perceptual abilities, however there is cautioned around the action of attributing meaning to scale scores. (Brown, et al., 2008).

After an approximate period of 10 years, the DTVP-2 was revised making use of various reviews, comments and queries from professions as well as the author's own ideas. What came forth from this was the new edition, the Developmental Test of Visual Perception – Third Edition (DTVP-3).

The DTVP-3 is the current 2014 revised version of 1961 & 1966 editions of the Developmental Test of Visual Perception by Frosting et al (Frostig, et al., 1961; Frostig, et al., 1966). The DTVP-3 has the same purpose as the earlier editions – it measures visual perception and visual-motor integration abilities. The third edition has advanced this test battery. The most significant changes made in the third edition, as compared to that of the second edition, are that in 2010 and 2011 new normative data were gathered which is stratified by age. In the DTVP-3 the composite score difficulty have been standardised to ensure no floor and ceilings. This means that no child will score on 0 or 100 percentile. (Hammill, et al., 2014).

A detailed investigation and analysis of the item bias has been elaborated on. Position in space (PS), spatial relations (SR) and visual-motor speed (VMS) are three subtests that were removed from the test. The first two items mentioned were removed from the test as the writers become aware of certain flaws (for example, for the children aged 8 to 10 years old there were too little challenging items and this generated ceiling effects for these ages). The writers also become mindful of the way in which the subtests were set out as this was not suitable with the 11 and 12 year olds included in the DTVP-3.

Initially, a reviewed edition of the VMS subtest was incorporated in the compilation of the DTVP-3 normative data. However, after data collection and the analysing thereof, the VMS subtest was found to inadequately correspond with the other visual-motor integration subtests. The factor analysis of the DTVP-3 subtests

demonstrated that the VMS subtest was not compatible with the theoretical model upon which the test was based. The age span for which the DTVP-3 is suitable has been expanded to incorporate children who are 12 years of age. Lastly a great attempt was made to demonstrate that the DTVP-3 is both reliable and valid. This was done by the use of more studies with greater number of participants than were used in the second edition. The attempt also included a confirmatory factor analysis and binary classification analyses relating to sensitivity, specificity, false positives and receiver operating characteristic / area under the curve (ROC/AUC) (Hammill, et al., 2014).

The DTVP-3 consists of five sub-tests: two of which are motor-enhanced (eye-hand co-ordination and copying) and three which are motor-reduced (figure-ground perception, form constancy and visual closure). All five subtests combined form the general visual perception composite score. The DTVP-3 is standardised to be used with children aged four to twelve years. The test battery was normed using a sample of 1,035 American children. The content sampling error was measured making use of the Cronbach's alpha method. The coefficient alpha for the composites were found to be all over .90 indicating excellent reliability. For the approximation of the time-sampling error of the test, the test-retest method was used. The subtests correlation coefficients were found to range from .70 to .85 and those for the composite indexes ranged from .87 to.90. The DTVP-3 was therefore found to have acceptable test-retest reliability as displayed in the greatness of the coefficients. The inter-scorer reliability of the DTVP-3 was supported by coefficients that all exceeded .90. For the content-description validity three demonstrations are offered for the DTVP-3 subtests: selection of content and formats for the subtests, conventional item analysis and differential analysis. The test battery was also found to be non-discriminatory towards gender, race, ethnicity and handedness. The criterion-prediction validity is confirmed by the size of the coefficients. The DTVP-3 was also found to have adequate construct-identification validity. Each subscale of the test yields raw scores. These raw scores can be changed into age equivalents, percentile ranks and scaled scores (Hammill, et al., 2014).

Current research on the DTVP-3 in clinical practice includes a study conducted by Brown in 2016 with 39 normally developing Australian children aged six to eight years. The findings of this study indicated that the DTVP-3 showed adequate levels of internal consistency as well as moderate levels of convergent validity with that of the Beery VMI-6 (Brown, 2016).

2.5.3.2 Test of Visual-Perceptual Skills (TVPS)

Another norm-referenced test broadly utilised by occupational therapists to assess young children attending school (Schneck, 2010) is the test of Visual-Perceptual skills-Revised (TVPS-R). It is the 1996 edition, which was originally authored by Gardner. It was developed to evaluate children's visual perceptual strengths and weaknesses from the ages of four years to 12 years, 11 months (Gardner, 1996) In a research study conducted by Brown et al in 2003 giving an overview and critiquing the TVPS-R it was found that in the manual minimal data on the reliability and validity of the test had been described. Concerns were raised around the content reliability and the unreported time sample coefficients. The minimum was described in the manual on the construct validity data and the sample on which normative data is standardised, was represented by a narrow geographical area. Various judges assert that the writer of the manual described minimal investigations to substantiate the criterion validly of the TVPS-R. The judges also remarked that the only estimation of reliability described was that of the internal consistency. Further, it was added that the Cronbach's alpha coefficients proved only to be sufficient within the younger age (Brown, et al., 2003). From research it is suggested that the most important consequence for occupational therapists using the TVPS-R in practice is that the TVPS-R's perceptual quotient cannot be used as a general summary of performance score of motor-free perceptual capabilities but alternatively the individual subscale scores can be utilised. Results from the study indicate that therapists can use five of the TVPS-R subscales with assurance: visual discrimination, visual spatial relations, visual sequential memory, visual figure-ground and visual closure (Brown & Gaboury, 2006).

Similar results were obtained in a study evaluating the validity of the TVPS-R by using the Rasch Measurement Model. Results indicated that the seven TVPS-R scales can be utilised on a separate basis with children to obtain results on the

achievement of their motor-free perceptual skills, however the scales cannot be combined together to calculate a general summary motor-free perceptual score or perceptual quotient. The seven separate scales of the TVPS-R were found to have supported construct validity; however, the TVPS-R's composite scale displayed inadequate construct validity (Brown & Rodger, 2009).

Research conducted with children from a South African sample, attending a remedial school in KwaZulu-Natal found the DTVP-2 and TVPS-R to be of equivalent worth when evaluating visual-perceptual dysfunction in learners. However when certain subtests of these assessments were considered, there appeared to be differences in the outcomes of the two assessments (Richmond & Holland, 2011). In examining the reliability and validly of the TVPS-R for Chinese pre-schoolers the study concluded that when based on the total scores, the TVPS-R was reliable and valid. However, there is cautioned on utilising the subscale and item scores for making decisions or goal setting for treatment. (Chan & Chow, 2005). Various reviewers and researches indicated the necessity for further research to address areas of concerns that were found to be problematic which brought about the revision and updating of the TVPS-R.

The Test of Visual-Perceptual skills- Third Edition (TVPS-3) was developed from the combination of the TVPS-R and the TVPS-upper level revised (Gardner, 1996). This is the most resent revised visual perceptual test which was originally authored by Gardner. The purpose of the TVPS-3 is to evaluate visual perceptual skills without the need for involving motor actions when making a response. In the TVPS-3 the fundamental motive, multiple-choice layout and individual administration have been kept, however one do become aware of some structural differences as compared to that of the earlier editions.

The change most noticeable in the TVPS-3 is that it makes one test available for use with ages four through to 18 years. Secondly, in the introductory chapter of the manual the literature review of visual processing has been brought up to date. The aspects of the subtest structure are a further obvious difference. The TVPS-3 selected a few items from each of the levels of the earlier editions and incorporated the items for subtests of a consistent length of 16 items. In the earlier editions the lower level made use of 16 items, while the upper level only made use

of 12 items per subtest. In the previous editions, only one example item was included, however the TVPS-3 has two example items for each subtest. No basal levels have been specified and after three consecutive incorrect answers the subtest ceilings are attained. The TVPS-3 can still be administered in a 30 minutes period. The scoring structure is a further difference of the TVPS-3. Subtests still provide raw and scaled scores, including a general score based on the sum of scaled sores. Formerly, only the lower level yielded an overall score. A non-obligatory scoring comprising of three composite scores namely; basic processes, sequential processing and complex processes is made available based on factor analysis. This will permit the examiner to assess related skills in a relevant way (Martin, 2006).

In the TVPS-3 there is made use of 112 black and white drawings. The TVPS-3 is separated into seven subtests namely: visual discrimination, visual memory, spatial relationships, form constancy, sequential memory, figure-ground perception and visual closure. Each of the seven subtests starts with two example items. This is then followed by 16 items which are arranged from undemanding to difficult. The test was administered to 2,008 students in the 38 states of the USA. The TVPS-3 was found to be a reliable assessment as it provides a constant measure which is basically free of error. It has content which has a high level of uniformity and it provides a constant measurement from one testing to the next. The inter-rater reliability is good. A high level of reliability was noted across all ages for which the test is purposed to measure. The TVPS-3 therefore has a high level of confidence in the test results. Each subscale of the TVPS-3 yields a raw-score. The raw scores can be converted to scaled scores, percentile ranks and age-equivalents while the overall performance score is reported as a standard score and percentile rank (Martin, 2006).

There are studies available examining the use of the TVPS-3 in clinical practice. In research conducted by Brown and Hockey in 2013 similar results were obtained to Martin's study, supporting the TVPS-3 reliability properties (Brown & Hockey, 2013). In a study examining the external validity of the visual memory subtest of the TVPS-3, results concluded that the correlation between the visual memory

subtest and an associated task requiring visual memory was found to be low to average (Cote, 2011).

2.5.3.3 The Developmental Test of Visual-Motor Integration (VMI)

The Developmental Test of Visual-Motor Integration (VMI) (Beery & Beery, 2004) is a norm referenced test and one of the standardised tests most broadly made use of by occupational therapists to assess visual-motor integration skills (Burtner, et al., 2002). The Developmental Test of Visual-Motor Integration – Fourth Edition (VMI-4) was reported as being commonly used by South African occupational therapists in 2011 and this use is consistent with that in Australia and Canada (van der Merwe, et al., 2011; Rodger, et al., 2005; Feder, et al., 2000).

The Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) is the current version available for use by clinicians. It is the 2010 revised version of the first 1967 VMI edition. The function of the Beery VMI is to evaluate the integration of visual perception with that of a motor action. The six edition of the VMI persists with the centre of interest upon early childhood education. It comprises of standardised norms for two year-olds, gives 600 developmental *stepping stones* norms for birth through to the age of six years and gives *teaching methods* on visual-motor for birth to elementary school. The sixth edition also supplies recent studies of medical, neuropsychological, international and other significant advances in the use of the Beery VMI in the latest years. A new part on occupational therapy research and practice has been included in the manual. The Beery VMI-6 was re-normed in late 2009, early 2010 on children acquired from the four major consensus regions of the USA (Beery & Beery, 2010).

The Beery VMI-6 test consists of a series of geometric shapes that needs to be copied on paper using a pencil. The Beery VMI-6 has two additional tests namely: Visual Perception and Motor Coordination. Research on the Beery VMI-6 indicated that is culture-free. The test is a standardised assessment battery that can be used with ages two to 100 years. For the evaluation of the content sampling there was made use of the Rasch-Wright analysis. The internal consistency was measured using the Spearman-Brown corrected results and coefficient alpha. The reliability coefficients and standard error of measurement for the Beery VMI-6 were found to be more than sufficient for the screening purposes for which they are

intended. The results indicate high content reliability and person reliability. The test appears to have adequate content validity, concurrent validity, construct validity and predictive validity. The coefficients for all validity measure between .80 and .95. The Beery VMI-6 and supplemental subtests yield raw scores. The following can be derived from the raw scores: standard scores, scaled scores, percentiles and age equivalents (Beery & Beery, 2010)

The Rasch Measurement Model was used to examine the construct validity of The Developmental Test of Visual-Motor Integration – Fifth Edition (VMI-5). Most of the VMI-5 scale items appeared to meet all the requirements, which includes the construct validity, scalability, hierarchal ordering and lack of differential function. Therefore it is suggested that the VMI-5 scale can be used in clinical practice. The VMI-5 items are arranged developmentally from a theoretical point of view; however results from the study found that this arrangement did not match the relative differences between the candidate's ability estimates and item difficulties of scores received (Beery & Beery, 2010). In a study conducted by Coallier and Rouleau in 2014 it was found that the visual-integration skills of Canadian pre-schoolers, except for the youngest group, were generally similar to that of the American population (Coallier & Rouleou, 2014).

2.6 SUMMARY:

Visual perception is the complete process for receiving and comprehending visual stimuli (Optometric Extension Program Foundation, 2006). Visual-motor integration (VMI) can be defined as the "degree to which a visual perception and finger-hand movements are well coordinated" (Beery & Beery, 2010, p. 13). Visual perceptual and visual-motor integration dysfunction have been found to hinder a child's ability and independence in areas of occupation such as personal management, education, work, play, leisure and social skills (Sortor & Kulp, 2003; Schneck, 2010; Coallier & Rouleou, 2014). Literature links visual–perceptual dysfunction with specific learning disabilities. Various investigators have proposed that visual-perceptual dysfunctions are typical of learners with a specific learning disability (Gershwind & Galaburda, 1985), however visual-perceptual dysfunctions are a consequence of a learning disability and not the cause (Handler & Fierson, Pediatrics 127.3 (2011): E818–856) (Arky, 2014-2017). In the assessment process

of specific learning disabilities, standardised tests are preferred (Department of Basic Education, 2014) . There are various standardised tests which are at the disposal of occupational therapists to evaluate children's visual perceptual and visual-motor integration skills (Schneck, 2010). The focus of this research study is on the use of the DTVP-3, TVPS-3 and Beery VMI-6 standardised visual perceptual tests in the evaluation of children's visual perceptual and visual-motor integration skills.

In the South African education system it has become a necessity to use assessments tools which are effective, precise and economical. A learner must be looked at in a holistic way in all areas of ability. All hindrances to learning must be identified in a learner, and resolved in an appropriate manner as soon as possible, without interrupting the process of learning (Department of Basic Education, 2014) (Richmond & Holland, 2011). Therefore it is essential for research to be carried out on a South African population to establish how South African children perform on the various standardised visual perceptual tests. This is important to ensure that South African occupational therapists make use of the most appropriate assessments which are valid, reliable and that will produce the best results.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION:

This chapter aims to describe the methods used in undertaking this study. Firstly the research design and the appropriateness for this study will be considered. The sample, the measurement instruments, research procedure as well as the data collection and data analysis methods for this study will be explained. Ethical considerations that were of essence in this study will be elaborated on.

3.2 RESEARCH DESIGN:

A cross-sectional, comparative, quantitative design was utilised in this study. Quantitative designs are concerned with the measurement of data and generalisation of scores from a sample drawn from the population of concern. The emphasis is on quantifying the prevalence of diverse theories and perspectives in a selected sample or the sum total of findings (MacDonald & Headlam, 2009). This design was appropriate for this study as the data collection was structured with the use of three standardised tests of visual perception which provided numerical scores as an indication of performance on the tests.

Quantitative designs have various methods by which data can be collected of which cross-sectional methods are one. Cross sectional designs are utilised to collect data on a group during a certain moment in time (MacDonald & Headlam, 2009). As each of the learners in this study was seen only once at a single point of time to administer the three standardised tests, this design was appropriate to the study. A correlation study is concerned with the quantification of two variables to determine if there is a correlation or an association between them (McLeod, 2008). This design was appropriate to the study as; firstly, the results of the mainstream learners were compared to the norms reported in the test manuals for USA children to determine how a South African sample performed on the tests. Secondly the results on standardised tests for mainstream learners where compared to those of the LSEN learners to determine if the assessments were

able to discriminate between the two groups and lastly the subtests scores on the three standardised tests evaluated in the study were correlated to determine if they measured the same constructs and whether the tests can be used interchangeably.

3.3 SAMPLE:

3.3.1 Study population

The population used in this study was learners from the West Rand area of Gauteng. Foundation phase learners from grade one to four from the ages of six to nine years was used in this study as this is the most favourable period for the development of visual perception even though development does take place up until the age of twelve years (Hanneford, 1995).

3.3.2 Study sample

The study sample consisted of learners attending a LSEN school and learners attending a public mainstream school. The LSEN group was drawn from learners attending a school for learners with special education needs (LSEN) remedial stream catering for learners identified with specific learning disabilities. The mainstream group was drawn from learners attending public mainstream schools.

3.3.3 Study setting

This study took place on the West Rand of Johannesburg in the Gauteng Province. There were four research sites located in an urban middle class setting that were selected using convenience sampling as they were accessible to the researcher and fell within district 12, as determined by the Gauteng Department of Education. A school for learners with special education needs (LSEN) remedial stream in the West Rand area of Gauteng was made use of, for the LSEN group. Secondly, for the mainstream group four public mainstream schools in the West Rand area of Gauteng were used. All four primary schools were fee paying government schools with Afrikaans and English as instruction medium. An aftercare facility was also utilised. The learners attending the aftercare facility were from fee paying mainstream public schools in the surrounding area instructing learners in both English and Afrikaans.

3.3.4 Sample selection

For the purpose of this study, stratified selection of learners form the LSEN school and mainstream schools was used to ensure an equal distribution of learners across the range of ages, from six to nine years. Once parents had given consent, learners were included in the four age groups, six years to six years 11 months, seven years to seven years 11 months, eight years to eight years 11 months and nine years to nine years 11 months. In the case were more learners were available than the number required for a specific age group, the number required to form the cohort for the age group was randomly selected from all the learners whose parents had given consent.

Inclusion criteria:

Learners attending a LSEN school - Group A:
Learners needed to:

- Be identified with a specific learning disability confirmed for admission to the LSEN school.
- Have an intellectual quotient within the normal range confirmed for admission to the LSEN school on West Rand.

Learners attending a mainstream school Group B:
Learners needed to:

- Be attending an Afrikaans or English mainstream school.
- Have no history of a known neurological, developmental or specific learning disability. This information was verified on the demographic questionnaire.
- Not be receiving or have received occupational therapy. This information was verified on the demographic questionnaire.

3.3.5 Sample size

A sample size of 45 learners per group was required based on a difference of ten in the raw score between the two groups on the Beery-Buktenica: Developmental Test of Visual-Motor Integration (VMI) and supplemental tests based on a standard deviation of 15, at the power of 90% and the determination of a significant difference set at ≤0, 05 (Beery & Beery, 2010).

According to the age bands and using stratified sampling, 12 learners needed to be assessed in each age group from six to nine years at both the LSEN and mainstream schools. Twelve learners were assessed; except in the age range of six years, 11 months of the LSEN group where only eight learners were assessed as no other learner's parents gave consent. Therefore 44 learners from the ages of six to nine years from a LSEN school were assessed and 48 learners were assessed in the mainstream group based on stratified sampling by age.

3.4 MEASUREMENT INSTRUMENTS:

3.4.1 Demographic Questionnaire

A demographic questionnaire (Appendix A1) was designed by the researcher. It was used to obtain personal information, medical and scholastic history of the learners. The questionnaire had to be completed by the learner's parent or guardian. This information was necessary to ensure that the participants complied with the inclusion criteria. Parents/guardians were asked to provide contact details so that feedback could be provided on the results of the assessments for the learners.

3.4.2 Developmental Test of Visual Perception – Third Edition (DTVP-3)

The DTVP-3 (Appendix A2) measures visual perception and visual-motor integration abilities. This test battery consists of five sub-tests: two of which are motor-enhanced (eye-hand coordination and copying) and three which are motor-reduced (figure-ground perception, form constancy and visual closure). Test administration time is between 20 to 40 minutes (Hammill, et al., 2014).

3.4.2.1 Scoring

The DTVP-3 has no set basal. All items on the eye-hand coordination subtest are administered. On the copying, figure-ground perception, form constancy and visual closure subtests, testing continue until the ceiling is achieved which is after three consecutive items in which the child scores a zero (Hammill, et al., 2014).

Each item on the eye-hand coordination subtest is divided into individual one-inch segments which are numbered. For items one and two, one point is given for every segment in which the participant's line has not gone over the boundary of

the segment and the continuousness of the line has not been broken. When a white space is visible between to the bounty line and pencil line, the line is considered as having gone over the boundary. The continuousness of the line is considered broken when the participant lifts the pencil and then continues with the line at a different point other than that of the precise position where the pencil was lifted. If the line goes beyond the boundary of the segment or if the continuousness of the line is broken, zero points are given for that segment. The grey path in items three, four and five is much narrower as compared to items one and two as extra lines have been placed on both sides of the path. These extra lines make up intervals which is utilised for scoring. Four points are given if the participants' line remains in the grey path and the line remains unbroken. For each line in a segment that diverges from the grey path into the neighbouring interval, either above or below the middle, marks are subtracted. When a white space can be seen between the pencil and track line, it is judged to be within the neighbouring interval. For every item, the score achieved for each of the segments by the participant is recorded in the boxes given on the record form. To calculate the raw score for this subtest, all the segment scores are added for each of the numbered items and the score is written in the allocated space on the record form (Hammill, et al., 2014).

On the copying subtest, a drawing can receive zero, one, two or three marks. Scoring guidelines and a transparent copying subtest scoring template are available to help with scoring. For a drawing to score three points it needs to meet the following criteria: the section demonstrating straight lines must be nearly straight; the same length lines sections should measure within one sixteenth of an inch of each other; sections of round figures should be a smooth arc; lines must not fail to meet or extend past a meeting point by more than one sixteenth of an inch and lastly, the angles should be within two degrees of the matching angle provided on the transparency. Two marks are rewarded for a drawing that is a good imitation however does not meet all five criteria to be rewarded three marks. Furthermore any add-ons, overstrikes or drawings that go beyond or touch the sides of the box will also cause an otherwise three point drawing to lose a point. One point is awarded if the child has a general idea of the drawing; however the drawing is not up to standard. The score for each item is written in the boxes given

on the record booklet. The copying raw score is the summation of all the scores from item one through to the ceiling or the final item if there is no ceiling (Hammill, et al., 2014).

On the figure-ground and form constancy subtests, the answers are written on the record booklet. A slash is put through the letter/letters corresponding to that which the participant has chosen for each item. The shapes may be randomly chosen. If a shape is chosen that is not in the stimulus figure or if no choice is made, zero points are awarded. The participant is given one mark for each shape correctly recognised. More than one point can be given per item. The raw score is the summation of all shapes correctly chosen; from item one through to the ceiling or to the final item if there is no ceiling (Hammill, et al., 2014).

The visual closure subtest has one correct answer for each of the items. The participant is given one mark for every right response and zero for every wrong response. The raw score is the summation of the items that scored one from item one to the ceiling or the final item if there is no ceiling (Hammill, et al., 2014).

All five subtests combined form the general visual perception composite score. The DTVP-3 has three composites namely; visual-motor integration, motor-reduced visual perception and general visual perception. These three composites are reported as standard scores with a mean of 100 and a standard deviation of 15. The indexes for the aforementioned composites are the most valuable and dependable scores to be used for the DTVP-3. Each subscale of the test yields raw scores. These raw scores can be converted into age equivalents, percentile ranks, scaled scores and composite indexes. Age equivalents are scores obtained from computing the mean score for a normative group over a six month period. Scale scores give an indication of a child's achievement on a subtest. It is based on a normal distribution with a mean of ten and a standard deviation of three. If utilised sensibly, analysis of subtest achievement will generate some information about a child's strengthens and weaknesses. However it is cautioned that assessors should not put too much confidence on the clarification of subtest results. Lastly percentile ranks are used to signify the percentage of distribution which is equivalent or below a certain score (Hammill, et al., 2014).

3.4.2.2 Reliability

To demonstrate reliability, the writers of the DTVP-3 assessed the standard error of measurement (SEM), the Cronbach's alpha and test-retest as well as the inter-scorer reliability. A relative small SEM was described utilising the total normative sample of 1053 children for all the subscales and composite scores. This showed that the acquired scores for a single person were an allocation of the real score, therefore substantiating the proof of reliability for the DTVP-3. The coefficient's alpha for the composites were found to be all over .90 indicating excellent reliability. For the approximation of the time-sampling error of the test, the test-retest method was used. The subtests' correlation coefficients were found to range from .70 to .85 and those for the composite indexes ranged from .87 to.90. The DTVP-3 was therefore found to have acceptable test-retest reliability. The inter-scorer reliability of the DTVP-3 was supported by coefficients that all exceeded .90 (Hammill, et al., 2014).

3.4.2.3 Validity

The developers demonstrated proof of validity for the DTVP-3 by utilising the content-description procedures, criterion procedures and construct identification procedures. For the content-description validity, three demonstrations are offered for the DTVP-3 subtests: selection of content and formats for the subtests and conventional item. The authors reported that the outset and content of the DTVP-3 is unchanging and substantiated by 12 recent test batteries that also evaluates visual perceptual abilities. Satisfactory discriminative power and adequate levels of average toughness were found in items of the subscales for every age group. This was not found to be true for the eye-hand coordination subtest as the children completed this subtest with very little effort. Lastly the authors made use of Differential Item Functioning (DIF) to determine if the subscale items were prejudiced towards certain groups. The test battery displayed insignificant group prejudice toward the children who took part in the study subject to their gender, race, ethnicity and handedness (Hammill, et al., 2014).

The criterion-prediction procedure quantified the concurrent and the discriminant validity. Concurrent validity is utilised to assess the correlation between a current evaluation and the bench-mark assessment that quantifies a similar construct

(Anastasi & Urbina, 2007). A strong correlation was found between the visual-motor integration composite index of the DTVP-3 and the VMI-5. Furthermore, the motor-reduced visual perception composite was also found to strongly correlate with the total composite score of the TVPS-3 (Martin, 2006). The aforementioned thus serves as proof for the current validity of the DTVP-3. The DTVP-3 was also found to have adequate construct-identification validity. The discriminative validity assesses the capacity of a test battery to discriminate those with special features from those without for the purpose of demonstrating the efficiency of an assessment in anticipating a person's achievement in clearly identified tasks (Anastasi & Urbina, 2007). The ROC/AUC value between the DTVP-3 and two other assessments were found to be 0.92 which is indicative that the DTVP-3 is able to discriminate between two groups of learners participating in the study with and without visual-perceptual deficits (Hammill, et al., 2014).

The sensitivity of the DTVP-3 was published as being 0.70 and its specificity was 0.94. Therefore a very low percentage of false positives and false negatives were found. Construct-identification validation methods look into "the degree to which the underlying traits of a test can be identified and the extent to which those traits reflect the assumptions on which the test is based" (Hammill et al, 2014, p45). Construct validity of the DTVP-3 was assessed by determining the relationship of the DTVP-3 subscale and composite index scores to children's chronological age, the DTVP-3 scales, differences between groups with known dissimilarities and the academic performance of children. The confirmatory factor analysis (CFA) is the last component of construct validity reported in the test booklet. The confirmatory factor analysis was utilised to verify that the DTVP-3 factor structure matched the theoretical model on which it was established (Hammill, et al., 2014).

3.4.3 Test of Visual Perceptual Skills – Third Edition (TVPS-3)

The purpose of the TVPS-3 (Appendix A3) is to evaluate visual-perceptual skills without the need for involving motor actions when making a response. The TVPS-3 is divided into seven subtests namely: visual discrimination, visual memory, spatial relationships, form constancy, sequential memory, figure-ground perception and visual closure. The administration time of the TVPS-3 is appropriately 30 minutes (Martin, 2006).

3.4.3.1 Scoring

The TVPS-3 comes with a form on which the participant's responses are recorded. For the TVPS-3 there are no basal set. All participants start with the first item on the subtest after they have tried the example items. The participant's answers are recorded on the form whether it is correct or wrong. Each correct response is scored one and incorrect answers is scored zero. For each subtest, the correct answers are added and the raw scores are recorded on the record form in the column provided. The participants give response choices verbally by saying the number or by pointing to the correct answer. On the TVPS-3, a ceiling is reached on a subtest when the child has answered all 16 items or after three consecutive items in which the child scores a zero. Each of the subtests yields raw scores. The raw scores can be converted into scale scores. The scale scores report subtest achievement. For the TVPS-3, the scale score is a distribution of scores that have been integrated to a normal distribution with a known mean of 10 and standard deviation of three. The raw scores can also be converted into standard scores which report composite scores as well as the overall test score. The standard scores for the TVPS-3 represents a score with a mean of 100 and the standard deviation is 15. The index or composite score is derived from the summation of scaled scores from chosen subtests and are described as standard scores. There are three additional composite scores namely; basic processes, sequencing and complex processes. The basic processes composite is derived from the sum of the visual discrimination, visual memory, spatial relationships and form constancy subtests. The sequencing composite is the sum of the visual sequential memory subtest and the complex processes composite is derived from the summation for the figure- ground and visual closure subtests. Percentile ranks correlate exactly to the normal distribution, therefore a certain standard score achieved at any age will always be related with the same percentile rank correlating to the scaled and standard scores. Lastly age equivalents can be obtained from the raw scores. Age equivalents correlates to the median raw scores achieved by persons at the centre of a certain age group (Martin, 2006).

3.4.3.2 Reliability

The author of the TVPS-3 investigated the reliability of this test battery by assessing the internal consistency, test-rest reliability and the SEM. The

Cronbach's coefficient alpha was calculated for the evaluation of the internal consistency for each subtest and for the test as a whole. The Cronbach's coefficient alpha was found to range from 0.75 to 0.88 for the subtests and 0.96 for the entire test. The split half coefficient – Spearman's Brown coefficient was also utilised. It was found to range from 0.76 to 0.88 for the subtest and 0.96 for the overall test. Therefore the TVPS-3 was found to display acceptable to satisfactory levels of internal consistency. The test-retest correlation for the TVPS-3 for the entire assessment was found to be 0.97 and ranges from 0.34 to 0.81 were found for the subtests providing a constant measurement from one testing to the next. The inter-scorer reliability was found to be good and a high level of reliability was noted across all ages for which the test is purposed to measure (Martin, 2006).

3.4.3.3 Validity

The author demonstrated proof of validity for the TVPS-3 by applying the content validity, the criterion-related validity and the construct validity. The content validity of the TVPS-3 is incorporated into the test battery by means of the layout requirements and methods used in the selection of items. The preceding editions of the test battery were used when items were chosen for the new TVPS-3. This included easy and difficult items from both the upper and lower levels. The last step in choosing the items was through item analysis. The definite items published in the TVPS-3 were assessed to determine the discrimination of items as well as item bias. The criterion-related validity was established by the correlation of the TVPS-3 with that of the Visual Supplement of the Developmental Test of Visual-Motor Integration (VMI-5). A moderately strong correlation (0.67) was found. The assessment of the construct-validity involves data from various origins. Information was given to address the following assumptions: chronological age and exceptional group differences. Proof of the relationship of the TVPS-3 and achievement to chronological age was published in the manual. Furthermore the standard scored achieved by children diagnosed with a specific learning disability was compared to the normative standard scores. The mean standard scores was not completely one standard deviation below the expected mean; however the difference that was found can be taken as being statistically of importance. All subtests were found to correlate reasonably high with the overall

score, in spite of the two memory subtests which correlated a little lower as compared to the other subtests (Martin, 2006).

3.4.4 Beery-Buktenica: Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6)

The function of the Beery VMI-6 (Appendix A4) is to evaluate the integration of visual perception with that of a motor action. The test consists of a series of geometric shapes that needs to be copied on paper using a pencil. The Beery VMI-6 has two additional tests; namely, Visual Perception and Motor Coordination. The test is administered in 10 to 15 minutes. In the Beery VMI-6 manual it is suggested that it is not obligatory to administer all three standardised tests. For this study, the researcher felt that the supplemental standardised Visual Perception and Motor co-ordination tests would provide the same information as could be obtained from the DTVP-3 and TVPS-3 and therefore the administration thereof would lead to the over-testing of learners (Beery & Beery, 2010).

3.4.4.1 Scoring

For every correctly imitated or copied item, one point is awarded. The Beery VMI-6 has a basal with the items below the basal counted even if they were not completed. Scoring is stopped after three consecutive drawings are failed. A specific scoring criterion for each drawing is given in the manual. If all the scoring criteria are met, the drawing is given a score of one point, if not met; the drawing is given no score. Only the child's first drawing attempt is scored (Beery & Beery, 2010).

The Beery VMI-6 and supplemental subtests yield raw scores. The following can be derived from the raw scores: standard scores, scaled scores, percentiles and age equivalents. Standard scores can be summed together and a mean can be obtained which is a huge advantage for especially research. Scale scores essentially have the same arithmetical properties as standard scores, however scale scores have a mean of 10 and standard deviation of three (Beery & Beery, 2010). In this study, scores were reported as scale scores.

3.4.4.2 Reliability

The authors investigated the reliability of the Beery VMI-6 by assessing the content sampling, internal consistency, Standard Error of Measurement and test-retest reliability and lastly the inter-scorer reliability. For the evaluation of the content sampling the Rash-Wright analysis was used. The results showed high content reliability and person reliability with the overall group item separation being 1.00 and the overall group person separation being .96. The results therefore indicate high content reliability and person reliability. The internal consistency was measured using the split half coefficient – Spearman's Brown coefficient and the Cronbach's coefficient alpha. The odd-even split-half correlation across the age groups was found to be .95 and the Cronbach's coefficient alpha was found to be .89. The reliability coefficients and standard error of measurement for the Beery VMI-6 were found to be more than sufficient for the screening purposes for which they are intended. In the test- manual, the Beery VMI-6, test-retest coefficient was reported as .88 and the inter-score reliability was reported as .93 (Beery & Beery, 2010).

3.4.4.3 Validity

The Beery VMI-6 appears to have adequate content validity, concurrent validity, construct validity and predictive validity. The content validity of the Beery VMI-6 and its supplemental tests has been strongly substantiated. For the investigation of the concurrent validity, the Beery VMI-6 was correlated with the copying subtest of the Developmental Test of Visual perceptual (DTVP-2) and the Drawing subtest of the Wide Range Assessment of Visual Motor Abilities (WRAVMA). The results found, substantiated the validity of the Beery VMI-6 even though the correlations were only moderately high between the Beery VMI-6 and the more current, less advanced geometric form-copying assessments. The Beery VMI-6 developed various hypotheses to support elemental constructs; namely, chronological age, part-whole hierarchy, part-whole intercorrelations, intelligence, academic achievement and lastly item and person correlations. The Beery VMI-6 has been found to be useful predictor of scholastic performance (Beery & Beery, 2010).

3.5 ETHICAL CONSIDERATIONS:

Clearance for the study was obtained from the Human Research Ethics Committee (medical) before the study was conducted, Certificate no: **M140648** (Appendix B). Further, permission was also obtained from the Gauteng Department of Education for the use of three primary schools and one LSEN remedial stream school as research sites, from the period dated 14 August 2014 to 2 October 2015 (Appendix C) as well as from the principals of the schools chosen for the study (Appendix D).

Respect for persons: Information sheets to explain the purpose of the study, to obtain consent and demographic information was distributed to the parents and guardians of possible participants for the study (See appendix E and F). The parent/guardian was asked to sign the consent form. Verbal assent was obtained from each child. A witness was asked to sign for the purpose of confirming the learner's verbal assent (See appendix G). Parents/guardians and learners were informed that participation was voluntary and that refusal to participate or withdrawing from the study at any time would be without consequence.

Principle of beneficence: To ensure confidentiality of participants, assessment forms were marked with codes instead of using names. The parents/guardians of the participants were given the opportunity to request feedback on the study. The parents/guardians of any participant in the mainstream group, identified with a problem, were provided with feedback in the form of a report and information on services for further assessment and treatment. In the identification of problems in the LSEN group, permission was obtained from the parents/guardians to provide the learner's treating occupational therapist at the LSEN school with the results of the assessment.

Principle of justice: Participants for the study were selected equitably. No vulnerable populations were exploited.

3.6 RESEARCH PROCEDURE:

After obtaining ethical clearance, permission from the Gauteng Department of Education and principals of the LSEN school and mainstream schools,

arrangements were made with the schools and aftercare centre to distribute information sheets to the learners' parents/guardians. Consent forms and demographic sheets were distributed, via the class teacher and aftercare manager to all the learners in Grade one to Grade four attending the LSEN school, mainstream school and aftercare centre via the learner's homework diaries. Parents/guardians were asked to return the completed demographic sheets and consent forms to the schools or aftercare centre and these were collected by the researcher who then identified participants for the research. The researcher informed the parents when the assessments would be done.

Arrangements were made with the schools and aftercare centre for suitable times for the assessments to be completed, before the assessment commenced, the learner was provided with a short explanatory statement and verbal assent was obtained and witnessed for each learner.

Each participant was seen individually for the assessment tests which were administered face to face in a quiet and comfortable room at a table and chair. The duration of the assessment was approximately 60 to 90 minutes. A five to ten minute break was given between the tests. The examiner provided the child with test booklets and a pencil. The testing room and test material were all ready before the participant entered the room. The assessments at the LSEN school were conducted in the morning and early afternoon during time set aside for occupational therapy. The assessments at the mainstream schools and aftercare centre were conducted in the afternoon as not to interfere with the academic programme.

3.7 DATA COLLECTION:

The DTVP-3, Beery VMI-6 and TVPS-3 were administered to the participant. The administration standardised specifications of the DTVP-3, Beery VMI-6 and TVPS-3 were adhered to as stated in the various manuals.

For the DTVP-3, the assessment was administered using the manual with instructions, the picture book, response booklet and the examiner's record booklet. The order in which the subtests were administered as specified in the manual was:

(1) eye-hand coordination, (2) copying, (3) figure -ground, (4) visual closure and (5) form constancy. The response booklet with the eye-hand coordination and copying subtests where positioned parallel to the table top in a normal writing position in front of the child. In the case were the participant turned the booklet, the participant was stopped and the booklet was placed back in the initial position. The examiner ensured that the participant had a sharp pencil to use when executing the eye-hand coordination and copying subtests and no erasing was allowed (Hammill, et al., 2014).

The TVPS-3 was administered making use of the manual with instructions, picture book and record form. The example items foregoing the various subtests were administered first. For the participants who were unable to ascertain the correct answer for the example item, the task was taught to them by identifying the correct answer and an explanation was given as to why it was the correct answer. No further teaching was done beyond the example items. The subtests were administered as set out in the manual: (1) visual discrimination, (2) visual memory, (3) spatial relationships, (4) form constancy, (5) sequential memory, (6) figure-ground and (7) visual closure (Martin, 2006).

For the Beery VMI-6, the manual with instructions and response booklet were utilised. The examiner ensured that the participant had a sharp pencil and erasing was not allowed. The response booklet was placed squared, in front of the participant on the table. The booklet was kept centred and squared on the desk during the testing. The participant was encouraged to stabilise the booklet with their non-dominant hand. Only one attempt was allowed per item. When the examiner found that the participant was responding well they were encouraged to continue and finish all the items. Participants were encouraged to try both the easy and difficult items and not to skip any (Beery & Beery, 2010).

English instructions were translated into Afrikaans verbally by the researcher. Participants were given the instructions in the language that they are taught in at their school.

The order in which the tests were presented was randomised to minimise the impact of test-order effect. Test order was randomised by making use of a random

number table and the order in which the tests were presented was listed in a table according to the code allocated for each participant. The tests were administered in the order dictated by this table and all completed assessments were placed in a box. Once the assessments were all completed, the researcher scored the assessments which were coded in such a way that she did not know which participants had completed them, i.e. whether they were completed by participants from the LSEN school or the mainstream schools and aftercare centre. Once the assessment's had been scored they were matched to the codes on the demographic questionnaire and sorted into the LSEN and mainstream groups for data capture on an excel spread sheet.

3.8 DATA ANALYSIS:

Demographic data was analysed using descriptive statistics including means and percentages. The participants' chronological age in years and months were computed. For all three assessments, 15 days were rounded off to one month for consistency. This was needed to determine the participants scale and standard scores.

Test raw scores were converted to standard scores and to scaled scores. Descriptive data using means and standard deviations as well as z scores were determined for all the tests. The Statistica version 12 was used to analyse data.

To determine the validity of the TVPS-3, DTVP-3 and Beery VMI-6, the mean scaled scores for the USA samples reported in the manuals were compared to the scaled scores for the mainstream group of the South African sample and a Chi-squared test was used to determine if there was a statistically significant difference in the mean scaled scores. Significance was set at 0.05

To determine the discriminative validity of the TVPS-3, DTVP-3 and Beery VMI-6, the difference in the mean scaled scores for the mainstream group and the LSEN group were determined for all subtests and total scores on the TVPS-3, DTVP-3 and Beery VMI-6 was tested for significance, using a Mann Whitney U test as the data were not normally distributed. The data was not normally distributed as the Lilliefors values where all significant.

In this study the normal population curve was used as follows: normal range (1SD to -1 SD) which is 68% of the population, at risk range (-1SD to -2SD) which is 13.5% of the population and lastly dysfunctional range (-2SD to -3SD) which is 2 % of the population (Richardson, 2010).

The clinical accuracy (sensitivity and specificity) of the three assessments for this sample of learners was also established to determine the clinical accuracy of the tests in identifying visual perception problems in learners with and without learning disabilities. The accepted level for sensitivity and specificity was set at 0.8 (Friberg, 2010).

To determine the concurrent validity of the TVPS-3, DTVP-3 and Beery VMI-6 the scaled scores on the tests were correlated and regression analysis and Bland-Altman plots were completed on those subtests or composite scores which had moderate to strong correlation. The strength of correlations used is presented in Table 3.1 (Hazarika, 2013).

Table 3.1 Strength of correlations

Range of r_s	Strength of Correlation
below 0.16	"very low"
0.16 - 0.29	“weak to low”
0 .30 - 0.49	“moderate to low”
0.50 - 0.69	“moderate”
0.70 - 0.89	“strong”
0.90 - 1.00	“very strong”

The Cronbach’s alpha coefficient was utilised to establish the reliability of the tests in terms of internal consistency of the constituent items on the TVPS-3, DTVP-3 and Beery VMI-6

CHAPTER 4: RESULTS

4.1 INTRODUCTION:

The Test of Visual Perceptual Skills - Third Edition (TVPS-3), the Developmental Test of Visual Perception - Third Edition (DTVP-3) and the Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) were completed on a sample of 44 children attending a LSEN school. The tests were also completed on 48 children attending a mainstream school with no history of a known neurological, developmental or specific learning disability.

4.2 DEMOGRAPHICS OF THE PARTICIPANTS:

The sample consisted of 92 participants between the ages of six and nine years from the community of the West Rand, Gauteng. The mainstream group consisted of 54% female and 46% male participants and their ages aged ranged from six years 11 months to nine years 11 months. The LSEN group consisted of more male participants (61%) than female participants (39%) and their ages ranged from six years 11 months to nine years 11 months. The LSEN group had four less participants in the age range six years, 11 months.

English was the most common language spoken by more than half the participants in this study, followed by Afrikaans (43%). Of the participants, two thirds were White, a quarter was Black, and just under 10% were Coloured followed by a small minority of Indian and Asian participants. The Chi squared and Fischer's exact tests indicated there were no significant difference for any demographic variables between the mainstream and LSEN groups, which meant the groups were comparable for these variables (Table 4.1).

Table 4.1 Demographics of the participants for the Mainstream and LSEN groups

	Total group (n=92)	Mainstream group n= 48	LSEN group n= 44	Chi Squared (df)	p value
	n(%)				
AGE					
6.0 -6.11 years	20 (21.73%)	12 (25%)	8 (18.18%)	1.36 (3)	0.71
7.0-7.11 years	24 (26.08%)	12 (25%)	12 (27.27%)		
8.0-8.11 years	24 (26.08%)	12 (25%)	12 (27.27%)		
9.0-9.11 years	24 (26.08%)	12 (25%)	12 (27.27%)		
GENDER:					
Male	49 (53.26%)	22 (45.83%)	27 (61.36%)	2.224 (1)	0.13
Female	43 (46.73%)	26 (54.17%)	17 (38.63%)		
LANGUAGE:					
Afrikaans:	40 (43.47%)	19 (39.58%)	21 (47.72%)	0.62 (1)	0.43
English:	52 (56.52%)	29 (60.41%)	23 (52.27%)		
ETHNICITY:					
White:	59 (64.13%)	32 (66.66%)	27 (61.36%)	0.11	
Black:	22 (23.9%)	11 (22.91%)	11 (25%)		
Coloured:	9 (9.78%)	4 (8.3%)	5 (11.36%)		
Indian:	1 (1.08%)	1 (2.08%)	0 (0%)		
Asian:	1 (1.08%)	0 (0%)	1 (2.27%)		

4.3 THE VALIDITY OF THE TVPS-3, DTVP-3 AND THE BEERY (VMI-6) FOR SOUTH AFRICAN LEARNERS:

The mean scale scores achieved by the South African mainstream participants on the DTVP-3, TVPS-3 and Beery VMI-6 were compared to that of the USA based norms as reported in each of the respective test manuals.

4.3.1 The Test of Visual Perceptual Skills - Third Edition (TVPS-3)

The scores obtained by the South African mainstream group were normally distributed. The general composite standard score obtained by the South African

mainstream group (100.31) were comparable to that of the USA based norms (100) as reported in the manual. There was slightly less variance due to the small sample size and the SD was 10.42 compared to the standard SD of 15 used for standardised tests. All subtests for the TVPS-3 have a subtest mean of 10. The South African mainstream group obtained a higher score for the spatial relations subtest (13.10) and lower scores for the visual discrimination (8.81) and the form constancy (8.81) subtests (Table 4.2).

Table 4.2 Mean subtest scale scores of the Test of Visual Perceptual Skills - Third Edition (TVPS-3) for mainstream group compared to American norms

	TVPS-3: Mainstream: Group (n=48)	**TVPS-3: USA based norms (n=2,008)**		
Variable	**Mean Scale Score (SD)**	**Mean Scale Score (SD)**	**Difference between means**	**p value**
Visual discrimination	8.81 (2.80)	10 (3)	-1.19	0.78
Visual memory	10.79 (4.27)	10 (3)	0.79	
Spatial relations	13.10 (3.43)	10 (3)	3.1	
Form constancy	8.81 (3.49)	10 (3)	-1.19	
Visual sequential memory	10.79 (3.51)	10 (3)	0.79	
Figure-ground	9.58 (3.63)	10 (3)	-0.42	
Visual closure	10.02 (3.32)	10 (3)	0.02	
	Standard Score			
General Composite Score	100.31 (10.42)	100 (15)	0.31	

Significance p≤ 0.05*

4.3.2 The Developmental Test of Visual Perception – Third Edition (DTVP-3)

All three composite scores on the DTVP-3 had standard mean scores that were comparable with that of the USA based norms with a mean of 100 and mean scale scores achieved by the South African mainstream group fell within 0.6 of the USA means (Table 4.3).

Table 4.3 Mean subtest scale scores of the Developmental Test of Visual Perception - Third Edition (DTVP-3) for mainstream group compared to the American norms

	DTVP-3: Mainstream group: (n=48)	**DTVP-3: USA based norms. (n=1,035)**		
Variable	**Mean Scale Score (SD)**	**Mean Scale Score (SD)**	**Difference between means**	**p value**
DTVP-3 Eye-hand co-ordination	8.68 (2.26)	10 (3)	-1.32	0.40
DTVP-3 Copying	11.12 (2.61)	10 (3)	1.12	
DTVP-3 Figure-ground	10.20 (2.05)	10 (3)	0.2	
DTVP-3 Visual closure	9.72 (2.45)	10 (3)	-0.28	
DTVP-3 Form constancy	10.25 (2.05)	10 (3)	0.25	
	Standard scores			
DTVP-3 Visual-Motor integration composite	99.43 (11.80)	100 (15)	-0.57	
DTVP-3 Motor reduced composite	100.35 (9.53)	100 (15)	0.35	
DTVP-3 General visual perceptual composite	99.89 (9.35)	100 (15)	-0.11	

Significance p≤ 0.05*

The subtests had a mean score of 10 and compared to this, the South African mainstream group obtained a lower mean scale score for the eye-hand coordination subtest (8.68) and a higher mean scale score for the copying subtest (11.12).

4.3.3 The Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6)

The South African mainstream group obtained a mean scale score (9.47) for the Beery VMI-6 which was thus comparable to the mean of 10 for USA based norms (10). There was less variance in the small sample with a SD below 3 as reported for the USA sample (Table 4.4).

Table 4.4 Mean subtest scale scores of the Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) for mainstream compared to the American norms

	Beery VMI-6: Mainstream Group (n=48)	**Beery VMI-6: USA based norms. (n=1,737)**		
Variable	**Mean Scale Score (SD)**	**Mean Scale Score (SD)**	**Difference between means**	**p value**
VMI	9.47 (1.70)	10 (3)	0.53	0.87

Significance p≤ 0.05*

Considering the above results, the null hypothesis for objective one can be accepted as all three assessments of visual perception, the TVPS-3, DTVP-3 and Beery VMI-6 had p values greater than 0.05. Therefore being indicative of no significant differences between the normative scores reported in the manuals of the TVPS-3, DTVP-3 and Beery VMI-6 for a sample of USA learners compared to a sample of mainstream South African learners from the Gauteng province without a learning disability aged six to nine years.

4.4 THE DISCRIMINATIVE VALIDITY OF THE TVPS-3, DTVP-3 AND THE BEERY (VMI-6):

Discriminative validity assesses the capability of an assessment to discriminate individuals with certain features from other individuals for the purpose of demonstrating the successfulness of the assessment foreseeing a person's achievement in particular tasks (Anastasi & Urbina, 2007). The discriminate validity of the three tests was determined by comparing the scores of the participants with and without a specific learning disability. The difference in the mean scores between the two groups were determined and analysed for significance. The mean and median scores on all three tests were similar for both groups even though the data for the groups were not normally distributed. Therefore mean differences were considered in the analysis of the data.

4.4.1 The Test of Visual Perceptual Skills - Third Edition (TVPS-3)

4.4.1.1 Subtest scale scores of the Test of Visual Perceptual Skills - Third Edition (TVPS-3) for mainstream and LSEN groups

The TVPS-3 consists of seven subtests, a general composite score and three index scores which includes a basic processes index (visual discrimination, visual memory, position in space and figure-ground), a sequencing index (visual sequential memory) and a complex processes index (form constancy and visual closure)(Table 4.5).

Table 4.5 Mean subtest scale scores of the Test of Visual Perceptual Skills - Third Edition (TVPS-3) for mainstream and LSEN groups

	TVPS-3 Mainstream: Group (n=48)		TVPS-3 LSEN: Group (n=44)			
Variable	**Mean Scale Score (SD)**	**Median (Quartile ranges)**	**Mean Scale Score (SD)**	**Median (Quartile ranges)**	**Difference between means**	**p value**
Visual discrimination	8.81 (2.80)	8.5 (7-11)	8.47 (4.23)	7.5 (5-11)	0.34	0.65
Visual memory	10.79 (4.27)	12 (7-17)	10.86 (4.16)	11 (7-14)	-0.09	0.93
Spatial relations	13.10 (3.43)	13 (10-16)	11.54 (4.32)	11 (8-15)	1.56	0.05*
Form constancy	8.81 (3.49)	8 (7-11)	7.81 (4.26)	7 (5-9)	1.00	0.22
Visual sequential memory	10.79 (3.51)	11 (9-14)	9.25 (3.74)	10 (6-12)	1.54	0.04*
Figure-ground	9.58 (3.63)	10 (6-12)	8.86 (4.78)	8 (5-12)	0.72	0.41
Visual closure	10.02 (3.32)	10 (8-12)	9.19 (3.96)	8 (7-11)	0.83	0.28
	Mean Standard Score (SS)		**Mean Standard Score (SS)**			
General Composite Score	100.31 (10.42)	101 (93-108)	96.45 (14.51)	98.5 (85-109)	3.86	0.14

Significance p≤ 0.05*

All mean and median scores fell into the normal range (8-12) for both the mainstream and LSEN groups although the scores for spatial relations and visual sequential memory were significantly lower for the LSEN group (Table 4.5).

4.4.1.2 The Test of Visual Perceptual Skills - Third Edition (TVPS-3) subtest z scores for mainstream and LSEN groups

The percentage of mainstream participants who scored in the dysfunctional range below – 2SD and -3SD was slightly higher than expected (8%) but Figure 4.1 shows the varied ability of these participants on the subtests of the TVPS-3.

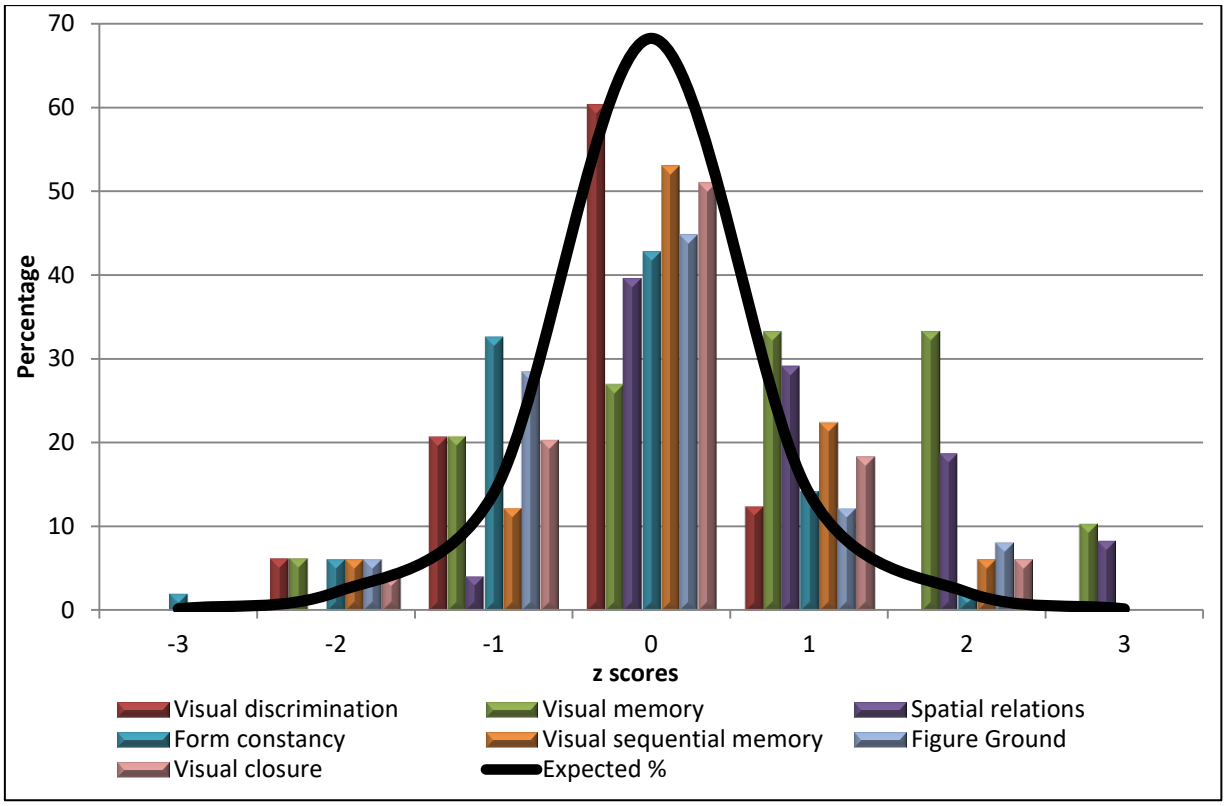


Figure 4.1 The Test of Visual Perceptual Skills - Third Edition (TVPS-3) subtest z scores for mainstream group

The highest percentage (32%) of students with at risk scores (<-1SD) were on the form constancy subtest which had the lowest mean score in Table 4.1 as well. The TVPS-3 does show that distribution of scores for this small mainstream sample was much as expected, except for visual memory, visual sequential memory and spatial relations where scores were higher than anticipated.

Figure 4.2 indicates that a higher percentage of participants in the LSEN group were at risk for the form constancy subtest (39.52%). Furthermore, a higher percentage of participants also obtained at risk scores for visual discrimination and visual closure as compared to the mainstream group. Between 9%-20% of participants scored as dysfunctional at -2SD and -3SD, particularly for the figure-ground subtest as well as confirming the low score in Table 4.5. A higher percentage of this group fell into the -1SD to -2SD range indicating a poorer performance on all subtests. When compared to the mainstream group nearly 10% more participants fell into the dysfunctional range for the visual sequential memory, visual discrimination and visual closure subtests.

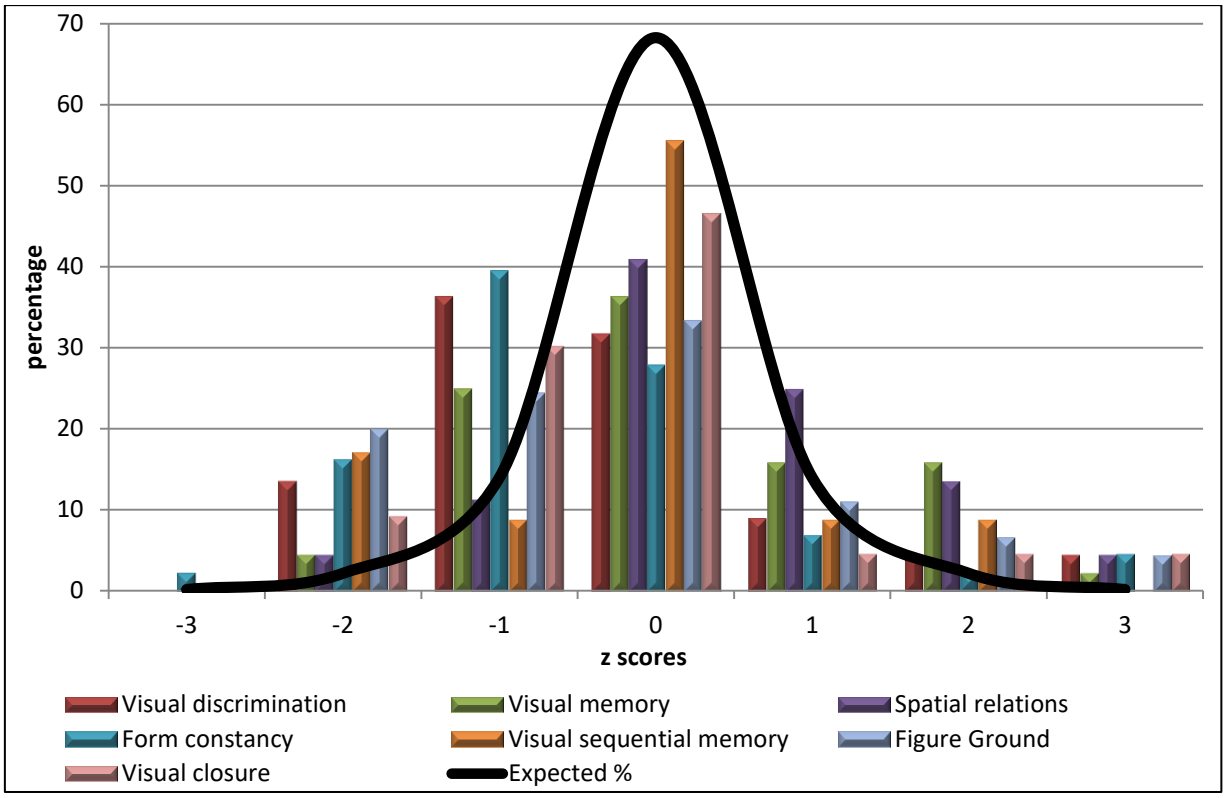


Figure 4.2 The Test of Visual Perceptual Skills - Third Edition (TVPS-3) subtest z scores for LSEN group

4.4.1.3 Composite and index scores for the LSEN and mainstream groups for the Test of Visual Perceptual Skills - Third Edition (TVPS-3)

Composite and index scores for the TVPS-3 indicate that the majority of the participants were scoring in the normal range (-1SD and 1SD). The scores achieved by the mainstream group were in a normal distribution however the overall composite where higher than the expected norm (Figure 4.3).

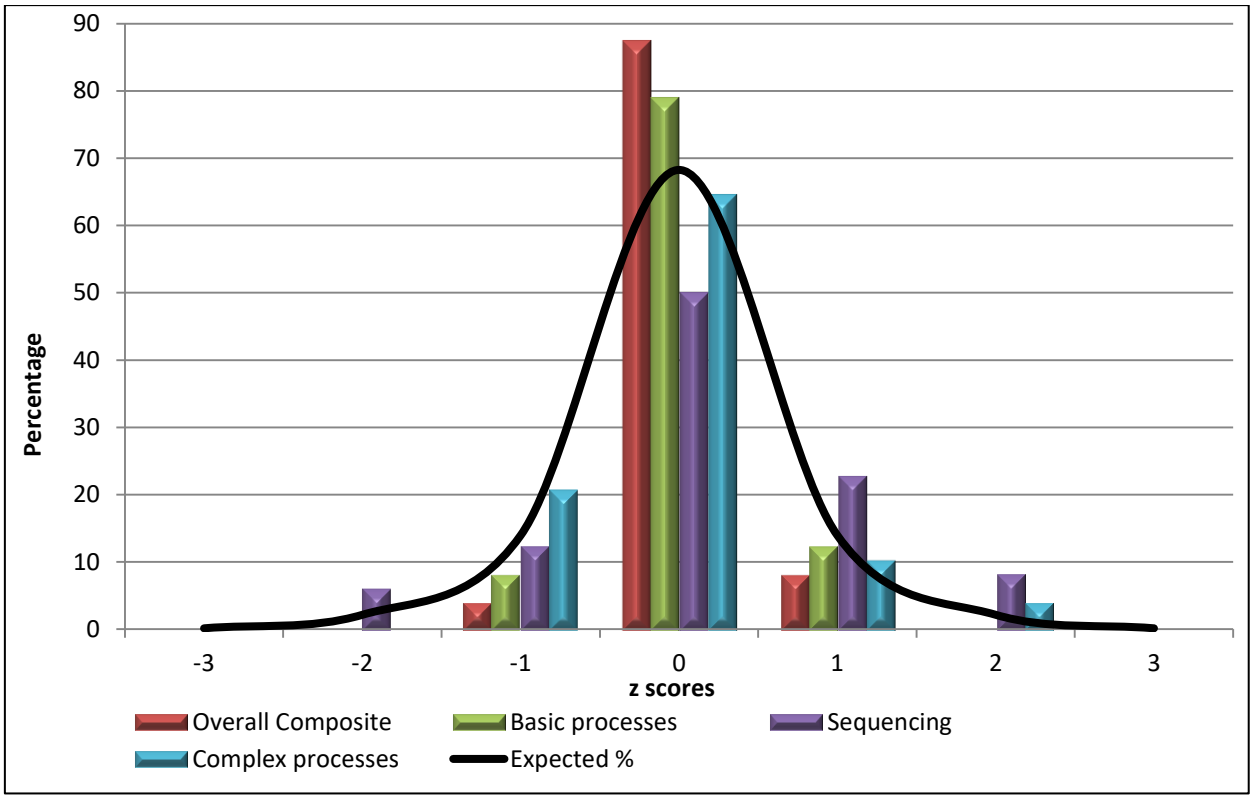


Figure 4.3 Z scores obtained on the Test of Visual Perceptual Skills (TVPS-3) composite and indexes for mainstream group

More of the LSEN group fell into the at risk category (<-1SD) for the overall composite, basic processes and sequencing composite with some of the participants scoring in the dysfunctional range below -2SD for the complex processes composite (Figure 4.4).

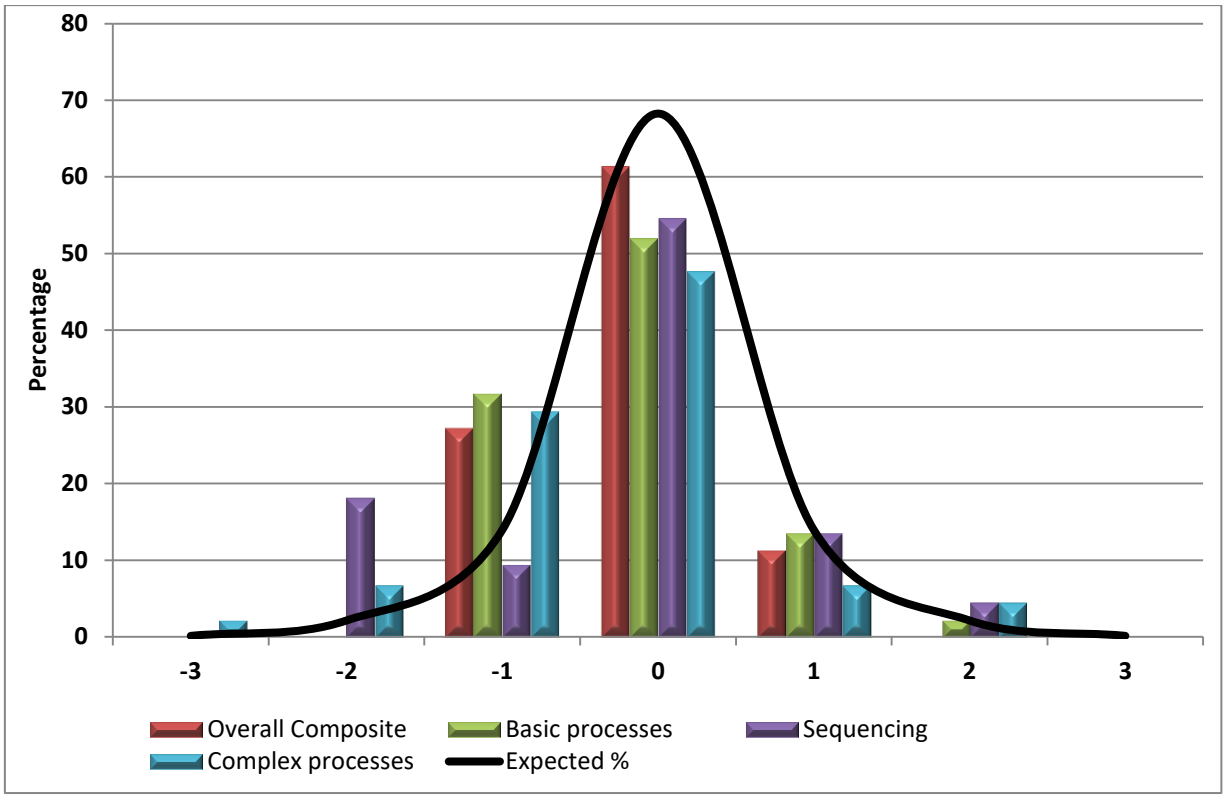


Figure 4.4 Z scores obtained on the Test of Visual Perceptual Skills - Third Edition (TVPS -3) composite and indexes for LSEN group.

4.4.2. The Developmental Test of Visual Perception - Third Edition (DTVP-3)

4.4.2.1 Mean subtest scale scores of the Developmental Test of Visual Perception - Third Edition (DTVP-3) for mainstream and LSEN groups

The DTVP-3 consists of five subtests and three composites; visual-motor integration (eye-hand coordination and copying), motor-reduced visual perception (figure-ground, form constancy and visual closure) and general visual perception. All means and median scores fell into the normal range for both the mainstream and LSEN groups although the scores for figure-ground, visual closure and form constancy were significantly lower for the LSEN group and the score for eye-hand coordination was slightly lower for the mainstream group.

4.4.2.2 Developmental Test of Visual Perception - Third Edition (DTVP-3) subtest z scores for mainstream and LSEN group

The distribution of scores obtained on the DTVP-3 for this small mainstream sample was much as expected with most scores falling into the normal distribution. The scores for figure-ground and visual closure in the average range were slightly higher than expected (Table 4.6).

Table 4.6 Mean subtest scale scores of the Developmental Test of Visual Perception - Third Edition (DTVP-3) for mainstream and LSEN groups

	DTVP-3: Mainstream group (N=48)		DTVP-3: LSEN group N=44			
Variable	**Mean Scale Score (SD)**	**Median (Quartile ranges)**	**Mean Scale Score (SD)**	**Median (Quartile ranges)**	**Differences between means**	**P value**
DTVP-3 Eye-hand coordination	8.68 (2.26)	9 (7-10)	8.75 (2.12)	9 (8-10)	0.07	0.89
DTVP-3 Copying	11.12 (2.61)	11 (10-12.5)	10.38 (2.53)	10 (9-12)	0.74	0.17
DTVP-3 Figure - ground	10.20 (2.05)	10 (9-11.5)	8.81 (3.01)	9 (6.5-11)	1.39	0.01*
DTVP-3 Visual closure	9.72 (2.45)	9.5 (8-11.5)	7.79 (2.66)	8 (6-10)	1.93	0.00*
DTVP-3 Form constancy	10.25 (2.05)	10 (9-11)	8.77 (2.28)	9 (7-10)	1.48	0.00*
	Mean Standard score (SS)		**Mean Standard score (SS)**			
DTVP-3 Visual-Motor integration composite	99.43 (11.80)	97 (91-107.5)	97.40 (11.53)	97 (91-106)	2.03	0.40
DTVP-3 Motor reduced composite	100.35 (9.53)	100 (95-109)	90.22 (12.63)	90 (82-100.5)	10.13	0.00*
DTVP-3 General visual perceptual composite	99.89 (9.35)	100 (93-107)	93.52 (10.24)	93 (84.5-101)	6.37	0.00*

Significance p≤ 0.05*

The percentage of mainstream participants who scored in the dysfunctional range below -2SD and -3SD were as expected, however the z score for eye-hand coordination was higher than expected with 30.6% of participants scoring in the at risk range (<-1SD). Eye-hand coordination also had the lowest mean (Figure 4.5).

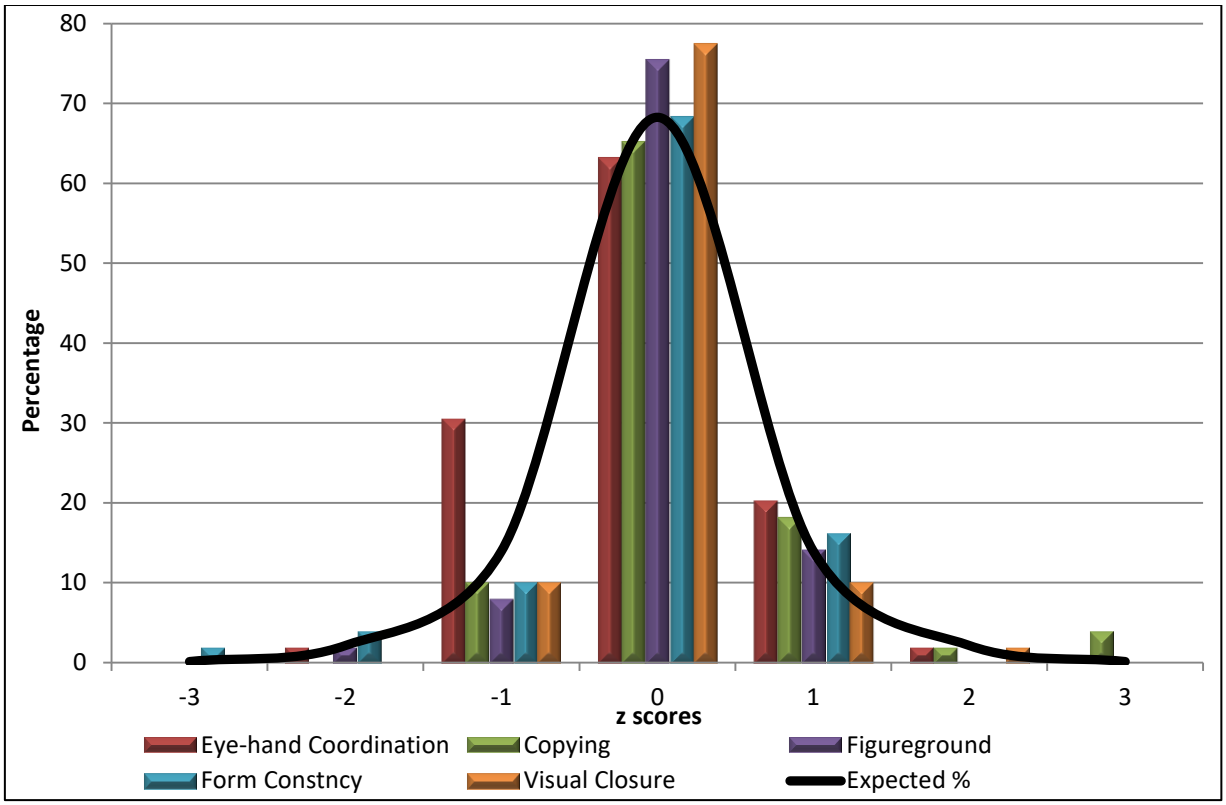


Figure 4.5 The Developmental Test of Visual Perception - Third Edition (DTVP-3) subtest z scores for mainstream group

The percentage of LSEN participants who scored in the dysfunctional range below -2SD to -3SD where slightly higher than expected (6.6% -8.8%). The highest percentage (37.75%) of participants with at risk scores (-<1SD) were on the form constancy subtest. Figure 4.6 indicates that a higher percentage of this group fell in the -1SD to -2SD range indicating poor performance on all subtests as compared to the mainstream group. A higher than expected percentage as compared to the normal distribution was obtained on the eye-hand coordination subtest.

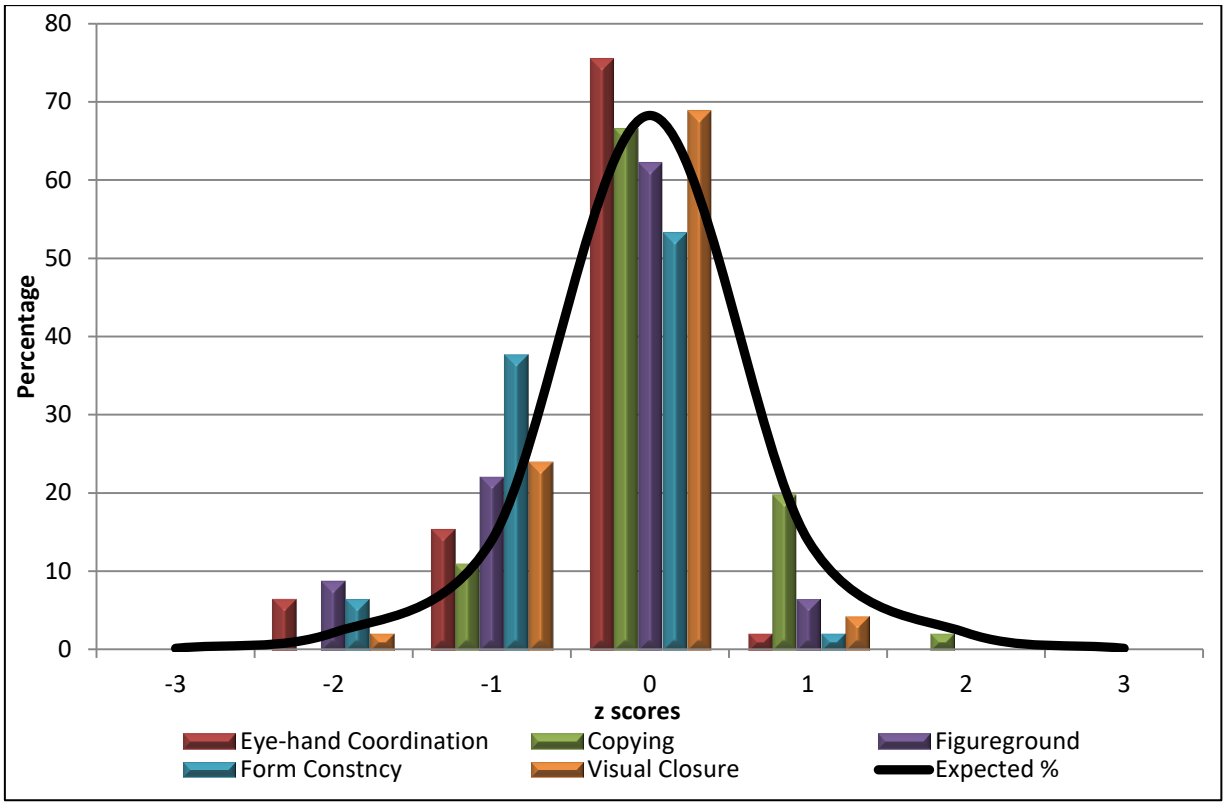


Figure 4.6 The Developmental Test of Visual Perception - Third Edition (DTVP-3) subtest z scores for LSEN group

4.4.2.3 Composite scores for mainstream and LSEN groups of the Developmental Test of Visual Perceptual Skills - Third Edition (DTVP-3)

The general composite score for the DTVP-3 indicates that the majority of participants were scoring in the normal range (1 SD to -1SD). The mainstream group were in a normal distribution with no extreme scores. More of the LSEN group (26.86%) fell into the at risk category (<-1SD) with no participants scoring in the dysfunctional range below -2SD for this composite (Table 4.6).

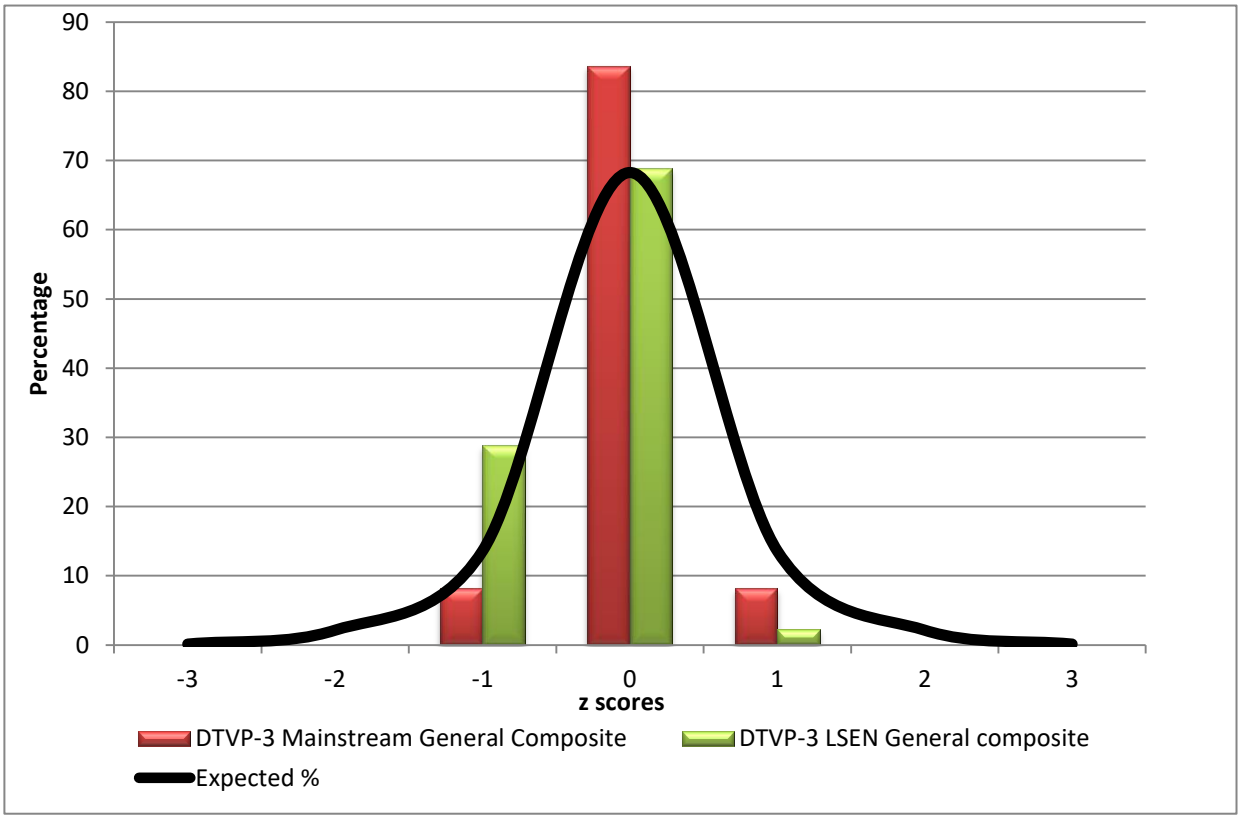


Figure 4.7 General composite scores for mainstream and LSEN groups for the Developmental Test of Visual Perceptual Skills - Third Edition (DTVP-3)

The visual-motor integration composite score for the DTVP-3 indicate that the majority of participants were scoring in the normal range (1SD to -1SD). Both the mainstream group (18.34%) and the LSEN group (17.76%) fell into the at risk category (<-1SD) with no participants scoring in the dysfunctional range below -2SD for this composite (Figure 4.7).

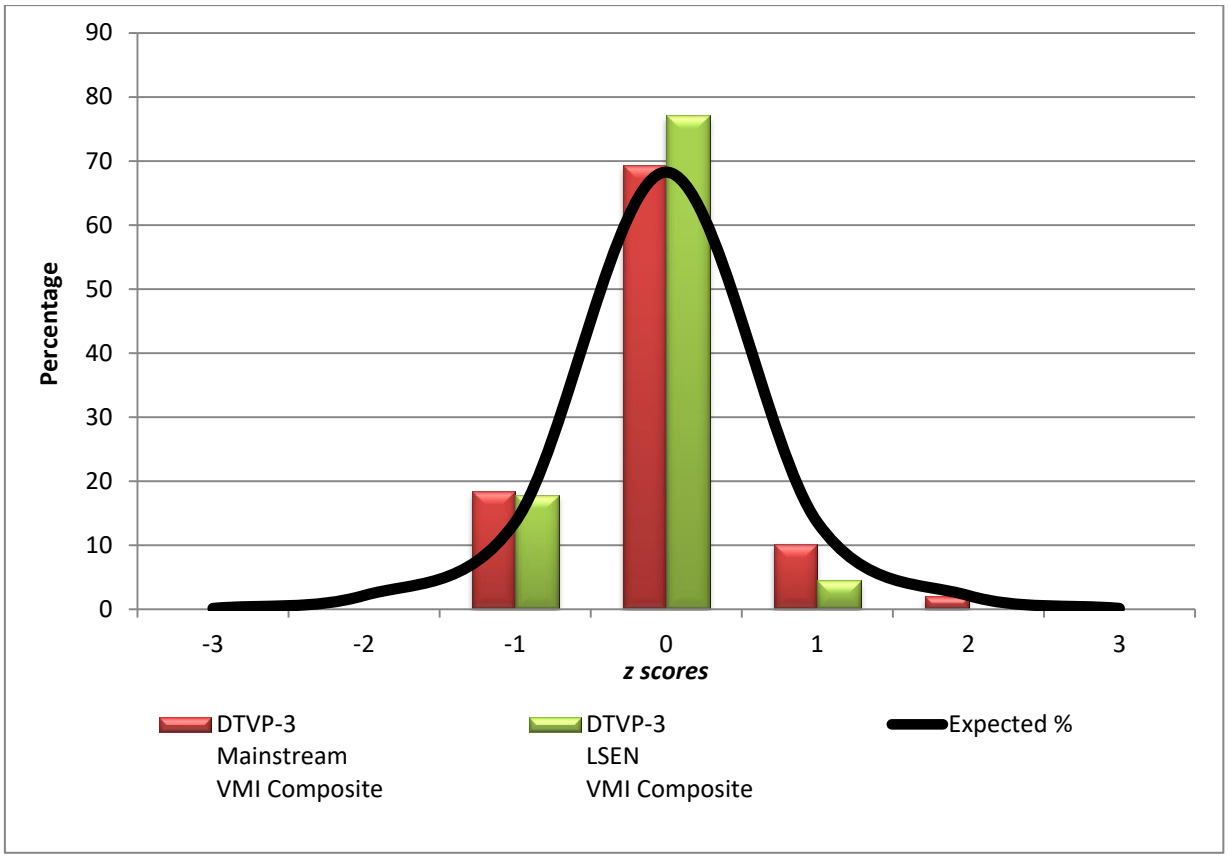


Figure 4.8 Visual-motor integration composite scores for mainstream and LSEN groups for the Developmental Test of Visual Perceptual Skills - Third Edition (DTVP-3)

The motor reduced composite score of the DTVP-3 indicate that the majority of participants were scoring in the normal range (1 SD to -1SD). No participants scored in the at risk category below -1SD or the dysfunctional range below -2SD for this composite (Figure 4.8).

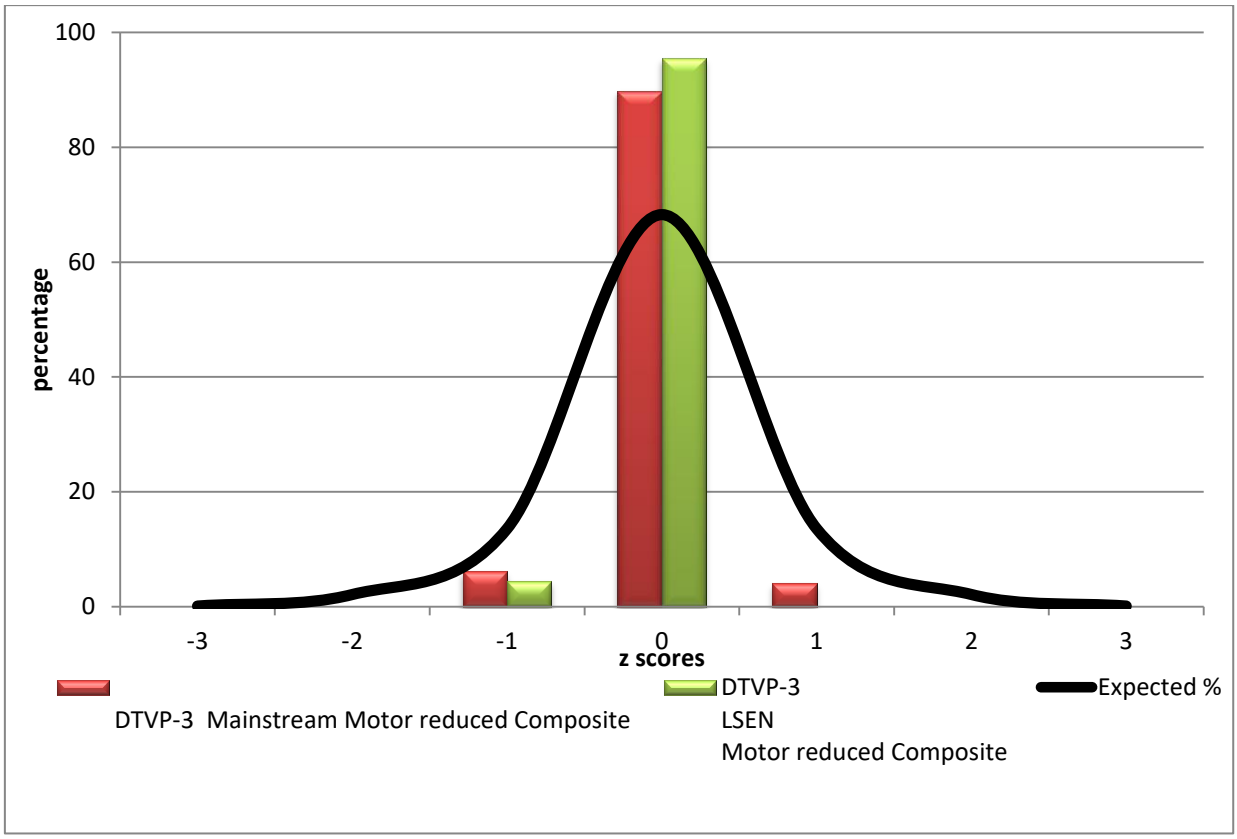


Figure 4.9 Motor-reduced composite scores for mainstream and LSEN groups for the Developmental Test of Visual Perceptual Skills – Third Edition (DTVP-3)

4.4.3. Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6)

4.4.3.1 Mean subtest scores for The Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) for mainstream and LSEN groups

The Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) consists of 30 items. There is no composite score; however, raw scores can be converted in scale or standard scores. The mean for the LSEN group was significantly lower than that of the mainstream group (Table 4.7).

Table 4.7 Mean subtest scores for mainstream and LSEN groups for Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6)

	Mainstream: group (N=48)		LSEN: group N=44			
Variable	**Mean Scale Score (SD)**	**Median (Quartile ranges)**	**Mean Scale Score SD**	**Median (Quartile ranges)**	**Differences between means**	**p value**
Visual-Motor Integration	9.47 (1.70)	9 (8.5-10.5)	7.97 (1.79)	8 (7-9)	1.5	0.00*

Significance p≤ 0.05*

4.4.3.2 The Developmental Test of Visual-Motor Integration – Six Edition (Beery VMI-6) z scores for mainstream and LSEN groups

The percentage of LSEN participants who scored in the at risk range (-1SD) was high (45.44%). When compared to the mainstream group nearly 31% more LSEN participants fell into the at risk range. The scores obtained by the mainstream group was mostly normally distributed, however the mainstream participants did obtain a higher percentage (87.48%) as expected in the average range (Figure 4.10). The above results obtained were not unexpected as this study anticipated that more LSEN participants would fall within the at risk to dysfunctional range of the normal curve as compared to the mainstream group.

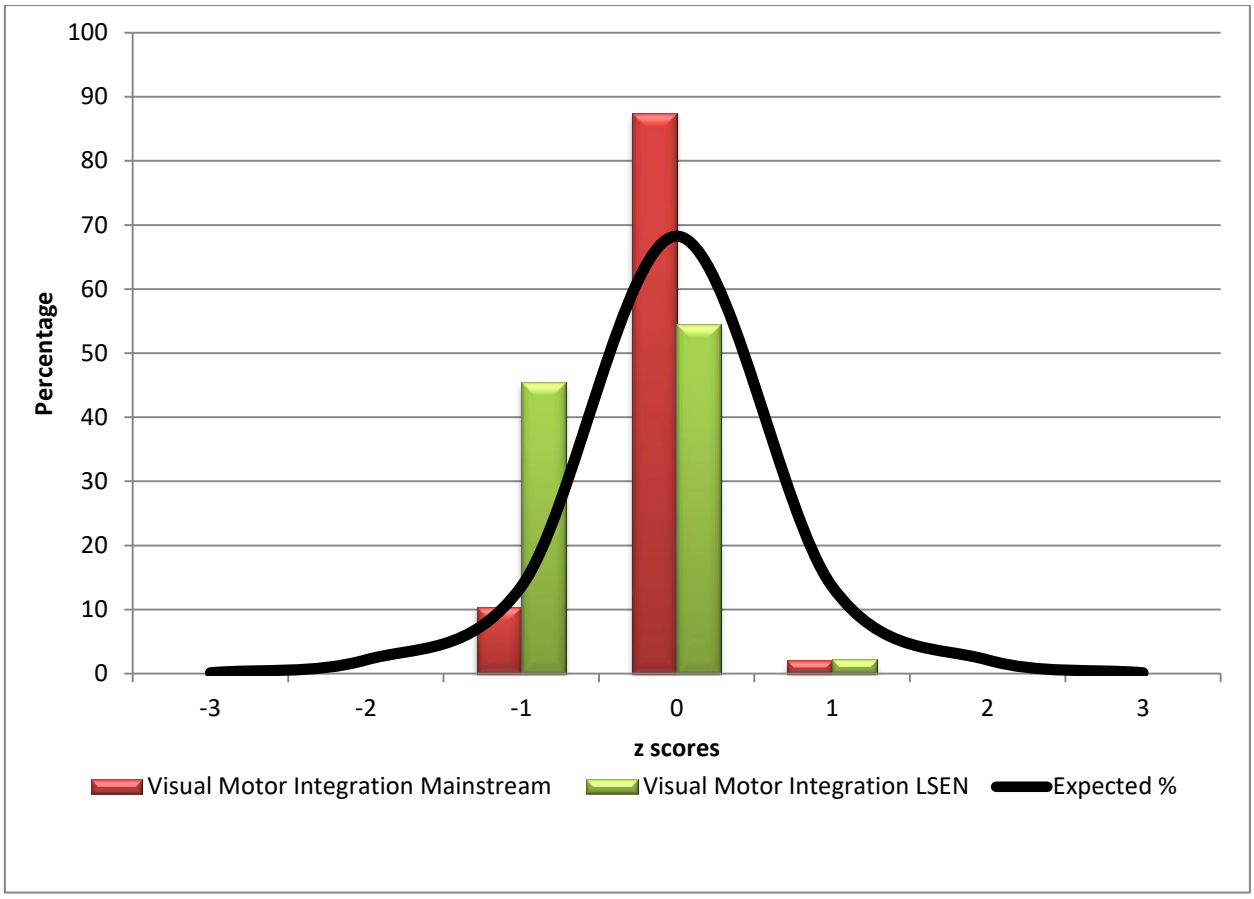


Figure 4.10 Z scores for mainstream and LSEN groups for the Developmental Test of visual-motor integration - Six Edition

The null hypothesis of objective two can therefore be rejected as there was difference found between the scaled scores for learners, aged six to nine years, from the Gauteng Province, South Africa, with a specific learning disability as compared to those without a specific learning disability.

4.5 THE CLINICAL ACCURACY (SENSITIVITY AND SPECIFICITY) OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6):

Sensitivity and specificity are two major components to regard when the validity of a diagnostic test battery is assessed. These two factors can be of assistance to ascertain if the results of an assessment are symptomatic of the actual condition during the patient evaluation (Campo, et al., 2010). Sensitivity and specificity are regarded as proportions generated as the outcome to validity studies, estimating the diagnostic precision of an assessment (Fritz & Wainner, 2001).

Specificity indicates the capability of an assessment to accurately detect children who do not have visual perceptual difficulties (Hammill, et al., 2014). It is suggested that the specificity and sensitivity indexes should be at least 0.80, however, various researchers recommend that sensitivities should be as high at 0.90. Positive predictive values indicate that children identified with a learning disability do have a visual perceptual problem and the negative predictive value indicates those scoring in the normal range do not have a specific learning disability. The positive and negative predictive value reflects the proportions in tests that are true positive and true negative results.

4.5.1 The Test of Visual Perceptual Skills - Third Edition (TVPS-3)

All of the subtests of the TVPS-3 had sensitivity rates of below 0.80. The lowest sensitivity was seen for the TVPS-3 spatial relations (0.15). Only one subtest's specificity score was acceptable at above .80, spatial relations (0.95) (Table 4.8).

Table 4.8: The sensitivity and specificity of the Test of Visual Perceptual Skills – Third Edition (TVPS-3)

Test of Visual Perceptual Skills- Third Edition **Research group: (n=92)**		
Variable	**Sensitivity**	**Specificity**
TVPS- 3 Visual discrimination	0.48	0.72
TVPS- 3 Visual memory	0.70	0.72
TVPS- 3 Spatial relations	0.15	0.95
TVPS- 3 Form constancy	0.58	0.58
TVPS- 3 Visual sequential memory	0.46	0.51
TVPS- 3 Figure-ground	0.44	0.65
TVPS- 3 Visual closure	0.39	0.77

4.5.2. The Developmental Test of Visual Perception – Third Edition (DTVP-3)

None of the subtests had sensitivity values above .80. The copying subtest of the DTVP-3 had the lowest level of sensitivity (0.11). All of the subtests of the DTVP-3 had acceptable levels of specificity above 0.80 except for eye-hand coordination (0.68) (Table 4.9).

Table 4.9 The sensitivity and specificity of the Developmental Test of Visual Perception - Third Edition (DTVP-3)

Developmental Test of Visual Perception – Third Edition (DTVP-3) Research group: (n=92)		
Variable	**Sensitivity**	**Specificity**
DTVP-3 Eye-hand coordination	0.22	0.68
DTVP-3 Copying	0.11	0.87
DTVP-3 Figure-ground	0.31	0.89
DTVP-3 Visual closure	0.44	0.85
DTVP-3 Form constancy	0.26	0.89

4.5.3 Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6)

Visual-motor integration displayed poor levels of sensitivity, however specificity was found to be acceptable at 0.89 (Table 4.10).

Table 4.10 The sensitivity and specificity of The Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6)

The Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6) Research group: (n=92)		
Variable	Sensitivity	Specificity
Visual-Motor Integration	0.40	0.89

From the results obtained, the TVPS-3, DTVP-3 and Beery VMI-6 overall showed poor sensitivity in accurately identifying children attending a LSEN school with visual perceptual difficulties.

4.6 THE INTERNAL CONSISTENCY RELIABILITY OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6):

The third objective of the study was to determine the reliability of the tests related to the internal consistency of the constituent items on the DTVP-3, TVPS-3 and Beery VMI-6 for a sample of children from the Gauteng province, South Africa.

The internal consistency has to do with how participants answer various items in a once off test. The Cronbach's alpha is the applied index of internal consistency (Cortina, 1993).

These scores were compared to those reported for each test in the test manual (Table 4.11). All the subtests of the TVPS-3, DTVP-3 and Beery VMI-6 had Cronbach's alphas within acceptable ranges of ≥ 0.70.

Only the DTVP-3 general visual perceptual composite test had a Cronbach's alpha below the acceptable range (0.67). The Cronbach's alpha scores were similar to those in the manual for the TVPS-3 but lower for the DTVP-3 and Beery VMI-6 were scores from over 0.80 and 0.90 were reported for both tests (Table 4.11).

Table 4.11 Reliability scores for the Test of Visual Perceptual Skills - Third Edition (TVPS-3), the Developmental Test of Visual Perception – Third Edition (DTVP-3) and Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6) (n=92)

Test of Visual Perceptual Skills – Third Edition (TVPS-3)		
Variable	**Cronbach's alpha for study**	**Cronbach's alpha score from manual**
TVPS- 3 Visual discrimination	0.76	0.76
TVPS- 3 Visual memory	0.76	0.76
TVPS- 3 Spatial relations	0.77	0.87
TVPS- 3 Form constancy	0.74	0.75
TVPS- 3 Visual sequential memory	0.78	0.78
TVPS- 3 Figure -ground	0.76	0.82
TVPS- 3 Visual closure	0.78	0.82
Total score composite	0.76	0.96
Developmental Test of Visual Perception – Third Edition (DTVP-3)		
DTVP-3 Eye-hand coordination	0.78	0.90
DTVP-3 Copying	0.79	0.85
DTVP-3 Figure-ground	0.79	0.90
DTVP-3 Visual closure	0.78	0.80
DTVP-3 Form constancy	0.78	0.86
DTVP-3 Visual-motor integration composite	0.78	0.92
DTVP-3 Motor reduced composite	0.76	0.92
DTVP-3 General visual perceptual composite	0.67	0.95
Developmental Test of Visual-Motor Integration - Six Edition (Beery VMI-6)		
Visual-Motor Integration	0.74	0.82

The TVPS-3, DTVP-3 and Beery VMI-6 all had ranges of Cronbach's alpha coefficients of ≥ 0.70 therefore exhibiting adequate levels of internal consistency for this sample of children. Only the TVPS-3 visual perceptual composite had a Cronbach's alpha of ≤ 0.70.

4.7 THE CONCURRENT VALIDITY OF TVPS-3, DTVP-3 AND BEERY (VMI-6):

Correlations between all the scores on all three tests were determined to establish if any of the subtests or composite scores were related as the tests all assess aspects of visual perception and some subtest indicate assessment of similar components. Only weak correlations were found between the scores for the three tests except for moderate correlations between the subtests of visual closure and form constancy on the TVPS-3 and DTVP-3 (Table 4.12).

Table 4.12 Correlation between the Standard Scores of the three standardised tests

Subtests		**Correlation**
		rho
DTVP-3 Copying	Beery VMI-6	0.31
DTVP-3 Eye-hand coordination	Beery VMI-6	0.04
DTVP-3 Composite VMI	Beery VMI-6	0.20
DTVP-3 Visual closure	TVPS-3 Visual closure	0.52
DTVP-3 Figure-ground	TVPS-3 Figure-ground	0.35
DTVP-3 Form constancy	TVPS-3 Form constancy	0.40
TVPS-3 Composite	DTVP-3 Motor-Reduced Composite	0.64

There was also a moderate correlation between the DTVP-3 motor reduced composite score and the TVPS-3 general composite score indicating that these two subtests measure a similar construct. The Beery VMI-6 and copying subtest on the DTVP-3 was found to have a weak correlation. The figure-ground subtest

on the DTVP-3 and TVPS-3 was expected to correlate. However, the two subtests were found to have a very weak correlation. This is an indication that the subtests do not exactly measure the same construct.

Bland Altman plots were used to determine if the scores obtained for these subtests and composite scores could be used interchangeably.

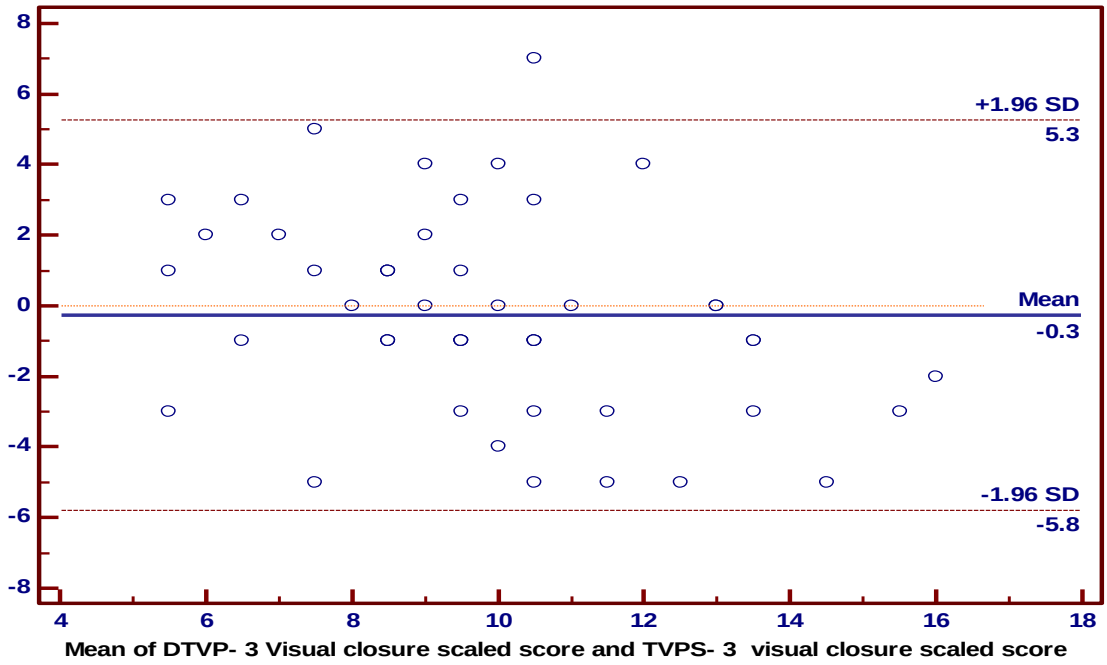


Figure 4.11 Bland Altman plot for the visual closure subtests of the Test of Visual Perceptual Skills – Third Edition (TVPS-3) and the Developmental Test of Visual Perception – Third Edition (DTVP-3)

The plots indicate for visual closure that the scores are very similar and these tests can be used interchangeably (Figure 4.11).

A similar finding for the TVPS-3 composite score and the DTVP-3 motor-reduced composite score was found and these tests appear to measure similar constructs.

The same was not true for the form constancy scores on the TVPS-3 and DTVP-3 as there was a difference of 20% which indicates one test rates participants 1.4 higher on the scale scores (Figure 4.12). The scores from these tests cannot be used interchangeably.

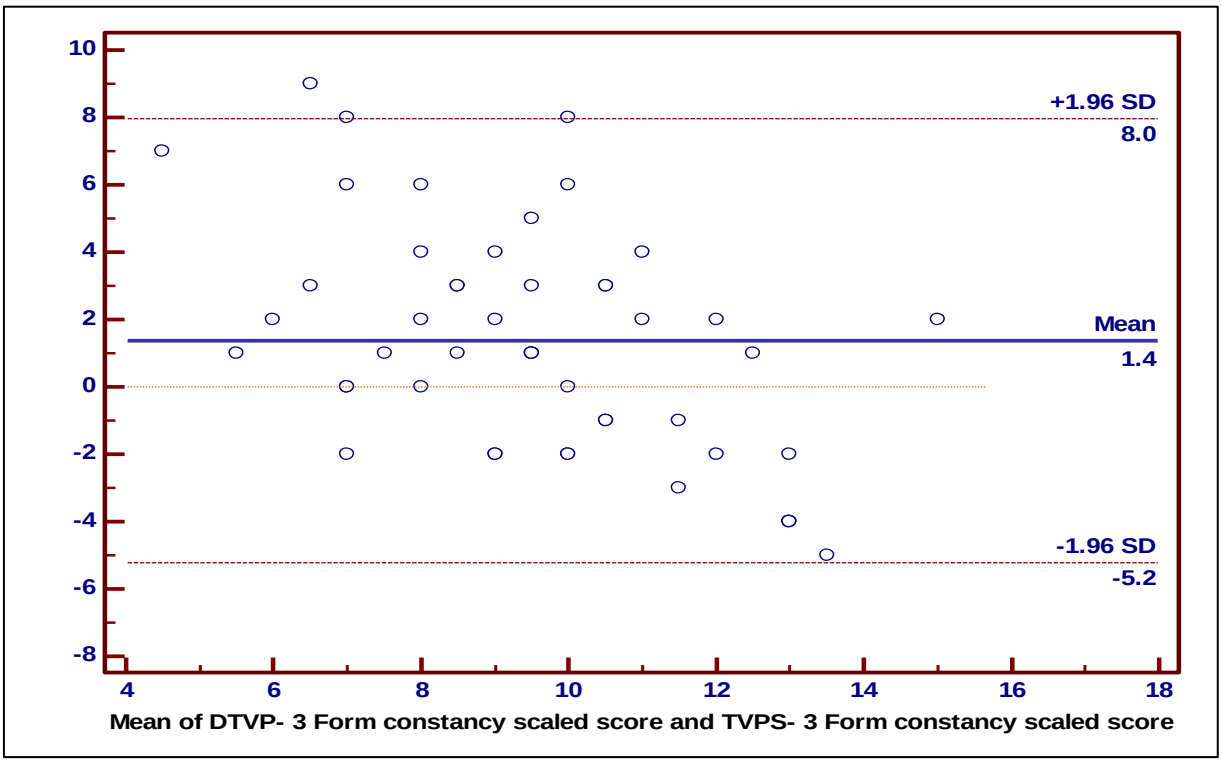


Figure 4.12 Bland Altman plot for the form constancy subtests of the Test of Visual Perceptual Skills - Third Edition (TVPS-3) and the Developmental Test of Visual Perception – Third Edition (DTVP-3)

The null hypothesis for objective is therefore rejected as moderate correlations were found between the subtests of visual closure and form constancy on the TVPS-3 and DTVP-3. However the Bland Altman plots did indicate that the visual closure subtest can be used interchangeably, however, the form constancy subtest cannot.

4.8 SUMMARY

Chapter four presented the results found in this study by means of tables and graphs. This study aimed to determine the diagnostic value of the DTVP-3, Beery VMI-6 and TVPS-3 by determining the discriminative validity of the tests for a

sample of children with a specific learning disability compared to those without a specific learning disability within a sample of children from the Gauteng province, South Africa. The scores for the mainstream group fell within the United States of America's norms for all three tests. The DTVP-3, TVPS-3 and Beery VMI-6 were found to discriminate between children with and without a specific learning disability. Overall the TVPS-3, DTVP-3 and Beery VMI-6 showed poor sensitivity in accurately determining children with visual perceptual difficulties. All three tests had ranges of Cronbach's alpha coefficients of ≥ 0.70 therefore exhibiting adequate levels of internal consistency for this sample of children. Moderate correlations were found between the subtests of visual closure and form constancy on the TVPS-3 and DTVP-3. The Bland Altman Plot found that the visual closure subtest can be used interchangeably, however, the form constancy subtest cannot.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION:

In this chapter the findings of the study will be discussed according to the demographics of the participants as well as the objectives of the study in terms of the validity of the TVPS-3, DTVP-3 and Beery VMI-6 for mainstream learners six to nine years as well as the diagnostic value of the TVPS-3, DTVP-3 and Beery VMI-6 by determining the discriminative validity of the tests for a sample of participants with a specific learning disability compared to those without a specific learning disability. The sensitivity and specificity of the TVPS-3, DTVP-3 and Beery VMI-6 and the reliability of the tests in terms of the internal consistency as well as whether the tests can be used interchangeably in determining visual-perceptual dysfunction will also be considered.

5.2 DEMOGRAPHICS:

South African learners from the West Rand area of Gauteng participated in this study. The participants were sourced using convenient sampling from the learners attending a LSEN school, two mainstream schools and an aftercare facility. A sample of 48 participants was recruited from the mainstream schools and aftercare centre with an almost equal number of boys and girls. The participants represented various race groups but were predominantly from the White race group including White, Black, Coloured, Indian and Asian learners. All the schools were fee paying schools which cater for 46% of learners attending public schools in Gauteng (Mtshali, 2015). The schools and aftercare centres were located in a middle class area. This demographic was similar to that of the LSEN school. Thus the sample in this study was not an adequate representation of the percentage of the different racial groups in the South African population and of learners from lower socio-economic areas.

A sample of 44 participants with a specific learning disability were recruited from a remedial school which had 471 boys and 216 girls enrolled at the school. There was a noticeable difference in gender ratio in the LSEN school group with more boys (65.75%) identified with a specific learning disability when compared to girls (34.24%) (Education, 2015). This trend is supported by the findings of the National Centre for Learning Disabilities in the USA where it was reported that two thirds of American learners identified with a learning disability were males (Cortiella & Horowitz, 2014).

Research findings further propose that even in mainstream schools boys present with more reading difficulties (Rutter, et al., 2004; Moloi, M.Q. & Chetty, M., 2011), while Moll et al, (2014) observed in their study that more boys demonstrated spelling deficiencies but that girls struggle with mathematics (Moll., et al., 2014). From a South African perspective however this may not apply, as it has been found that girls are doing better in mathematics, with girls from four provinces achieving above the Southern and Eastern Africa Consortium for Monitoring Educational Quality mean score of 500 (Hungii, 2012).

In the age range of six years, 11 months, there were four less participants in the LSEN group compared to that of the mainstream group. This may be due to learning difficulties in learners only being identified later in a child's school career. As a consequence, learners are not referred to a LSEN school promptly enough. It was observed at the LSEN school, that learners mostly have to repeat a grade once they are admitted due to poor consolidation of skills, making them a year older than the grade one learners in the mainstream schools.

5.3 VALIDITY OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6) FOR SOUTH AFRICAN LEARNERS:

5.3.1 Learners without specific learning disabilities

The first objective of this study was to determine the validity of the TVPS-3, DTVP-3 and Beery VMI-6 scores obtained by the South African mainstream participants compared to the USA based norms. The indices and overall scores for the TVPS-3 and DTVP-3 are reported as standard scores that are based on a normal distribution with a mean of 100 and SD of 15. The subtest scale scores of the

TVPS-3, DTVP-3 and Beery VMI-6 are based on a normal distribution with a mean of 10 and a SD of 3 (Beery & Beery, 2010; Hammill, et al., 2014; Martin, 2006).

The scores obtained on the TVPS-3 by the South African mainstream group participants fell within the normal distribution. The findings indicated that the general composite score obtained by South African participants were a mean standard score of 100.13 therefore the visual perceptual skills assessed on this test for the South African participants were comparable to the USA based norms. Hence, the results support the use of the American TVPS-3 norms with South African mainstream learners aged six years 11 months to nine years 11 months.

However, the general composite score of the TVPS-3 is derived from the sum of the scale scores of the seven subtests namely; visual discrimination, visual memory, spatial relations, form constancy, visual sequential memory, figure-ground and visual closure (Hammill, et al., 2014). There were differences for the South African participants on the mean scale scores for the spatial relations, visual discrimination and form constancy subtests. The South African participants had a significantly higher score on the spatial relations subtest (13.10) but lower mean scale scores on the visual discrimination (8.81) and form constancy (8.81) subtests as compared to the USA sample. Similar results were found in a research study conducted by Brown (2012) with Australian primary school learners. The Australian learners also obtained a higher mean scale score on the spatial relations subtest (13.24) and lower mean scale scores for visual discrimination (8.11) and visual form constancy (7.93) (Brown, 2012). Therefore, it can be accepted that for these subtests a new cut off point may need to be set when using these tests with learners in South Africa, particularly as participants scored 1SD higher for the spatial relations subtest.

No marked differences were found for the DTVP-3 and the scores obtained by South African mainstream participants were much as expected with the majority of scores falling into the normal distribution. The mainstream participants obtained a mean general visual perceptual composite score of 99.89, a mean motor–reduced composite score of 100.35 and a mean visual-motor integration composite score of 99.43. Therefore, visual perceptual skills assessed by the DTVP-3 were found to be generally similar to that of the USA based norms. In the DTVP-3 manual the

composite scores are regarded as being the most reliable and most functional scores (Hammill, et al., 2014). Thus, the results found in this study do substantiate the utilisation of the American DTVP-3 norms with South African mainstream learners aged six years 11 months to nine years 11 months.

The mean scale scores of two subtests on the DTVP-3 were found to differ from that of the American norms; namely, eye-hand coordination and copying. South African participants obtained a lower mean scale score (8.68) for the eye-hand coordination subtest and a slightly higher mean scale score (11.12) for the copying subtest.

For both these tests, since composite scores are used for the identification of learners who are at risk for visual perceptual problems or have dysfunctional visual perceptual skills, the differences between the South African and USA norms may not influence determining who needs therapy. However, in the subtests where the mean scale score is higher, specific problems may be missed and not treated at a level expected in six to nine year old learners in South Africa. The lower scores may also result in problems being identified when the level of ability expected should be a little lower but the differences were small and did not constitute 1 SD.

The mainstream participants in the sample for this study obtained a mean standard score of 98 for visual-motor integration on the Beery VMI-6. The findings thus indicated that the visual-motor integration skills of the South African mainstream sample were comparable to the American based norms. The findings support the use of the Beery VMI-6 with South African mainstream learners aged six years 11 months to nine years 11 months.

The small differences in the scale scores on the subtests in the TVPS-3 and the DTVP-3 indicate the possible differences in tests where certain items may not be relevant to all cultural environments. It is important to consider the subtests where the scale scores differed as the tests may not truly reflect the abilities and skills of the learners in a South African context of this study. In his research, Brown (2011) has therefore emphasized the importance of evaluating assessment tools in cross-cultural backgrounds (Brown, et al., 2011).

It should be noted that all three assessment tools; namely- the TVPS-3, DTVP-3 and Beery VMI-6 were developed in the USA and was normed on children from the USA. Furthermore, the DTVP-3 has been critiqued as there is no normative data available on children from differing ethnic backgrounds outside of the USA (Brown & Murdolo, 2015). This study was conducted with South African children from a middle class background. In comparison to the USA, South Africa differs in terms of culture, environment and educational background.

Visual perception is subject to many of the influences that shape human behaviour as well as experiences and therefore assessments of visual perception may differ due to cultural practices and beliefs. This is also influenced by the occupations in which the child engages. The tests used in this study have been evaluated across different cultures in the USA but not in other countries (Cheung, et al., 2005).

South Africa is a developing middle-income republic with differences in the socio-economy (Zere & McIntyre, 2003). While the socio-economic status of the participants in this study could be considered similar to those in the USA, South Africa also has 11 official languages of which English for most learners are their second language. The DTVP-3 and TVPS-3 requires sufficient receptive language skills. For this study just over half of the participants were taught in English but not all of them were first language English speakers. Thus, these participants may have been disadvantaged by being instructed in English as this was not their home language, while the participants who spoke Afrikaans were given instructions in their home language which could have given them an advantage of understanding what was expected of them in each of the visual perceptual tests.

5.3.2 Learners with specific learning disabilities

The scores indicating the ability of the three tests to discriminate between typical children and those with dysfunction are reported in the manuals of the TVPS-3 and DTVP-3 as mean standard scores for children with learning disabilities. Therefore, the scores of the participants at the LSEN school could be compared to the scores reported for children within the USA.

For the TVPS-3 the LSEN sample in this study obtained a general composite mean standard score of 96.45. This was compared to the general composite mean

standard score of 90.23 obtained by the USA sample with learning disabilities. This higher score was due to the findings of this study, and indicated that a higher percentage of the LSEN group obtained scores in the at risk range (-1SD below the mean) rather than the dysfunctional range (-2SD below the mean) for the form constancy subtest (39.52%), visual discrimination subtest (36.35%) and visual closure subtest (24.99%). Furthermore, compared to the mainstream group, only 10% more LSEN participant's scored within the dysfunctional range for the visual sequential memory subtest, visual discrimination subtest and visual closure subtest (Table 4.5). The LSEN group in this study also scored above the mean scale score of 10 for the spatial relations subtest which confirms the findings in the mainstream group.

The DTVP-3 manual reports mean scale and standard scores for eight disability subgroups which includes learning disabilities and ADHD. The South African LSEN group participants obtained slightly higher mean standard scores for the three composites as compared to the USA sample with a learning disability. For the visual-motor integration composite score, the South African LSEN group obtained a mean standard score of 97 which was significantly higher as compared to the score of the USA sample at 88. There were no significant differences for the motor reduced composite score the South African LSEN group (mean standard score of 90) and the USA sample (mean standard score of 92) and for the general visual perceptual composite score the South African LSEN group (mean standard score of 93) and the USA sample (mean standard of 89). The South African LSEN group were found to have similar mean scale scores when compared to the USA sample for four of the five subscales with no deficits found in mean scale score for the copying subtest which was 10 (Hammill, et al., 2014)

The Beery VMI-6 manual references literature substantiating that learners with a learning disability achieve lower scores on the VMI than average children (Beery & Beery, 2010). However, on the negative side, the Beery VMI-6 appears to lack up-to-date research on validity and no data on the scores are published in the manual. Most of the psychometric data published in the test booklet manual, is related to the earlier versions. There is concern that the research results published may not therefore be a sufficient portrayal of recent research on this test

(McCrimmon, et al., 2012). This study found that a higher percentage of LSEN learners scored in the at risk to dysfunctional range of the normal curve when compared to the mainstream group.

The mean standard scores available on the LSEN sample in this study had higher scores than those reported for the children with learning disabilities on the composite score for the TVPS-3 and the composite scores on the DTVP-3 except for the motor reduced composite score. Furthermore, it was expected that learners with a specific learning disability would have obtained more scores in the dysfunctional range (-2SD below the mean) rather than the at risk range (-1SD below the mean). This may reflect the fact that the participants in this study are attending a LSEN school where they receive occupational therapy twice a week in a small group and remedial education for their learning disabilities and therefore, some of their visual perception problems could have been remediated and resolved. The scores on the tests may have been affected by this as the participants receiving therapy may have moved from dysfunction (-2SD below the mean) to an at risk level (-1SD below the mean) or to an average score, affecting the comparison of the TVPS-3 and DTVP-3 standard scores to those published for children with learning disabilities in the USA.

5.4 THE DISCRIMINATIVE VALIDITY OF THE TEST OF TVPS-3, DTVP-3 AND BEERY (VMI-6):

The second objective of the study was to determine the discriminative validity of the DTVP-3, TVPS-3 and Beery VMI-6 between learners with and without a specific learning disability. Results obtained in this study showed a difference in scores for the participants with and without a specific learning disability for all three assessment tools; the TVPS-3, DTVP-3 and Beery VMI-6.

When the mean scale scores on the TVPS-3 were compared for the two groups, the participants with a learning disability were found to have lower mean scale scores for the visual discrimination, spatial relations, form constancy, visual sequential memory, figure-ground and visual closure subtests. Significant statistical differences were found between two subtests only; namely, spatial relations and visual sequential memory. The mainstream group had a slightly

lower score for visual memory. This meant that although the general composite score obtained by the participants with a specific learning disability was lower than that of the mainstream group, the difference was not statistically significant (Table 4.5).

In that regard, TVPS-3 did discriminate between participants with and without a specific learning disability. This supported the findings of Martin (2006) who reported on the capability of the TVPS-3 to discriminate between children with and without a specific learning disability. Results indicated that children who were identified with a specific learning disability did obtain a lower mean standard score for the general composite as compared to the normative sample (Martin, 2006). No results comparing the scores of children with and without specific learning disability on the seven subgroups are reported in the TVPS-3 manual so the performance of the LSEN group could not be compared to those of children in the USA.

Although the TVPS-3 was able to discriminate between participants with and without a specific learning disability, the TVPS-3 had sensitivity indexes below 0.80 (Table 4.8) for all the subtests, therefore, displaying poor accuracy and under-identifying learners with a specific learning disability who have visual perceptual problems. The only subtest that had a specificity score above the accepted level of 0.80 was the spatial relations subtest. Thus, only on this subtest could it be assured that learners who scored in the average range and above did not have a visual perceptual problem. While other subtest specificity scores were close to the 0.80 score and could be considered as identifying learners with no problems. The form constancy, visual sequential memory and figure-ground subtests had low specificity scores. These subtests may over-identify learners as having a problem. This may account for the lower scale scores on these tests found in the mainstream group when compared to the USA norms.

On the DTVP-3, when the standard and scale scores of the mainstream group were compared to those of the LSEN group with specific learning disabilities, statistically significant mean differences between the groups were observed. The LSEN group had significantly lower scores on the general composite scores and the motor- reduced composite scores which included the figure-ground, visual

closure and form constancy subtests. The difference in the scores for the visual-motor integration composite score was not significant as the LSEN group did better than the mainstream group on the eye-hand coordination subtest.

It was accepted that the DTVP-3 was able to discriminate between the two groups and the results provide evidence to support the discriminative validity. In the establishment of the DTVP-3's validity, the authors investigated the achievement of dissimilar groups of individuals on the assessment battery. The results they obtained found that participants with a specific learning disability obtained lower mean scale scores in all the subtests. The mean standard scores of the three composite scores were also found to be lower than the average norm. Contrary to the finding in this study they found that the visual-motor integration composite score had the lowest mean standard score. The reason that the visual-motor integration composite score may be the highest of the three in this study is probably related to the high copying score achieved by the participants in both groups in this study. The general visual perceptual composite scores were higher than the motor-reduced visual perceptual composite scores and this finding concurs with the order reported by Hammill et al. in the DTVP-3 manual (Hammill, et al., 2014).

All the sensitivity indexes for the DTVP-3 (Table 4.8) were below 0.80, therefore showing poor accuracy and may under identify learners with a specific learning disability who has visual perceptual problems. The lowest sensitivity scores were for the DTVP-3 copying subtest and the eye-hand coordination subtest. The researcher found that the marking progress of the copying subtest were quite tedious and lengthy as there were various guidelines to follow and details to consider. Although this adds to the accuracy of the scoring the drawings were scored from naught to three which may not be a big enough scale to clearly identify differences in the drawings.

The low sensitivity index and specificity index of 0.68 resulted in poor accuracy in identifying learners with and without eye-hand coordination difficulties. The eye-hand coordination subtest requires learners draw exact straight or rounded lines within borders. This can be seen as a forced task as children usually practice eye-hand coordination activities in pre-school and grade one and thus it becomes a

splinter skill. Brown et al. (2015) also noted this in their review and critique of the DTVP-3 and commented that the test deliberately uses created tasks rather than tasks arising naturally or spontaneously in the assessment of fundamental functional skills (Brown & Murdolo, 2015). The poor specificity index could have resulted from participants not always understanding that they are not allowed to lift up their pencil from the paper once they have started drawing their line. Even with numerous verbal reminders and explanations some children just continued to do so, obtaining zero points for each time the pencil was lifted from the paper. The high specificity index of between 0.87 and 0.89 for the other subtests indicates the DTVP-3 does not over identify dysfunction.

The low sensitivity index for the form constancy subtest may have occurred because participants often did not understand that there could be two or three correct answers and often only gave one answer, even though this was explained to and practiced with them during the example items. This could have compromised their test-score. Furthermore, the form constancy subtest in the DTVP-3 has also been criticised for having insufficient applicability to actual life occupational-performance activities which kids require to perform their everyday regimes (Brown & Murdolo, 2015).

A statistically significant difference between the mainstream group and LSEN group was noted in the results of the Beery VMI-6. Compared to the mainstream group, nearly more than 31% of the participants in the LSEN group scored in the at risk category. The results thus provide evidence to support the discriminative validity of this test between children with and without specific learning disabilities. Various research studies have found that the VMI is able to discriminate between specific learning disabilities and no learning disabilities scale scores obtained by learners with a specific learning disability were found in the literature (Yoder & Kibria, 1986). However, the Beery VMI-6 had a sensitivity index below 0.80 (Table 4.7), therefore having poor accuracy in identifying visual-motor integration dysfunction in children with a specific learning disability. The test has a high specificity index of 0.89 indicating it does not over identify dysfunction.

Possible reasons are proposed for the poor sensitivity and specificity of the standardised perceptual assessments in this study. All three assessments had

sensitivity indexes below 0.80, which means that visual perception and visual-motor integration dysfunction in children with a specific learning disability may be missed. The results of this study indicated that the participants attending the LSEN school were not all identified with a having a visual perceptual and visual-motor integration dysfunction. The participants scoring at 1 and 2SD above the mean fell into the expected percentage for the TVPS-3 (Figure 4.2) but not the DTVP-3 and the VMI -6 (Figure 4.6 and Figure 4.10). A higher percentage of participants than expected scored in the average range (1SD to -1SD) on the visual-motor integration and motor reduced composite scores on the DTVP-3. It was clear, therefore, that although all the participants attending the LSEN school have been diagnosed with a specific learning disability not all of them presented with visual perceptual deficits on the tests evaluated in this study.

This is because learners with a specific learning disability have visual perceptual problems as individuals with a specific learning disability form a diverse group (Rourke, 1985) (Hung, et al., 1987). Secondly, while as mentioned participants of the LSEN group receive occupational therapy twice a week it is possible that they also developed splinter skills and can easily master some subtests but, however they are unable to carry over or apply their skills in scholastic tasks.

The findings obtained in this study indicated that the participants with a specific learning disability did obtain lower mean scale and standard scores as compared to the average population. Therefore, there are learners with a specific learning disability that present with visual perception difficulties. This is further supported by the findings published in the DTVP-3 and TVPS-3 manuals on participants with a learning disability (Hammill, et al., 2014; Martin, 2006). Hammill, et al.(2014) reported children with ADHD scored lower than the average norm for eye-hand coordination and copying (Hammill, et al., 2014). The TVPS-3 manual also reports the mean standard scores of learners identified with ADD, who were found to have general composite mean standard scores that were lower than the normative sample. Consequently, visual perceptual problems have been found to be present in other diagnosed learning disabilities specifically ADHD, developmental coordination disorder and language disorders. The important link in the degree of visual perceptual dysfunction was found in a study by Jongmans et al. (2003) to be

the amount of co-existing disorders. Children with DCD, reading/learning disability and ADHD displayed predictably more dysfunctions in visual perceptual skills as compared to children with fewer disorders (Jongmans, et al., 2003).

Attention deficit hyperactivity disorder (ADHD) has been found to be the most commonly occurring neurodevelopmental disorder and has particular consequences for a learner's functioning especially in their scholastic performance (Hendrikse, et al., 2015). The prevalence of ADHD in children is approximately five percent as indicated by population studies. In this study, approximately 80 percent of the learning disabled group participants had a diagnosis of ADHD/ADD. There appears to be an association between specific learning disabilities and ADD/ADHD co-occurring with visual motor skills (Crawford & Dewey, 2008).

From the above literature reviewed it is evident that visual perceptual difficulties are possibly not present in all children with a specific learning disability. This was confirmed by mean standard scores for children with specific learning disabilities on TVPS-3 or the DTVP-3 which was not -1SD below the mean in figures reported in the manuals and for this assessment. This indicates that some children with specific learning disabilities are scoring in an average range or above average range (-1SD or more above the mean).

And thus it is important to understand the validity of the tests used in identifying the learners that do present with these problems. In this study the specificity score which guides over-identification of dysfunction were high for the DTVP-3 and Beery VMI-6 for the sample in this study. These tests can therefore be accepted as being more accurate in ruling in visual perceptual problems in learners six to nine years old in the middle class South African context, and it can be accepted in that they have a score below -1 SD more than 87-89% of the time they will have a visual perceptual deficit.

5.5 THE INTERNAL CONSISTENCY RELIABILITY OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6):

The third objective of this study was to determine the reliability in terms of internal consistency of the constituent items on the DTVP-3, Beery VMI-6 and TVPS-3 for the sample of participants in this study. An outcome measure that is reliable is of

essence to the occupational therapy profession as this ensures valid evaluations of patients. The Cronbach's Alpha is regarded to be the most commonly applied index for determining the internal consistency reliability (Cortina, 1993).

The Cronbach's alpha coefficients obtained for the different subtests for the TVPS-3 were found to be very similar to that reported in the test manual of the TVPS-3 as 0.96 (Martin, 2006), however in this study it was found to be 0.76. (Tavakol & Dennick, 2011). The internal consistency Cronbach's alpha coefficients as reported in the DTVP-3 test manual ranges from 0.80 to 0.95 (Hammill, et al., 2014). The Cronbach's alpha coefficients for this study were found to be within the acceptable ranges at greater than 0.70, except for general visual perceptual the Cronbach's alpha coefficient was 0.67 which is below the acceptable level. In the Beery VMI-6 edition test manual the Cronbach's alpha coefficient is reported as 0.82 (Beery & Beery, 2010). In this study the Cronbach's alpha coefficient was found to be within the acceptable range 0.74.

Various reasons are suggested for the potential discrepancies found between the Cronbach's alpha coefficients reported in the various test manuals and the Cronbach's alpha coefficients found in this study. Firstly, sample size, as this study was based on a sample size of 92 participants in comparison to the thousands of children used in the standardisation of the three tests. Although the use of larger samples is more desirable, it has been cautioned that larger sample sizes could raise the alpha approximations (Spiliotopoulou, 2009).

Secondly, the variability of data should be taken into consideration. The TVPS-3, DTVP-3 and Beery VMI-6 made use of heterogeneous samples (children with normal development) which should demonstrate higher reliability approximations. For this study a homogenous sample was used and therefore the lower reliability approximation could be reflective of a scale that is fulfilling its purpose. Thirdly, geographical location and ethnicity (Spiliotopoulou, 2009) can affect the internal consistency of a test and the scores for certain subtests. Therefore, the verbal translation of Afrikaans' instructions for the three tests could have changed the meaning of instructions influencing the internal consistency.

5.6 THE CONCURRENT VALIDITY OF TEST OF THE TVPS-3, DTVP-3 AND BEERY (VMI-6):

The final objective of this study was to determine the concurrent validity of the tests to see if the subtests on the DTVP-3 and TVPS-3 and Beery VMI-6 can be used interchangeably in determining visual-perceptual dysfunction for the sample in this study.

When the total and composite scores on the tests were considered, a moderate correlation was found between the DTVP-3 motor-reduced components and the TVPS-3 general composite score. This is indicative that the two visual perceptual tests are measuring similar motor-reduced components. However, there was little correlation between the subtests on the DTVP-3 motor-reduced components and the TVPS-3 except for a moderate correlation between the visual closure subtest of the DTVP-3 and TVPS-3. This is indicative that the two subtests do measure the same construct. Furthermore, the Bland Altman Plots indicated that scores where very similar and as a result scores can be used interchangeably.

The form constancy subtest of the DTVP-3 and TVPS-3 was found to have a moderate correlation. However the Bland Altman Plot indicated a 20% difference which indicates the DTVP-3 rates participants 1.4 points or half a SD higher on the scale scores. Therefore, the scores cannot be used interchangeably. A possible reason for this could be that the TVPS-3 introduces figure-ground components in this subtest and the two subtests do not appear to be measuring the same construct.

In theory, the Beery VMI-6 and the copying subtest on the DTVP-3 are expected to correlate as both scales evaluate the capability to reproduce geometric shapes which starts with easy items and increases in difficulty levels. However, in this study a weak correlation was found. This agrees with results found in a study conducted by Brown (2016) where there was also no noteworthy correlation established between the DTVP-3 copying subtest and the Beery VMI-6 (Brown, 2016). These findings do not agree with the results published in the DTVP-3 manual which reports a noteworthy correlation between the DTVP-3 copying subtest and VMI-5 score (Hammill, et al., 2014). This could be because of a

differing scoring system. With the Beery VMI-6 a point is awarded for each correctly imitated or copied item. A simple scoring guideline is provided in the test-booklet (Beery & Beery, 2010). Nevertheless, with the DTVP-3 the participant can score a one, two or a three for a copied item. The marker is provided with a scoring template as well as an appendix with various example drawings that have been scored in the manual for both tests. On the DTVP-3 each drawing had to be checked against the criteria. Both the Beery VMI-6 and DTVP-3 have ceilings after three incorrect answers (Beery & Beery, 2010; Hammill, et al., 2014).

There are many factors which could have led to the differences in results. The factors proposed by Brown (2016) are: differences in sample size, the age range of the sample, cultural context and ethnic composition (Brown, 2016).

The figure-ground subtest on the DTVP-3 and TVPS-3 was expected to correlate, however in the study a weak correlation was found. This could be that the two visual perceptual tests might be examining figure-ground perception in a different way and consequently not examining the same constructs. The TVPS-3 figure-ground subtest requires the child, after being shown a stimulus figure, to identify the figure in the foreground from the background. The figure can have lines on top of it, it can be turned around or it could be a different size. A form constancy component is also brought into this subtest. The DTVP-3 figure-ground subtest shows the child a stimulus figure with overlapping shapes or disguising lines. The child needs to find which shapes can be seen in the stimulus figure. In comparison to the TVPS-3 figure-ground subtest, the drawing at the top has shapes that stay the same size. Another reason for the weak correlation could be a differing scoring system. In the TVPS-3 there is only one correct answer while with the DTVP-3 there can be more than one correct answer (Hammill, et al., 2014; Martin, 2006).

It is clear that the tests are measuring visual perception using different constructs and they cannot be used interchangeably. Both the TVPS-3 and DTVP-3 have a subtest in which the participants in both the mainstream group and LSEN group achieved a higher than expected score - spatial relations and copying respectively. This affects the validity for the South African sample used in this study. The DTVP-3 however demonstrated greater discriminative validity between the two groups and had higher specificity for this sample and can be considered a valid

assessment for middle class South African children. The Beery VMI-6 also had significant discriminative validity between the two groups as well as acceptable specificity and is therefore also a valid test for this sample of participants. Both tests need to be used to obtain a clear picture of visual-perceptual dysfunction in learners with specific learning disabilities as different constructs of visual perception are assessed with the tests.

The only reason to use the TVPS-3 is to obtain a score for spatial relations, a subtest which has been removed from the DTVP-3. Yet, this is the one subtest which proved to have questionable validity on the TVPS-3 and the scores on this subtest need to be interpreted with caution.

Visual perception is a complex concept that can be approached from different angles, which can make the assessment of this construct extremely difficult. There appears to be confusion in the definition of the different components. This means that the standardised tests use different forms of presentations and scoring for components even if they have the same name. The results of this study indicate that it is difficult to isolate components of visual perception and assess them in isolation.

5.7 LIMITATIONS OF THE STUDY:

The findings on the study reflect that not all participants with a specific learning disability had visual perceptual problems. While this is true for learners with specific learning disability internationally, the participants at the LSEN school were also receiving biweekly occupational therapy which may have further affected their scores for visual-perceptual dysfunction.

This study included participants from the West Rand of Johannesburg, Gauteng. It therefore just represented one region of Johannesburg and one province in South Africa. The majority of participants in this study were from a middle class urban area and this study was not an adequate representation of participants in lower-socio-economic areas. Since more than half the learners in Gauteng attend non fee paying schools it is important to extend the study to these schools as well in the future.

This study only included participants aged six to nine years of age. Therefore, the results obtained in this study cannot be generalised as to how five, ten, eleven and twelve year olds would perform on the various assessments.

The assessments took 60 to 90 minutes to complete which challenged the participants' concentration ability even though the tests were presented randomly to compensate for this. The area used for administering the assessments differed at each school but did consist of an area with an office space or suitable area where there was a table and chair. Often the chair or table were found to be ergonomically inappropriate as it was either too high or too low; hampering sitting posture. At times, there were other learners around the administration site playing and making noises which could have been a distraction to the participants. The researcher did not use any control measures for the above-mentioned as she had to make use of the room and furniture given to her at each of the respective research sites. It was not always possible for the researcher to control the time of day at which the children were assessed as it had to be done when the children where available. Therefore some children were assessed in the mornings and some in the afternoons.

In the case where participants had difficulty with following the instructions, the researcher had to repeat some of the instructions. This occurred irrespective of the participants' home language and the language in which the instructions were given. The administrator felt that the instructions of the various assessment tools could have been more simplified for children.

CHAPTER 6: CONCLUSION

6.1 INTRODUCTION:

This study aimed to determine the validity of the TVPS-3, DTVP-3, and Beery VMI-6 for learners aged six to nine years, in a middle class South African context in the Gauteng Province. The scores of the group attending mainstream schools and an aftercare facility were compared to the normative data reported on USA samples in the test manuals. The scores for participants with specific learning disabilities were compared to those reported for children with learning disabilities in the test manuals of the TVPS-3, DTVP-3, and Beery VMI-6.

The psychometric properties of the TVPS-3, DTVP-3, and Beery VMI-6 were determined for this sample of participants in relation to discriminative validity, specificity and sensitivity, internal consistency as well as the concurrent validity of the three tests.

The results in this study found that the scores obtained by South African mainstream and LSEN participants on the TVPS-3, DTVP-3, Beery VMI-6 were valid in comparison to the mean standard and scale scores reported for the USA samples. The South African mainstream participants obtained lower mean scale scores for visual discrimination and form constancy on the TVPS-3 and both groups obtained a higher mean scale score for spatial relations. The mainstream participants also obtained a lower mean scale score on the eye-hand coordination subtest and both groups had a higher scale score on the copying subtest of the DTVP-3.

This does affect the validity of these subtests for the South African sample used in this study but the composite scores were all comparable to the USA scores. The participants with specific learning disabilities all achieved higher standard composite scores than those reported for children with specific learning disabilities in the TVPS-3 and DTVP-3 manuals. Unfortunately, no mean scale scores were available for children with specific learning disabilities for the Beery VMI-6. The results may have been affected by the participants in this study receiving

occupational therapy at the LSEN school and thus problematic perceptual areas could have been integrated or remediated.

The TVPS-3, DTVP-3 and Beery VMI-6 were able to discriminate between learners with and without a specific learning disability. Overall the learners with a specific learning disability obtained lower mean scale scores as compared to that of the mainstream learners except for the visual memory subtest of the TVPS-3 and the eye-hand coordination subtest on the DTVP-3. The discriminative validity of the Beery VMI-6 was significant as was that for the DTVP-3 on two of the three composite scores – the motor-reduced composite score and the general visual perceptual score. The TVPS-3 only differed significantly between the participants with and without specific learning disabilities on two subtests and not the composite scores indicating less discriminative ability for this sample.

Overall the TVPS-3, DTVP-3 and Beery VMI-6 showed poor levels of sensitivity resulting in the under-identification of learners with a specific learning disability that may have visual-perceptual difficulties. This may be due to the fact not all children with a learning disability have visual-perceptual difficulties. The specificity was high for the DTVP-3 and Beery VMI-6 indicating that the tests rule in learners with visual-perceptual problems and those who score below -1SD on these tests can be considered to have a visual-perceptual deficit. The specificity on a number of subtests for the TVPS-3 indicate that this test may over-identify learners with visual-perceptual problems in this sample and therefore the validity of this test for the participants in this study must be questioned.

In terms of reliability in relation to the internal consistency, all three tests had ranges of Cronbach's alpha coefficients of greater than 0.70 therefore exhibiting adequate levels of internal consistency for this sample of children.

In this study, little concurrent validity was found between the TVPS-3, DTVP-3 and Beery VMI-6 with moderate correlations between the subtests of visual closure and form constancy on the TVPS-3 and DTVP-3. The Bland Altman Plot found that the visual closure subtest can be used interchangeably; however, the form constancy subtest cannot as the DTVP-3 has scores that are half a SD higher for this test. For the sample of participants in this study the DTVP-3 with the exception

of the copying subtest can be considered a valid test as can the Beery VMI-6. The TVPS-3 did not have adequate psychometric properties for this sample and the results on this test need to be interpreted with caution when used with middle class South African urban children in the sample used for this study. The subtests for visual discrimination and form constancy on the TVPS-3 and eye-hand coordination on the DTVP-3 should be used with caution and need further investigation.

6.2 CLINICAL RECOMMENDATIONS:

The TVPS-3 assesses motor-reduced visual perceptual skills only. Even though the TVPS-3 gives a bit of background theory on visual perception, it did not provide reasoning as to how the assessment results can be related to therapeutic or scholastic purposes. Furthermore, the TVPS-3 also does not report how the assessment discriminates different skills (Ackerman, 2010). An additional assessment needs to be conducted with this test in order to assess visual-motor integration abilities. Overall the TVPS-3 challenged participant's concentration skills as they found the assessment very tiring and effortful. Therapists need to take note that South African participants obtained a higher mean scale score for the spatial relations subtest and lower mean scale scores on the visual discrimination and form constancy subtests.

The DTVP-3 is able to assess both motor and visual perceptual abilities. Three composite test-scores can be obtained; namely, a visual-motor integration composite score, a motor-reduced composite score and a visual-perceptual general composite score. The participants were found to focus better when completing this assessment as this test alternates between motor and motor-reduced components. The DTVP-3 however had several disadvantages. Therapists that want to make use of this assessment battery need to take note that there is no subtest to evaluate spatial perception skills as both the spatial relations and position in space subtests were omitted from the DTVP-3. Furthermore, in the test manual an error was found in table C1, page 82 in the general visual perception column. Instead of being 29, the figure is given as 19 (Hammill, et al., 2014). Therapists need to be aware of this mistake as this could lead to the conversion into the wrong index score. South African participants were found to

have a lower mean scale score for the eye-hand coordination subtest and a higher mean scale score for the copying subtest. Furthermore, the DTVP-3 has also been critiqued for having poor ecological validity. This is because the DTVP-3 has not taken into account coherent elements like human factors, the surroundings or conditions in which a person lives and factors of activity participation (Hammill, et al., 2014).

The Beery VMI-6 was found to be a valuable assessment battery in evaluating visual-motor integration skills. The Beery VMI-6 indicated a significant difference and therefore clearly discriminated between learners with a specific learning disability and those without. It may have been useful to have administered the supplemental tests of the Beery VMI-6 to establish concurrence between these tests and the TVPS-3 and the DTVP-3 subtests, but this would have made the testing too long and a second testing session would have been necessary. It would be of clinical value to use both subtests; namely, visual perception and motor-coordination together with the visual-motor integration assessment.

Since the sample in this study was chosen from a specific urban area with a middle-class income the results can only be generalised to comparable South African populations. Further research on a more representative sample of South African learners is required as socio-economic status and environmental conditions have been shown to affect the performance on these tests.

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APPENDIX A1: Demographic Questionnaire

THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PRVINCE, SOUTH AFRICA.

SECTION A

Code: _____

Dear parent/guardian, please complete the following demographic questionnaire concerning your child. Please note that all information given will be kept strictly confidential.

PERSONAL INFORMATION:	
Parent	
Contact number:	
Child	
Age:	
Gender:	
Current grade:	
Language:	
Dominance:	

Thank you for your time and co-operation, it is highly appreciated. Ms. Monique Harris - Researcher

SECTION B: Code: _____

MEDICAL HISTORY:

Illness	Comment/Specify
Have there been any childhood illnesses?	Yes ☐ No ☐
If yes, what childhood illnesses has your child had and has it been treated?	_____
Has your child had any periods of hospitalisations?	Yes ☐ No ☐
If yes what was the reason thereof and for how long was it?	_____
Is your child on any medication at present?	Yes ☐ No ☐
If yes,	over the counter medication Yes ☐ No ☐ prescribed by a doctor or specialist Yes ☐ No ☐
What is the name of the medication your child is using?	_____
What is the reason they are taking the medication?	_____
Under the care of which Doctor is your child?	Specialist Yes ☐ No ☐ General practitioner Yes ☐ No ☐
Did/does your child suffer from seizures?	Yes ☐ No ☐
If yes, what type?	_____
How often?	_____
Can you recall when your child experienced their first seizure and when last the child has experienced one?	_____
Is it currently under control?	_____

Therapy

Has your child ever received Occupational therapy? Yes ☐ No ☐

If yes, reason for therapy. _____

For how long did your child receive therapy? _____

Are they currently still receiving therapy? Yes ☐ No ☐

What was/is the outcome of therapy? _____

SCHOLASTIC HISTORY:

Did your child attend a nursery school? Yes ☐ No ☐

If yes, from which age and for how long? _____

Was your child assessed for school readiness before starting grade 1? Yes ☐ No ☐

If yes, when was this and what was the outcome of the assessment? _____

How is your child currently performing at school in the areas of his/her writing, mathematics, spelling and reading? _____

Has your child ever repeated any grades? Yes ☐ No ☐

If yes, which grades has been repeated and when was this? _____

What was the reason for repeating the grade/s? _____

Has any problems ever been identified with your child's learning, for example problems with reading, writing, spelling and mathematic skills? Yes ☐ No ☐

Difficulties recalling work or performing an output? _____

Demografiese Vraelys

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

("DIE DISKRIMINERENDE GELDIGHEID VAN VISUELE PERSEPSIE GESTANDARDISEERDE TOETSE VIR DIE IDENTIFISERING VAN SPESIFIEKE LEERGESTREMDHEDE IN KINDERS VAN DIE GAUTENG PROVINSIE, SUID-AFRICA")

AFDELING A

KODE: _____

Geagte ouer/voog, kan u asb. die volgende demografiese vraelys voltooi aangaande u kind. Neem asb.kennis dat alle inligting streng vertroulik gehou sal word.

PERSOONLIKE INLIGTING:	
Ouer	
Kontaknommer:	
Kind	
Ouderdom:	
Geslag:	
Huidige graad:	
Taal:	
Dominansie:	

Dankie vir u tyd en samewerking, dit word opreg waardeer. Me. Monique Harris - Navorser

AFDELING B: KODE: _____

MEDIESE GESKIEDENIS:

Siekte	Kommentaar/Spesifiseer
Het u kind enige kindersiektes gehad?	Ja ☐ Nee ☐
Indien ja, watter kindersiektes het u kind vantevore gehad en is dit voldoende behandel?	_____
Was daar enige periodes van hospitalisering?	Ja ☐ Nee ☐
Indien ja, wat was die rede hiervoor en vir hoe lank was dit gewees?	_____
Gebruik u kind tans enige medikasie?	Ja ☐ Nee ☐
Indien ja,	Oor die toonbank medikasie Ja ☐ Nee ☐ Voorgeskryf deur 'n dokter of spesialis Ja☐ Nee ☐
Wat is die naam van die medikasie wat u kind tans gebruik?	_____
Wat is die rede vir die medikasie?	_____
Onder die sorg van watter Dokter is u kind?	Spesialis Ja ☐ Nee ☐ Algemene praktisyn Ja ☐ Nee ☐
Het/ly u kind aan epilepsie?	Ja ☐ Nee ☐
Indien ja, watter tipe?	_____
Hoe gereeld?	_____
Kan u onthou wanneer u kind sy/haar eerste epileptiese aanval gehad het en wanneer laas u kind 'n aanval gehad het?	_____
Is dit tans onder beheer?	_____

Terapie:

Het u kind al ooit Arbeidsterapie ontvang? Ja ☐ Nee ☐

Indien ja, rede vir terapie. _____

Vir hoe lank het u kind terapie ontvang? _____

Ontvang hy/sy tans nog terapie? Ja ☐ Nee ☐

Wat is/was die uitkoms van die terapie? _____

SKOLASTIESE GESKIEDENIS:

Het u kind 'n kleuterskool bygewoon? Ja ☐ Nee ☐

Indien ja, vanaf watter ouderdom en vir hoe lank? _____

Was u kind geassesseer vir skoolgereedheid voor hy/sy met graad 1 begin het? Ja ☐ Nee ☐

Indien ja, wanneer was dit gewees en wat was die uitkoms van die assessering? _____

Hoe presteer u kind tans op skool in die areas van sy/haar skrif, wiskunde, spelling en lees? _____

Het u kind al enige grade herhaal? Ja ☐ Nee ☐

Indien ja, watter grade het hy/sy herhaal en wanneer was dit gewees? _____

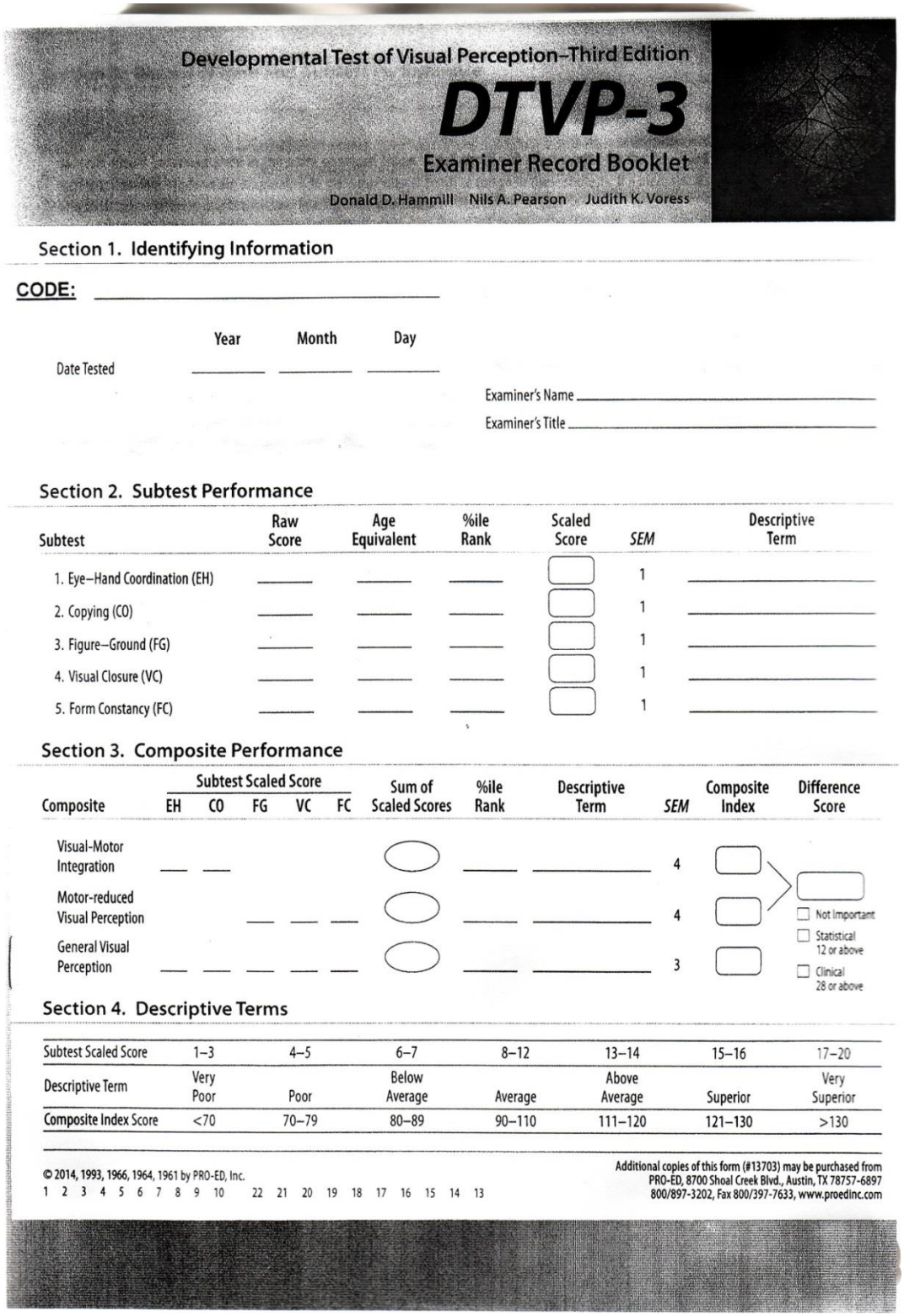
Wat was die rede vir die herhaling van die graad/grade? _____

Is daar enige probleme geïdentifiseer aangaande u kind se leervermoë bv. probleme met lees, skrif, spelling of wiskunde? Ja☐ Nee ☐

_____

Is daar enige probleme met die herroeping van werk? _____

APPENDIX A2: DTVP- 3 Score Sheet



Developmental Test of Visual Perception–Third Edition

DTVP-3

Examiner Record Booklet

Donald D. Hammill Nils A. Pearson Judith K. Voress

Section 1. Identifying Information

CODE: _____

	Year	Month	Day
Date Tested	_____	_____	_____

Examiner's Name _____

Examiner's Title _____

Section 2. Subtest Performance

Subtest	Raw Score	Age Equivalent	%ile Rank	Scaled Score	*SEM*	Descriptive Term
1. Eye–Hand Coordination (EH)	_____	_____	_____	☐	1	_____
2. Copying (CO)	_____	_____	_____	☐	1	_____
3. Figure–Ground (FG)	_____	_____	_____	☐	1	_____
4. Visual Closure (VC)	_____	_____	_____	☐	1	_____
5. Form Constancy (FC)	_____	_____	_____	☐	1	_____

Section 3. Composite Performance

Composite	Subtest Scaled Score EH	CO	FG	VC	FC	Sum of Scaled Scores	%ile Rank	Descriptive Term	*SEM*	Composite Index	Difference Score
Visual-Motor Integration	___	___				⬭	_____	_____	4	☐	☐
Motor-reduced Visual Perception			___	___	___	⬭	_____	_____	4	☐	☐ Not Important ☐ Statistical 12 or above ☐ Clinical 28 or above
General Visual Perception	___	___	___	___	___	⬭	_____	_____	3	☐	

Section 4. Descriptive Terms

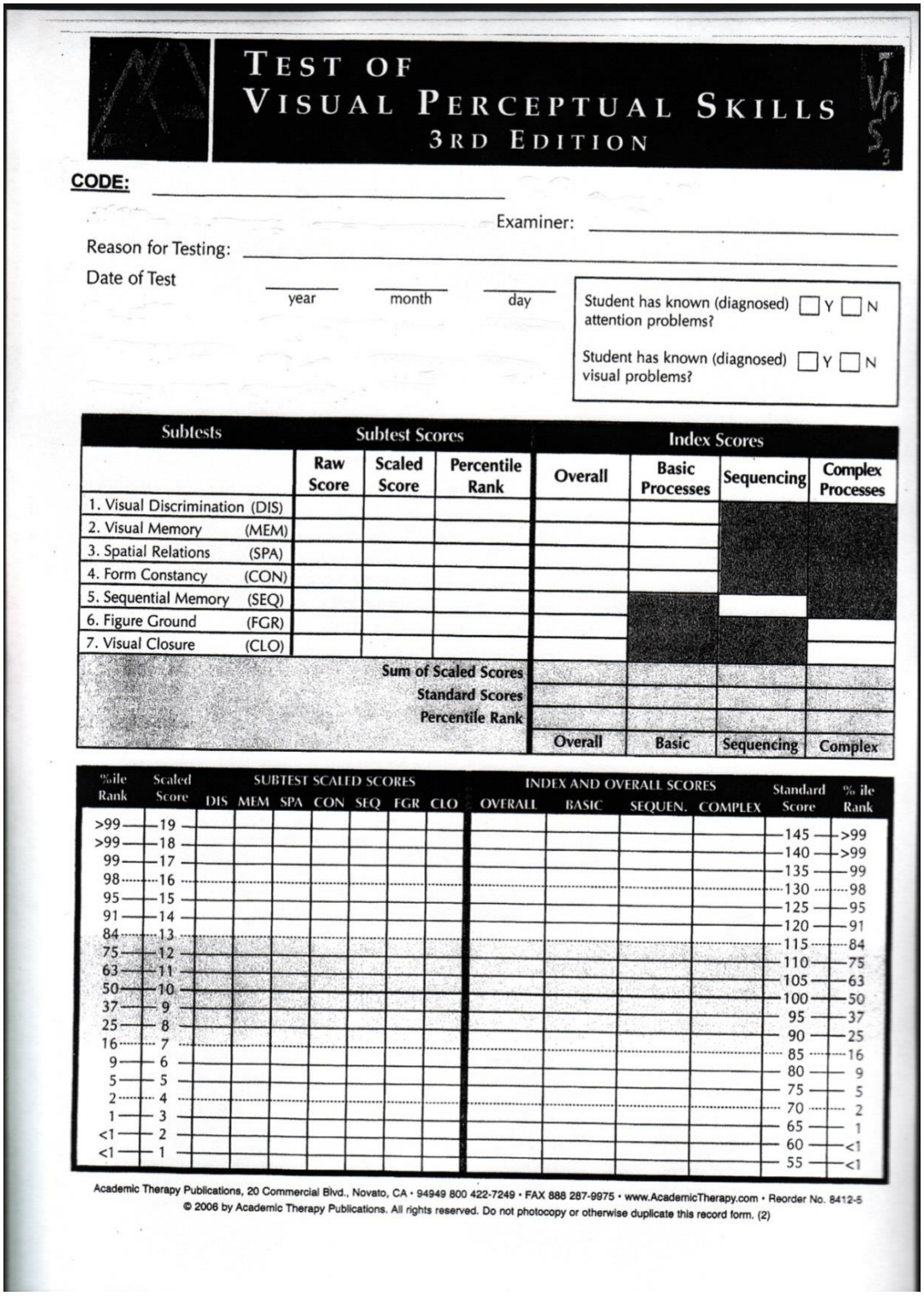
Subtest Scaled Score	1–3	4–5	6–7	8–12	13–14	15–16	17–20
Descriptive Term	Very Poor	Poor	Below Average	Average	Above Average	Superior	Very Superior
Composite Index Score	<70	70–79	80–89	90–110	111–120	121–130	>130

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1 2 3 4 5 6 7 8 9 10 22 21 20 19 18 17 16 15 14 13

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APPENDIX A3: TVPS- 3 Score Sheet



TEST OF VISUAL PERCEPTUAL SKILLS
3RD EDITION

CODE: _____

Examiner: _____

Reason for Testing: _____

Date of Test _____ year _____ month _____ day

Student has known (diagnosed) attention problems? ☐ Y ☐ N

Student has known (diagnosed) visual problems? ☐ Y ☐ N

Subtests	Subtest Scores			Index Scores			
	Raw Score	Scaled Score	Percentile Rank	Overall	Basic Processes	Sequencing	Complex Processes
1. Visual Discrimination (DIS)							
2. Visual Memory (MEM)							
3. Spatial Relations (SPA)							
4. Form Constancy (CON)							
5. Sequential Memory (SEQ)							
6. Figure Ground (FGR)							
7. Visual Closure (CLO)							
Sum of Scaled Scores							
Standard Scores							
Percentile Rank							
				Overall	Basic	Sequencing	Complex

%ile Rank	Scaled Score	SUBTEST SCALED SCORES DIS	MEM	SPA	CON	SEQ	FGR	CLO	INDEX AND OVERALL SCORES OVERALL	BASIC	SEQUEN.	COMPLEX	Standard Score	%ile Rank
>99	19												145	>99
>99	18												140	>99
99	17												135	99
98	16												130	98
95	15												125	95
91	14												120	91
84	13												115	84
75	12												110	75
63	11												105	63
50	10												100	50
37	9												95	37
25	8												90	25
16	7												85	16
9	6												80	9
5	5												75	5
2	4												70	2
1	3												65	1
<1	2												60	<1
<1	1												55	<1

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APPENDIX A4: Beery VMI-6 Score Sheet

The Beery–Buktenica Developmental Test of Visual–Motor Integration

Beery™ VMI

Sixth Edition

Ages 2 through 100 (FULL FORM)

by Keith E. Beery, Norman A. Buktenica, and Natasha A. Beery

CODE: _____

Examiner: _____

Test Date: _____ year _____ month _____ day

SUMMARY

See the Beery VMI manual (sixth edition) for norms.

	Beery VMI	Visual Perception	Motor Coordination
Raw Scores:	____	____	____
Standard Scores:	____	____	____
Scaled Scores:	____	____	____
Percentiles:	____	____	____
Other Scaling:	____	____	____

Comments and Recommendations:

PROFILE

Standard Score	Beery VMI	Visual Perception	Motor Coordination	Percentile
145	-	-	-	99.7
140	-	-	-	99.2
135	-	-	-	99
130	-	-	-	98
125	-	-	-	95
120	-	-	-	91
115	-	-	-	84
110	-	-	-	75
105	-	-	-	63
100	-	-	-	50
95	-	-	-	37
90	-	-	-	25
85	-	-	-	16
80	-	-	-	9
75	-	-	-	5
70	-	-	-	2
65	-	-	-	1
60	-	-	-	.8
55	-	-	-	.3

Begin testing on page 1. Turn booklet over with bound edge toward the examinee. If subtests are used, always test in this order: VMI → Visual → Motor.

PEARSON

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 A B C D E F

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Page 24

APPENDIX B: Ethical Clearance

R14/49 Ms Monique Harris

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M140648

NAME: (Principal Investigator)	Ms Monique Harris
DEPARTMENT:	Occupational Therapy West Rand Schools and Study Centre
PROJECT TITLE:	The Discriminitive Validity of Visual Perceptual Standardised Tests in Identifying Specific Learning Disabilities in a Sample of South African Children
DATE CONSIDERED:	27/06/2014
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Denise Franzsen
APPROVED BY:	Professor P Cleaton-Jones, Co-Chairperson, HREC (Medical)
DATE OF APPROVAL:	25/07/2014

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**.

Principal Investigator Signature _____ Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX C: Permission Gauteng Education Department

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

For administrative use:
Reference no. D2015 / 450 A

GDE AMENDED RESEARCH APPROVAL LETTER

Date:	**31 March 2015**
Validity of Research Approval:	**31 March 2015 to 2 October 2015**
Previous GDE Research Approval letter reference number	**D2015 / 259 dated 14 August 2014**
Name of Researcher:	**Harris M.**
Address of Researcher:	**P.O. Box 287; Florida Hills; 1716**
Telephone / Fax Number/s:	**011 672 7767; 074 359 8192; 011 763 2282**
Email address:	**moniqueharris77@yahoo.com**
Research Topic:	**The discriminative validity of visual perception standardized tests in identifying specific learning disabilities in children from the Gauteng province, South Africa**
Number and type of schools:	**THREE Primary and ONE LSEN school**
District/s/HO	**Johannesburg West**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved. A separate copy of this letter must be presented to the Principal, SGB and the relevant District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted. However participation is VOLUNTARY.

The following conditions apply to GDE research. The researcher has agreed to and may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

CONDITIONS FOR CONDUCTING RESEARCH IN GDE

Office of the Director: Knowledge Management and Research
9th Floor, 111 Commissioner Street, Johannesburg, 2001
P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506
Email: David.Makhado@gauteng.gov.za
Website: www.education.gpg.gov.za

1. The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter;
2. A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB);
3. A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned;
4. The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, SGBs, teachers and learners involved. Participation is voluntary and additional remuneration will not be paid;
5. Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal and/or Director must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage;
6. Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year;
7. Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.
8. It is the researcher's responsibility to obtain written parental consent and learner;
9. The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources;
10. The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations;
11. On completion of the study the researcher must supply the Director: Education Research and Knowledge Management with one Hard Cover, an electronic copy and a Research Summary of the completed Research Report;
12. The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned; and
13. Should the researcher have been involved with research at a school and/or a district/head office level, the Director and school concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

.....

Mrs F.L. Tshabalala

Acting Director: Education Research and Knowledge Management

DATE: 02/04/2015

Making education a societal priority

Office of the Director: Knowledge Management and Research
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Email: David.Makhado@gauteng.gov.za
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Occupational Therapy
School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

APPENDIX D1: Permission Letter – mainstream school principals

PERMISSION LETTER

PRINCIPAL MAINSTREAM SCHOOL

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

Principal ……..
…. School
PO Box

Dear Sir/Madam,

Good day, my name is Monique Harris. I am an occupational therapist currently doing by Master's degree in Occupational Therapy at the University of the Witwatersrand. My research topic is the investigation of the revised standardised visual perception assessments in the identification of visual perceptual problems in South African learners.

Why I'm I conducting this study? Occupational therapists often make use of standardised visual perception assessments to identify problems in visual perception and visual motor integration skills. The tests used by occupational therapists have currently been revised and the new editions are available in South Africa for use. The reason for the study is to determine if these new editions of the standardised visual perception assessments will be more responsive in identifying visual perceptual problems in children with a specific learning disability. The children attending a mainstream school will form part of the control group for the purpose of comparing the results with those learners attending a remedial school.

I am asking permission to complete the study with the learners at your school.

What do I except from the learners in the study?

The child will be seen once only. They will complete assessments namely: the Developmental Test of Visual Perception-3, Beery VMI 6th edition and Test of

Visual Perceptual Skills-3. This will involve them copying simple figures, completing simple drawings and matching designs.
The duration of the assessment will be approximately one hour and 30 minutes. The child will be given a 5-10 minute break between the different assessments. A time to do the tests will be arranged with the school and with the parents.

Are there benefits or foreseeable risks to the participants? In the case of the identification of visual perceptual or visual-motor integration problems, the parent/guardian will be contacted and be informed. Information on services for further assessment and treatment will be given.

May the parents withdraw their child from the study? Certainly, parents may withdraw their child from the study at any time without having to give a reason. The study is completely voluntary and not taking part or withdrawing from it carries not penalty of any sort and schooling will not be influenced.

What about confidentiality? Confidentiality will be ensured by the use of a code instead of names on the assessment forms. Only the researcher will have access to the list with your name and your child's name on it. Any information uncovered regarding your child's participation in this study will be held in strict confidence.

Contact details of researcher/s – for further information:
If you have any questions which are not fully explained in this form, you are welcome to contact me on 0743598192

Contact details of HREC chair – for reporting of complaints / problems:
Should there be any ethical queries about the research please feel free to contact the Human Research Ethics Committee (HREC) Chairman Prof P Cleaton-Jones at 011 7171234 or anisa.keshav@wits.ac.za

If you are happy to allow your child to take part in the study, please read and sign the consent form.



Monique Harris
Occupational therapist
BSc. OT (WITS)

PERMISSION TO DO RESEARCH

PRINCIPAL MAINSTREAM SCHOOL

I hereby confirm that I have been informed by the researcher, Monique Harris about the the study entitled "**THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."**

I have also read and understood the above written information regarding the study.

I understand that the results including the children's personal details regarding date of birth, initials etc. will be anonymously processed into a study report.

I agree to allow learner's from my school to participate in the study outlined in the information sheet.

PRINCIPAL'S NAME: _____
PRINCIPAL'S SIGNATURE: _____
DATE: _____

PERMISSION TO DO RESEARCH

PRINCIPAL: MAINSTREAM SCHOOL

I hereby confirm that I have been informed by the researcher, Monique Harris about the study entitled "**THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA**".

I have also read and understood the above written information regarding the study.

I give permission for using school records if needed to.

I agree to allow learners from my school to participate in the study as outlined in the information sheet.

PRINCIPAL'S NAME: J. L BENTZKE

PRINCIPAL'S SIGNATURE: _____

DATE: 25/09/2014

FROM:lantern school TO:0116729754 2014/09/25 09:07:52 #27775 P.004/007

PERMISSION TO DO RESEARCH

PRINCIPAL: MAINSTREAM SCHOOL

I hereby confirm that I have been informed by the researcher, Monique Harris about the study entitled "**THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA**".

I have also read and understood the above written information regarding the study.

I give permission for using school records if needed to.

I agree to allow learners from my school to participate in the study as outlined in the information sheet.

PRINCIPAL'S NAME: Mr JPA Marais

PRINCIPAL'S SIGNATURE: _____

DATE: 13/4/2015

GAUTENG DEPT. OF EDUCATION / GAUTENG DEPT. VAN ONDERWYS
LAERSKOOL DIE RUITER PRIMARY
2015 -04- 13
TEL: 011 760 1636
FAKS/FAX: 086 634 2732
POSBUS/PO BOX 2277, FLORIDA 1710

Occupational Therapy
School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

APPENDIX D2: Permission Letter - Aftercare study centre principal

PERMISSION LETTER

PRINCIPAL AFTERCARE STUDY CENTRE

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

Principal ……..
…. School
PO Box

Dear Sir/Madam,

Good day, my name is Monique Harris. I am an occupational therapist currently doing by Master's degree in Occupational Therapy at the University of the Witwatersrand. My research topic is the investigation of the revised standardised visual perception assessments in the identification of visual perceptual problems in South African learners.

Why I'm I conducting this study? Occupational therapists often make use of standardised visual perception assessments to identify problems in visual perception and visual motor integration skills. The tests used by occupational therapists have currently been revised and the new editions are available in South Africa for use. The reason for the study is to determine if these new editions of the standardised visual perception assessments will be more responsive in identifying visual perceptual problems in children with a specific learning disability. The children attending a mainstream school will form part of the control group for the purpose of comparing the results with those learners attending a remedial school.

I am asking permission to complete the study with the learners at your school.

What do I except from the learners in the study?

The child will only be seen once. They will complete assessments namely: the Developmental Test of Visual Perception-3, Beery VMI 6th edition and Test of Visual Perceptual Skills-3. This will involve them copying simple figures, completing simple drawings and matching designs.

The duration of the assessment will be approximately one hour and 30 minutes. The child will be given a 5-10 minute break between the different assessments. A time to do the tests will be arranged with the school and with the parents.

Are there benefits or foreseeable risks to the participants? In the case of the identification of visual perceptual or visual-motor integration problems, the parent/guardian will be contacted and be informed. Information on services for further assessment and treatment will be given.

May the parents withdraw their child from the study? Certainly, parents may withdraw their child from the study at any time without having to give a reason. The study is completely voluntary and not taking part or withdrawing from it carries not penalty of any sort and schooling will not be influenced.

What about confidentiality? Confidentiality will be ensured by the use of a code instead of names on the assessment forms. Only the researcher will have access to the list with your name and your child's name on it. Any information uncovered regarding your child's participation in this study will be held in strict confidence.

Contact details of researcher/s – for further information:

If you have any questions which are not fully explained in this form, you are welcome to contact me on 0743598192

Contact details of HREC chair – for reporting of complaints / problems:

Should there be any ethical queries about the research please feel free to contact the Human Research Ethics Committee (HREC) Chairman Prof P Cleaton-Jones at 011 7171234 or anisa.keshav@wits.ac.za

If you are happy to allow your child to take part in the study, please read and sign the consent form.



Monique Harris
Occupational therapist
BSc. OT (WITS)

PERMISSION TO DO RESEARCH

PRINCIPAL AFTERCARE STUDY CENTRE

I hereby confirm that I have been informed by the researcher, Monique Harris about the study entitled "**THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."**

I have also read and understood the above written information regarding the study.

I understand that the results including the children's personal details regarding date of birth, initials etc. will be anonymously processed into a study report.

I agree to allow learners from my aftercare Study Centre to participate in the study outlined in the information sheet.

PRINCIPAL'S NAME: _____
PRINCIPAL'S SIGNATURE: _____
DATE: _____

Occupational Therapy
School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

APPENDIX D3: Permission Letter – LSEN school principal

PERMISSION LETTER

PRINCIPAL LSEN SCHOOL

THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN A SAMPLE OF SOUTH AFRICAN CHILDREN

Principal ……..
…. School
PO Box

Dear Sir/Madam,

Good day, my name is Monique Harris. I am an occupational therapists currently doing by Master's degree in Occupational Therapy at the University of the Witwatersrand. My research topic is the investigation of the revised standardised visual perception assessments in the identification of visual perceptual problems in South African learners.

Why I'm I conducting this study? Occupational therapists often make use of standardised visual perception assessments to identify problems in visual perception and visual motor integration skills. The tests used by occupational therapists have currently been revised and the new editions are available in South Africa for use. The reason for the study is to determine if these new editions of the standardised visual perception assessments will be more responsive in identifying visual perceptual problems in children with a specific learning disability.

I am asking permission to complete the study with the learners at your school

What do I except from the learners in the study? The child will be seen once only. They will complete assessments; namely, the Developmental Test of Visual Perception-3, Beery VMI 6th edition and Test of Visual Perceptual Skills-3. This will involve them copying simple figures, completing simple drawings and matching designs. The duration of the assessment will be approximately one hour and 30 minutes. The child will be given a 5-10 minute break between the different

assessments. A time to do the tests will be arranged with the school and with the parents.

Are there benefits or foreseeable risks to the participants? In the case of the identification of visual perceptual or visual-motor integration problems, the child's occupational therapist will be given a copy of the results and the child's occupational therapy intervention plan will be adjusted accordingly to ensure that he\she will benefit from therapy.

May the parents withdraw their child from the study? Certainly, parents may withdraw their child from the study at any time without having to give a reason. The study is completely voluntary and not taking part or withdrawing from it carries not penalty of any sort and schooling will not be influenced.

What about confidentiality? Confidentiality will be ensured by the use of a code instead of names on the assessment forms. Only the researcher will have access to the list with your name and your child's name on it. Any information uncovered regarding your child's participation in this study will be held in strict confidence.

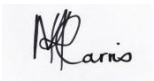
Contact details of researcher/s – for further information:

If you have any questions which are not fully explained in this form, you are welcome to contact me on 0743598192.

Contact details of HREC chair – for reporting of complaints / problems:

Should there be any ethical queries about the research please feel free to contact the Human Research Ethics Committee (HREC) Chairman Prof P Cleaton-Jones at 011 7171234 or anisa.keshav@wits.ac.za

If you are happy to allow your child to take part in the study, please read and sign the consent form.



Monique Harris
Occupational therapist
BSc. OT (WITS

PERMISSION TO DO RESEARCH

PRINCIPAL LSEN SCHOOL

I hereby confirm that I have been informed by the researcher, Monique Harris about the study entitled “The discriminative validity of visual perceptual standardised tests in identifying specific learning disabilities in a sample of South African children”.

I have also read and understood the above written information regarding the study.

I understand that the results including the children’s personal details regarding date of birth, initials etc. will be anonymously processed into a study report.

I agree to allow the learners in my school to participate in the study outlined in the information sheet.

PRINCIPAL’S NAME: _____
PRINCIPAL’S SIGNATURE: _____
DATE: _____

PERMISSION TO DO RESEARCH

PRINCIPAL LSEN SCHOOL

I hereby confirm that I have been informed by the researcher, Monique Harris about the study entitled **"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA".**

I have also read and understood the above written information regarding the study.

I give permission for using school records if needed to.

I agree to allow learners from my school to participate in the study as outlined in the information sheet.

PRINCIPAL'S NAME: Timo Greenwood.

PRINCIPAL'S SIGNATURE: _____

DATE: 2014/08/21

Occupational Therapy
School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
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APPENDIX E1: Information Sheet – Parents mainstream school (English)

PARENTS MAINSTREAM SCHOOL

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

Dear parent/guardian,

Good day, my name is Monique Harris. I am an occupational therapist currently doing by Master's degree in Occupational Therapy at the University of the Witwatersrand. My research topic is the investigation of the revised standardised visual perception assessments in the identification of visual perceptual problems in South African learners. I would be most grateful if you would allow your child to participate in the study.

Why I'm I conducting this study? Occupational therapists often make use of standardised visual perception assessments to identify problems in visual perception and visual -motor integration skills. The tests used by occupational therapists have currently been revised and the new editions are available in South Africa for use. The reason for the study is to determine if these new editions of the standardised visual perception assessments will be more responsive in identifying visual perceptual problems in children with a specific learning disability. Your child attending a mainstream school will form part of the control group for the purpose of comparing the results with those learners attending a remedial school.

I am inviting your child to participate in the study with your permission. If you agree to allow your child to participate, I will also ask them to give signed assent that they are willing to take part.

What do I except from the learners in the study? Your child will be seen once only. They will complete the following assessments namely: The Developmental Test of Visual Perception-3, Beery VMI (6th edition) and The Test of Visual

Perceptual Skills-3. This will involve them copying simple figures, completing simple drawings and matching designs. The duration of the assessment will be approximately one hour and 30 minutes. Your child will be given a 5-10 minute break between the different assessments. A time to do the tests will be arranged with the school and with you at your convenience.

Are there benefits or foreseeable risks to the participants? In the case of the identification of visual perceptual or visual-motor integration problems, you as parent/guardian will be contacted and be informed. Information on services for further assessment and treatment will be given.

May I withdraw my child from the study? Certainly, you or your child may withdraw from the study at any time without having to give a reason. The study is completely voluntary and not taking part or withdrawing from it carries not penalty of any sort and schooling will not be influenced.

What about confidentiality? Confidentiality will be ensured by the use of a code instead of names on the assessment forms. Only the researcher will have access to the list with your name and your child's name on it. Any information uncovered regarding your child's participation in this study will be held in strict confidence.

Contact details of researcher/s – for further information:

If you have any questions which are not fully explained in this form, you are welcome to contact me on 0743598192.

Contact details of HREC chair – for reporting of complaints / problems:

Should there be any ethical queries about the research please feel free to contact the Human Research Ethics Committee (HREC) Chairman Prof P Cleaton-Jones at 011 7171234 or anisa.keshav@wits.ac.za

If you are happy to allow your child to take part in the study, please read and sign the consent form.



Monique Harris
Occupational therapist
BSc. OT (WITS)

INFORMED CONSENT

PARENTS MAINSTREAM SCHOOL

I hereby confirm that I have been informed by the researcher; Monique Harris about the study entitled **"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN A SAMPLE OF SOUTH AFRICAN CHILDREN".**

I have also read and understood the above written information regarding the study.

I understand that the results including the children's personal details regarding date of birth, initials etc. will be anonymously processed into a study report.

I agree to allow my child to participate in the study outlined in the information sheet.

PARENT'S/GUARDIAN'S NAME: _____

PARENT'S/GUARDIAN'S SIGNATURE: _____

DATE: _____

Occupational Therapy
School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

APPENDIX E2: Information Sheets – Parents mainstream school (Afrikaans)

INLIGTINGBLAD

OUERS: HOOFSTROOMSKOOL

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

("DIE DISKRIMINERENDE GELDIGHEID VAN VISUELE PERSEPSIE GESTANDARDISEERDE TOETSE VIR DIE IDENTIFISERING VAN SPESIFIEKE LEERGESTREMDHEDE IN KINDERS VAN DIE GAUTENG PROVINSIE, SUID-AFRICA")

Geagte ouer/voog,

Goeie dag, my naam is Monique Harris. Ek is 'n Arbeidsterapeut wat tans besig is met my Meestersgraad by die Universiteit van die Witwatersrand. Die onderwerp van my navorsing is die ondersoek van die hersiene gestandardiseerde visuele persepsie assserings in die identifisering van visuele persepsie probleme in Suid-Afrikaanse kinders. Ek sal dit opreg waardeer as u sal toelaat om u kind aan die studie te laat deelneem.

Hoekom onderneem ek hierdie studie? Arbeidsterapeute maak gereeld gebruik van gestandardiseerde visuele persepsie assesserings om probleme in visuele persepsie en visuele- motoriese integrasie te identifiseer. Die toetse waarvan Arbeidsterapeute gebruik maak is huidiglik hersien en die nuwe uitgawes is beskikbaar in Suid-Afrika vir gebruik. Die rede vir die studie is om te bepaal of hierdie nuwe uitgawes van die gestandardiseerde visuele persepsie assesserings meer antwoordend sal wees in die identifiseering van visuele perseptuele probleme in kinders met 'n spesifieke leergestremdheid. U kind, wat 'n hoofstroomskool bywoon sal deel uitmaak van die kontrolegroep vir die doel om die resulate te vergelyk met dié van leerders in 'n LSEN remediërende skool.

Ek nooi u kind uit om deel te neem aan die studie met u toestemming. As u instem en u kind toelaat om deel te neem, sal ek hulle ook vra om getekende toestemming te gee dat hulle gewillig is om deel te neem.

Wat verwag ek van deelnemers in die studie?U kind sal slegs eenkeer gesien word. Hulle sal gevra word om die volgende assesserings te voltooi naamlik: Die "Developmental Test of Visual Perception-3", Die "Beery VMI (6th edition)" en Die "Test of Visual Perceptual Skills-3". Dit sal behels dat hulle eenvoudige figure moet kopieer, eenvoudige tekeninge moet voltooi en ontwerpe moet pas. Die duur van die assessering sal ongeveer een uur en 30 minute wees. 'n Tyd om die toetse af te lê sal met die skool en met u gereël word volgens u gerieflikheid.

Is daar enige voordele of risiko's vir die deelnemers?In die geval waar probleme in visuele persepsie of visuele- motoriese integrasie geïdentifiseer word, sal u as ouer/voog gekontak word en ingelig word. Inligting van dienste oor verderde assessering en behandeling sal gegee word.

Mag ek my kind ontrek uit die studie?Verseker, u en u kind mag ontrek uit die studie op enige tyd sonder om 'n geldige rede te gee. Die studie is heeltemal vrywillig en om nie deel te neem nie of om te onttrek dra geen penalisering nie en onderrig sal nie beïnvloed word nie.

Wat van vertroulikheid? Vertroulikheid sal verseker word deur die gebruik van kodes in plaas van name op die asseringsvorms. Slegs die navorser sal toegang hê tot die lys met u en u kind se naam. Enige inligting wat ontboot word aangaande u kind se deelname in die studies sal in streng vertroulikheid gehou word.

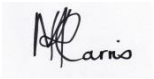
Kontakbesonderhede van die navorser/s – vir verdere inligting:

Indien u enige vrae het wat nie ten volle duidelik is op hierdie vorm nie, is u welkom om my te kontak by 0743598192

<u>Kontakbesonderhede van HREC voorsitter – vir die rapportering van klagtes of probleme:</u>

Indien daar enige etiese navrae aangaande die navorsingsstudie is voel asb. vry om die “Human Research Ethics Committee (HREC)” voorsitter Prof P Cleaton-Jones te kontak by 011 7171234 of anisa.keshav@wits.ac.za

As u tevrede is om u kind te laat deelneem aan die sutdie, lees asb. en teken die toestemmingsvorm.



Monique Harris
Arbeidsterapeut
BSc. AT (WITS)

TOESTEMMINGSBRIEF

OUERS: HOOFSTROOMSKOOL

Hiermee bevestig ek dat ek ingelig is deur die navorser, Monique Harris oor die studie getiteld: **"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."**

("DIE DISKRIMINERENDE GELDIGHEID VAN VISUELE PERSEPSIE GESTANDARDISEERDE TOETSE VIR DIE IDENTIFISERING VAN SPESIFIEKE LEERGESTREMDHEDE IN KINDERS VAN DIE GAUTENG PROVINSIE, SUID-AFRICA")

Ek het ook die bogenoemde inligting gelees en verstaan die geskrewe inligting hierbo genoem aangaande die studie.

Ek verstaan dat die resultate aangaande die kinders se persoonslike besonderhede soos die datum van geboorte, voorletters ens anoniem geprossesser sal word in die studieverslag.

Ek gee toestemming om my kind aan die studie mag deelneem soos uiteengesit in die inligtingsblad.

OUER/VOOG SE NAAM: _____

OUER/VOOG SE HANDTEKENING: _____

DATUM: _____

Occupational Therapy
School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

APPENDIX F1: Information Sheet – Parents LSEN school (English)

PARENTS LSEN SCHOOL

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

Dear parent/guardian,

Good day, my name is Monique Harris. I am an occupational therapist currently doing by Master's degree in Occupational Therapy at the University of the Witwatersrand. My research topic is the investigation of the revised standardised visual perception assessments in the identification of visual perceptual problems in South African learners. I would be most grateful if you would allow your child to participate in the study.

Why I'm I conducting this study? Occupational therapists often make use of standardised visual perception assessments to identify problems in visual perception and visual motor integration skills. The tests used by occupational therapists have currently been revised and the new editions are available in South Africa for use. The reason for the study is to determine if these new editions of the standardised visual perception assessments will be more responsive in identifying visual perceptual problems in children with a specific learning disability.

I am inviting your child to participate in the study with your permission. If you agree to allow your child to participate, I will also ask them to give signed assent that they are willing to take part.

What do I except from the learners in the study? Your child will be seen once only. They will complete the following assessments namely: The Developmental Test of Visual Perception-3, The Beery VMI (6th edition) and the Test of Visual Perceptual Skills-3. This will involve them copying simple figures, completing

simple drawings and matching designs. The duration of the assessment will be approximately one hour and 30 minutes. Your child will be given a 5-10 minute break between the different assessments. A time to do the tests will be arranged with the school and with you at your convenience.

Are there benefits or foreseeable risks to the participants? In the case of the identification of visual perceptual or visual-motor integration problems, the child's occupational therapist will be given a copy of the results and the child's occupational therapy intervention plan will be adjusted accordingly to ensure that he\she will benefit from therapy.

May I withdraw my child from the study? Certainly, you or your child may withdraw your child from the study at any time without having to give a reason. The study is completely voluntary and not taking part or withdrawing from it carries not penalty of any sort and schooling will not be influenced.

What about confidentiality? Confidentiality will be ensured by the use of a code instead of names on the assessment forms. Only the researcher will have access to the list with your and your child's name on it. Any information uncovered regarding your child's participation in this study will be held in strict confidence.

Contact details of researcher/s – for further information:

If you have any questions which are not fully explained in this form, you are welcome to contact me on 0743598192.

Contact details of HREC chair – for reporting of complaints / problems:

Should there be any ethical queries about the research please feel free to contact the Human Research Ethics Committee (HREC) Chairman Prof P Cleaton-Jones at 011 7171234 or anisa.keshav@wits.ac.za.

If you are happy to allow your child to take part in the study, please read and sign the consent form.



Monique Harris
Occupational therapist
BSc. OT (WITS)

INFORMED CONSENT

PARENTS LSEN SCHOOL

I hereby confirm that I have been informed by the researcher; Monique Harris about the study entitled "**THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."**

I have also read and understood the above written information regarding the study.

I understand that the results including the children's personal details regarding date of birth, initials etc. will be anonymously processed into a study report.

I agree to allow my child to participate in the study outlined in the information sheet.

PARENT'S/GUARDIAN'S NAME: _____

PARENT'S/GUARDIAN'S SIGNATURE: _____

DATE: _____

Occupational Therapy
School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

APPENDIX F2: Information Sheet – Parents LSEN school (Afrikaans)

INLIGTINGSBLAD

OUERS: LSEN SKOOL

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

("DIE DISKRIMINERENDE GELDIGHEID VAN VISUELE PERSEPSIE GESTANDARDISEERDE TOETSE VIR DIE IDENTIFISERING VAN SPESIFIEKE LEERGESTREMDHEDE IN KINDERS VAN DIE GAUTENG PROVINSIE, SUID-AFRICA")

Geagte ouer/voog,

Goeie dag, my naam is Monique Harris. Ek is 'n Arbeidsterapeut wat tans besig is met my Meestersgraad by die Universiteit van die Witwatersrand. Die onderwerp van my navorsing is die ondersoek van die hersiene gestandardiseerde visuele persepsie assserings in die identifisering van visuele persepsie probleme in Suid-Afrikaanse kinders. Ek sal dit opreg waardeer as u sal toelaat om u kind aan die studie te laat deelneem.

Hoekom onderneem ek hierdie studie? Arbeidsterapeute maak gereeld gebruik van gestandardiseerde visuele persepsie assesserings om probleme in visuele persepsie en visuele motoriese integrasie te identifiseer. Die toetse waarvan Arbeidsterapeute gebruik maak is huidiglik hersien en die nuwe uitgawes is beskikbaar in Suid-Afrika vir gebruik. Die rede vir die studie is om te bepaal of hierdie nuwe uitgawes van die gestandardiseerde visuele persepsie assesserings meer antwoordend sal wees in die identifiseering van visuele perseptuele probleme in kinders met 'n spesifieke leergestremdheid.

Ek nooi u kind om deel te neem aan die studie met u toestemming. As u instem en u kind toelaat om deel te neem, sal ek hulle ook vra om getekende toestemming te gee dat hulle gewillig is om deel te neem.

Wat verwag ek van deelnemers in die studie?U kind sal slegs eenkeer gesien word. Hulle sal gevra word om die volgende assesserings te voltooi naamlik: Die "Developmental Test of Visual Perception-3", Die "Beery VMI (6th edition)" en die "Test of Visual Perceptual Skills-3". Dit sal behels dat hulle eenvoudige figure moet kopieer, eenvoudige tekeninge moet voltooi en ontwerpe moet pas. Die duur van die assessering sal ongeveer een uur en 30 minute wees. 'n Tyd om die toetse af te lê sal met die skool en met u gereël word volgens u gerieflikheid.

Is daar enige voordele of risiko's vir die deelnemers?In die geval waar probleme ge-ïdentifiseer word in visuele persepsie of visuele motorise integrasie sal die kind se Arbeidsterpeut hieroor ingelig word en hulle sal 'n kopie van die resultate ontvang sodat die kind se Arbeidsterapieprogram daarvolgens aangepas kan word om te verseker dat hy/sy sal baatvind by terapie.

Mag ek my kind ontrek uit die studie?Verseker, u en u kind mag ontrek uit die studie op enige tyd sonder om 'n geldige rede te gee. Die studie is heeltemal vrywillig en om nie deel te neem nie of om te onttrek dra geen penalisering nie en onderrig sal nie beïnvloed word nie.

Wat van vertroulikheid? Vertroulikheid sal verseker word deur die gebruik van kodes in plaas van name op die asseringsvorms. Slegs die navorser sal toegang hê tot die lys met u en u kind se naam. Enige inligting wat ontboot word aangaande u kind se deelname in die studies sal in streng vertroulikheid gehou word.

Kontakbesonderhede van die navorser/s – vir verdere inligting:

Indien u enige vrae het wat nie ten volle duidelik is op hierdie vorm nie, is u welkom om my te kontak by 0743598192

Kontakbesonderhede van HREC voorsitter – vir die rapportering van klagtes of probleme:

Indien daar enige etiese navrae aangaande die navorsingsstudie is voel asb. vry om die “Human Research Ethics Committee (HREC)” voorsitter Prof P Cleaton-Jones te kontak by 011 7171234 of anisa.keshav@wits.ac.za

As u tevrede is om u kind te laat deelneem aan die sutdie, lees asb. en teken die toestemmingsvorm.



Monique Harris
Arbeidsterapeut
BSc. AT (WITS)

TOESTEMMINGSBRIEF

OUERS: LSEN SKOOL

Hiermee bevestig ek dat ek ingelig is deur die navorser, Monique Harris oor die studie getiteld “The discriminative validity of visual perceptual standardised tests in identifying specific learning disabilities in a sample of South African children” **(Die diskriminerende geldigheid van visuele persepsie gestandardiseerde toetse vir die identifisering van spesifieke leergestremdhede in ‘n proef van Suid-Afrikaanse kinders)**.

Ek het ook die bogenoemde inligting gelees en verstaan die geskrewe inligting hierbo genoem aangaande die studie.

Ek verstaan dat die resultate aangaande die kinders se persoonslike besonderhede soos die datum van geboorte, voorletters ens anoniem geprossesser sal word in die studieverslag.

Ek gee toestemming om my kind aan die studie mag deelneem soos uiteengesit in die inligtingsblad.

OUER/VOOG SE NAAM: _____

OUER/VOOG SE HANDTEKENING: _____

DATUM: _____

APPENDIX G: Verbal Assent

LEERDER TOETSTEMMINGSVORM:

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

("DIE DISKRIMINERENDE GELDIGHEID VAN VISUELE PERSEPSIE GESTANDARDISEERDE TOETSE VIR DIE IDENTIFISERING VAN SPESIFIEKE LEERGESTREMDHEDE IN KINDERS VAN DIE GAUTENG PROVINSIE, SUID-AFRICA")

Hallo, my naam is Monique. Ek is 'n Arbeidsterapeut. Hoe gaan dit vandag? Ek ek vra of jy saam met my sal kom om 'n bietjie te teken, te kopieër en goedjies te pas?

Baie dankie.

NAAM VAN GETUIE: _____

HANDTEKENING VAN GETUIE: _____

DATUM: _____

NAAM VAN NAVORSER: _____

LEARNER ASSENT FORM:

"THE DISCRIMINATIVE VALIDITY OF VISUAL PERCEPTUAL STANDARDISED TESTS IN IDENTIFYING SPECIFIC LEARNING DISABILITIES IN CHILDREN FROM THE GAUTENG PROVINCE, SOUTH AFRICA."

Hallo, my name is Monique. I am an Occupational Therapist. How are you today? I am asking you please to come with me and do some drawing, copying and matching.

Thank you so much.

NAME OF WITNESS: _____

SIGNATURE OF WITNESS: _____

DATE: _____

SIGNATURE OF RESEARCHER: _____