CROSS-CULTURAL NORMATIVE INDICATORS ON THE WECHSLER MEMORY SCALE (WMS) ASSOCIATE LEARNING AND VISUAL REPRODUCTION SUBTESTS

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For Conrad

"Too many have suffered for the love of freedom."
Nelson Mandela (Crwys-Williams, 2004, p. 37).

ABSTRACT

A comprehensive battery of commonly used neuropsychological tests, including the WMS Associate Learning and Visual Reproduction subtests, forming the focus of this study, were administered to a southern African sample (n = 33, age range 18-40). This sample composed of black South African, IsiXhosa speakers with an educational level of Grade 11 and 12, derived through DET and former DET schooling. The gender demographics were as follows; females n = 21 and males n = 12. This sample was purposefully selected based on current cross-cultural research which suggests that individuals matching these above-mentioned demographics are significantly disadvantaged when compared to available neuropsychological norms. This is due to the fact that current norms have been created in contexts with socio-cultural influences; including culture, language and quantity and quality of education distinctly dissimilar to individuals like that composed in the sample. Hence the purpose of this study was fourfold namely; 1) Describe and consider socio-cultural factors and the influence on test performance 2) Provide descriptive and preliminary normative data on this neuropsychologically underrepresented population 3) Compare test performance between age and gender through stratification of the sample and finally to 4) Evaluate the current norms of the two WMS subtests and assess their validity for black South Africans with DET and former DET schooling with comparisons to the results found in the study. Information derived from the statistical analyses indicated that a higher performance in favour of the younger group over the older age range was consistently found for both WMS subtests. With regards to gender, some higher means were evident for the male population in the sample than was produced by the female group. Lastly, due to the fact that most scores derived from the sample were considerably lower when compared to the available norms, it is felt that socio-cultural factors prevalent to this population are a significant cause of lower test performance and thus warrant the development of appropriate normative indicators.

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CHAPTER 1: INTRODUCTION

1.1 Contextual underpinnings of this study

Neuropsychological assessment is a dynamic and comprehensive applied science assessing a broad spectrum of cognitive modalities, evaluating the brain-behaviour relationship. More specifically it is the investigation of outward behavioural expressions of individuals to detect and evaluate the presence and effect of brain pathology or dysfunction (Groth-Marnat, 2000). One of these vital cognitive modalities is that of memory. This important faculty is central to effective and optimal living, as a dysfunction in this area, renders the individual dependent and without personal continuity and contextuality. Unfortunately the areas of the brain responsible for this important cognitive domain are found in several different regions, and thus are particularly sensitive to injury or disease (Lezak, Howieson, & Loring, 2004). Added to this complexity is that memory is negatively affected by most common psychiatric and neurological disorders and is one of the most frequently seen complaints in outpatient settings and henceforth, reason for a request of a neuropsychological assessment (Lezak, et al., 2004).

Although memory disorder has been found to be one of the most sensitive indicators of brain pathology (Lishman, 2006), in light of the considerations above and confounding factors which will be highlighted shortly, the assessment of memory can be a compound endeavour. In general, any data elicited from neuropsychological testing needs to be compared to norms in order to contextualise and place the results on a continuum, drafted from results of a *similar* population. However this poses a specific conundrum within the South African context as most neuropsychological tests have been developed and normed in Western cultures; the U.S., Canada and United Kingdom occupying the majority (Nell, 2000). Thus within this culturally diverse country, characterised by a long history of acknowledged educational inequalities (Kallaway, 1984), and the well documented and accepted fact that socio-cultural factors greatly influence test performance and memory functioning (Ardila, & Rosselli, 2003), using these available norms appears problematic and moreover ethically contraindicated.

Psychologists working in South Africa have responded to this dearth of normative data (Gaylard, 2005; Horsman, 2007; Shuttleworth-Edwards, Donnelly, Reid, & Radloff,

2004; Shuttleworth-Edwards, Kemp, Rust, Muirhead, Hartman, & Radloff, 2004; Van Tonder, 2007). Forming part of a broader and on-going local normative research project, this study attempts to provide preliminary cross-cultural normative data on a population which currently fails to be accounted for adequately neuropsychologically. Thus a sample of black, IsiXhosa speaking non-skilled workers without tertiary education were tested on two well-established and widely used memory tests, namely the Associate Learning and Visual Reproduction subtests of the Wechsler Memory Scale (WMS) in both the immediate and delayed recall tests (Wechsler, 1945). These are two commonly used memory instruments, which tap into verbal and visual memory categories respectively, allowing conclusions to be made on memory as a composite or whether there is a presence of specific hemispheric pathology.

This study with continue with an extensive literature review presented in Chapter 2. Firstly, the approach to the assessment of memory is presented that is practitioner orientated and clinically indicated. Secondly, the original WMS (1945) and the two subtests forming the focus of this study will be highlighted and discussed and compared to its subsequent revisions. Thirdly, the available normative data will be presented with an argument that supports the need to create new normative data that takes into account socio-cultural factors.

Chapter 3 will detail the steps taken to conduct this research in the methodology section. Information regarding the sampling, procedure and data analyses of the study will be illuminated. Additionally the ethical considerations of this study will be presented.

The results from the descriptive analyses will next be presented in Chapter 4. The results will be stratified across age and gender to allow comparisons of performance across these two demographics of the sample.

Lastly Chapter 5 will address the overall aim and argument of this research with a discussion of the results with reference to the highlighted literature presented in Chapter 2. Furthermore any similarities or differences found in performance in this cross-cultural study will be discussed and compared with reference to current available norms. Lastly recommendations for future research are offered and motivated for.

CHAPTER 2: LITERATURE REVIEW

If any one faculty of our nature may be called more wonderful than the rest, I do think it is memory. There seems something more speakingly incomprehensible in the powers, the failures, the inequalities of memory, than in any other of our intelligences. The memory is sometimes retentive, so serviceable, so obedient - at others so bewildered and so weak- and at others again, so tyrannic, so beyond control! –We are to be sure a miracle every way- but our powers of recollecting and forgetting, do seem peculiarly past finding out.

Jane Austen, Mansfield Park, 1814 (1961)

This chapter aims to highlight briefly how memory is conceptualised and assessed clinically. Further to this a comprehensive review of relevant literature on this complex faculty and potentially confounding variables that should be considered in cross-cultural contexts will be provided. Specific attention will be paid with this regard to the South African context on two memory instruments namely the Wechsler Associate Learning and Visual Reproduction (1945) subtests on both the immediate and delayed recall additions.

2.1. A Clinical Model of Memory

2.1.1 Verbal and Visual Memory

For the clinician, memory assessment can be a daunting task due to the plethora of divergent theories and terminologies on memory and the sheer complexity and intricacies of neuroanatomy. Coupled with this is the panoply of memory testing procedures and broad range of amnestic syndromes (Reeves, & Wedding, 1994). Yet within neuropsychological batteries, the clinical assessment of memory is approached and subsequently achieved through two useful divisions, namely verbal and visual memory subtypes. This partition is clinically indicated and practical as it allows conclusions to be drawn on the presence of diffuse damage; via overall poor performance on both memory subtypes or specific hemispheric pathology, indicated by a differential performance on just one division. Physiologically these inferences can be made because of the landmark studies conducted by Scoville and Milner (1957). Evidence from their research exhibited how verbal and visual memory were affected differently depending on the site of a lesion in the brain, with a deficit in verbal skills resulting from pathology in the left hemisphere and visual skills, the right. (Lezak et al., 2004; Reeves, & Wedding, 1994).

2.1.2 Short-term memory (Immediate Recall) and Long-term memory (Delayed recall)

Another useful development in the assessment of memory also came about in the 1960's, where the theoretical fractionation of memory occurred with regards to short and long term memory storage (Badderley, 2004; Reeves, & Wedding, 1994). The prevailing and dominant conceptualisation posited memory as a unitary construct. Thus it was originally thought that the amount of brain matter negatively affected, rendered more dysfunction and debilitation. Hence the assessment of memory was considered to be adequately captured through a single memory test. However the body of neuropsychological research increased and varying symptoms and contrasting abilities began to be observed in different amnestic and degenerative disorders. For example; some participants with damage to their perisylvian region of the left hemisphere could only recall a span of one or two digits, but appeared to have an intact remote memory; that is, ability to retrieve personal information and past events (Shallice, & Warrington, 1970). This was a clear indication of a dissimilar and longer memory store functionality as opposed to recent information that could not be immediately held or maintained. These insurmountable and contradictory facts to the prevailing theoretical argument called for a theoretical rethink (Mitrushina, Boone, & D'Elia, 2005). Hence in response, the antiquated conceptualisation evolved to include two distinct processes namely short-term and long-term memory systems (Badderley, 2004)[1].

Coupled with this was the identification of the distinction between recognition and recall. Memory failure can result from two problems, namely an inability to retrieve the information or an incapability to retain it (Badderley, 2004; Reeves, & Wedding, 1994). Retrieval of information can be negatively affected by an inability to correctly register the information, or it could be explained by the fact that the information decayed, either through interference or rate of processing (Reeves, & Wedding, 1994). This concept can be further explained and elaborated through understanding memory as a sequence of

[1] The author acknowledges that some theorists house immediate memory (ultra-short memory) and delayed recall (recent memory) both under the label of short-term memory (see Lishman, 2005). As there is no general consensus on this matter, the terms short and long term memory have been used as conceptualised by Badderley, 2004 and Reeves, & Wedding, 1994. For a comprehensive model on memory with particular focus on short and long term memory, the author directs readers to Badderley, A. D., Kopelman, M. D. ,& Wilson, B. A. (2004). (Eds.). *The essential handbook of memory disorders for clinicians.* Chichester: John Wiley & Sons.

three complex cognitive processes whereby information is: *encoded* (registration), *stored* (maintenance), and *retrieved* (recollection) (Badderley, 2004). Encoding is essential in the uptake and registration of information and occurs in both short and long term memory processes. However there is a difference with this dual storage system (Lezak et al., 2004) with regards to the second and third process. Short term memory has a restricted storage capacity, with information tending to decay, ranging from seconds to a few minutes (Reeves, & Wedding, 1994). Thus clinically, tests of immediate recall merely measure how information just presented can be reproduced.

Long-term memory on the other hand has a slower rate of information decomposition and can last from minutes to years (Wedding, & Reeves, 1994). Thus the third stage, retrieval is more closely associated with long-term memory as the ability to hold and manipulate the information is required in this cognitive function. Within clinical assessment the terms commonly used to test these two functions of recognition and recall are immediate recall and delayed recall respectively. As explained above, these two cognitive tests are in response to the broadening of memory understanding and aids in a useful manner for the assessor in establishing a difference in dysfunction between the dual storage of information. Moreover the immediate memory test occurs straight after a stimulus has been presented and taken away, whereas the delayed recall commonly occurs around 30 minutes after the original exposure. During the interim between the stimulus and delayed recall, interference should occur so that rehearsal of the stimulus is avoided. This is pivotal as the clinician wants to discriminate between material which is maintained on the basis of repeated rehearsal or is truly reflective of learning; information which has been fused into a longer term storage capacity (Horsman, 2007).

2.2 The Wechsler Memory Scale (WMS)

The Wechsler Memory Scale (*WMS*) was developed in 1945 with the intention of providing "a rapid, simple and practical memory examination" (Wechsler, 1945, p. 87). It was the first standardised memory battery to be developed and since then the WMS and its revisions are ubiquitous with memory assessment being; "likely the most widely used and most recognizable memory battery" (Butler, Retzlaff, & Vanderploeg, 1991, p. 512). Even though this is one of the oldest batteries used currently, it is "convenient in use,

widely available, commands an extensive literature, and has...demonstrated neuropsychological validity" thus its pervasive usage is comprehensible and moreover logical (Skilbeck, & Woods, in Crawford, Parker, & McKinlay, 1992).

This original version of the WMS consists of seven subtests, of which the two tests, Associate Learning and Visual Reproduction, testing verbal and visual memory respectively, formed part of. Two alternate forms exist for the WMS, Form I and Form II. However Form II is rarely used, standardisation of it is poor and under-researched and is shown to have a poor equivalence to Form I (Crawford et al., 1992; Lezak, 1983; Lezak et al., 2004; Mitrushina, et al., 2005; Spreen, & Strauss, 1998). Based on this, Form I for both subtests was used for this study.

The WMS has undergone two subsequent facelifts, the WMS-R (1987) and WMS-III (1997) respectively, each time trying to address the predecessor's weaknesses. However with every reincarnation, some of the strengths of the original have been lost. Although these newer versions exist, the original version of the WMS is favoured by most clinicians due to the quantity and quality of data accrued (Guilmette, Faust, Hart, & Arkes, in Spreen, & Strauss, 1998). Therefore informed by evidence based practice, using these two internationally recognised and standardised memory instruments of the original WMS appears informed and good practice for this study, when investigating memory. The benefits of the original version shall be discussed in further detail however later in this chapter.

2.2.1 The Associate Learning[2] subtest of the Wechsler Memory Scale

The WMS Associate Learning subtest consists of a list of ten paired words, six forming "easy" associations (e.g., north-south) and four "hard" associations (e.g., crush-dark) (Wechsler, 1945). In test administration, the list of paired words is read, followed by a memory trial, in which the examiner provides a stimulus to which the testee must provide the correct association. This is repeated three times. The score is a combined value in which the sum of the correct "easy" associations is halved and added to the sum of the correct "hard" associations, 21 being the maximum attainable score (Wechsler, 1945). In

[2] Referred to as Verbal Paired Associates from the WMS-R version (Lezak et al., 2004).

addition, within the three lists, the order of paired words is randomised so that retention cannot be attributed to positional learning (Lezak, et al., 2004).

2.2.2 The Visual Reproduction subtest of the Wechsler Memory Scale

The WMS Visual Reproduction subtest consists of three cards, each with different geometric designs. Each card is presented to the testee and given 10 seconds to memorise. Cards A and B contain one design each, and card C contains two. After the card is taken away, the testee is asked to draw immediately what they can remember on a blank piece of paper. Maximum score for Card A is 3, Card B, 5 and Card C, 6, thus the total maximum score for all figures is 14 (Wechsler, 1945).

2.2.3 Benefits of using the original WMS subtests

2.2.3.1 Delayed recall as an indicator of a problem in retrieval and improved validity

One of the main criticisms of the original WMS lay in the absence of any delayed recalls measures (Crawford et al., 1992; Lezak, 2004; Mitrushina et al., 2005; Spreen, & Strauss, 1998). Thus assessing a client's retention of information could not commented on. Many examiners now include a delayed recall after Russell (1975) recommended a delayed recall addition to the original WMS after a 30 minute period based on the above concerns. As noted earlier, delayed recall; measures information that is not simply held in a temporary or immediate capacity (Horsman, 2007). Therefore the distinction between an encoding or retrieval problem can be ascertained through this inclusion. In addition, both the Associate Learning and Visual Reproduction subtests validity are improved through the addition of a delayed recall task (Spreen, & Strauss, 1998).

2.2.3.2 Delayed recall as an indicator of specific hemispheric pathology and discriminator between this and depression

As mentioned earlier, the delayed recall test is also particularly sensitive to illuminating cerebral pathology (Mitrushina et al., 2005), as more complex cognitive processes are involved to encode, maintain and recall the information. Further to this, immediate recall has been found to be less sensitive from discriminating depression from brain dysfunction. Typically the difference in the delayed recall between brain damage and depression is that depression will cause a participant to score one point lower than they

did in the immediate recall, whereas the participant with cerebral pathology will drop on the delayed recall by approximately five points (Reeves, & Wedding, 1994).

2.2.3.3 Delayed recall as a useful measure in cross-cultural contexts

Within cross-cultural studies, the inclusion of the delayed recall is particularly beneficial and indicated as appropriate and representative norms are often not available in multi-cultural contexts (Shuttleworth-Edwards, 2002). Henceforth an intra-individual comparison between the performance of the immediate and delayed recall can render useful information on short and long-term memory functioning.

2.2.3.4 The original Associate Learning and Visual Reproduction subtests as useful clinical instruments

Another criticism of the original WMS is that of the Memory Quotient (MQ), a single figure that was added from all the seven subtests (Wechsler, 1945). This certainly was reflective of the thinking of the time, memory as a unitary concept or serving a unidimensional function, which in addition rendered differential diagnosis unattainable. Further to this a low internal consistency and incongruence in difficulty levels between the subtests renders confusing and sometimes conflicting data (Mitrushina et al., 2005). Despite these considerable weaknesses of the Wechsler Memory Scale as a full battery, the subtests of Associate Learning and Visual Reproduction "have proven to be useful in research as well as clinically" (Lezak, 1983, p. 466) and thus retain their importance in current neuropsychological batteries.

2.2.3.5 Benefits of the original Associate Learning subtest

Another merit to be found in the selection of the original WMS over the newer versions is found in the scoring. With regards to the Associate Learning subtest, the WMS-R contains eight word pairs, four "easy" and four "hard" but gives equal value to both associations. Similarly, the WMS-III has eradicated the "easy" associations completely and only contains eight "hard" pairs. One merit that lies in the original version of using both "easy" and "hard" associations is that two different mental processes are being assessed. Thus the "easy" associations are words which are well-learnt or are reflective of old learning, because of the understandable linkage and usage in everyday living. "Hard" associations on the other hand reflect new learning because the stimuli are unfamiliar and

thematically unrelated (Lezak, 1983). Thus these important neuropsychological inferences cannot be made in the subsequent WMS versions because of the structural changes in this subtest. It is important to note that in both the "easy" and "hard" pairs, educational effects have been reported (Ivnik, Malec, Smith et al., 1991).

2.2.3.6 The brevity of the Associate Learning subtest

Although the original WMS has ten paired words, it is a quicker test to administer because it has fewer trials as opposed to the WMS-R and WMS-III. In administering the WMS-R, the participant can have an additional three trials after the standard three trials are completed to get all the associations correct. Additionally recall is administered one and a half hours later. The WMS-III contains four trials (Lezak et al., 2005).

2.2.3.7 The Associate Learning subtest as an aid in detecting suboptimal effort or malingering

Qualitatively, the inclusion of both "easy" and "hard" associations can allow for inferences to be made on poor performance on the "easy" associations in comparison to the "hard" associations, serving as a flag for suboptimal effort or malingering on the part of the participant (Rawling, & Brooks, 1990; Lezak et al, 2005). Suboptimal effort is particularly important to detect especially in neuropsychological assessment where a testee may have a financial incentive to fake a deficit (Groth-Marnat, 2000).

2.2.3.8 The original Associate Learning subtest for use on participants with impoverished memories or education

Moreover Lezak et al., (2004) highlights the psychological value of including "easy" associations, particularly when testing those participants with severe memory deficits. Correct performance on "easy" associations allows the testee to experience success, amongst more demanding stimuli which they may more likely fail at. Additionally this success on the "easy" associations can be a motivating factor for optimal effort across the test and neuropsychological battery. The same argument applies to less educated participants, who may also become despondent if faced with stimuli that they repeatedly get incorrect. This psychological advantage is however eradicated completely in the WMS-III (1997) and on the WMS-R (1987), the ability to score more right than wrong is no longer available to participants in the above mentioned demographic.

2.2.3.9 Benefits of the original Visual Reproduction subtest

Lezak (1983) states that the immediate recall of the Visual Reproduction subtest is not sensitive in itself to pick up on hemispheric lateralization. Further to this the simplicity of the designs do promote cognitive encoding but this factor may attribute to the relative insensitivity to the picking up upon right and left sided lesions (Delaney, Prevey, & Mattson, 1982). Yet the delayed recall after 30 minutes has been found to elicit differential scores on participants with right temporal lesions which were considerably lower than over normal control participants or those with left temporal lesions (Lezak, 1983).

2.2.3.10 The original Visual Reproduction subtest as a culture fair test

Although the idea of a culture-fair test is still a contentious issue, which will be expanded on later in the chapter (Ardila, & Rosselli, 2003; Shuttleworth-Jordan, 1996), non-verbal tasks such as copying a figure is a skill that is considered universal (Lezak et al, 1995). Due to the fact that the designs in the original Visual Reproduction subtest are more simple than later versions, it is considered to be more culture-fair test than the later designs, which is of particular importance when using in diverse cultural settings.

2.2.3.11 The original Visual Reproduction subtest as an indicator of dementia of the Alzheimer's type (AD)

Jacobs (in Spreen, & Strauss, 1998) found that qualitative analysis of the original Visual Reproduction subtest could help differentiate between other neurological disorders or normality from dementia of the Alzheimer's type (AD). Generally participants with AD would include characteristics of the former design into the recall of a subsequent image. This trend of "prior-figure inclusion errors" (Spreen, & Strauss, 1998, p. 381) was similarly generated by participants suffering from Huntington's disease (HD), although to a lesser extent to the AD population, however both to a larger extent in the deficit when compared to the control group. It was hypothesized that the similarity of the designs contained in the original WMS subtest more likely educes these inclusion errors on the AD and HD participants, than the WMS-R. This is attributed to the fact that the designs contained in the revision have fewer similarities (Lezak et al., 2004; Spreen & Strauss, 1998).

2.3 Relationship between WMS performance and demographic factors

Gender and age have been found to be demographic variables to affect most WMS measures, including the Associate Learning and Visual Reproduction subtests (Spreen, & Strauss, 1998).

2.3.1 Gender

2.3.1.1 Associate Learning

On the Associate Learning subtest, women consistently perform one point higher than men. This trend continues up until the 60's age bracket when a two point margin again in favour of women was found (Ivison and Verhoff et al., in Lezak, 1983).

2.3.1.2 Visual Reproduction

It is interesting to note that in terms of gender differences, an Australian study composed of a large sample, found the opposite trend with regards the Visual Reproduction subtest, women scoring slightly lower than men (Mitrushina et al., 2005; Ivison in Lezak, 1983). On other studies, no difference has been found (Lezak, 2004; Trahan, Quintana, Willingham, & Goethe, 1988). It has been reported that in older adults, over the age of 55 years, no difference in gender on this subtest have been found (Verhoff et al., in Lezak, 1983).

2.3.2. Age

It is widely accepted that memory function regresses with age (Lezak, 1983, Lezak et al., 2004). This trend is consistent with the original WMS scores which fall with increasing age (Lezak, 1983; Prigatano, in Spreen, & Strauss, 1998).

2.3.2.1 The Associate Learning and Visual Reproduction subtests

The two subtests have been found to be more difficult with age (Spreen & Strauss, 1998). The Visual Reproduction subtest has been found to be the most sensitive for the detection of deterioration of performance with the advancement of age (Ivnik, Malec & Smith, 1992) and has the steepest gradient between age ranges than any other subtest of the WMS (Lezak, 1983).

2.4 Available Norms of the WMS Subtests

The normative data from the original WMS is considered inadequate, given that the sample is small, $n = 96$, ($n = 50$, 20-29 years, $n= 46$, 40-49 years). Wechsler did however provide correction scores on age for the range 20-64 however the descriptive information on the sample is imprecise and vague (Spreen, & Strauss, 1998). The only information that Wechsler provided was that his sample was "non-hospitalized patients" (Wechsler, 1945). Critical information such as years of education and gender composition within the study was not supplied for this population.

A comprehensive review of available normative data of the original WMS utilizing Form I can be found in Appendix A. The norms which corresponded within the age range of this study have been highlighted in this table and were drawn from both Mitrushina et al., 2005; Shuttleworth-Jordan, 1996 and Spreen, & Strauss, 1991. Of this group, eight were created in the U.S (one jointly with Canada), two in Canada (one jointly with the U.S), two in Australia and one each from Turkey, U.K. and South Africa. It is not clear from which country the Spreen and Strauss, 1991 norms are derived from. Of the studies which provided data on the education levels, the range of education years by research participants varied between 7.04 - 15 years.

Table 1 and 2 detail the relevant norms available currently of the WMS Associate Learning and Visual Reproduction subtests respectively. Norms on the delayed recall trails of both tests are scanty. To the author's knowledge, only Shuttleworth-Jordan, (1996) and Spreen and Strauss, (1991) have provided delayed recall call norms for the Associate Learning subset. Only the delayed norms provided by Shuttleworth-Jordan, 1996; have been additionally split into "easy" delayed and "hard" delayed. For the Visual Reproduction subtest, Russell (1975); Ryan et al., in Mitrushina et al., 2005 (1987); Shuttleworth-Jordan (1996); Spreen and Strauss (1991); Trahan et al., (1988) and Ivnik et al., (1991) provide delayed recall norms.

Table 1: Available Normative data on the Associate Learning subtest within the age ranges research in this study.

Study	**Associate Learning-** ***Immediate Recall*** ***Sum***		**Associate Learning-** ***Immediate Recall*** ***Easy***		**Associate Learning-** ***Immediate Recall*** ***Hard***		**Associate Learning-** ***Delayed Recall*** ***Sum***	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Wechsler, 1945								
Age range: 20-29 $n = 50$	15.72	2.81	8.56	.45	7.16	2.63	-	-
Age range: 40-49 $n = 46$	13.91	3.12	8.26	.24	5.70	2.73	-	-
Hulicka, 1966								
Age range: 30-39 $n = 53$	15.48	3.48	-	-	-	-	-	-
Ivison, 1977								
Age range: 20-69 $n = 500$	12.89	3.93	-	-	-	-	-	-
Kear-Colwell, & Heller, 1978								
Age range: 17-34 $n = 56$	18.26	1.16	-	-	-	-	-	-
Age range: 35-64 $n = 60$	15.28	3.82	-	-	-	-	-	-
Bigler, Steinman, & Newton, 1981								
Age range: 16-20 $n = 10$	18.3	1.4	-	-	-	-	-	-
Age range: 21-35 $n = 15$	16.9	3.4	-	-	-	-	-	-
Age range: 36-50 $n = 12$	16.0	3.3	-	-	-	-	-	-

desRosiers, & Ivison, 1986								
Age range: 20-29 $n = 100$	-	-	16.65	1.70	7.45	3.29	-	-
Age range: 30-39 $n = 100$	-	-	16.19	2.35	5.59	3.25	-	-
Age range: 40-49 $n = 100$	-	-	15.28	2.75	4.61	3.28	-	-
Gilleard, & Gilleard, 1989 **Age range: 20-39** ***n* = 120**								
Nil or Elementary Education $n = 72$	11.22	3.16	-	-	-	-	-	-
Secondary or above $n = 47$	15.49	3.05	-	-	-	-	-	-
Age range: 40-59 ***n* = 80**								
Nil or Elementary Education $n = 59$	9.42	4.15	-	-	-	-	-	-
Secondary or above $n = 21$	14.00	0.00	-	-	-	-	-	-
Spreen & Strauss, 1991								
Age range: 20-29 $n = 23$	18.33	1.45	-	-	-	-	9.91	.29
Age range: 30-39 $n = 14$	18.21	2.28	-	-	-	-	9.92	.28
Age range: 40-49 $n = 14$	18.29	2.82	-	-	-	-	9.71	.61

Shuttleworth-Jordan, 1996								
English 1st Language							*E. Delay*	*H. Delay*
Age range: 18-25 *n* = 63 Immediate 54 Delayed	17.26	3.12	8.69	.45	8.57	2.91	3.65 (2.9)	2.3 (1.7)
African 1st Language								
Age range: 18-25 *n* = 46 Immediate 35 Delayed	15.48	3.37	7.64	1.84	7.99	2.23	2.94 (2.84)	1.6 (1.5)

(Mitrushina et al, 2005, pp. 274-282; Shuttleworth-Jordan, 1996, p. 100 and Spreen, & Strauss, 1991, p. 385).

Table 2: Available Normative data on the Visual Reproduction subtest within the age ranges research in this study.

Study	**Visual Reproduction - *Immediate Recall***		**Visual Reproduction - *Delayed Recall***	
	Mean	**SD**	**Mean**	**SD**
Wechsler, 1945				
Age range: 20-29 *n* = 50	11.00	2.73	-	-
Age range: 40-49 *n* = 46	8.35	3.17	-	-
Hulicka, 1966				
Age range: 30-39 *n* = 53	10.09	3.01	-	-
Russell, 1975				
Neurologically intact subjects No age range, mean is 36.5 *n* = 30	10.4	2.7	9.1	2.9
Clinical Comparison No age range, mean is 42.0 *n* = 76	5.6	3.7	3.7	3.7

Ivison, 1977 Age range: 20-69 *n* = 500	8.46	3.25	-	-
Kear-Colwell, & Heller, 1978 Age range: 17-34 *n* = 56	10.39	1.47	-	-
Age range: 35-64 *n* = 60	7.98	2.79	-	-
Bigler, Steinman and Newton, 1981 Age range: 16-20 *n* = 10	11.3	2.7	-	-
Age range: 21-35 *n* = 15	11.6	2.1	-	-
Age range: 36-50 *n* = 12	9.3	3.1	-	-
Ryan, Morrow, Bromet, & Parkinson, 1987 Age range: 21-30 *n* = 55	13.0	2.3	13.2	2.8
Age range: 31-40 *n* = 45	11.9	2.5	12.1	3.1
Trahan, Quitana, Willingham, & Goethe, 1988 Age range: 18-29 *n* = 97	10.48	1.93	9.84	2.21
Age range: 30-49 *n* = 81	10.10	2.55	9.26	2.74
Gilleard, & Gilleard, 1989 **Age range: 20-39** ***n* = 120** Nil or Elementary Education *n* = 72	6.25	3.20	-	-
Secondary or above *n* = 47	10.49	3.06	-	-

Age range: 40-59 ***n* = 80** Nil or Elementary Education *n* = 59	4.14	3.50	-	-
Secondary or above *n* = 21	10.10	2.64	-	-
Spreen, & Strauss, 1991 Age range: 20-29 *n* = 23	18.33	1.45	9.91	.29
Age range: 30-39 *n* = 13	18.21	2.28	9.92	.28
Shuttleworth-Jordan, 1996 ***English 1st Language*** Age range: 18-25 *n* = 60 Immediate 58 Delayed	12.39	1.54	11.54	2.04
African 1st Language Age range: 18-25 *n* = 48 Immediate 47 Delayed	11.53	2.44	10.77	2.63

(Mitrushina et al, 2005, pp. 274-282; Shuttleworth-Jordan, 1996, p. 100 and Spreen, & Strauss, 1991, p. 385).

2.5 Socio-Cultural Factors

As highlighted briefly in the introduction, representative norms for culturally diverse contexts are scarce but more importantly vital to prevent misleading data and subsequently misdiagnosis. This dearth of relative and appropriate norms becomes acutely challenging within South Africa as neuropsychological assessment is used extensively, with soaring incidences of learning difficulties, assaults and road accidents being reported in the country; events all requiring the input of a neuropsychological assessment (Skuy, Shutte, Fridjhon, & O'Carrol, 2000). This is comprehensible due to the fact that neuropsychological assessment is able to provide information pertaining to prognostic, management, occupational and placement issues. Studies conducted in South Africa found that 53% of psycho-legal work undertaken by South African Psychologists comprised of personal injury cases (predominantly head injuries following a motor vehicle accident) and child custody cases (Louw, & Allan, 1998). Thus specifically

within personal injury claims related to head injuries, neuropsychologists can provide answers of diagnosis, nature and impact of impairment and measurement of change (Crawford et al., 1992) many times, the decisions carrying substantial financial compensations.

In many instances, the high percentage of claims following a traumatic brain injury (TBI) are made in South Africa by individuals distinctly dissimilar in demographics from the norming populations used in creating the tests (Skuy et al., 2000). The norming populations have been predominately white, highly proficient in English and have been exposed to at least 12 years of schooling (Nell, 2000). This leads to a state in which at present, many tests are either rendered useless or qualitative judgement is relied upon without the supportive and essential empirical evidence, which in court, is given credence (Mitrushina et al., 2005).

However as aptly pointed out by Shuttleworth-Jordan (1996), a nihilistic approach would be to throw out all internationally accredited tests that were created in populations in stark contrast to contexts like South Africa in favour of creating new neuropsychological tests within the population for which testing would occur. Yet a few problems exist, not only would this be a time-consuming and expensive endeavour, but it fails to recognize three important issues; namely the similarities across all individuals in the brain-behaviour relationship, the varying levels of education, westernization and urbanization in South Africa and the fact that assessment should never be equated or reduced to the mere administration and scoring of tests (Shuttleworth-Jordan, 1996). Rather a compendium of resources including a detailed history (including collateral), awareness of the socio-cultural factors shaping that individual and clinical impression are a prerequisite in forming a correct diagnostic picture. Furthermore time and effort should rather be dedicated to developing *norms* and not new tests which acknowledge and take into account these socio-cultural factors, developed from these well-established and internationally accredited tests (Ardila, & Roselli, 2003; Shuttleworth-Jordan, 1996 and Skuy et al., 2000).

However this term socio-cultural needs to be further elaborated on and discussed on what exactly it constitutes. For the purposes of this study as divided by Shuttleworth-Jordan

(1996), the term 'socio-cultural' shall incorporate three interconnected factors namely; culture, language and education.

2.5.1 Cultural considerations for neuropsychological assessment

> *The measurement of cognitive abilities across race is a hotly contested and unresolved debate.*
>
> (Lezak et al., 2004, p. 310)

Many studies routinely have shown a ten point margin, in favour of whites over blacks in test scores evaluating intelligence (Howe, 1997; Skuy et al., 2000). A universalist assumption would be to explain this phenomenon as evidence that cognitive abilities are dissimilar based on purely racial or genetic differences as argued by Herrnstein and Murray's (1994) *The Bell Curve*. Although this viewpoint is convenient, as it misleadingly divorces psychology as being free from the influence of politics, it dangerously positions cognitive abilities as stable and unwavering, immune to change and varying external sources. Counteracting this argument, Ardila (1996) aptly highlights that neuropsychological tests are inherently biased, because cognitive abilities measured by these tests reflect abilities essentially learnt (Ardila, 1996; Ardila, & Rosselli, 2003; Lezak, 2004; Van Tonder, 2007). Thus a link between an individual's performance and the environmental/cultural influences from which they have been immersed in are intrinsically connected. Factors such as: "socioeconomic level, prenatal and perinatal complications, nutrition and health, family size, birth order and education" (Lezak et al., 2004, p. 312).

Hence culture can be defined as a way of living that is transmitted, learnt and shared through social interactions which communicate the ascribed values, beliefs, social norms, thinking, knowledge and feelings by a group of people (Harris, 1983; Lezak et al, 2004). Based on this definition, it would stand to reason that there would be a significant variance within different cultures and the prescribed value of what information and skills are deemed important and at what phase in life these should be acquired. Exploring this argument further, two factors as stressed by Nell (2000) as profoundly influencing performance in cognitive testing is acculturation and test-wiseness.

2.5.1.1 Acculturation

Acculturation is defined as "the extent to which an ethnic group adopts the behaviours, language, values and attitudes of the dominant culture" incorporating "interrelated variables *(such as)*, language usage, reading ability, level and quality of educational attainment and home and schooling socialisation experiences" (Shuttleworth-Edwards et al., 2004b, p. 905). An individual can be acculturated to a greater or lesser extent, depending on the level to which they embrace the ascribed values of the dominant culture. A direct link between the level of acculturation and performance on cognitive abilities has been found, with learners exposed to more westernized socio-cultural influences; consistently performing in a superior manner than those less acculturated (Helms, 1992; Shuttleworth-Jordan, 1996).

2.5.1.2 Test-wiseness

Nell (2000) highlights that at the very nucleus of acculturation is test-wiseness; that is test-taking skills which are essentially not taught but rather absorbed through constant exposure. This skill is heavily acquired in formal education, either being transmitted directly in circumstances like school examinations or indirectly in everyday classroom activities. This constant exposure routinely keys an individual to the appropriate behaviour required including; sitting in a desk, concentrating, working speedily and accurately as possible and correct usage of a pen and paper. Based on the fact that test-wiseness is most heavily swayed through formal education, it is understandable that this is not a universal skill and thus would vary considerably based on the individual's exposure to the quantity and quality of education.

Another important factor to note is that many neuropsychological tests are timed, requiring participants to work hastily and accurately. Not only are these feature of test-wiseness steeped in Western cultures, but the apparent contradictory notion of these two skills speed and accuracy is negated. Amongst other culture like South Africa, working accurately in favour of speed is considered the correct way to work (Nell, 2000).

2.5.2 Language and the effect on neuropsychological assessment

South Africa is in a unique position, in that it has 11 official languages. Of this, the language of IsiXhosa is spoken by about six million South Africans, most of these

speakers being based in the Eastern Cape Province (Statistics South Africa, 2001 Census). This is certainly a difficult factor pragmatically for the neuropsychologist working within the South African context, as this means that many participants will be evaluated in a medium other than their mother tongue. Not being assessed in one's mother tongue has been found in research to significantly affect test performance (Skuy et al., 2000). The difficulty however does lie in the fact that most tests have been constructed in predominantly English speaking countries. The non-English first language speaking participants' ability to express themselves adequately is pivotal before conducting tests. This should raise concern and caution when using verbal tests on this demographic, yet however non-verbal tests should not be considered devoid of this confounding variable, as all tests require participants to understand what is required of them through test instructions.

2.5.3 Education and the effects on neuropsychological assessment

> *The effects of education on neuropsychological functioning are potent and pervasive.*
>
> (Lezak, 2004, p. 315)

Before examining the specific factors in education which can lead to varying levels of performance in neuropsychological tests, a review of education in South Africa historically and currently is felt important to contextualize the following argument.

2.5.3.1 A brief history of South African Education

South Africa has a long-history of educational heterogeneity. This became particularly evident when the political climate negatively changed in the country and the Apartheid regime was instituted in 1948. Five years later, the repercussions of this political ideology and administration impacted on the face of education, with the passing of the Bantu Education Act in 1953. This perverse legislation gave the government the power to stratify the curriculum, resources, salaries and training of teachers and size of pupils per class across different races (Skuy et al., 2000). Hence at the core of this governmental decree, was the provision of education that was poles apart between white and black South Africans in terms of quality. More specifically, certain subjects which are pivotal for professional training or necessary for certain tertiary education courses, like Mathematics and Science where purposefully omitted in the curriculum for black South

Africans, rather being replaced by skills training like gardening, rendering learners only experienced and practised for unskilled or blue-collar work (Gaylard, 2005). The political gambit was clear; curbing non-whites from striving beyond the politically determined and regulated socio-economic status, assigned their ethnicity.

Under the Act of 1953, most black South Africans, comprising of about 75% of the population were educated by the Department of Education and Training (DET) (also referred to as Bantu Education) (Skuy et al., 2000). An alternative vernacular term for DET schools, including rural and farm schools is "township schools" (Gaylard, 2005). As will be highlighted shortly, many of the very conditions that rendered DET schools disadvantaged are still present currently and are thus still associated with a sub-standard educational system. Hence to acknowledge this unequal state currently, for this study, the term former DET will be employed.

Economic roll-out for DET schools was seriously deficient, with only 5-25% of the available educational expenditure being used on this disenfranchised sector, even though it represented 3/4 of the national student population (Claassen et al., in Gaylard, 2005). In contrast to this, white students received a curriculum that was modelled on the British public school system, with a full complement of diverse subjects under the scheme termed Private/Model C schools. Consequently it comes as no revelation that the Private/Model C education far outweighed the quality of overall education that was delivered through the DET scheme (Kallaway, 1984). Outside this public sector of schooling which incorporated both Private/Model C schools and DET schools, Private schools existed which were independently governed and funded. Thus they were not required to implement the segregation policies. In contrast to the public schooling sector, Private schools were multi-racial from the 1980's (Gaylard, 2005). The overall standard of schooling provided in this sector was exemplary.

2.5.3.2 The current educational climate in South Africa

The Apartheid regime formally dissolved in 1991. Schools began to reflect the changed political policies with Private/Model C schools becoming multi-racial and the educational restrictions on DET schools being lifted. There were hopes that the problems inherent to the educational milieu of South Africa would start to change effectively post-Apartheid,

with the overall standardising of resources. However the legacy of inequality in education lingered and this hope has unfortunately not been realised yet. Blazoned across a 2008 copy of The Herald newspaper was the following article which exposed the general woes of the education system. It featured the lack of adequate provisions nationally, revealing a state; albeit under significantly modified political ideals, in very much the same disarray. The opening headline read:

> It is a sad predicament that 13 years after it came to power the ANC government has still not managed to put in place a system to ensure pupil support materials are delivered to schools in time for the start of the academic year..... almost inevitably, it will be the schools that fell under the administration of the former Bantu education or homelands systems that will be worst affected, dealing yet another blow to previously disadvantaged children.
>
> (After 13 years ANC is still failing nation's children, 2008, p. 6)

In actual fact, former DET schools are dealt a crippling double blow, not only being struck by the inherited educational inequalities of a former government, but are further beaten by the lack of infrastructural change and service delivery by current political management. A closer lens shall now be focused on the harmful variables causing the educational department to weakly limp on its current path.

2.5.3.2.1 Nutritional deficiencies.

Government feeding schemes, developed to address the problems inherent to groups of children from poor socio-economic status and implemented at schools, however is found to be failing too in South Africa. Just this year, the progress of this scheme was reported on, stating;

> Scores of primary school pupils went hungry despite repeated promises by the provincial education department that feeding would start on the first day and there would be no repeat of the chaos that has plagued the school feeding scheme for several years.....For many of the children in this school the meal from the feeding scheme is the only meal they get for the rest of the day.
>
> (Matomela, 2008, p. 1)

This state is certainly problematic when considering the integral part that good nutrition plays in the healthy development of the brain which obviously affects test performance (Helms, 1992). Specifically a deficiency of folic acid or folate is of particular importance as a shortage of this nutritional constituent can lead to neuropsychological symptoms including memory impairments (Lishman, 1997). Amongst adolescents and young adult woman, a 1981 study found that nine out of 20 participants showed "slowed reaction times, reduced short-term memory, (and) retrieval deficits being the most prominent problems" (Hamsher, Halmi, & Benton, in Lezak, 2004, p. 285).

Commensurate to this Lezak et al., (2004) notes that it is a well accepted fact that malnutrition contributes to mental deficiencies to both children and adults. Further she draws attention from a study of elderly individuals with poor nutrition over the age of 60, particularly with "vitamin C, riboflavin, vitamin B12 and folic acid" below the levels recommended by professional health boards, had significantly poorer performance results on the Wechsler Memory Scale (p. 285).

2.5.3.2.2 Lack of resources.

Beyond the failing feeding scheme, further necessary resources are either insufficient or non-existent. Former DET school buildings that do exist are many times badly vandalised and remain so for years and government tenders for the building of new school structures are not advertised or done so timeously (Matomela, 2008). In extreme cases, learners have to be educated in facilities that lack basic amenities like electricity, proper insulation or ablution facilities. In the Eastern Cape, it is concerning that approximately 600 mud huts are used to educate learners. Due to the poor conditions, it appears that teaching only occurs for six months of the year as during winter, teaching totally desists because the conditions are just too extreme for the learners to endure (Matomela, 2008).

Another facet to the dysfunctional educational picture is that even in school buildings that have been erected, desks, stationery and textbooks are either broken, never get replaced, are not available in sufficient numbers or are just never delivered. Therefore even though the national curriculum post-Apartheid is homogenised in terms of its planned template, access and roll-out to it still seems disparate. Moreover historically under the 1953 Act,

black citizens completing their secondary schooling could become a teacher without further training. Thus presently, many teachers still absorbed in the former DET schools, lack mastery of school subjects, educational techniques and philosophies. Accordingly, teacher competence and training significantly varies between former DET schools and former Private/Model C schools. Government has made attempts to address this problem by devising fast-tracked training schemes, but at present, former DET schools seem to still be playing catch-up in this regard.

Another problem is that absenteeism amongst teachers is rife and the negative consequences via management are distressingly absent. Educational management is also to blame for incidences which demonstrate poor administrative foresight and certainly model skewed prioritization. For example, it was reported that 6000 school heads would be away from their schools on the first day of learner registration this year, as they had to attend a management 'indaba' in Bhisho (Matomela, 2008). As in many years, the first day of school is characterised by general chaos as learners try to register for the academic year. Recurring incidences of turning prospective learners away and lost days of teaching are becoming commonplace because of registration problems. Thus it begs belief that in light of these well known and persistent difficulties, principals would not be around to oversee this facet.

In addition, teacher-pupil ratios are extremely high. The established and accepted ratio from government is one teacher to every 35 children (Matomela, 2008). However incidences in former DET schools are reporting certain ratios double this, in one primary school in Port Elizabeth, only one teacher was available for 63 Grade 1 pupils (Matomela, 2008).

The psychological aspects of these failing services cannot be ignored either. The demoralization and wavering of student motivation in these appalling conditions can be understood leading many to give up on pursuing their studies further. This sentiment was relayed by the provincial chairman of SADTU (South African Democratic Teacher's Union), Mzoleli Mrara who said that "the dire shortage of teachers, administrative staff,

furniture, buildings, textbooks and stationery was forcing pupils to drop out" (Matomela, 2008, p. 1).

2.5.3.2.3 Focus on the Eastern Cape.

Unfortunately the Eastern Cape Province, where this study took place, fraught by its own failing economic status and high unemployment rates is not exempted from the current educational crisis. According to the 2001 National Census, approximately two million IsiXhosa speakers are currently learners at school in the Eastern Cape. Of this figure, about 800 000 have attended secondary school and only 311 876 have obtained a National Matriculant Certificate for completing secondary schooling (Statistics South Africa, 2001 Census). These figures are particularly concerning and disproportionate when considering that not even 1/6 of the IsiXhosa population living in the Eastern Cape have been able to attain a Grade 12 educational level.

However of those able to attend school in the Eastern Cape, the quality of education being delivered appears poor. Journalists reported that "In the Eastern Cape... pupils will again this year be disadvantaged as a result of the incompetence of officials, corruption and the lack of political will on the part of education MEC's" (After 13 years ANC is still failing nation's children, 2008, p. 1).

Just recently, another knock was suffered to education in South Africa, with 26 days of teaching lost, due to a national teachers strike last year. Just in the microcosm of the city of Grahamstown, which has a wide spectrum of Private, former Private/Model C schools and former DET schools, the discrepancies in results across the different schools can be seen in Table 3.

Table 3: A cross-section of Grahamstown Schools and the 2005-2007 pass rates and number of exemptions.

	High School	2005 pass rate	2006 pass rate	No. of Exemptions	2007 pass rate	No. of Exemptions
1	**Kingswood College**	100%	100%	85%	100%	Not available
2	**D.S.G.**	100%	100%	Not available	100%	Not available
3	**St. Andrews College**	100%	99%	92%	100%	83
4	**V.G.H.S**	100%	100%	41	100%	57
5	**P. J. Olivier**	97%	100%	8	100%	9
6	**Graeme College**	96%	98%	35	86.4%	35
7	**GADRA Matric School**	93%	93%	-	-	-
8	**Nombulelo**	81%	75%	17	64.3%	25
9	**Ntsika**	61%	74%	2	32.1%	0
10	**Mary Waters**	60%	85%	11	63.2%	6
11	**T.E.M. Mrwetyana**	45%	37%	0	81.8%	2
12	**Nathaniel Nyaluza**	44%	72%	7	70.2%	10
13	**Khutliso Daniels**	32%	28%	1	30.8%	2
14	**Benjamin Mahlasela**	20%	28%	0	18%	0

(Butana, 2008, p. 6)

The schools have been stratified according to the following groups, Private, former Private/Model C schools and former DET schools. The first three schools are the Private schools in Grahamstown, numbers four-six; the former Private/Model C schools and

seven-fourteen; the eight former DET schools. Examining the figures, it becomes evident that both the Private and former Private/Model C schools have consistently performed well and did not seem to be negatively affected by the loss of teaching days in 2007. However the former DET schools did not seem to fare as well and had a pass rate ranging from 80% to a very low 20%. Looking at the change from 2006 to 2007, when the effects of the strike would be represented in the figures, it seems to be a sad but evident truth that by and large the Private and former Private/Model C schools were able to absorb the effects of the strike more readily than former DET schools. It seems that all the pass rates lowered except for two schools namely; T.E.M. Mrwetyana and Khulitso Daniels. One school in particular Ntsika; is suspected to be severely affected by the strike and dropped dramatically from a 74% pass rate in 2006 to 32.1% in 2007. Overall the district's pass rate for Grahamstown plummeted from 65% in 2006 to 59.3% in 2007 (Butana, 2008). It is felt that this figure would have been significantly lowered if not for the stable figures of the Private, former Private/Model C schools which raised the average.

2.5.3.3 Quantity and quality of education and the effects on neuropsychological assessment

> *When taking years of education into account, it may sometimes be necessary to pay attention to the quality of education as well as the years, as similar grade levels may have quite different knowledge and skill implications.*
>
> (Lezak et al., 2004, p. 316)

Quantity of education has been routinely found to be a confounding variable in test performance. Studies have generally shown a correlation between years spent at school and higher test performance (Lezak et al, 2004). However in contexts with diverse educational delivery and structure, this factor alone becomes a poor predictive variable (Shuttleworth-Edwards et al., 2004a). Hence more importantly in contexts where education is not equivalent, *quality* of education often holds more significance and weight (Shuttleworth-Jordan, 1996).

This significant variable was successfully demonstrated in a U.S study (Hanney, 1992) as highlighted by Lezak (1995). It compared the test performances of children enrolled in different school contexts namely, inner city versus rural schools. Clinically significant

discrepancies in test performance were documented between these two groups. This was explained as a difference in quality of education, which different knowledge and skills being transferred at the two schools. Thus even in contexts which are considered significantly more homogenised than contexts like South Africa, the quality of education is of paramount importance. From the above argument, the quality of education in South Africa is varied and continues to be so. Therefore while it is evidence that political policies have been remarkably changed post-Apartheid, little has been done to translate this into an operational infrastructure that delivers on its promises. In this state, education is not equal and is still delivering imbalanced and disparate education.

2.6 Objective of the present study

In summary it is evident that relevant norms for non-English first language speakers with poor quality educational backgrounds and are from cultural contexts widely different from Westernized countries are needed desperately. Thus a sample of black, IsiXhosa speaking individuals exposed to former DET-type schooling, having attained a Grade 11-12 was sought for the study. Henceforth, the purpose for this study was to; 1) Describe and consider socio-cultural factors and the influence on test performance 2) Provide descriptive and preliminary normative data of the WMS Associate Learning and Visual Reproduction subtests on this neuropsychologically underrepresented population 3) Compare test performance between age and gender through stratification of the sample and finally to 4) Evaluate the current norms of the two WMS subtests and assess their validity for black South Africans with DET and former DET schooling with comparisons to the results found in the study.

CHAPTER 3: METHODOLOGY

3.1 Sampling

3.1.1 Research participants

Purposive sampling (Patton, 1990) was utilised to recruit volunteer participants based on the inclusion criteria highlighted in Chapter 1 and 2 namely; black, IsiXhosa first language speakers, educated in DET and former DET schooling, with an educational level of Grade 11 and 12. Rhodes University casual workers in Grahamstown, Eastern Cape were identified initially as a population group that would accurately meet the above criterion for participation in this study. Permission to use the University as a research site was sought and a letter addressed to the Registrar was drafted and sent (see Appendix B)[3]. After permission was granted and received, contact with the Human Resource Department was made in order to access potential participants via the University's database. Additionally the University's Union representative was contacted and informed of the nature and purpose of the study, to ensure that all relevant and appropriate parties were abreast with the study and had the opportunity to raise any potential concerns regarding it.

Existing files of casual workers were assessed and individuals meeting the inclusion criteria were then contacted telephonically, with an invitation to attend a research recruitment meeting. Three recruitment meetings were held on different days and at different times to maximize attendance and recruitment. During these research meetings, the purpose and requirements of the study were highlighted verbally via the researchers and additionally through a letter to the participant (see Appendix C). Furthermore a five page questionnaire (see Appendix E) was handed out to elicit detailed information on the potential participants. It was explained that following the meeting, certain participants, who met the inclusion criteria would be contacted and invited to participate in the study.

However during the recruitment phase, a high rate of participants met the exclusion criteria and then during data collection; a significant percentage dropped out or did not attend on testing days. Thus in order to increase the sample size, snowballing sampling

[3] The letter granting permission by the Rhodes University Registrar is available on request.

(The Association for Qualitative Research homepage, 2008) was next utilized in order to recruit further participants for the study. One participant from the original recruitment phase had volunteered to distribute the study's five page questionnaire, which was subsequently collected by the researchers. From this information, relevant participants were contacted and invited to attend a testing day. Therefore for this study, the final sample was $n = 33$.

3.1.1.1 Age

Participants age ranged between 18 and 40 years (M = 28.4 years). This was further stratified into two age ranges, namely: 18-29 years (n = 17, M = 23.65, SD = 3.463) and 30-40 years (n = 16, M = 33.44, SD = 3.326). This division was decided upon as it would allow any potential similarities or differences in performance across the two age groupings to be illuminated. As been established previously in this document, memory function decreases with age, thus the stratification is clinically useful to investigate if this trend is again replicated in this study.

Additionally due to the fact that there was a skewed distribution in the sample with regards to education level and gender distribution within the two age groups, a Pearson Chi-Square analysis was used to establish if these variances were of statistical significance and thus could invalidate the results. In both statistical analyses, namely age and highest grade (education) (Table 4) and age and gender (Table 5) the significance levels were p = .619 and p = .554 respectively. Henceforth, from this it is established that inferences can be made from the data because the critical value is within accepted statistical limits.

Table 4: Age and Highest Grade Cross Tabulation

Age and Highest Grade

			Highest Grade		
			11	12	Total
Age	18-29 yrs	Count	4	13	17
		% within Age	23.5%	76.5%	100.0%
	30-40 yrs	Count	5	11	16
		% within Age	31.2%	68.8%	100.0%
	Total	Count	9	24	33
		% within Age	27.3%	72.7%	100.0%

Pearson Chi-Square p = .619

Table 5: Age and Gender Cross Tabulation

Age and Gender

			Gender		
			Female	Male	Total
Age	18-29 yrs	Count	10	7	17
		% within Age	58.8%	41.2%	100.0%
	30-40 yrs	Count	11	5	16
		% within Age	68.8%	31.2%	100.0%
	Total	Count	21	12	33
		% within Age	63.6%	36.4%	100.0%

Pearson Chi-Square p = .554

3.1.1.2 Gender

Although the same number of males and females were ideally sought in sampling, exclusion criteria and subsequent drop-out resulted in a gender disproportion for the study: females n = 21 and males n = 12. The mean age for the female group was M = 11.76, SD = 6.700 whereas the mean age for the males was M = 27.50, SD = 4.622. Again the variance has been accounted for in both the correlation between gender and age (Table 6) and gender and education (Table 7) with critical values of p = .554 and p = .555 respectively. From the following values, it has been indicated that inferences can be made

from the following data. This stratification is again useful as differential performance based on gender which has been found in some studies (Ivison and Verhoff et al., in Lezak, 1983; Mitrushina et al., 2005) using the two WMS subtests can be noted and commented on.

Table 6: Gender and Age Cross Tabulation

Gender and Age

			Age		
			18-29 yrs	30-40 yrs	Total
Gender	Female	Count	10	11	21
		% within Gender	47.6%	52.4%	100.0%
	Male	Count	7	5	12
		% within Gender	58.3%	41.7%	100.0%
	Total	Count	17	16	33
		% within Gender	51.5%	48.5%	100.0%

(Pearson Chi-Square p = .554)

Table 7: Gender and Highest Grade Cross tabulation

Gender and Highest Grade

			Highest Grade		
			11	12	Total
Gender	Female	Count	5	16	21
		% within Gender	23.8%	76.2%	100.0%
	Male	Count	4	8	12
		% within Gender	33.3%	66.7%	100.0%
	Total	Count	9	24	33
		% within Gender	27.3%	72.7%	100.0%

(Pearson Chi-Square p = .555)

3.1.1.3 Education (Highest Grade)

Education composition was either Grade 11 or 12 from DET or former DET schooling. With regards to the age composition, the mean highest grade fro the 18-29 year group

was M = 11.76, SD = .437 and 30-40 M = 11.69, SD = .479. For the gender distribution, males had a mean education level of M = 11.67, SD = .492 and females M = 11.76, SD = .436. Again participant's education level with gender and age were evaluated statistically and inferences can be made from the data because the critical value is within accepted statistical limits with education and gender (Table 8) p = .555 and education and age (Table 9) p = .619.

Table 8: Highest Grade and Gender Cross Tabulation

Highest Grade and Gender

			Gender		
			Female	Male	Total
Highest Grade	11	Count	5	4	9
		% within Highest Grade	55.6%	44.4%	100.0%
	12	Count	16	8	24
		% within Highest Grade	66.7%	33.3%	100.0%
	Total	Count	21	12	33
		% within Highest Grade	63.6%	36.4%	100.0%

(Pearson Chi-Square p = .555)

Table 9: Highest Grade and Age Cross Tabulation

Highest Grade and Age

			Age		
			18-29 yrs	30-40 yrs	Total
Highest Grade	11	Count	4	5	9
		% within Highest Grade	44.4%	55.6%	100.0%
	12	Count	13	11	24
		% within Highest Grade	54.2%	45.8%	100.0%
	Total	Count	17	16	33
		% within Highest Grade	51.5%	48.5%	100.0%

(Pearson Chi-Square p =.619)

3.1.1.4 Language

As all the participants were IsiXhosa first language speakers, it was essential that participants would be able to comprehend test instructions. This was a crucial factor to ensure since all the neuropsychological tests were administered in English. This potentially confounding variable was addressed; firstly through the fact that inclusion into the University's database required participants to demonstrate basic English proficiency in receiving, comprehending and implementing instructions in the workplace. Secondly, for all the participants, bar two whom did not supply this information, the English symbol which they obtained at school was obtained. Of the 31 participants, their English symbols attained at school were as follows; C n =5; D n = 11; E n = 10; F n =5. Thirdly, participants were required to fill out questionnaires during recruitment meetings, which in itself required a basic level of English proficiency on par with instructions used in most neuropsychological tests. However with the advent of the snowballing sampling, the second step unfortunately was lost for the second recruited group of participants. However to counteract this, in a pre-screening questionnaire, participants were asked to rate their English proficiency, and secondly the researcher would compare this with their assessment.

3.1.1.5 Exclusion Criteria

Criteria that excluded certain participants were: a history or presence of any neurological disorders, learning difficulties, education in a special needs institution, repetition of more than two grades at school, current substance abuse, or the presence of a psychiatric disorder.

3.2 Procedure

3.2.1 Data Collection

3.2.1.1 Pre-Test Preparation

3.2.1.1.1 Steps to ensure standardised and reliable administration

This study formed part of a broader normative study, thus the comprehensive battery, including the two WMS subtests was administered by four clinically trained intern psychologists (For the full list of neuropsychological tests administered, refer to Appendix G). All the intern psychologists have undergone extensive training in the field of neuropsychological assessment and thus are well-equipped to conduct this research. Participants were randomly divided and assigned amongst the four psychologists and assessed separately. In accordance with test administration adherence, the full test battery order was standardised for administration and specifically designed in order to meet the specific delayed recall test requirements for both WMS subtests. Thus the required 30 minute time gap between the immediate and delayed recall would be attained by the full test design. Furthermore possible interference effects from previous tests were accounted for in the full test battery design; for example, two visual memory tests would not directly follow one another.

Prior to the test dates, all four intern psychologists practised the administration and scoring of each test. This was executed to ensure that all tests would be administered in a reliable and standardised manner.

3.2.1.2 Test Administration

Each of the four researchers administered the full battery of tests, in a set order according to each test's standard administration process. Testing was conducted individually in private offices of one of the researchers. The testing venues were all well lit and minimal

to no distraction was ensured during the assessment. All participants were asked to sign a consent form after the study was explained once again (see Appendix D). Testing time was approximately two hours, with an optional ten minute break between Rey Complex Figure Immediate Recall (Osterreith, 1944) and the TOMM (Tombaugh, 1996). The whole battery was administered in one sitting. Strict adherence to the test's standardised protocols of administration and scoring procedures were followed (Wechsler, 1945).

Further to the biographical questionnaire that was used in the initial recruitment of participants, another pre-test questionnaire (see Appendix F) was created and implemented on the test day. This was done for three reasons namely to; 1) cross-check that all participants did meet the inclusion criteria and that all the information they provided was correct, 2) to check English literacy and 3) lastly to elicit detailed information on potential confounding variables such as head injuries, psychiatric histories and substance abuse, which would meet any of the study's exclusion criteria's.

3.2.1.2 Data Processing

3.2.1.2.1 Scoring

Strict adherence to the scoring procedures for both subtests were adhered too. Steps to ensure inter-rater reliability were taken, thus all test scoring was triple-checked for each participants by the four researchers. However during the scoring phase of the study, it became evident that on some tests, scoring varied amongst the researchers. This was particularly problematic on the WMS Visual Reproduction subtest. Although detailed scoring procedures for the Visual Reproduction subtest have greatly improved the standardisation (Mitrushina, 2005), idiosyncratic scoring cannot be ruled out and is one of the test's limitations. Hence all four researchers met and went through each test to ensure reliability and validity to the scoring. However one aspect that was evident through this process was the original marking score sheet of the WMS Visual Reproduction failed to capture many of the visual-graphic images recalled by the study's sample. Therefore many participants scored markedly lower than would be expected. Through consultation with one of the supervisors and practicing neuropsychologists, Professor Shuttleworth-Edwards, it was decided to develop a new scoring protocol. Henceforth certain extra marking provision in the score sheet has been added to capture

marks for the participants (see Appendix H and G). This was specifically with reference to Card C-2. Numbers three, five and six were added as opposed to the original marking sheet. This allowed a broader scope for the participants to score in this reproduced designs.

Another aspect that was checked in test scoring related to both the immediate and delayed versions of the Associate Learning subtests. Some participants would recall the singular rather than the plural case of some of the paired words, for example; "cry" instead of "cries" and "groceries" instead of "grocery". These errors have been reported in Spreen and Strauss (1998) and have been found to be common mistakes made by participants on this subtest. As is indicated in test scoring (Wechsler, 1945), these errors do not effect the allocation of the full point for the recollection. This was communicated amongst the researchers to further ensure inter-rater reliability.

One of the critiques of the Associative Leaning subtest is that statistically only the combined score is provided. As explained earlier, this figure is derived from the halved sum of the "easy" associations with the full score of the "hard". However the margin between the recall of recognizable and well learned associations cannot be differentiated from the retention of newly learned and unfamiliar words found in the "hard" associations (Lezak, et. al., 2004). The benefit of this is that two very different types of cognitive functions of memory can be assessed. For this reason, it was decided to statistically represent not only the combined score, but to include a breakdown of both the "easy" and "hard" association scores, as represented by Shuttleworth-Jordan (1996). Hence in the data inputted, this useful division was included. It is hoped that inferences can be made then on this particular population with regards retention and new learning and whether age and gender affects are indicated.

3.3 Data Analysis

3.3.1 Descriptive Analyses

3.3.1.1 Descriptive statistics

Raw scores from all the neuropsychological tests and biographic data from both the general questionnaire and pre-screening questionnaire were consolidated into one

spreadsheet and sent off to Sarah Radloff, a statistician working in the Statistics Department at Rhodes University. Descriptive analyses were run on the data, including chi-square analyses to ensure equal distribution between all the variables and t-test comparisons between the demographics of age, gender and education. These variables which had been stratified according to age and gender have been represented statistically via means and standard deviations in normative tables.

3.3.1.2 Considerations for the sample size

The sample size (n = 33) is acknowledged to be small. However the purpose of this study is to provide preliminary normative indicators that can be useful in the Eastern Cape, based on the concerns already raised earlier in this study. In addition the results are designed to be practitioner orientated. Furthermore in relation to the data presented by Shuttleworth-Edwards et al., (2004a; 2004b) which had a similar sample size and has been cited in many seminal neuropsychological books and journals, these have been regarded clinically significant and robust for publishing (Strauss, Sherman, & Spreen, 2006).

3.4 Ethical considerations

A detailed description before the commencement of this study was presented and passed by the Ethics Committee of Rhodes University. Steps to ensure confidentiality and anonymity of the participants have been taken including, informing participants of this right and protecting and safe-guarding all identifying data outside of the research team. Voluntary participation was explained in the recruitment phase and during test administration, thus participants were routinely informed during the study of their right to withdraw at any point in the study.

A concerted effort was made to ensure that participants understood that attendance and participation throughout the study would by no means increase or decrease their chances at employment through Rhodes University. This was crucial to distinguish the study as a separate entity as the researchers were sensitive to the vast unemployment rate in South Africa and in particular the Eastern Cape and thus wanted to stress participation as separate from employment.

CHAPTER 4: RESULTS

4.1 Objective

The aim of this chapter is to present the results from the descriptive analyses conducted on the research sample for this study. The sample has been stratified across age and gender to allow statistical comparisons with regards to performance between these two sample demographics. Statistically significant results will be notated via asterisks in the p value column. Secondly any data approaching significance will be highlighted followed by any consistent trends indicated in the data.

4.2 Associate Learning - Age Comparison

4.2.1 Immediate recall

There are five significant results in the direction of the 18-29 age range over the 30-40 age group. These are the first "easy" association p = .008; the total "easy" score p = .015; the third "hard" association p = .015; the total "hard" score p = .047; followed lastly by the sum score, p = .017. The first "easy" association is considered of particular significance as the p-value falls below the critical value of p = 0.01, thus the younger age group far outperformed the older group on this task. One result again in favour of the younger age group shows a trend towards statistical significance. This is on the second "hard" association p = .062. No statistical significance between the age ranges of 18-29 years and 30-40 years were found for the following comparisons namely; second and third "easy" associations, p = .251 and p = .281 respectively and the first "hard" association p = .526.

Table 10: WMS Associate Learning - Age Comparison- **Immediate Recall**

	18-29 years			**30-40 years**			
	n	*M*	SD	*n*	*M*	SD	p- value
Highest Grade	17	11.76	.437	16	11.69	.479	-
Age	17	23.65	3.463	16	33.44	3.326	-
WMS Associate Learning ***Immediate Recall***							
Easy 1st Recall	17	5.47	.717	16	4.50	1.155	.008**
Easy 2nd Recall	17	5.71	.588	16	5.44	.727	.251
Easy 3rd Recall	17	5.94	.243	16	5.81	.403	.281
Easy Total	17	17.12	1.269	16	15.75	1.770	.015*
Hard 1st Recall	17	1.18	1.286	16	.94	.772	.526
Hard 2nd Recall	17	2.53	1.231	16	1.75	1.065	.062
Hard 3rd Recall	17	3.06	1.144	16	2.06	1.063	.015*
Hard Total	17	6.76	3.133	16	4.75	2.380	.047*
Sum Score	17	15.324	3.3258	16	12.625	2.7779	.017*

M= Mean
* p = 0.05
** p = 0.01

4.2.2 Delayed recall

With regards to the delayed recall, there is one significant result in favour of the 18-29 age group. This is notated with an asterisk in the p-value column with a critical value of p = .036. One result again in favour of the younger age group shows a trend towards statistical significance contained in the delayed "hard" score, p = .087. No statistical significance was found for the delayed "easy" score p = .130.

Table 11: WMS Associate Learning Delayed Recall - Age Comparison- **Delayed Recall**

	18-29 years			**30-40 years**			
	n	*M*	SD	*n*	*M*	SD	p- value
Highest Grade	17	11.76	.437	16	11.69	.479	-
Age	17	23.65	3.463	16	33.44	3.326	-
WMS Associate Learning ***Delayed Recall***							
Delayed Easy	17	5.82	.393	16	5.50	.730	.130
Delayed Hard	17	2.76	1.393	16	1.94	1.289	.087
Delayed Total	17	8.59	1.502	16	7.44	1.504	.036*

M= Mean
* p = 0.05

4.3 Associate Learning- Gender Comparison

4.3.1 Immediate recall

There was one significant result for the immediate recall in the direction of the males over the females for the third "easy" association p = .042. No statistical significance was indicated for any of the other comparisons. A trend in favour of the males over the females appears to be exhibited with regards to the "easy" associations in this subtest.

Table 12: WMS Associate Learning – "Easy" and "Hard" Associations - Gender Composition- **Immediate Recall**

	Males			**Females**			
	n	*M*	SD	*n*	*M*	SD	p- value
Highest Grade	12	11.67	.492	21	11.76	.436	-
Age	12	27.50	4.622	21	28.90	6.700	-
WMS Associate Learning ***Immediate Recall***							
Easy 1st Recall	12	5.25	1.055	21	4.86	1.062	.314
Easy 2nd Recall	12	5.42	.793	21	5.67	.577	.305
Easy 3rd Recall	12	6.00	.000	21	5.81	.402	.042*
Easy Total	12	16.67	1.670	21	16.33	1.683	.587
Hard 1st Recall	12	1.08	.996	21	1.05	1.117	.927
Hard 2nd Recall	12	2.17	1.267	21	2.14	1.195	.957
Hard 3rd Recall	12	2.75	1.215	21	2.48	1.209	.537
Hard Total	12	6.00	2.892	21	5.67	3.022	.759
Immediate Recall Sum	12	14.333	3.1861	21	13.833	3.4581	.684

M= Mean
* p = 0.05

4.3.2 Delayed recall

There is no statistical significance between the two genders for the delayed recall.

Table 13: WMS Associate Learning – "Easy" and "Hard" Associations- Gender Composition- **Delayed Recall**

	Males			**Females**			
	n	*M*	SD	*n*	*M*	SD	p- value
Highest Grade	12	11.67	.492	21	11.76	.436	-
Age	12	27.50	4.622	21	28.90	6.700	-
WMS Associate Learning ***Delayed Recall***							
Delayed Easy	12	5.75	.622	21	5.62	.590	.552
Delayed Hard	12	2.25	1.603	21	2.43	1.287	.728
Delayed Total	12	8.00	1.537	21	8.05	1.658	.936

M= Mean

4.4 Visual Reproduction- Age Comparison

4.4.1 Immediate recall

There is one significant result in favour of the 18-29 age group. This is notated with an asterisk in the p-value column with a critical value of p = .035 for Card 2. One result again in favour of the younger age group shows a trend towards statistical significance contained in the immediate total score, p = .076. No statistical significance was found for Cards 1 or 3.

Table 14: WMS Visual Reproduction - Age Comparison - **Immediate Recall**

	18-29 years			**30-40 years**			
	n	*M*	SD	*n*	*M*	SD	p- value
Highest Grade	17	11.76	.437	16	11.69	.479	-
Age	17	23.65	3.463	16	33.44	3.326	-
WMS Visual Reproduction ***Immediate Recall***							
Card 1	17	1.94	.827	16	1.50	.966	.168
Card 2	17	3.41	1.064	16	2.56	1.153	.035*
Card 3	17	3.00	1.275	16	2.50	1.826	.366
Immediate Recall Sum	17	8.35	2.029	16	6.56	3.444	.076

M= Mean
* p = 0.05

4.4.2 Delayed Recall

There are two significant results in favour of the 18-29 age group. These were with regards to Card 2 which contained a critical value of .024 and the delayed total with a critical value of p = .033. As with the immediate recall, no statistical significance was detected for Cards 1 or 3.

Table 15: WMS Visual Reproduction - Age Composition - **Delayed Recall**

	18-29 years			30-40 years			
	n	*M*	SD	*n*	*M*	SD	p- value
Highest Grade	17	11.76	.437	16	11.69	.479	-
Age	17	23.65	3.463	16	33.44	3.326	-
Delayed Recall							
Card 1	17	1.59	.795	16	1.31	1.014	.390
Card 2	17	3.12	1.111	16	2.06	1.436	.024*
Card 3	17	2.59	1.176	16	1.81	1.559	.115
Delayed Total	17	7.29	2.285	16	5.19	3.103	.033*

M= Mean
* p = 0.05

4.5 Visual Reproduction- Gender Comparison

4.5.1 Immediate recall

There is one significant result in favour of the male over the female groups contained in Card 2 with a critical value of p = .037. No statistical significance was found for Cards 1, 3 or the immediate total.

Table 16: WMS Visual Reproduction - Gender Comparison - **Immediate Recall**

	Males			Females			
	n	*M*	SD	*n*	*M*	SD	p- value
Highest Grade	12	11.67	.492	21	11.76	.436	-
Age	12	27.50	4.622	21	28.90	6.700	-
WMS Visual Reproduction ***Immediate Recall***							
Card 1	12	1.67	.778	21	1.76	.995	.778
Card 2	12	3.25	.866	21	2.86	1.315	.363
Card 3	12	3.50	1.567	21	2.33	1.426	.037*
Immediate Recall Sum	12	8.42	2.610	21	6.95	2.991	.167

M= Mean
* p = 0.05

4.5.2 Delayed Recall

There is one significant result in favour of the males over the females with a critical value of p = .054. There were no other results which indicated any statistical significance between the two genders.

Table 17: WMS Visual Reproduction- Gender Composition - **Delayed Recall**

	Males			**Females**			
	n	*M*	SD	*n*	*M*	SD	p- value
Highest Grade	12	11.67	.492	21	11.76	.436	-
Age	12	27.50	4.622	21	28.90	6.700	-
WMS Visual Reproduction ***Delayed Recall***							
Card 1	12	1.50	.798	21	1.43	.978	.831
Card 2	12	2.75	1.422	21	2.52	1.365	.655
Card 3	12	2.83	1.403	21	1.86	1.315	.054*
Delayed Total	12	7.08	2.778	21	5.81	2.892	.226

M= Mean

CHAPTER 5: DISCUSSION

The study's objective was to examine the WMS Associate Learning and Visual Reproduction subtests and assess the appropriateness of current norms for black South Africans with DET and former DET schooling. This study was conducted based on convincing and current research (Ardila, 1996; Ardila, & Roselli, 2003; Gaylard, 2005; Horsman, 2007; Shuttleworth-Edwards, Donnelly, Reid, & Radloff, 2004; Shuttleworth-Edwards, Kemp, Rust, Muirhead, Hartman, & Radloff, 2004; Skuy et al., 2000; Van Tonder, 2007) which correctly postulates that socio-cultural factors can negatively sway performance in contexts widely different from those in which the norms were created. Henceforth descriptive and preliminary norms on this underrepresented population in South Africa were created to investigate whether these socio-cultural factors negatively affect test performance evidenced through comparisons with available norms. In addition, the stratification of the sample with regards to age and gender allows further comparisons in terms of performance to be discussed.

Therefore this chapter will be approached by systematically reviewing the statistical data table by table as was presented in Chapter 4. The discussion will firstly focus on any data indicating statistical significance, followed by data approaching significance and lastly any trends between the performance with regards to age and gender. Then comparisons to current available norms presented in the Literature Review in Chapter 2 will be made. Lastly a summary of the findings will be highlighted and discussed in light of the influence of the socio-cultural factors argued previously with possible explanations offered in the presence of similarities or discrepancies.

5.1 Associate Learning- Age Comparison

5.1.1 Immediate recall

As posited in Chapter 2, a divergence in the performance between the two age groupings in the sample may be expected due to the widely accepted notion that memory decreases with age (Lezak, 1983, Lezak et al., 2004). Moreover the Associate Learning subtest has been found to be more difficult with older age ranges and variances in performance have been previously noted (Spreen, & Strauss, 1998). In evaluating the normative indicators

created in this sample, it appears that this trend between the age ranges of 18-29 and 30-40 years has been replicated. Overall between the "easy" and "hard" associations, where there have been statistically significant differences, this has always been in favour of the younger age group. Focusing on the "easy" associations, the first and total "easy" associations showed the younger age grouping 18-29 years outperforming the older age range. No statistical significance was noted on the second and third "easy" associations of the immediate recall of the WMS Associate Learning for the age ranges.

With regards to the "hard" associations of the immediate recall, the trend of the younger age group to demonstrate a superior performance was again evident, with statistical significance shown for the third and total "hard" associations. No significant difference was observed for the first "hard" recall, yet the second "hard" association demonstrated a figure that was approaching statistical significance. Lastly the Sum Score or combined score is again of statistical significance in favour of the younger age group.

5.1.1.1 Comparison to Available Norms[4]

As mentioned previously, the division of each "easy" and "hard" association adopted in this study has not been routinely implemented in other available norms. Yet in line with the fact that this separation is one of the very strengths of the original WMS as highlighted in Chapter 2, reporting on each association was decided upon in this study to create norms with data to allow further inferences and comparisons to be made presently and in future studies. Unfortunately to the author's knowledge, currently only one other researcher; Shuttleworth-Jordan (1996) has divided her norms into "easy" and "hard" divisions for both the immediate and delayed recall. Thus for some of the data produced in this study, no direct comparisons to the available norms can be made.

5.1.1.1.1 Immediate recall – Combined Score

The combined score of the immediate recall (Sum score) for this study is $M = 15.324$ for the **18-29** age range and $M = 12.625$ for the **30-40** age range. With regards to the original norms provided by Wechsler (1945), two age ranges; 20-29 and 40-49 years have been

[4] The reader is directed to Table 1 and 2 in the Literature Review and Appendix A following the comparisons to available norms referred to in the discussion. Please note that all norms referred to bar the Spreen, & Strauss (1991) and Shuttleworth-Jordan (1996) have been sourced in Mirushina et al., 2005, pp. 274-282.

accounted for. Henceforth the older age range in this study will be loosely compared to the Wechsler norms. Thus the means for the two age ranges are $M = 15.72$ and $M = 13.91$ respectively. Evaluating all the other normative data available, it seems that the sample's norms for both age groups are generally lower. A bigger margin is evident in the Hulicka (1966) norms with regards to the older age range in the sample. Only an age range of 30-39 has been reported on with the mean of $M = 15.48$. Due to the fact that the Ivison (1977) study has such a broad age range (20-69), perhaps the possible age effects have been absorbed, yet the overall mean of $M = 12.89$ is lower than the studies younger age range but is comparable to the older age range. In the Kear-Colwell and Heller (1978) study, the mean score of the age range of 17-34 is $M = 18.26$ and $M = 15.28$ for the 35-64 age margin. Both are higher overall mean scores as opposed the sample's age ranges. The 1981 study of Bigler, Steinman and Newton have norms for the age ranges of 16-20, 21-35 and 36-50. Again the performance of the study's sample underperforms for both age groups as opposed to means of $M = 18.3$, 16.9 and 16.0 respectively.

It is interesting to note and useful for this study that Gilleard and Gilleard (1989) have stratified the age range according to quantity of education. In the age range of 20-39, the participants with an education between nil and elementary school had a mean score of $M = 11.22$ whereas those with a secondary school and above score a mean of $M = 15.49$. The Spreen and Strauss (1991) norms are considerably higher than the study's sample with a 20-29 and 30-39 age ranges scoring 18.33, 18.21 and 18.29 respectively. Lastly an interesting study to compare this study's sample with is the Shuttleworth-Jordan (1996) norms as a division has been made between languages namely; English first language and African first language. It seems that the sample's data is comparable with the African first language mean $M = 15.48$ as opposed to the English first language participants who score a mean of $M = 17.26$.

5.1.1.1.2 Immediate recall – "Easy" and "Hard" Sums

As stated beforehand, the "easy" total score is the halved sum of correct "easy" associations with the total number of correct "hard" associations (Wechsler, 1945). However it appears that a general consensus on how to represent this figure has not been reached. Some studies have presented the "easy" total figure before, others after this

division. It was decided for this study to represent the "easy" total figure before this division as was done in the desRosiers and Ivison's (1986) study.

The **"easy"** total mean for the sample study is ***M* = 17.12 (8.56)** for the **18-29** age range and ***M* = 15.75 (7.875)** for the **30-40** age range. The Wechsler's (1945) study has presented the "easy" total score after the division. Although the younger age range has a wider age bracket by two years, the overall mean for the "easy" total was $M = 8.56$. Albeit a crude method, dividing the sample's "easy" total score of $M = 17.12$ in half; an exact comparable mean of $M = 8.56$ exists. It seems that age affects in the Wechsler's sample is less apparent than is being observed in this study. The mean for the total "easy" association for the 40-49 year age range is $M = 8.26$ as compared to the sample's mean $M = 7.875$ in a slightly younger age range.

A direct comparison with the desRosiers and Ivison (1986) study is afforded due to the congruency in data procedure between the studies for the "easy" total score. However as opposed to most of the other findings, it appears that the study's sample with regards to the 18-29 age range performed better than this available norm namely $M = 17.12$ as opposed to $M = 16.65$. It additionally highlights the statistical significant difference in the age groups of the study's sample as the older age group's mean is once again lower than the 1986 norms, namely; $M = 15.75$ versus $M = 16.19$ of the study's sample. It seems that the study's older age group is more comparable with the age grouping of 40-49 with a mean of $M = 15.28$.

The Shuttleworth-Jordan (1996) study presented findings for the age range of 18-25 years. A discrepancy between the English first language group with an "easy" total of $M = 8.69$ exists as opposed to the mean of $M = 7.64$ for the African first language population. It appears that this study is more closely aligned to the first language group, however the larger standard deviation of SD = 1.84 in the African first language does indicate a similar range of the study's findings.

The total **"hard"** mean for the sample study is ***M* = 6.76** for the **18-29** age range and ***M* = 4.75** for the **30-40** age range. A considerably larger margin is present when comparing the study's normative indicators with available norms. For example Wechsler's (1945)

"hard" mean for his 20-29 age group is $M = 7.16$ and $M = 5.70$ for the 40-49 age group. The results of the desRosiers, & Ivison's (1986) study closely mirrors the results of the Wechsler (1945) norms, with $M = 7.45$ and $M = 5.59$ for age ranges 20-29 and 30-39 respectively. Even though Shuttleworth-Jordan (1996) reports a distinction for the two languages, both are still higher than the study's results, namely $M = 8.57$ and $M = 7.99$.

No "easy" or "hard" comparisons could be made for the following studies because they were not reported on namely; Bigler, Steinman, & Newton (1981); Gilleard, & Gilleard (1989); Hulicka (1966); Ivison (1977); Kear-Colwell, & Heller (1978); and Spreen, & Strauss (1991).

5.1.2 Delayed recall

Age effects were again observed in the delayed recall of the WMS Associate Learning subtest. This was particularly evident in the delayed total score with a statistically significant result being observed in favour of the younger age group. Although no significant differences were found with regards to the "easy" delayed scores, data approaching significance was observed with regards to the "hard" association, with the younger age group outperforming the older.

5.1.1.2 Comparison to Available Norms

Disappointingly, even post-1975, there is still a general paucity of delayed norms for the original WMS. No delayed comparisons are available from the following studies namely; Bigler, Steinman, & Newton (1981); desRosiers, and Ivison (1986); Gilleard, & Gilleard (1989); Hulicka (1966); Ivison (1977); Kear-Colwell, & Heller (1978); and Wechsler (1945).

The delayed total mean for the sample study is $\boldsymbol{M = 8.59}$ for the **18-29** age range and $\boldsymbol{M = 7.44}$ for the **30-40** age range. The sample's delayed scores again are lower when compared to the results of Spreen and Strauss (1991) norms with $M = 9.91$ for the 20-29 age range and $M = 9.92$ for the 30-30 age range.

Further analyses is afforded in the Shuttleworth-Jordan (1996) norms for the younger age group due to the additional division of "easy" and "hard" delayed norms provided in this

study. The delayed "easy" mean for the sample study in the age range of **18-29** is ***M* = 5.82** and delayed **"hard"** of ***M* = 2.76.** However an opposite trend in which this study's sample has a superior performance as compared with the 1996 study with the "easy" having a mean of $M = 3.56$ and $M = 2.94$ and the "hard" of $M = 2.3$ and $M = 1.6$ for each language group respectively.

5.1.3 Summary of the findings for age comparisons of the Associate Learning

Therefore in review of the above findings, it appears that the Associate Learning test has provided data that appears to concur with other published research findings which states that performance decreases with age on original WMS subtests (Lezak, 1983; Prigatano in Spreen, & Strauss, 1998). Moreover in evaluating verbal memory with age affects, performance declines in both immediate and delayed recall subtest inclusions. Furthermore the sample's delayed recall test results for the older age range indicated a larger and substantial lower margin in comparison to other norms and complied age differences. It appears that the inclusion of the "easy" and "hard" divisions has proven useful indicators additionally for this population with substandard education as the margin in performance does seems to depress in the more complex "hard" associations and between the age groupings.

One would expect that the norms created by Shuttleworth-Jordan (1996) for the African first language speakers would be similar and comparable for the norms created in this sample. At first glance, this does not seem to be the case. However the standard deviation is critical to evaluate and take into account. The 1996 norms have a broader standard deviation than has been produced in this sample. Thus both means with their respective standard deviations are within the same acceptable range of one standard deviation from each other and are thus not considered contradictory.

Another aspect that does not follow the overall trend as reported above was with regards to the younger age group with the desRosiers and Ivison (1986) Australian norms. No information has been provided on the educational level of the participants but an even distribution of gender was attained. One hypothesis with regards to this comparative normative anomaly is that perhaps a broader margin of quantity of education in the sample was used in the Australian normative study. Similarly participants were excluded

for this study with any substance abuse history which does not seem to have been an exclusion criterion for the Australian study. Lastly the Australian study was conducted on medical and surgical inpatients. Although neurological and psychiatric impairment were deemed exclusion criteria for the 1986 study, perhaps the setting and context of participants having health complaints, which could have been a distracting factor or resulted in low motivation whilst engaging in the study, resulted in lower overall performance.

5.2 Associate Learning- Gender Comparison

Gender differences have been reported for the Associate Learning subtest in favour of women by around one point (Lezak, 1983) This finding has not been demonstrated in the present study, with the opposite trend in favour of the male population being observed. This was evident with statistical significance in the third "easy" association of the immediate recall.

5.2.1 Immediate recall

Overall the male population in the sample performed slightly better than the females on both the "easy" and "hard" associations, although only in one instance to produce a statistically significant difference.

5.2.1.1 Comparison to Available Norms

5.2.1.1.1 Immediate recall – Combined Score

The mean for the sample study is **males** is M = **14.333** and M = **13.833** for **females**. The total combined score of the sample is remarkably lower than most of the available norms in terms of gender. The sample's means are lower than both Wechsler's (1945) age group means M = 15.72 and 13.91 respectively and Hulicka's (1966) 30-39 age range with a mean of M = 15.48. Similarly the Bigler, Steinman and Newton (1981); Kear-Colwell and Heller (1978); Shuttleworth-Jordan (1996) and Spreen and Strauss (1991) norms indicate performance wielding higher overall mean figures. At face value it appears that the sample under study has performed more favourably than the data provided in the Ivison (1977) study M = 12.89, yet as mentioned previously the broad age range and no information detailing the gender distribution in the study makes adequate and valid

comparisons problematic. Again it is of interest to have the Gilleard and Gilleard (1989) study included for comparison in this study as it stratifies the sample based on quantity of education. It appears that for both males and females composed in this study, the norms are closer to the sample with secondary or above education than the nil to elementary education. Even in comparison to African first language speakers as was composed in the Shuttleworth-Jordan (1996) study, both males and females performed poorer in this study.

5.2.1.1.2 Immediate recall – "Easy" and "Hard" Sums

The total **"easy"** association is M = **16.67** for **males** and M = **16.33** for **females**. It appears that in comparison with the desRosiers and Ivison (1986); Shuttleworth-Jordan (1996) and Wechsler (1945) norms, the figures are comparable with regards to gender.

The total **"hard"** association is M = **6.00** for **males** and M = **5.67** for **females**. A discrepancy between the "hard" total score is more apparent in comparison to the available norms than that of the "easy" associations. The sample scores are significantly lower than both Wechsler (1945) and desRosiers and Ivison (1986) age grouping 20-29 with means of M = 7.16 and M = 7.45 respectively. The second age range of the 1986 study is more closely associated with the older age grouping of 30-39 with a mean M = 5.59. Unlike the "easy" associations, the "hard" associations with the Shuttleworth-Jordan (1996) norms fairs less favourably with M = 8.57 and M = 7.99 for the English and African first language speakers respectively.

5.2.2 Delayed recall

The trend for males to perform better than the females is not replicated in the delayed recall. Slightly elevated scores are recorded for the delayed "hard" and total associations in favour of the female group, yet no statistical significance was found in this gender comparison.

5.2.1.2 Comparison to Available Norms

The delayed total score is M = **8.00** for **males** and M = **8.05** for **females**. For both gender groupings in the sample, the delayed total scores are lower than recorded in Spreen and Strauss (1991) with M = 9.91 and M = 9.92 for the age groups 20-29 and 30-39.

The delayed **"easy"** association is $M = 5.75$ for **males** and $M = 5.62$ for **females** with the delayed **"hard"** association is $M = 2.25$ for **males** and $M = 2.43$ for **females.** In comparison to the Shuttleworth-Jordan (1996) data, it appears that the opposite trend has been noted. For the English first language speakers, a mean score of $M = 3.65$ and $M = 2.3$ were observed for the "easy" and "hard" associations. The African first language speakers produced norms of $M = 2.94$ and $M = 1.6$ for the "easy" and "hard" associations respectively.

5.2.3 Summary of the findings for gender comparisons of the Associate Learning

In summary, the anticipated results in accordance with published findings (Ivison and Verhoff et al., in Lezak, 1983) of the Associate Learning subtest in investigating gender effects has not been found. Rather it appears that males have slightly performed better than the female counterparts in the study. Another factor was that statistically significant differences for gender were generally less than what was seen in the age comparison analyses. The same trend for the sample to perform higher than current norms was observed in the gender comparison for the Shuttleworth-Jordan (1996). It is again argued that the standard deviations must be considered when comparing this data, which again provides data within one standard deviation of one another. Overall however similar to the findings of the age comparisons, the sample's mean underperformed when compared to the available data.

5.3 Visual Reproduction- Age Comparison

The Visual Reproduction subtest has been found to be one of the most sensitive indicators to detect a decline in performance with the advancement with age (Ivnik, Malec, & Smith, 1993) and as compared to any other WMS subtests, has the steepest age gradients in most of the norms created for it (Lezak, 1983). Thus it was expected that this would be reflected in the study sample, which it was for both the immediate and delayed recall tests, but to a larger degree on the delayed task.

5.3.1 Immediate recall

On the immediate recall test, no statistical significance between the two age groups is evident between Card 1 and Card 3. However there is a statistically significant

discrepancy in favour of the younger age group with regards to Card 2 and an overall trend approaching significance with regards to the immediate total score.

5.3.1.1 Comparison to Available Norms

The immediate total mean for the sample study is M = **8.35** for the **18-29** age range. Regrettably, no other norms have reported on each card but some have researched and reported on both the immediate and delayed recalls. A huge divergence exists between the sample's immediate total for the 18-29 age range with most normative data in a similar age bracket. Firstly Wechsler's (1945) 20-29 age range has a mean of M = 11.00, followed by the Kear-Colwell and Heller (1978) study with the age range of 17-34 presenting a mean of M = 10.39. Both are significantly higher than that recorded in the sample. With no age range, it is difficult to make direct comparisons with the Russell (1975) study, yet in the Ivison (1977) study, which contains a wide age range of 20-69, the study's mean of M = 8.46 appears comparable. The same concern of the large age range that was raised for the Associate Learning subtest is felt again warranted here, as it is felt that possible age effects have been absorbed and thus is not a truly reflective comparison sample.

The following studies follow a similar trend with results outperforming the study's sample. The Bigler, Steinman and Newton (1981) study presents a mean of M = 11.6 for the age range of 21-35, whereas the Ryan, Morrow, Bromet and Parkinson (1987) have a mean of M = 13.0 for the age range of 21-30. Equally the Trahan, Quitana, Willingham and Goethe (1988) study for the age range of 18-29 has a mean of M = 10.48 which is considerably smaller than the results of Spreen and Strauss (1991) which reports a mean of M = 18.33 for the age range of 20-29. Even in comparison to the Shuttleworth-Jordan (1996) norms, for both language speakers, the sample underperformed in comparison to the means of M = 12.39 and 11.53 respectively. Only the Gilleard and Gilleard (1989) study demonstrated a norm lower than reported in the study for the age range of 20-39 for participants with nil to elementary schooling M = 6.25 as opposed to those with secondary or above M = 10.49.

Similar findings can be seen with regards to comparisons with the study's older age group. The **30-40** age group recorded an immediate recall of ***M* = 6.56**. This score is not closely associated with the Kear-Colwell and Heller (1978) study of M = 10.39 or the data recorded for the age group of 36-50 M = 9.3 of the Bigler, Steinman and Newton (1981) study. The Trahan, Quitana, Willingham and Goethe (1988) study with an age grouping of 30-49 years M =10.10 and the Gilleard and Gilleard (1989) with a 40-59 age group with secondary and above education M =10.10 both far outweigh the sample results. Lastly the sample's mean is dramatically lower than the Spreen and Strauss (1991) of M = 18.21.

5.3.2 Delayed Recall

The delayed recall results follow the same trend as has been reported in all the other age comparison tests. Thus the younger age grouping performs better than the older group with statistically significant differences observed with regards to Card 2 and the delayed total score.

5.3.1.2 Comparison to Available Norms

The delayed total mean for the sample study is ***M* = 7.29** for the **18-29** age range and ***M* = 5.19** for the **30-40** age range. Five studies provide normative data on the delayed recall test. There is generally more data to compare for the Visual Reproduction subtest with regards to delayed recall as opposed to the Associate Learning subtest. Again comparisons with the delayed total can only be commented on, as the divisions in this study have not been adopted by the other studies. Although the Russell (1975) study does not divide the norms into age ranges, it appears that the sample's delayed means still either fall below the neurologically intact group of M = 9.1. This can additionally be observed in the Ryan, Morrow, Bromet and Parkinson (1987) norms of M = 13.2 and M = 12.1 for the age ranges of 21-30 and 31-40 respectively. As too the Trahan, Quitana, Willingham and Goethe (1988) study for the age range of 18-29 with a mean of M = 9.84 and M = 9.26 for the 30-49 year olds. Similar results of higher means scores for the delayed recall were reproduced by Spreen and Strauss (1991) with M = 9.91 and M = 9.92. The Shuttleworth-Jordan (1996) results demonstrate even larger margins with the sample with the English first language mean M = 11.54 and African first language M =

10.77. No norms are available for Biger, Steinman and Newton (1981); Gilleard and Gilleard (1989); Hulicka (1966); Ivison (1977); Kear-Colwell and Heller (1978) and Wechsler (1945).

5.3.3 Summary of the findings for age comparisons of the Visual Reproduction

Age affects have been detected in this sample which is consistent with the expected results based on the reviewed literature presented earlier in this study (Ivnik, Malec, & Smith, 1992). For both the immediate and delayed recall tasks, a general trend of a two point margin in the mean scores has been observed. However in the comparison between the Spreen and Strauss (1991) norms in the immediate test, a 12-point margin was observed, supporting other studies where margins of more than ten points have been found between blacks and whites (Howe, 1997; Skuy et al., 2000). This again stresses the effect of socio-cultural factors and how they cannot be negated when conducting neuropsychological assessments. Henceforth not only is the age effects reiterated in this sample, back furthermore a significant age gradient between the two age ranges is evident. Due to the break-down of the results in this study, a consistent trend of statistical significance between Card 2 has moreover been detected.

5.4 Visual Reproduction- Gender Comparison

Conflicting results have been reported from two studies with regards to gender effects with the Visual Reproduction subtest. One Australian study indicates that males perform better than females (Mitrushina et al., in Lezak, 1983) however other studies have reported no gender differences (Lezak et al., 2004; Verhoff et al., in Lezak, 1983).

5.4.1 Immediate recall

Contrary to the age comparison of this subtest where Card 2 and the total score produced significant differences, Card 3 produced significant differences in favour of males over females.

5.4.1.1 Comparison to Available Norms

The total of the immediate recall for **males** was M = **8.42** and **females** M = **6.95**. Both gender scores in the sample are lower than Russell's (1975) mean of M = 9.1 as are the norms provided by Ryan, Morrow, Bromet and Parkinson (1987), of M = 13.2 and M =

12.1 for the age ranges of 21-30 and 31-40 respectively. It appears that for both the Trahan, Quitana, Willingham and Goethe (1988) norms of $M = 9.84$ and $M = 9.26$ and the Spreen and Strauss (1991) norms of $M = 9.91$ and $M = 9.92$, both are relatively closer to the mean of the sample's male population, but far outweigh the performance of the female population in the sample. The Shuttleworth-Jordan (1996) results again demonstrate large margins with the sample with the English first language mean $M = 11.54$ and African first language $M = 10.77$.

No norms are available for Biger, Steinman and Newton (1981); Gilleard and Gilleard (1989); Hulicka (1966); Ivison (1977); Kear-Colwell and Heller (1978); and Wechsler (1945).

5.4.2 Delayed Recall

Card 3 is again the only task of significance between the genders as was recorded in the immediate recall.

5.4.1.2 Comparison to Available Norms

The total of the delayed recall for **males** was $M = 7.08$ and **females** $M = 5.81$. Through scanning the results of the available norms, it appears that the sample's mean scores fall considerably lower in comparison. Russell's (1975) mean of $M = 9.1$ and Ryan, Morrow, Bromet and Parkinson (1987), of $M = 13.2$ and $M = 12.1$ for the age ranges of 21-30 and 31-40 respectively both have considerably larger scores. The margin of the males mean score is more distinct than it was in the immediate recall with the Trahan, Quitana, Willingham and Goethe (1988) norms of $M = 9.84$ and $M = 9.26$ and Spreen and Strauss (1991) with $M = 9.91$ and $M = 9.92$ norms. Lastly the Shuttleworth-Jordan (1996) results of English first language mean $M = 11.54$ and African first language $M = 10.77$ are significantly higher.

No norms are available for Biger, Steinman and Newton (1981); Gilleard and Gilleard (1989); Hulicka (1966); Ivison (1977); Kear-Colwell and Heller (1978) and Wechsler (1945) as they were not reported on.

5.4.3 Summary of the findings for gender comparisons of the Visual Reproduction

It appears that gender effects have been observed in this sample akin with the findings in the Australian study (Trahan et al., 1977) with females performing slightly lower than males. Thus for visual memory, in both recognition and recall tasks, males appear to have a slight advantage. The normative division of each card for the results of this sample has rendered useful data that may have been missed if just the immediate and delayed totals were reported on. Card 3 is unique in the fact that it contains two geometric designs and in both recall tasks showed that the male population performed significantly better than the female group.

5.5 Socio-Cultural indicators

Overall in the evaluation of current norms and the validity of their use for black South Africans with DET and former DET schooling, it appears that they are *not* appropriate. Routinely it was found that the mean scores produced by the sample were lower, and in many cases significantly so, than the available normative means. Thus if used on an individual who matched the demographics composed in this sample, data would fallaciously steer towards conclusions of an intellectual level inferior to what the individual was truly capable of and functioning at.

Secondly through stratification of the sample, age and gender effects could be assessed. The younger age group for both WMS subtests performed superiorly. Thus it appears that memory decline with age has again been supported in this study. Although gender effects were evident, it was to a lesser degree than what was observed with the age comparison. In both tests, contrary to the majority of other research findings, males outperformed females.

It is of concern that 33 years after the Russell (1975) article, normative studies still omit providing data for the delayed task of the subtests, with particular normative rarity being observed for the Associate Learning subtest. Thus it is felt that this study alongside Shuttleworth-Jordan (1996) are of particular value, especially when considering the unique merits that the delayed addition affords namely: improved validity (Spreen, & Strauss, 1998) identification of a retrieval problem (Lezak, 1983), usefulness in cross-

cultural contexts (Shuttlworth-Edwards, 2002) and indicator of specific hemispheric pathology (Mitrushina et al., 2005).

The importance of education and the deleterious effects it can cause on test performance has been routinely stressed in this thesis. This was acutely demonstrated in the Gilleard and Gilleard (1989) study which contained an almost four-point margin in the mean for the age range of 20-39 and a six point margin in the mean for the 40-59 year sample. The variable that stratified these two groups was the quantity of education thus this important variable has been recognised for its possible neuropsychological effects.

It appears that the consistent performance of the 18-29 age group over the 30-40 age group possibly speaks to the fact that the quality of education within DET and former DET schooling cannot be exclusively homogenised. The 30-40 group would have been exposed to DET schooling and the Apartheid regime to a greater extent than the 18-29 group. Therefore even though the educational climate in South Africa has not changed so that its delivery can be considered equal for all, it may have improved to some degree. Furthermore it is expected that the younger age group in this sample would demonstrate a higher level of test-wiseness and would be more acculturated towards westernization.

It is hypothesized that this is demonstrated in the Associate Learning Immediate recall task. The critical level reported for the first "easy" association was 0.008 which is of particular statistical significance. As this was the very first test and task required of the sample's participants, perhaps the younger age group were more keyed into what may be expected of them and thus were able to perform to a higher level.

However this margin between the age groups, albeit important does not extinguish the fact that DET and former DET schooling it is not equal with regards to former Private/Model C schooling. Thus the overall dominance displayed by the younger age group is felt to be a combination of these factors but additionally reflective of the fact that memory, in both the visual and verbal subtypes declines with age.

Thus in conclusion, the evidence provided in this study does seem to support the notion that socio-cultural effects do heavily sway performance and that appropriate normative data should be created in the contexts for which neuropsychological tests will be used.

5.6 Recommendations for future research

i) To the author's knowledge, the divisions of each test adopted in this study have never been produced or presented in normative data. These divisions proved valuable with particular reference to the WMS Visual Reproduction subtest in both the immediate and delayed recall task in the comparison for performance in gender. The total scores had no statistical difference, yet performance on Card 3 was significantly different between males and females. Based on these findings, it is firstly recommended that future researchers adopt this way of representing WMS data and secondly, to research whether this trend of Card 3 is duplicated in other studies.

ii) The term socio-cultural in this study housed three variables namely: culture, language and education. Further studies are recommended to assess these variables independently to see to which varying degrees they contribute to different test performances.

iii) Continued research that investigates the effects of different quality of education, is suggested in the context of South Africa as it is certainly not a static factor and has been proven to be such a moderating factor in test performance.

iv) Based on the disproportionate amount of IsiXhosa learners who have obtained Grade 12 in the Eastern Cape as compared to the overall figure of IsiXhosa speakers living in the province (Statistics South Africa, 2001 Census), it is suggested that future research focus on further normative indicators for Grades 8-10. It is expected that mean scores will be even lower that was expressed by this study's sample.

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Appendix A: Available WMS studies within the age range of this study and accompanying normative data.

	The study	Age range	Sample	Composition of Sample	Education	Country	Full WMS or subtests administered	Additional Information
1	**Wechsler, 1945**	20-29 40-49	50 46	"Not hospital patients." Men and women No information regarding the stratification of gender	Mean education level = 7.04 years	U.S	Full WMS	-
2	**Hulicka, 1966**	30-39	53	Hospitalized veterans. No information regarding the stratification of gender	10.7 years	U.S	Full WMS except Orientation subtest not administered.	-
3	**Russell, 1975**	Controls No range reported. Mean age = 36.5 years Brain	30 75	28 =Males 2 = Females Controls were referred from the departments of neurology, psychiatry and extended care services. No history of brain damage.	12.5 years 11.6 years	U.S	Visual reproduction and Logical memory subtest were only administered.	

		damaged Sample No range reported. Mean age = 42.0 years		Participants referred from the wards of neurology, psychiatry, outpatient and extended care services. Verified history of brain damage- heterogeneous etiology.				
4	**Cauthen, 1977**	20-29 30-39 40-49	15 14 13	No information regarding the stratification of gender. It was just reported that both male and female participants were healthy.	No information regarding education reported.	Canada	Full WMS	
5	**Ivison, 1977**	20-69	500	No information regarding the stratification of gender. Exclusion criteria included known memory, neurological or psychiatric	No information regarding education reported.	Australia	Full WMS	Alteration to test content made to avoid American idioms or references. On the visual reproduction subtest, women performed

				impairment. Recruited from general wards.				slightly worse than men.
6	**Kear-Colwell & Heller, 1978**	17-34 35-64	56 60	Health service employees in a hospital in England. Stratified quota samples	No information regarding education reported.	U.K	Full WMS	
7	**Bigler et al., 1981**	16-20 21-35 36-50	10 15 12	Selected group of males and females with no neurological disorders.	11.1 years 13.9 years 14.4 years	U.S	Full WMS	
8	**desRosiers & Ivison, 1986**	20-29 30-39 40-49	For all ranges, there was an even distribution of males and females. Males =50 Females = 50/	Medical and surgical inpatients with no known neurological or psychiatric impairment.	No information regarding education reported.	Australia	Paired Associates	Reanalysed data of Ivison's earlier studies, 1977. It provides comparison data for the recall of high and low associates.
9	**Ryan et al., 1987**	21-30 31-40	55 45	No information regarding the stratification of gender. 182 Caucasian, English speaking blue collar workers. Exposure to heavy metals and toxic	12.3 years 11.9 years	U.S	Visual Reproduction subtest only	

				substances reported. No psychiatric or neurological disorders reported.				
10	**Trahan et al., 1988**	18-29 30-41	96 40	No information regarding the stratification of gender. Neurologically stable population.	13.7 years 14.7 years	U.S	Visual Reproduction subtest only.	No gender effects were observed.
11	**Gilleard & Gilleard, 1989**	20-39 40-59	120 80	No information regarding the stratification of gender. Information reports that participants were from both urban and rural areas.		Turkey	Full WMS	The purpose of the study was to compare Western norms with Turkish norms on the WMS. Turkish translation was used on Form I minor procedural changes were made.
12	**Spreen & Strauss, 1991**	20-84	Unknown	"healthy adult volunteers".	Unknown	Unknown	Associate Learning and Visual Reproduction	Unpublished norms.
13	**Heaton et al., 1991**	20-34 35-39 40-44	378 No age range or sample size in each age range	15 years study through multi-centre collaboration. Urban and rural	Mean = 13.6 years. Range 6-18 years	U.S and Canada	Visual Reproduction subtest only.	

			reported.	volunteers. M = 65% of study.				
14	**Russell & Starkey, 1993**	20-29 30-39 40-49	200	Neurological patients but deemed 'neurologically normal' after a neurological exam.		U.S		
15	**Shuttleworth-Jordan, 1995**	18-25		University students attending an English medium educational institution. The African first language was 67% Xhosa, 18% Sotho and 15% Mixed language including Venda, Tswana, Shona, Shangaan and Zulu speaking participants.	Tertiary Education, therefore at least 13 years of education.	R.S.A	Paired Associates, Visual Reproduction and Logical Memory	Cross-cultural study between South African English versus African first language university students

(Mitrushina et al., 2005, p. 275-282; Shuttleworth-Jordan, 1995, p. 10 and Spreen & Strauss, 1991, p. 385).

APPENDIX B: LETTER TO REGISTRAR

The Registrar
Rhodes University
Grahamstown
Date:_____

Re: Permission to Utilize Rhodes University as a Research Site

Four Intern Psychologists under the supervision of Professor Ann Edwards, Mr. Jan Knoetze and Mr. Gary Steele of the Psychology Department at Rhodes University would like to request your permission to utilize Rhodes University as a research site in order to conduct a research project during 2008, which is a requirement for a Masters degree in Clinical and Counselling Psychology at Rhodes University.

The purpose of this research is to provide preliminary normative data in respect of a nonclinical sample of black South African individuals with a relatively low level of education and relatively disadvantaged quality of education (Department of Education and Training [DET]-type schools), for a number of commonly used clinical and medico-legal tests in the neuropsychological assessment arenas.

We request permission to approach the Human Resources (HR) Department to select possible participants from the unskilled, support staff at Rhodes University and who have no background of any learning disabilities, psychiatric disorders, neurological disorders, alcohol or substance abuse, education in a special-needs facility or more than one repeated school grade.

The neuropsychological tests that will be administered are regularly used by psychologists for professional purposes and their administration is not considered to be invasive or harmful. Confidentiality is assured and no personal information will be disclosed. Only members of the research team will have access to the data, which will be stored in a confidential filing system by the supervisor at the Rhodes Psychology Clinic. The data may be used anonymously for research and publication purposes under the auspices of the Rhodes University Psychology Department. No individual test results will be offered to participants, their department managers or to Rhodes University.

Participation will require signed consent from each participant. It is understood that participation in this research project is completely voluntary and a participant can withdraw at any stage in the process.

Yours sincerely

Professor Ann Edwards

Karen Anne Hope Andrews

Andrea Jane Wong

Jan Knoetze

Lauren Fike

Gary Steele

Anita Da Silva Pita

APPENDIX C: LETTER TO PARTICIPANTS

The Participant

Re: Participation in Research Project

Four Intern Clinical and Counselling Psychologists under the supervision of Professor Ann Edwards, Mr. Jan Knoetze and Mr. Gary Steele of the Psychology Department at Rhodes University would like to request your participation in our research study, scheduled to take place during 2008.

The purpose of this research is to provide preliminary normative data on certain neuropsychological tests in respect of black South African individuals who speak an indigenous South African language as their first language, with a Grade 11 – 12 education level, from a former Department of Education and Training (DET)-type school.

These data are important for use in professional clinical settings in South Africa, because these frequently used tests are currently standardized on people in other countries, whose first language is English.

The researchers have been trained in the administration and scoring of the neuropsychological tests to be used in the study, by the supervisors who are all registered Psychologists. The tests that will be administered are regularly used by psychologists for professional purposes and their administration is not considered to be invasive or harmful. Confidentiality is assured and no personal information will be disclosed. Only members of the research team will have access to the data, which will be stored in a confidential filing system by the supervisor at the Rhodes Psychology Clinic. The data may be used anonymously for research and publication purposes under the auspices of the Rhodes University Psychology Department. No individual test results will be offered to participants, their department managers, or to Rhodes University.

Should you agree to participate in our study, we will also carefully explain the nature of consent to you again and ask you to sign a consent form. Participation in this research project is completely voluntary and you can withdraw at any stage in the process.

Yours sincerely

Professor Ann Edwards | Karen Anne Hope Andrews | Andrea Jane Wong

Jan Knoetze | Lauren Fike

Gary Steele | Anita Da Silva Pita

APPENDIX D: PARTICIPANT CONSENT FORM

RHODES UNIVERSITY
DEPARTMENT OF PSYCHOLOGY
PARTICIPANT CONSENT FORM

I, _____ have been informed of the nature of the research in which I will participate. I understand that four intern clinical and counselling psychologists from Rhodes University, Karen Anne Hope Andrews, Andrea Jane Wong, Lauren Fike and Anita Da Silva Pita will be administering some neuropsychological tests on me, and I hereby agree to participate in this project.

I understand that:

1) The above-mentioned intern clinical and counselling psychologists are conducting research as a requirement for a Masters degree in clinical and counselling psychology at Rhodes University. Their aim is to provide preliminary normative data on various neuropsychological tests for black South African people who speak an indigenous South African language as their first language.

2) The research will involve willing, black, indigenous South African language speakers with a Grade 11 – 12 education, from a former Department of Education and Training (DET)-type school.

3) Participants will be assessed using various commonly used neuropsychological tests.

4) Participation in the research is completely voluntary and I have the right to withdraw from the study at any stage.

5) The information collected on individual participants will be strictly confidential, with no personal information being disclosed. Access to this data will be restricted to members of the research team.

6) No individual test results will be given to me or to any other person outside of the research team. The information collected will be used for research purposes only by the researchers and will not be made available to my employers under any circumstances.

7) Data arising out of this project may be used anonymously for thesis and publication purposes.

_____ _____

Signed Date

_____ _____

Name Email

_____ _____

Address Contact Telephone Number(s)

APPENDIX E: PARTICIPANT GENERAL INFORMATION QUESTIONNARIE

General Information Questionnaire:

Please Note: All information that you write on this report is strictly CONFIDENTIAL and will ONLY be used for the research project. It will NOT be passed onto any employers.
Your ANONYMITY will be maintained.

Demographic Information:

Name: _____

Gender: _____

Age: _____

Date of Birth: _____

Place of Birth (City & Country):

_____

Occupation (Employment at present time):

_____

E-mail Address: _____

Contact Number: _____

First Language: _____

Education History:
1. Name, location and dates of **High School** (s) **(Secondary School)** attended:

1: Name: _____ **3. Name:** _____

Location: _____ Location: _____

Dates: _____ Dates: _____

2. Name: _____ **4. Name:** _____

Location: _____ Location: _____

Dates: _____ Dates: _____

3. **Highest Level of Education** (Highest Grade Reached):
Tick appropriate level.

3.1. Grade 10: _____ Grade 11: _____ Grade 12: _____

3.2. **YEAR** that you finished school?

_____

3.3 If you **TICKED Grade 10** or **Grade 11**, what was the reason you left before completing Grade 12?

_____

_____

_____

3.4 What **symbol** (eg, D, E, F) did you get for **English** at School?

_____

Socio-Economic Information:
Please answer this section **WHEN YOU WERE AT SCHOOL**, not at PRESENT
Please answer YES or No/

1. When you were still at SCHOOL, did you have:

1a: Electricity at home?

_____

1b: Running water?_____

1c: Did you have your own room?_____

1d: Did you have at least 2 meals per day? _____

1 e: Did you have your own toys worth in total over R50? _____

1 f: What was the attitude of your parents towards your schooling? Positive, negative or neutral?

_____

_____

General Information:

1.a. Did you **fail or repeat** any **grades** at school?

_____

b. If **YES, which grade** and **how many times** did you fail or repeat?

_____

2. Have you ever been diagnosed with a **learning problem** (e.g. dyslexia), or received treatment for a learning problem? Please give details.

_____

3. Have you ever been admitted to a **psychiatric (mental) hospital** or unit? Please give details.

_____

4. Are you currently taking any **medications** (tablets, injection) for a **psychological** or **psychiatric disorder** (mental illness)?
Please give details.

_____

_____

5. Have you ever taken any **medications** (tablets, injection) for a **psychological** or **psychiatric**
disorder (mental illness) in the **PAST?** Please give details.

_____

_____

6. Do you suffer or have you ever suffered from any **serious illnesses**? Please give details.

_____

_____

7. Have you ever suffered any form of **head injury** (eg. hit your head after falling off a bicycle, injured your head in a car accident or during sports)? Please give details, including whether or not you **lost consciousness** and for **how long** you lost consciousness (minutes or hours).

_____

_____

8. Do you know if there were any **complications** (things went wrong) during your mother's **pregnancy** and/or **your birth**? Please give details.

_____

_____

9. Do you **drink alcohol** at all? Please give specific details of **how much** you drink and **how often** (eg. 3 beers every day or 8 beers once a week etc.).

_____

_____

10. Have you ever used any **drugs** (eg. dagga, mandrax, ecstasy, glue or paint thinners)? Please give specific details of **frequency** (how much) of use and when you **began** using (eg. a packet of dagga every day since you were 15 etc.).

_____

_____

11. Is there any other **educational** or **medical** information that you think might have a detrimental (negatively or badly) affect your performance on a cognitive test? Specify.

_____

_____

_____

_____

_____

APPENDIX F: PRE-TEST SCREENING QUESTIONNAIRE

Encourage participant to answer as accurately as possible. Tick the option that applies and elaborate when requested. If some questions do not apply to the participant or she/he does not know the answer, record N/A if not applicable, or UK if unknown. Assure participants that information obtained will be kept in the strictest confidence.

Tester: _____

Biographical information

Name:				
Gender: **M**		**F**		
Age:		**Date of Birth:**		
Handedness: Right		**Left**		
First Language: **English Proficiency:** **Poor 1** **4**	**Average 2**	**Good 3**	**Excellent**	
Elaborate:				
Test Date:				

General

1. Have you had something eat this morning?
   - o Yes
   - o No

2. Have you slept well?
   - o Yes
   - o No

3. Do you wear glasses?
   - o Yes
   - o No

4. Do you experience any problems with your eyes?
   - o Yes
   - o No

5. Do you have a problem with hearing?
   - o Yes
   - o No

6. Have you ever broken an arm?
   - o Yes
   - o No

7. If yes, which one?
   - o Right
   - o Left

Remedial treatment for learning disabilities

Did you experience any difficulties or problems with learning at school?

- o No
- o Yes

If yes, elaborate

_____
_____
_____
_____
_____

Did you receive any extra help for those problems or difficulties from someone other than your teacher like an Occupational Therapist, Psychologist, Doctor etc?

- o No
- o Yes

Neurological

Have you had any head injuries or any other problem that might have effected your brain?

- o No
- o Yes

2. If yes,

(To researcher, if yes, indicate number of previous head injuries sustained by participants and type of head injury. (eg: MVA, fall, assault, gunshot wound etc,)

Pathology Type	**1**	**2**	**3**
Date (month/year)			
Type			
Hospitalized (Yes/No)			
Length of Unconsciousness			
Duration of stay in hospital			

3. When you left the hospital, did you have to continue to see the doctor as an outpatient?

- o Yes
- o No

4. Are you experiencing any problems related to this injury currently?
   - o No
   - o Yes

   If yes, please give further information

   _____
   _____
   _____
   _____

Education

1. What was the last grade you **passed**? (NB, not just started)

- o Grade 10
- o Grade 11
- o Grade 12

2. Did you fail or repeat any grades at school?

- o Yes
- o No

3. If YES, which grade and how many times did you fail or repeat?

- o Once
- o Twice
- o 3 times or more

4. What was the reason you failed/repeated?

- o Financial
- o Family responsibilities
- o Lack of interest
- o Political unrest/Strike, School closing
- o Poor academic performance
- o Other

Substance Use

1. How often do you have a drink containing alcohol?

- o Never
- o Monthly or less
- o 2 four times a month
- o 2 three times a week
- o 4 or more times a week

2. How many drinks containing alcohol do you have on a typical day of drinking?

- o 1 or 2
- o 3 or 4
- o 5 or 6
- o 7 to 9
- o 10 or more

3. How long have you been drinking in this way?

- o Within the past 6 months
- o From 6 months to 5 years
- o More than 5 years

4. During the past year, have you needed a drink in the morning to get yourself going after a heavy drinking session?

- o Within the past 6 months
- o From 6 months to 5 years
- o More than 5 years

5. Are there financial, legal or family problems related to your drinking?

- o No
- o Yes, but not in the past year
- o Yes, during the past year

6. Has a relative, friend, doctor or health worker been concerned about your drinking or suggested you cut down?

- o No
- o Yes, but not in the past year
- o Yes, during the past year

7. Have you ever gone to anyone for help about your drinking?

If **YES**,

- o Within the past 6 months
- o From 6 months to 5 years
- o More than 5 years

8. Have you ever been admitted to hospital for substance use?

If **YES**,

- o Within the past 6 months
- o From 6 months to 5 years
- o More than 5 years

OPTIONAL as directed by information contained on questionnaire

9. Have you ever used any **drugs** (eg. dagga, mandrax, ecstasy, glue or paint thinners)? Please give specific details of **frequency** (how much) of use and when you **began** using (eg. a packet of dagga every day since you were 15 etc.).

Order of Neuropsychological Battery

1. CONSENT Form
2. WMS Visual Reproduction (Wechsler, 1945).
3. WMS Associative Learning (Wechsler, 1945).
4. Finger Tapping (Denckla, 1973).
5. Purdue Pegboard (Tiffin, 1948).
6. Trail Making Test (Reitan, 1956).
7. WMS Visual Reproduction – Delayed (Wechsler, 1945).
8. WMS Associative Learning – Delayed (Wechsler, 1945).
9. Digit Span (Wechsler, 1997)
10. Rey Complex Figure – Copy and Immediate (Osterreith, 1944).
11. TOMM (Tombaugh, 1996).
12. Words in a minute (Baker, 1967).
13. "S" Words in a minute
14. Stroop (Golden, 1978).
15. TOMM Retention (Tombaugh, 1996).
16. Rey Complex Figure Delayed (Osterreith, 1944).
17. Screening Questionnaire
18. Rey 15 item (Rey, 1964).

Hand Steers Voucher to participant and thank them for their effort and participation.

APPENDIX H: ALTERNATE WMS VISUAL REPRODUCTION

WMS: VISUAL REPRODUCTION: SCORE SHEET

Name:_____ **Clinician:**_____ **Date:**_____

Card A

1. Two lines crossed, four flags ..... (1) _____
2. Correctly facing one another .....(1) _____
3. Accuracy (lines nearly equal, nearly bisected, nearly at right angles, flags nearly square .....(1) _____

Maximum Score .....(3) _____

Card B

1. Large square with two diameters .....(1) _____
2. Four small squares within a large square .....(1) _____
3. Two diameters in each small square.....(1) _____
4. Sixteen dots, each alone in a small square.....(1) _____
5. Accuracy of proportion (width of spaces around the four small squares between ¼ and ½ the width of the 16 smaller squares or lines .....(1) _____
6. If design is complete but with superfluous squares or lines .....(3) _____

Maximum Score .....(5) _____

Card C (C-1) ***(Score each design separately)***

1. Large rectangle with smaller rectangle inside .....(1) _____
2. All vertices of inner rectangle connected to vertices of larger rectangle.....(1) _____
3. Smaller rectangle correctly shifted to the right and approximately that of exposed figure .....(1) _____

Maximum Score .....(3) _____

Card C (C-2)

1. Open rectangle with correct loop at each end .....(1) _____
2. Centre and either left or right side correctly reproduced .....(1) _____
3. Figure correct except one or both loops do not extend beyond the square and the centre tower is not in approximate proportion.....(1) _____
4. Figure correct except one of the loop incorrectly reproduced .....(2) _____
5. Figure correct except the bottom line of one or both loops do not extend beyond the square.....(2) _____
6. Figure correctly reproduced but height of centre tower not in approximate proportion...(2) _____
7. Figure correctly reproduced and in approximate proportion.....(3) ____

Maximum Score .....(3) _____

Total maximum score on all figures .....(14) ____

APPENDIX G: ALTERNATE WMS VISUAL REPRODUCTION DELAYED RECALL

WMS: VISUAL REPRODUCTION - DELAYED RECALL: SCORE SHEET

Name:_____ **Clinician:**_____ **Date:**_____

Card A

1. Two lines crossed, four flags ..... (1) _____
2. Correctly facing one another .....(1) _____
3. Accuracy (lines nearly equal, nearly bisected, nearly at right angles, flags nearly square ....(1) _____

Maximum Score .....(3) _____

Card B

1. Large square with two diameters .....(1) _____
2. Four small squares within a large square .....(1) _____
3. Two diameters in each small square.....(1) _____
4. Sixteen dots, each alone in a small square.....(1) _____
5. Accuracy of proportion (width of spaces around the four small squares between ¼ and ½ the width of the 16 smaller squares or lines .....(1) _____
6. If design is complete but with superfluous squares or lines .....(3) _____

Maximum Score .....(5) _____

Card C (C-1) ***(Score each design separately)***

1. Large rectangle with smaller rectangle inside .....(1) _____
2. All vertices of inner rectangle connected to vertices of larger rectangle.....(1) _____
3. Smaller rectangle correctly shifted to the right and approximately that of exposed figure .....(1) _____

Maximum Score .....(3) _____

Card C (C-2)

1. Open rectangle with correct loop at each end .....(1) _____
2. Centre and either left or right side correctly reproduced .....(1) _____
3. Figure correct except one or both loops do not extend beyond the square and the centre tower is not in approximate proportion.....(1) _____
4. Figure correct except one of the loop incorrectly reproduced .....(2) _____
5. Figure correct except the bottom line of one or both loops do not extend beyond the square.....(2) _____
6. Figure correctly reproduced but height of centre tower not in approximate proportion...(2) _____
7. Figure correctly reproduced and in approximate proportion.....(3) _____

Maximum Score .....(3) _____

Total maximum score on all figures .....(14) _____