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VALIDATION OF THE REVISED QUICK COGNITIVE SCREENING TEST IN A GHANAIAN SAMPLE

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DECLARATION

This is to certify that this thesis is the result of research undertaken by Tina Frempong-Boakye under supervision towards the award of Master of Philosophy in Clinical Psychology Degree in the University of Ghana, Legon.

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DEDICATION

This thesis is dedicated to God, my family and all the participants who were used in this study.

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ABSTRACT

The Revised Quick Cognitive Screening Text is a portable cognitive screening test used in the detection of cognitive impairment in individuals suffering from neurological, medical and psychiatric conditions. Although many cognitive screening tests such as Montreal Cognitive Assessment (MoCA) and Mini-Mental State Examination (MMSE) are being used in Ghana, to my knowledge none of them have been standardized. This study examined the psychometric properties of the Revised Quick Cognitive Screening Test (RQCST). Five hundred and ninety-six (596) participants between the ages of sixteen and eighty- two years were recruited from Korle-Bu Teaching Hospital, Pantang Psychiatric Hospital and Accra Psychiatric Hospital. The participants comprised three groups; healthy/ control group, psychiatric patients and participants with various medical conditions. Using Principal Component Analysis, taking into consideration cultural dimensions, the RQCST was reduced from the original 50 items to 31 items. The modified RQCST was administered together with some standardized measures. The modified RQCST had a Cronbach alpha of .84 and an area under the curve of .70. Results showed that the RCQST discriminated between the healthy group and the disease condition groups (Medical and Psychiatric groups). The RQCST significantly correlated with the other standardized measures demonstrating its psychometric properties in a Ghanaian population. The updated RQCST will provide a brief, sensitive and cost effective cognitive test for screening cognitive impairment among Ghanaians.

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LIST OF ABBREVIATIONS

ADAS-Cog	Alzheimer's Disease Assessment Scale- Cognitive Subscale
ANCOVA	Analysis of variance Covariance
CONCOG	Concise Cognitive Test
COWAT	Controlled Oral Word Association
CNVS	Central Nervous system Vital Signs
CT	Computer Tomograph
DSM-IV-TR	Fourth Edition of Diagnostic and Statistical Manual of Mental Disorders, Text Revision
ECH	Ethical Committee of the Humanities
EEG	Electroencephalogram
FAQ	Functional Activities Questionnaire
HIV	Human Immunodeficiency Virus
ICD	International Classification of Diseases
IQ	Intelligent Quotient
KBTH	Korle Bu teaching Hospital
NART	National Adult Reading Test
MANOVA	Multivariate Analysis of Variance
MCI	Mild Cognitive Impairment
MCST	Modified Card Sorting Test
MMSE	Mini Mental State Examination
MoCA	Montreal Cognitive Assessment
MRI	Magnetic Resonance Imaging
PASS	Planning, Attention, Simultaneous and Successive
PCA	Principal Component Analysis
QCST	Quick Cognitive Screening Tests

ROCF	Rey-Osterrieth Complex Figure
RQCST	Revised Quick Cognitive Screening Tests
TMT	Trail Making Test
UNDESA/PD	Population Division of United Nation Department of Economic and Social Affairs.
WAIS- IV	Fourth edition of Wechsler Adult Intelligence Scale
WAIS-R	Wechsler Adult Intelligence Scale- Revised
WCST	Wisconsin Card Sorting Test
WHO	World Health Organization

CHAPTER ONE

1.0. INTRODUCTION

The Population Division of United Nation Department of Economic and Social Affairs (UNDESA/PD, 2016) stated that there has been a marked increase in average life expectancy in recent years and this is attributed to improved health habits such as diet and exercise. The report further indicated that 901 million people are sixty (60) years and over. This constitutes 12% of the world's population. Majority of these older people live in non-western countries (World Health Organization-WHO, 2015). This increase in elderly population is worldwide as it is estimated that by 2050, persons over the age of sixty (60) years in Sub-Sahara Africa will increase from forty-six (46) million to one hundred fifty-seven (157) million (Wilunda et al., 2015). In 2013, the Ghana Statistical Service reported that 6.5% of the Ghanaian population is over the age of sixty (60) years.

Longevity usually is accompanied by various age-related diseases, disability and loss of autonomy (Noale, 2012). As people age, biological and psychological changes occur such as alterations in the brain structure which affects cognitive functions. For instance, the risk of dementia significantly increases with age (WHO, 2015).

In Africa, for example, a research by Kanmogne et al. (2010) reported that Cameroonians in advanced stages of the Human Immunodeficiency Virus (HIV) perform poorly on neuro-cognitive tests which suggest that certain medical conditions affect cognitive functioning.

It is vital to detect cognitive impairment in the early stage. Cognitive impairment can be detected through the administration of psychological tests which can assess multiple areas of the

brain (Harvey, 2012). The scores collected on the tests help the clinician give appropriate and effective treatment, care and rehabilitation. Early detection slows the rate of cognitive decline. Unfortunately, cognitive impairment due to some conditions such as sickle cell disease can go undetected (Catayong, 2007). Dulce et al. (2010) stated that detecting Mild Cognitive Impairment (MCI) and dementia in the early stages helps the clinician to identify individuals with poor health outcomes due a decrease in the individual's ability to perform daily activities, social activities or learn new things. It is therefore important to have a screening test which is sensitive and specific enough to detect cognitive dysfunction (Cullen, O'Neill, Evans, Coen, & Lawlor, 2007).

Neuropsychological assessment is a technique used by clinicians to assess an individual's cognitive functioning usually after a suspected brain damage (Harvey, 2012). The assessment concentrates on cognitive, behavioural, emotions, and learning abilities (Chang & Davis, 2011). Neuropsychological assessment is time-consuming (Janssen et al., 2015) hence the need for a short, cost effective and sensitive cognitive test such as the Revised Quick Cognitive Screening Test (RQCST).

The purpose of the present study is to determine the psychometric properties of the Revised Quick Cognitive Screening Test (RQCST) (Mate- Kole, Conway, Catayong, Bieu, Sackey, Wood, & Fellows, 2009) in Ghana. The RQCST norms were developed in North America; thus, it is important to ensure that it is sensitive to the African population especially Ghana before it is used. The reliability and validity of the RQCST in differentiating between diagnostic groups is investigated.

1.1 Cognitive Screening Tests

Cognitive impairment is not always detected during routine medical examination. There are people living with cognitive impairment, unknowingly and undetected (Bartfay et al., 2013). Some medical conditions such as cancer, kidney diseases and hypertension are associated with cognitive impairment (Gasqoine, 2011). Nasser et al. (2012) reported that cognitive impairment associated with these medical conditions are sometimes masked as evidenced by their research which revealed that patients suffering from acute kidney failure had mild cognitive impairment which improved after their kidney failure was resolved. Physicians are usually pressed for time so may not screen every patient they review for cognitive impairment. For example, patients over sixty (60) years who report to the hospital with medical conditions often leave undetected despite evidence of cognitive impairment (Gustav et al., 2012).

Cognitive screening is the first step in early detection of cognitive impairment and this can lead to early intervention which could slowdown the progression of cognitive decline of the individual (Trayford, 2014).

Neuropsychological assessment in general is time-consuming (Janssen et al., 2015) whereas cognitive screening tests are short to administer so can quickly identify cognitive impairment. They are easier to use and cost effective as compared to the full neuropsychological assessment. However, there may be occasions when cognitive screening may not be enough; thus, full neuropsychological assessment may be done to reveal an underlying condition like dementia (Soo et al., 2013).

According to Catayoung et al. (2007), there are three types of cognitive screening tests, namely; Brief Cognitive Screening Test, Mid-Range Computerized Cognitive Screening Test and Mid-Range Cognitive Screening Test.

Brief Cognitive Screening Tests

These instruments serve as an initial assessment tool to determine if one is showing evidence of cognitive impairment (Mate-Kole et al., 2009). They are short to administer, efficient to use and are not costly as compared to the other types of cognitive screening tests (Cullen et al., 2007). The Mini-Mental State Examination (MMSE) is an example of a brief assessment test. It is the most widely used cognitive screening test. It comprises eleven (11) items which test the following areas; Orientation, Registration, Recall, Language, Attention and Calculation. It takes 5-10minutes to administer (Kurlowicz et al., 1999). The maximum score is 30 and a score lower than 23 indicates cognitive impairment. Unfortunately, the MMSE has been reported to have high false negatives (Mitchell, 2009). Further, these tests do not assess different areas of cognition and they have been deemed inferior to longer cognitive tests (Woodford & George, 2007). For example Cullen et al. (2007) stated that many screening tests overstress on memory dysfunction and most times ignore other domains such as praxis.

Mid-Range Computerized Cognitive Screening Tests

These screening tests are computer based. They are short to administer, very efficient and have reduced scoring errors (Bauer et al., 2012). MicroCog is an example of a computerized cognitive screening test. The patient can answer the questions without any guidance or supervision. It assesses attention, memory, reasoning, calculation, spatial processing and reaction time.

Despite its various advantages, the computerized cognitive screening tests are limited due to difficulty in evaluating and analysing oral answers (Fichman et al., 2008).

Mid-Range Cognitive Screening Tests

These tests take a longer time than brief cognitive screening tests. They are easy to administer and provide a more comprehensive and detailed information about cognitive deficits (Podhorna et al., 2016). It takes between fifteen to twenty minutes to administer. It assesses multiple areas of cognition and enables the clinician establish rapport and a relationship with the patient (Catayong, 2007). Unfortunately, education, age and severity of illness affect the results of the mid-range cognitive screening test (Mate-Kole et al., 2009). An example of a mid-range test is the Alzheimer's disease Assessment Scale- Cognitive Subscale (ADAS-Cog) which was designed to measure the severity of Alzheimer's disease (Hannesdottir et al., 2002). It takes 30 minutes to administer and measures language, memory, attention and praxis (Kolibas, 2000). It gives more detailed symptoms of Alzheimer's disease but it is insensitive in the detection of change during the early stages of the disease (Podhorna et al., 2016). The RQCST is a mid-range cognitive screening test (Mate-Kole et al., 2009).

Relevance of Cognitive Screening Test

With the help of cognitive screening test, a clinician can detect and identify cognitive impairment. The initial cognitive screening of an individual will serve as the baseline to see how the condition is progressing (Brooks & Loewenstein, 2010).

Early detection of cognitive impairment may lead to a better treatment outcome, especially when the underlying condition is reversible (Soo et al., 2013). Thus, a proper health care management

such as prevention and rehabilitation services can be addressed when cognitive impairment is detected (Trayford, 2014).

After detection and identification of cognitive impairment, the next step for both the clinician and the individual is planning for effective care and rehabilitation. Behavioural, emotional and cognitive changes such as mood change, personality change, memory loss, inattention, problems with language and motor skills are detected and described (Piccinelli et al., 2010).

Limitations of Cognitive Screening Tests

One major limitation of a cognitive screening tool is that it is primarily used in the detection of cognitive dysfunction, thus, cannot assess all the different parts of cognition (Larner, 2016). Two drawbacks of cognitive screening testing are false negatives and false positives (Edmonds et al., 2016). False negatives are produced when the test is unable to detect an existing cognitive impairment while false positive is when a test reveals that an otherwise healthy individual has cognitive impairment. An example of such a test is the MMSE (Mitchell, 2009).

Another limitation of cognitive screening testing is the effect of education on an individual's results. Srinivasan (2010) reported that age and education significantly influenced performance on both Mini-Mental State Examination (MMSE) and Concise Cognitive Test (CONCOG). Naqui et al. (2015) stated that those who do not speak English as their first language have difficulty when administered the MMSE although it is used worldwide.

Quick Cognitive Screening Test (QCST)

The Quick Cognitive Screening Test (QCST) is another example of Mid-range test (Mate-Kole et al., 1994). In an attempt to solve problems such as extensive administration time and cost associated with full neuropsychological tests, the Quick Cognitive Screening Test (QCST) was

developed. It assessed Orientation, Attention, Concentration, Memory, Visuo-Spatial, Constructional Praxis, Vocabulary, Naming, Arithmetic, Object Identification, Geometric Designs and Perceptual Closure. It took about 20-30minutes to administer (Mate- Kole, Major & Connolly, 1994).

Mate-Kole et al. (1994) grouped recruited participants into three, namely; Neurological Group, Psychiatric Group and Control Group. The Neurological Group were made up of individuals diagnosed of cerebrovascuar disease, traumatic brain injury and other neurological conditions. The Psychiatric Group comprised individuals with schizophrenia, bipolar affective disorder, anxiety, depression and personality disorders. The Control Group were healthy volunteers. The participants were assessed with the QCST, the National Adult Reading Test and the Wechsler Adult Intelligence Scale-Revised (WAIS-R).

Results showed that QCST was able to detect cognitive impairment in traumatic brain injury patients and psychiatric patients. It also showed that it was correlated to the subtests of WAIS-R. The QCST had a coefficient alpha of 0.87 proving that it had reliability and validity (Catayong, 2007). Unfortunately, severity of the brain damage could not be captured by the QCST. Also it could not discriminate between the psychiatric and neurological groups (Mate-Kole et al., 1994).

Unsworth, Lovell, Terrington and Thomas (2005), used the QCST to assess drivers. The test was used to compare with nineteen other cognitive assessment instruments. The QCST was ranked tenth out of twenty in assessing driving capabilities. The study revealed that the QCST assessed cognitive and visual abilities but had poor face validity for driving.

The QCST was revised by Mate-Kole et al. (2009) in order to reduce the administration time. Sub-scales such as Unusual views, Spatial neglect and Object naming were added to the RQCST

while Perceptual closure, Clock drawing test and Mental arithmetic were removed. RQCST is shorter in administration as compared to QCST taking about twenty minutes to administer.

As a new screening test in Ghana, the RQCST has be standardized to ensure its reliability and validity to meet acceptable psychometric level. Validitation is the process of gathering and evaluating tests to provide the test user with evidence of validity in the test manual (Kaplan & Saccuzzo, 2009). Validity seeks to estimate how well a test measures what it is supposed to measure in a particular context (Groth- Marnat, 2003). According to Cohen-Swerdik (2010), there are three approaches to assessing validity of a test, namely;

- Scrutinizing the test's content
- Relating scores obtained on the test to other measures
- Executing a comprehensive analysis

These three approaches assess content validity, criterion-related validity and construct validity. Reliability is the extent to which measurements are consistent or repeatable (Cohen- Serdik, 2010). It is assessed in four ways;

Factors affecting reliability of a test include time between two testing administrations that affect test-retest and alternative forms of reliability. Expectations of those answering the tests affect the alternate form, split-half and internal consistency of the test. Poor test instructions, subjective scoring and changes in an individual's behavior, emotions and physiology affect test reliability (Kaplan & Saccuzzo, 2009).

1.2. Aims and objectives of the of study

The study aimed to examine the psychometric properties of the Revised Quick Cognitive Screening Test in an African population, specifically, Ghana. Specifically, it examined:

1. The psychometric properties of the RQCST in a Ghanaian sample.
2. The RQCST's ability to discriminate between healthy group and non-healthy group
3. Whether the RQCST's could assess different domains of cognition.

1.3. Statement of the Problem

Cognitive impairment is on the increase, especially in the Sub-Saharan region (Mavrodaris et al., 2013). Most of the time, cognitive impairment such as dementia is normally viewed as normal ageing or witchcraft so the affected people are usually not given the appropriate treatment (Penaranda, 2011). Another oversight is that most patients with medical conditions leave the hospital undiagnosed of any cognitive impairment (Patridge et al., 2014). Clinicians in Ghana need a quick and efficient screening tool to identify cognitive deficits in the elderly and people with underlying cognitive impairment masked by other medical conditions such as kidney failure, sickle cell, diabetes mellitus, hypertension and psychiatric conditions such as schizophrenia, bipolar affective disorder and substance abuse. It is expected that the RQCST, a mid- range cognitive screening test may solve the above issues and provide an alternative to extensive neuropsychological assessment.

1.4. Relevance Of The Study

In the past few years there has been a rise in validation of western psychological instruments in Ghana but none on a cognitive screening test. For example, Edwin (2001) and Miezah (2015) validated the third edition of Wechsler Intelligence Scale for Children and the fourth edition of

the Wechsler Adult Intelligence Scale respectively. These are all full neuropsychological tests and not screening tools. The study will help develop norms on the RQCST so that it can be used in the Ghanaian setting. The RQCST will help clinicians in Ghana identify impaired cognitive functions which may have been caused by medical, neurological or psychiatric conditions. When cognitive impairment is detected, appropriate care and rehabilitation can be provided as the patient's specific deficits have been identified. The study will provide researchers with a tool to measure cognitive functions.

Quality of life policies can be developed by the Ministry of Health when data shows how many people are being diagnosed of cognitive impairment.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

Neuro-imaging techniques reveal the part of the brain affected by an injury or disease but no information is given on the cognitive function affected, thus, the need for neuropsychological assessment (Kosaka, 2006). A neuropsychological assessment is a testing tool which collects data about an individual's cognitive, motor, behavioural, linguistic and executive functioning (Malik et al., 2017). Results from neuropsychological assessment helps a clinician understand the nature and severity of cognitive deficit (Kosaka, 2006). It also helps in patient care, research, treatment planning and treatment evaluation (Puente & Puente, 2013). There are two approaches to neuropsychological assessment, namely: Flexible and Fixed approach (Puente & Puente, 2013). The flexible approach assesses cognitive functions by administering a range of tests based on what the clinician perceives about patient's complaints whiles the Fixed approach is when cognitive functions of every patient are assessed using a standardized test regardless of their complaints (Puente & Puente, 2013). Both the flexible and fixed approach to neuropsychological assessment is bulky and administration time is lengthy (Carter, 2008).

A simple and short test is therefore needed to screen for cognitive impairment for early detection. Cognitive screening test is the first step to a more detailed neuropsychological assessment as they do not detect all cognitive impairments (Larner, 2016). Despite its shortness a cognitive screening tool should be able to assess the cognitive state of an individual accurately (Cullen et al., 2007). The RQCST is a mid-range cognitive screening test that assesses various cognitive functions. This chapter will cover cognitive screening and neuropsychological assessment. Two

theories will be discussed to help explain what the RQCST wishes to measure cognitively. Similarly, review of related studies will be discussed. This chapter will also cover the rationale for the study and the statement of hypothesis.

2.2. Overview of Literature Review

Many studies have over the years examined how cognitive impairment can be assessed and explained (Flanagan et al., 2013). This has led to several approaches to neuropsychological assessment.

Theories to be discussed in this study include Luria's Functioning Theory (Luria, 1973) and the Cognitive Reserve Theory (Stern, 2006). Luria's Functioning Theory will explain the functions of the brain and the Cognitive Reserve Theory will explain why different people with the same cognitive impairment have varying symptoms.

2.2.1 Theoretical Framework

Luria's Functioning Theory

Tellez and Sanchez (2016) stated that one goal of neuropsychology is to identify brain functions that are consistent with psychological processes known as higher processes (attention, motor skills, perception, memory, language) so as to identify their associating disorders such as inattention, apraxia, agnosia and aphasia.

Luria envisioned the brain as divided into three primary blocks. The first block according to this theory controls arousal and wakefulness, therefore, making the brain stable enough to organize various processes and have goal-directed activities (Luria, 1973). Optimal conditions of arousal are needed for more complex forms of attention such as selective recognition of a specific

stimulus and inhibition of irrelevant stimuli. Both arousal and attention must be adequately attained before an individual can move to the second and third blocks (Luria, 1973).

The second block is in charge of the reception, analysis and storage of information (Luria, 1973). Zaytseva et al. (2015) stated that the second block is where specific sensory inputs are analysed, integrated and synthesized into complex perceptions which contain information from different sensory modalities. The processing in this block is in two parts namely; Simultaneous Processing and Successive Processing. Simultaneous Processing is where the incoming information is arranged into holistic pattern (visual recognition). Successive Processing is where encoding of information is put into distinct order (Zaytseva et al., 2015)

The third block addresses the formation of intention, programming, regulation, control of behaviour and performance of complex task (Luria, 1973).

According to the Luria's Functioning Theory any form of psychological activity involves these three functional units. Psychological functions are not localized to a specific area of the brain; rather, it involves different parts of the brain. This is where damage to one part of the brain affects other regions of the brain due to neural network. Damage to the brain produces loss of functions at different levels. For instance, a simple task such as writing involves multiple areas of the brain; a focal lesion will disrupt the ability to perform fine movements needed for writing, spatial organization of writing, selection of words and can extend to drawing of figures (Arcinegas et al., 2002).

The clinician sees the client as a unique individual who is entitled to an in-depth analysis. The clinician is more interested in the mistakes, deviations and errors the client makes and not how well the client performs on the test (Ardila,1992). Kopp et al. (2015) reported that for example,

the number or errors in Trail Making Test is associated with lesions in the right frontal hemisphere.

According to Luria's approach multiple cognitive skills must be assessed. These include; spatial knowledge, visuo-spatial knowledge, somatosensory knowledge, assessments of movements, reading, language, writing, memory, calculations and Intellectual process (Ardila, 1992). These cognitive functions can be assessed using the RQCST.

Cognitive Reserve Theory

Cognitive reserve is an active model which states that the brain attempts to cope with brain damage by using pre-existing cognitive processing approaches or compensatory approaches (Stern, 2006). This implies that individuals will have varying symptoms despite having the same kind of brain damage dut to their varying cognitive variables such as intelligence, age, education and occupation (Steffener & Stern, 2012). Many of these cognitive variables are interrelated. For example, a high intelligent quotient (IQ) leads to more education, which in-turn raises the individual's IQ.

Cognitive Reserve Theory is explained by two mechanisms, namely; neural reserve and neural compensation. Neural Reserve is when some individuals have brain networks that are less vulnerable to damage because these brain networks are more efficient through past cognitive processes (Stern, 2006). For example, it has been reported that learning enhances the survival of brain cells (Sisti et al., 2007). This indicates that an individual's past cognitive processes increases his/her neural network. Neural Compensation is when brain structure previously not used for a particular skill or mental activity is now being used to compensate for the skill lost due to brain damage. This mechanism is only reached when demands exceed a particular level (Stern,

2006; Steffener & Stern 2012). However, Tucker et al. (2011), states that many factors used in assessing cognitive reserve theory are associated with socioeconomic status (example; education).

Stern (2006) reported that lifetime experiences have an effect on cognitive skills such as attention, spatial knowledge, visuo-spatial skills, arithmetic, reading, language and memory and these can be assessed using the RQCST (Mate-Kole et al., 2009).

2.3. Review of Related Studies

Medical Conditions and Cognitive Impairment

Giordano et al. (2012) conducted a research to investigate the cognitive functions in relation to hypertension. Two hundred and eighty-eight (288) males and females who were over the ages of fifty (50) were recruited. They were administered cognitive screening tests such as the Mini-Mental State Examination, Trail making Test, Phonemic Verbal Fluency Test and the Clock Drawing Test. Results showed that participants with cognitive impairment had higher blood pressure values. The researchers concluded that high blood pressure was a risk factor for cognitive decline.

Bowie et al. (2006) suggested that schizophrenics are bound to have cognitive impairment. Talreja et al. (2013) assessed cognitive impairment in people living with schizophrenia. One hundred (100) schizophrenia patients were recruited and assessed using Addenbrooke's Cognitive Examination Revised and Mini- Mental State Examination. Results showed that seventy percent (70%) of the patients had one form of cognitive impairment in attention, memory, concentration, language and executive functioning.

Sanger et al. (2016) investigated the relationship between unemployment and intellectual functioning. Fifty (50) participants suffering from sickle cell anaemia were recruited and administered Wechsler Adult Intelligence Scale-IV. Medical variables such as phenotype, cerebral infarct and frequency of pain were also assessed. The study concluded that there was evidence of cognitive impairment in sickle cell patients and this may explain their predicament. According to Naglieri et al. (2005), Luria's Functioning Theory is the foundation for neuropsychological tests based on the PASS theory (Planning, Attention, Simultaneous and Successive).

Ageing and Cognitive Impairment

Research has revealed that in normal ageing there is a volume reduction in the grey and white matter and decline in the neurotransmitters which results in decline in cognitive abilities that include processing speed, memory functions, language abilities, visuospatial abilities and executive functions (Harada et al., 2013).

Cognitive impairment in the elderly population usually goes undetected when they visit the general hospitals (Torisson et al., 2012). Early recognition of cognitive impairment can prevent complications such as falls, loss of mobility, dehydration, delirium and incontinence (Campbell et al., 2010).

A comprehensive review by Tang-Wai et al. (2003) compared a Short Test of mental status with the Mini-Mental State Examination (MMSE) in people with mild cognitive impairment. The participants were put into four groups comprising seven hundred and eighty-eight (788) patients with normal cognition, seventy-five (75) patients with normal cognition baseline but developed mild cognitive impairment, one hundred and twenty-nine (129) patients with mild cognitive

impairment as baseline and two hundred and thirty-five (235) patients with Alzheimer's Disease. The results revealed that the Short Test of Mental Status was sensitive in detecting cognitive impairment as compared to the Mini Mental State Examination (MMSE). The limitation of the MMSE is its insensitive to mild cognitive impairment and high false negatives (Mitchell, 2009). This means that people who have cognitive impairment may have a score on the MMSE which will be interpreted as they having no cognitive deficits (Cohen & Swerdlik, 2009). Patients with hearing and visual impairment, communication disorders or low English literacy may perform poorly in the MMSE (Kurlowicz, 1999).

Education and Cognitive Reserve

Farfel et al. (2013) conducted a clinopathologic study to investigate the relationship between very low education and cognitive reserve. It was a cross-sectional study that recruited six hundred and seventy-five (675) individuals who were at least fifty (50) years of age from a Brazilian Aging Brain Study Group. Informants who had close contact with the deceases were interviewed upon arrival at the autopsy service. Information on educational level, sex and age of the deceased were collected. Clinical Dementia Rating scale and the Informant Questionnaire of the Cognitive Decline in the Elderly were used to assess the cognitive abilities of the deceased person. Autopsy was performed within twenty (20) hours of death to determine the presence of neuropathologic lesions, vascular changes and Lewy bodies. Results revealed those without formal education, lower socioeconomic status had higher frequency of Alzheimers' related disease and vascular disease. The research results revealed that higher levels of education were associated with the lowest frequency of cognitive impairment such as dementia. It concluded that education contributes to cognitive reserve (Farfel, et al., 2013).

Herrera et al. (2002) in a study in Brazil, reported that only 3.5% of the elderly who had eight (8) or more years of education suffered from dementia as opposed to 12% of the elderly who were illiterates. They found out that educational level was independently associated with higher prevalence of dementia.

A life-course study of cognitive reserve in dementia was investigated by Serhiy et al. (2015). For twenty-one (21) years, seven thousand, five hundred and seventy-four (7,574) men and women were followed and assessed annually. Information on school performance, occupational attainment and education were collected. Results revealed that participants with higher childhood grades were at a low risk of developing dementia.

Standardization of Cognitive Tests

Mate-Kole et al. (2009) examined the psychometric properties of the RQCST; three hundred and seventy-seven (377) participants were recruited. Two hundred and one (201) participants were in the Healthy Control group, ninety-three (93) were in the Dementia group, thirty-five (35) were in the Psychiatric group and twelve (12) were in the Traumatic Brain Injury group. The participants were administered the Revised Quick Cognitive Screening Test (QCST), Alzheimer's Disease Assessment Scale, Mini-Mental State Examination (MMSE), Tests of Oral Fluency, Trail Making Test (TMT) and Functional Activities Questionnaire (FAQ). Results of the study suggested that the RQCST could discriminate between healthy controls and the neuropsychiatric patients. As a screening tool, the RQCST could detect the presence of cognitive deficits and even went on further to reveal specific cognitive areas affected. The limitation to this study was that it could not be generalized to minority groups.

Gil et al. (2015) examined the psychometric properties of the Montreal Cognitive Assessment (MoCA) using the Colombian population in **Bogotá**. One hundred and ninety-three (193) participants were recruited for the study. One hundred and nine (109) were patients with mild cognitive impairment whiles eighty-four (84) of the participants were healthy. Using the cutoff scores of twenty-three (23) or higher, MoCA had a 76% sensitivity in detecting mild cognitive impairment. The researchers therefore concluded that MoCA was a screening tool that could detect mild cognitive impairment and memory disorders.

Miezah (2015) examined the reliability and validity of the Wechsler Adult Intelligence Test, fourth edition (WAIS-IV) using the Ghanaian population. In the process, local norms were developed for the population. Two hundred and fifty-one (250) participants were recruited from two senior high schools and a university. They were administered the WAIS-IV and Raven's Standard Progressive Matrices. The study revealed that there were potential cultural biases when using psychological tests developed for the western world.

Hoops et al. (2009), investigated the validity of the Montreal Cognitive Assessment (MoCA) and the Mini-Mental State Examination (MMSE) in individuals suffering from mild cognitive impairment and dementia. A convenience sample of 132 patients was recruited. 92 had no cognitive disorder, 23 had mild cognitive disorder and 17 had dementia. All groups were administered both the MoCA and MMSE. Results revealed that MoCA had discriminant validity in MCI and dementia.

Cognitive screening tests are short to administer, efficient, portable and can detect cognitive impairment as evidenced by the reviewed studies discussed above (Lorentz et al., 2002). Studies

have shown that short cognitive screening tests can detect cognitive impairment despite being portable and short in administration (Tangalos et al., 2003).

2.4. Critique of Cognitive Screening Tests

Most of the cognitive screening test requires the individual to read, understand and write. Unfortunately low form of education is a problem that limits the usage of short cognitive tests (Carnero- Pardo et al., 2011).

Many screening tests overstress memory dysfunction, neglecting other domains such as language, praxis and executive functions (Cullen et al., 2007). Cullen et al. (2007) also stated that emphasis on cut-off scores instead of impairment characteristics poses a problem.

Some of the cognitive screening tests are unable to correctly detect a cognitive deficit. The Mini-mental state for an example has low sensitivity to mild cognitive impairment and it is highly influenced by age and education (Saxton et al., 2009).

Some of the cognitive screening tests have reported high false negatives. For example, Mitchell (2009) stated that the MMSE has been found to have high false negatives.

These tests do not assess different areas of cognition and so have been deemed inferior to longer cognitive tests (Woodford & George, 2007).

2.5. Rationale of the Study

There are many cognitive screening tests worldwide, however, it appears that only few countries have been able to validate and modify them to suit their culture. Unfortunately, the only cognitive screening test which has been validated in Ghana pertains more to assessing intelligence. The Wechsler Adult Intelligence Scale (WAIS) was validated by both Edwin (2001) and Miezah (2015). However, WAIS is bulky and takes a long time to administer so a

clinician at the general hospital may find it time consuming and expensive to administer. Yawson (2008) developed the norms on Standardized Progressive Matrices but it equally measures only intelligence. Although some clinicians use the RQCST in screening for cognitive impairment, no study has been conducted in examining its psychometric properties. This means that the clinicians resort to using the American published norms for interpreting the results in the Ghanaian setting. Thus, Ghana has not yet developed a neuropsychological screening test which is short but effective to administer. This implies that there is the need to validate the RQCST for the Ghanaian population.

This study seeks to provide health practitioners with a quick and efficient screening tool to identify cognitive deficits in the elderly and people with underlying cognitive impairment masked by other medical conditions such as stroke, sickle cell disease or kidney failure.

The RQCST assesses different parts of cognition which can detect specific impairments in patients with suspected underlying neurological damage.

When areas that have been impaired are detected, appropriate care and rehabilitation can be provided as the patient's specific deficits have been identified.

Quality of life policies can be developed when data shows how many people are being detected with cognitive impairment.

2.6. Statement of Hypotheses

Hypothesis 1: There will be a statistically significant difference among the Healthy group, various Medical conditions and Psychiatric groups. Thus, the healthy control group will obtain significantly higher score than the psychiatric group and medical group.

Hypothesis 2: There will be a statistically significant difference between participants with psychiatric disorders and medical disorders. Thus, participants with medical disorders will obtain higher scores on the RQCST than participants with psychiatric disorders.

Hypothesis 3: There will b significant correlation between the RQCST and the standardized measures.

2.7. Operational Definitions

Cognitive functioning: skills associated with orientation, attention, concentration, memory, spatial neglect, spatial orientation, vocabulary, abstract reasoning and visuospatial skills.

Medical patients: Individuals diagnosed of renal, endocrine, cardiovascular and genito-urinary and haematological disorders.

Psychiatric patients: Individuals diagnosed of mood disorders, anxiety disorders and psychosis.

CHAPTER THREE

METHODOLOGY

3.0. Introduction

This section examines the method used in this study. The setting, sample technique, participants, research design, measures and procedure employed are discussed in this section.

3.1. Research Design

This was a cross-sectional study. Cross-sectional design was used because the study took place at a single point in time where the same variables were measured for each of the participants across the different groups (Howitt & Cramer, 2011). Furthermore, cross-sectional design helps to differentiate between two or more populations (Shaughnessy et al., 2012).

3.2. Sampling Technique

Purposive sampling method was used in the recruitment of the participants as there were some specific characteristics needed for this study. Participants had received a minimum of six years of education. Also, participants fulfilled inclusion criteria to belong to any of the three groups, namely; Healthy Control Group, Medical Group (comprising neurological, sickle cell, renal, cardiovascular) and Psychiatric Group. All participants volunteered after the purpose, procedure, risks and benefit were explained to them.

3.3. Setting

Participants were recruited from Department of Medicine, Department of Haematology and Department of Psychiatry at the Korle-Bu Teaching Hospital (KBTH), Accra. In addition other participants were recruited from Accra Psychiatric Hospital and Pantang Psychiatric Hospital.

3.4. Population

The study recruited participants between the ages of 16 to 84 years with a mean age of 33.82 and a standard deviation of 13.40. Accra is the most populated city in the country consisting of diverse people with different educational and occupational background. People living in Accra were chosen on account that this population covers individuals with various disorder characteristics and different levels of education. Greater Accra Regional population is estimated to be 4,010,054 (Ghana Statistical Service, 2013).

3.5. Participants

Five hundred and ninety-sic participants were recruited. Informed consent was given to the participants about the purpose, the procedures and the risks and benefits of the study. They were assured of confidentiality and the right to withdraw at any point in time. The participants consisted of Healthy Control Group, Non-neurological/Medical Group, and Psychiatric Group. All participants had at least six (6) years basic education. Consent was sought from parents and guardians of participants who were under 18years of age.

Healthy Group

There were 215 participants in this group. According to Table 3.1, this group comprised one hundred and nineteen (119) males and ninety-six (96) females. The age range for this group was between 16-84 years with a mean age of 28.36 years and a standard deviation of 9.55. The mean of number of years for education was 14.11 with a standard deviation of 2.54.

Inclusion Criteria-

1. Participants were aged sixteen (16)years and above

2. Participants must have received at least six (6) years of basic education to enable them read, write, understand and answer the test instruments in English Language.

Exclusion Criteria

1. Participants diagnosed with any medical and psychiatric conditions.

Medical Group

The medical group comprised 385 participants. Of this, two hundred and thirty-seven (237) were males and one hundred and forty-eight (148) were females. The age range of this group was between 16-82years with a mean age of this group was 36.84 with a standard deviation of 14.28. The mean for the number of education in years was 12.47 with a standard deviation of 3.02. In this group; there were one hundred and five (105) participants with medical conditions such as, diabetes, cardiovascular diseases and renal impairment, eighty-two (82) participants who had sickle cell disease and forty-two (42) participants with neurological conditions such as cerebrovascular disease (CVD), brain tumours, cerebral meningitis.

Diagnosis of the participants was confirmed by laboratory investigations such as renal function tests, full blood count, lipid profile and liver function tests. Computerized Tomograph (CT Scan), Magnetic Resonance Imaging (MRI), Electroencephalogram (EEG) and x-rays were also used by the physicians to confirm diagnosis were also included by the physicians to confirm diagnosis.

Inclusion Criteria

1. Participants were at least sixteen (16) years old;

2. They must have received at least six (6) years of basic education to enable them read, write, understand and answer the test instruments in English Language;
3. They had been diagnosed with medical conditions based on physician's review using the International Classification of Diseases, Tenth edition (ICD-10) in addition to laboratory investigations and neuro-imaging techniques

Exclusive Criteria

1. Participants who had been diagnosed with any psychiatric condition were excluded from this group.

Psychiatric Group

There were one hundred and fifty-six (156) participants in this group comprising one hundred and eleven (111) males and forty-five (45) females according to Table 3.1. The age range of this group was between 16-69 years with a mean age of 34.51 with a standard deviation of 11.33. The mean for the number of education years was 12.02 with a standard deviation of 2.58. The Psychiatric Group comprised participants who had been diagnosed of psychiatric illness such as schizophrenia and mood disorders. The greater number of people in this group suffered from schizophrenia as diagnosed by the psychiatrist using the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) (American Psychiatric Association, 2000).. The various tests were administered to the participants in this group during their remission and lucid period of the psychiatric conditions.

Inclusion Criteria

1. This group comprised participants aged 16years and over;

2. The participant had been diagnosed of a psychiatric condition based on a psychiatrist's review using the DSM-IV (American Psychiatric Association, 2000).
3. Participants must have at least 6 years basic education to help them in the reading, understanding and answering of the test instruments in English Language.

Exclusion Criteria

1. Participants who had history of neurological, medical or sickle cell condition aside psychiatric condition were excluded from this group.

3.6. Demographic Data

The demographic characteristics in Table 3.1 reveal the frequencies of the variables sex, age, education, occupation and handedness. It also gives the means and standard deviations of these variables. Two variables are measured in years and these are age and education.

Table 3.1: Demographics

Variables	Healthy n=215	Medical n=385	Psychiatric n=156
Sex: Male (n)	119	237	111
Female (n)	96	148	45
Age: Mean	28.36	36.84	34.51
SD	9.55	14.28	11.33
Educ: Mean (number of years)	14.11	12.47	12.02
SD	2.54	3.02	2.58
Occupation (n)			
Employed	77	248	102
Unemployed	11	42	16
Retired	1	20	1
Student	93	42	17
Handedness(n)			
Right	202	351	140
Left	11	20	10
Ambidextrous	1	7	2

3.7. Ethical Consideration

This study was approved by the Ethical Committee of the Humanities (ECH) of the University of Ghana. A letter of introduction was collected from the Department of Psychology to introduce the researcher to the various departments at the Korle-Bu Teaching Hospital so as to be permitted to collect data from Renal Unit, Sickle Cell Unit, Stroke Unit, Medical department and Out-patient Departments. Data was collected from the wards and Out-patient Departments of Accra Psychiatric Hospital and Pantang Psychiatric Hospital. Consent forms were given to the participants to sign after the purpose, risks and benefits of the study had been explained to participants. This was to help them decide whether to participate or not. The likelihood of developing stress was emphasized since the study required them to answer different tests. This was strenuous for some of these participants thus psychological counselling was provided to help relieve the participants' stress. Confidentiality and privacy was ensured. Participants were assured that any information given will not be used outside this study. Abbreviations of participants' names were used for the study so as to maintain confidentiality and privacy. The right to withdraw from the research anytime was emphasized.

3.8. Instruments/ Measures

3.8.1. Revised Quick Cognitive Screening Test [RQCST] (Mate-Kole et al., 2009)

The RQCST was published by Mate-Kole et al. (2009). It is a revised version of the Quick Cognitive Screening Test (QCST) which was developed in 1994 by Mate-Kole, Major, Lenzer& Connolly. It was developed to detect cognitive impairment and specific areas of cognitive deficit (Mate-Kole, Major, Lenzer & Connolly, 1994). It takes about 20minutes to administer. There are three (3) major subscales of this test: Orientation, Total Verbal and Total Non-Verbal. The

Orientation has a total score of 12 and a Cronbach alpha of 0.78. Total Verbal score is forty-four (44) and has a Cronbach alpha of 0.84. The Total Non-Verbal score is thirty-four (34) with a Cronbach alpha of 0.92 (Mate-Kole et al., 2009).

Table 3.2: Summary of Original Revised Quick Cognitive Screening Tests

	Verbal Tests	Nonverbal Tests	Summary Scores
Orientation	Vocabulary Arithmetic	Memory - Immediate Delay	Total Verbal Total Nonverbal
	Naming	Spatial Neglect	Global Score
	Attention/Concentration	Constructional Praxis	
	Memory verbal- Immediate	Spatial Orientation	
	- Delay	Memory Delayed Recall	
	New Learning	Attention/ Concentration	
	Abstract Reasoning	Unusual Views	
	- Similarities		
	- Analogies		

Subtests of the RQCST

Orientation

It consists of 12 items assessing time, place and person. Questions such as "what date of the month is this?" "What is the name of the current president" and "Say your full address" are asked to assess the participant's orientation to all the three spheres stated above (Mate-Kole et al., 2009). It had a Cronbach alpha of .76.

Attention/Concentration

This subtest has two components, namely; verbal and visual subtests. It assesses the individual's ability to maintain attention, concentration, and tracking of a specific problem. Under the verbal subtest, the participant is asked to count by threes as fast as he/she can. For the visual subtest the participant is expected to tell the researcher the number of dots he/she sees in two clusters of dots. The participant is not to use the hand to count the number of dots presented to him/her (Mate-Kole et al., 2009).

Spatial Neglect

It measures the participant's visuo-spatial skills and spatial neglect. The participant is required to draw a line in the middle of four (4) horizontal lines (Mate-Kole et al., 2009).

Arithmetic

The Arithmetic subtest detects dyscalculia and the participant's ability to recognize symbols. The participant is required to solve four (4) mathematical problems depending on the mathematical operation. The mathematical calculation consists of addition, subtraction, multiplication and division (Mate-Kole et al., 2009).

Constructional Praxis

This subtest assesses a participant's planning, spatial organization, and visual constructional skills. The participant copies a drawing of three (3) interconnected geometric figures. These geometric figures are circle, square and triangle. Each figure when drawn correctly is scored one (1) each. The placement of the figures carries a score of one (1) each and where the figures are interconnected also carries a score of one (1) each (Mate-Kole et al., 2009).

Memory

Immediate Recall: It has two parts, namely; non-verbal and verbal. The nonverbal portion requires the participant to draw the three (3) geometric figures again from memory immediately after coping. The verbal portion requires the participant to repeat five (5) items immediately after the examiner reads it out loud to him/her. It assesses the participant's visual memory, spatial memory and verbal memory (Mate-Kole et al., 2009).

Delayed Memory: This subtest also has two parts, namely; visual and verbal. It assesses the participant's long term memory. With the visual portion, the participant is required to draw from memory the three (3) geometric figures he/she drew previously. The participant is required to repeat the five (5) objects he/she named earlier for the verbal part (Mate-Kole et al., 2009).

New Learning: This subtest assesses a participant's ability to acquire and remember new information. The examiner reads out the following sentence; "One thing a nation must have to be rich and great is to have a large secure supply of wood" (Mate-Kole et al., 1994). The participant must repeat this Babcock sentence exactly as said. Ten (10) trials are given for the participant to repeat the sentence successfully without any mistake (Mate-Kole et al., 2009).

Vocabulary

The Vocabulary subtest assesses a participant's language ability. It comprises five (5) items. The participant is presented with five (5) words to which he/she is to identify other words with the same meanings or definitions (Mate-Kole et al., 2009). It had a Cronbach alpha of .76.

Naming

This subtest assesses the participant's naming ability. It has five (5) items. The participant is presented with five objects to which he/she is to identify and name correctly. These objects

include umbrella, butterfly, teapot, knife and a book (Mate-Kole et al., 2009). It had a Cronbach alpha of .49.

Abstract Reasoning

It is made up of two parts, namely; similarities and analogies with a Cronbach alpha of .67 and .53 respectively. In the Similarities section, the participant is presented with four (4) words or phrases to which he/she describes. In the Analogies section, the participant is presented with four (4) words or phrases to which he/she is to provide words that best complete the sentences (Mate-Kole et al., 2009).

Unusual Views

According to Warrington and Taylor (1973), this subtest assesses the participant's perception and object recognition. It has five (5) items. The participant is presented with five different objects with unconventional angles. The participant is required to identify these objects (Mate-Kole et al., 2009). It had a cronbach alpha of .51.

Spatial Orientation

The participant is asked to identify matching designs so as to help measure the individual's visual spatial orientation and relations. It has five (5) items (Mate-Kole et al., 2009). It had a Cronbach alpha of .72.

The scores for the RQCST are sub-divided into four. Orientation score sums up to 12 and has a Cronbach Alpha of .76. Total Verbal score sums up to 44 with a Cronbach Alpha of .77, Total Non-Verbal score sums up to 34 with a Cronbach Alpha of .75 and Total Global Score is 90 with a Cronbach Alpha of .84 (Mate-Kole et al., 2009).

3.8.2. Standardized Measures

Some standardized instruments were used concurrently to measure cognitive functions of the participants so as to ensure that the RQCST assesses and measures what it is purported to measure. The instruments used alongside the RQCST include the Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV), Trail Making Test (A & B), Boston Naming Test, Rey-Osterrieth Complex Figure (ROCF) and the Modified Card Sorting Test (Wechsler, 2008; Reitan & Wolfson, 1993; Goodglass & Kaplan, 2001; Osterrieth, 1944; Nelson, 1976). WAIS-IV was the only instrument validated in Ghana (Miezah, 2015).

Subtests of the Wechsler Adult Intelligence Scale-Fourth Edition [WAIS-IV]

WAIS is an intelligence test which seeks to measure intelligence in people between the ages of 16 and 90 years. It takes 60-90minutes to complete. WAIS-IV consists of ten (10) main subtests and five (5) supplemental subtests (Wechsler, 2008). For the purpose of this study only five of them will be used namely, Digit Span, Arithmetic, Similarities, Picture Completion and Block Design. These selected WAIS-IV subtests assess similar cognitive skills as the RQCST. The Cronbach Alpha of WAIS-IV ranges from .87-.98 (Wechsler, 2008).

Digit Span Subtest (Wechsler, 2008)

The Digit Span measures an individual's auditory attention and span of immediate verbal memory recall (Wechsler, 2008). In this subtest, the examiner reads series of numbers to the participant. The participant is expected to repeat the numbers to the examiner in the same order it was mentioned (forward) or produce the numbers from the last number mentioned to the first (Backward). The participant is given two trials with dissimilar series of numbers. If he/she fails

both trials, the test is stopped. The participant receives a point for each trial he/she passes. The maximum score for both the Digit Forward and Digit Backward is fourteen (Wechsler, 2008).

Similarities (Wechsler, 2008)

This subtest comprises eighteen (18) pairs of words. The participant is shown two words that share common concepts. The client is asked to describe how these words are similar. This subtest measures abstract thinking skill, concept formation and verbal reasoning. It seeks to assess the participant's ability to understand, use and think with spoken language (Wechsler, 2008).

Picture Completion (Wechsler, 2008)

The participant after viewing a picture with an important missing part is expected to identify the missing part. This task is carried out in a specified limited time. It measures an individual's perception, concentration, visual recognition and organization (Wechsler, 2008).

Block Design (Wechsler, 2008)

The Block Design consists of two dimensional designs which the participant attempts to copy using three dimensional blocks. It assesses an individual's visual-motor skills, part-whole recognition skills and the ability to analyze geometric patterns (Wechsler, 2008).

Trail Making Test (Reitan & Wolfson, 1993)

This measures an individual's scanning, visuomotor tracking, divided attention and cognitive flexibility (Lezak et al., 2004). It also assesses scanning, sequencing, psychomotor speed, abstraction and ability to maintain two trains of thoughts at the same time (Strauss et al., 2006). The test has two parts namely; A and B. In Part A, the individual is to connect the numbered circles in sequence whiles being timed. The individual is required to connect both numbered and lettered circles in sequence alternating between the two whiles being timed in Part B. When

errors occur the participants are corrected. Scores are based on the time the participant uses to complete the task. To control for speed variable, scores from Part A are deducted from Part B. It has a Cronbach alpha reliability of 0.70 (Partington & Leiter, 1949).

Boston Naming Test (Kaplan, Goodglass and Weintraub, 2001)

This is a thirty (30) item test where the participant is required to name objects. Line drawings are presented to the participants to name. This helps the researcher determine the individual's visual confrontation naming abilities. Items are ranked in order of their difficulty. It takes between 35-45 minutes to administer (Goodglass and Kaplan, 2001). It has a Cronbach alpha of .96 (Brouillette et al., 2011).

Rey-Osterrieth Complex Figure [ROCF] (Osterrieth, 1944)

The ROCF assesses visuo-spatial abilities and memory of an individual. It involves planning, organizational abilities and problem-solving abilities (Strauss et al., 2006). It is a neuropsychological assessment that requires participants to recognize and recollect a line drawing. The individual is requested to copy a design on a paper in a maximum time of five (5) minutes. He/she is expected to recall the design and draw it again after a thirty (30) minute interval. Scoring is based on precision of eighteen constituents of the design. The highest score is 36 (Strauss et al., 2006). Different functions of the brain being assessed are visuo-spatial abilities, memory, attention, planning and memory. It has a Cronbach alpha of 0.93 (Osterrieth, 1944).

Modified Card Sorting Test (Nelson, 1976)

The Modified Card Sorting Test (MCST) is a simplified version of the Wisconsin Card Sorting test (WCST) which assesses executive functions of an individual (Caffarra et al., 2004) between

the ages of 18-90 years. It takes between 7-10 minutes to administer and about three minutes to score. The MCST is made up of two sets of twenty-four cards amounting to forty-eight cards which are used together with four stimulus cards. The MCST assesses perseveration and abstract reasoning. Because of its simplicity, the elderly and individuals with impairment find it easier to use. The participant is scored on; number of Categories Correct, Number of Perseverative Errors, Number of Total Errors and percent of Perseverative Errors and Executive Function Composite Score (Caffarra et al., 2004) . According to Cianchetti et al. (2005) only six consecutive correct responses are needed and the participant is informed when the rules change.

3.9. Procedure

Individuals within the inclusion criteria were recruited after signing consent forms. After this stage, the participants were first administered the RQCST which took about twenty minutes to complete (Mate-Kole et al., 2009). All the participants were administered the rest of the neuropsychological tests (subtests of the WAIS-IV, Rey's Copy, Trail making, Boston Naming test and Modified Card Sorting Test). During the administration of the neuropsychological tests, participants were given breaks in-between so as to reduce fatigue and boredom. To ensure that the participants were not distracted by the environment, all the sessions were done in consulting rooms at the various departments. Psychological counselling was provided to relax the participants and also relieve their stress. After testing was completed, participants were thanked as a sign of gratitude for their time. The completed tests were collected, scored and analyzed.

3.10. Data Analysis

The Coefficient alpha values of the RQCST subtests were analyzed to determine the internal consistency of RQCST. Multivariate analysis of variance (MANOVA) was used to determine the

differences among the healthy, medical and psychiatric groups on the various subtests of RQCST. Post Hoc analysis was done to determine the exact differences between the subgroups. Receiver Operating Characteristic Curve Analysis (ROC analysis) was computed to discriminate healthy individuals from cognitive impaired individuals so as to acquire a cutoff score for the RQCST (Hajian-Tilaki, 2013). To measure the strength of association between RQCST and the other test instruments, Pearson r Correlation Coefficient was computed.

CHAPTER FOUR

4.0. RESULTS

In this chapter, the collected data are analyzed. The aim of this study was to investigate whether RQCST could be used in Ghana and also to determine if disease condition, age and education can affect an individual's cognitive function. To test the hypotheses, the Statistical package for the Social Sciences (SPSS) version 20.0 was used to analyze the data.

The RQCST subtests, WAIS- IV subtests, Trail Making Test, Rey Copy, Boston Naming and Modified Card Sorting were examined for any possible missing data and outliers before continuing with the hypothesis testing.

4.1. Factor Analysis of the Revised Quick Cognitive Screening Test

A Principal Component Analysis (PCA) with a Varimax rotation of all the subtests of the RQCST raw scores was conducted on the data collected from the five hundred and ninety-six (596) participants recruited for this study. Items with eigenvalues above 1 were retained yielding eighteen components. A varimax rotation was conducted and items with factor loadings above .4 were retained (Field, 2009). The results from Table 4.1 revealed that the RQCST was therefore modified to suit the Ghanaian population after conducting Principal Component Analysis as some items had been removed yielding 31 out of 50 items.

Table 4.1: Factor Structure and Factor Loadings of the RQCST Using Varimax Rotation method with Kaiser Normalization

Factor 1: **VERBAL AND ABSTRACT REASONING**

Item Number	Item Content	Item Loading
17.	Arithmetic	0.73
20.	Delicate	0.54
21.	Caution	0.49
22.	Allow	0.58
23.	Particle	0.48
24.	Regenerate	0.60
30.	Knife & Fork	0.59
31.	Ruler & Scale	0.52
32.	Nose & Tongue	0.56
33.	Spider is to Web as Bird is to:	0.40
36.	Sun is to Heat as Lamp is to:	0.49

Factor 2: **ORIENTATION**

Item Number	Item Content	Item Loading
4.	What date of the month is this?	0.47
5.	What year is this?	0.48
7.	What is your age?	0.46
8	What is your date of birth?	0.48
10.	What is the name of the previous president?	0.48
11.	Write or say all the days of the week.	0.43

Factor 3:

PERCEPTUAL REASONING

Item Number	Item Content	Item Loading
18.	Constructional Praxis	0.62
19.	Visual Immediate Recall	0.61
48.	Visual Delay Recall	0.61

Factor 4

SPATIAL ORIENTATION

Item Number	Item Content	Item Loading
43.	Spatial Orientation 1	0.45
44.	Spatial Orientation 2	0.46
45.	Spatial Orientation 3	0.47

Factor 5:

NAMING

Item Number	Item Content	Item Loading
25.	Naming 1	0.63
26.	Naming 2	0.58
28.	Naming 4	0.52
29.	Naming 5	0.65

Factor 6:

Item Number	**VERBAL RECALL** Item Content	Item Loading
15.	Immediate Verbal Memory	0.61
49.	Delayed verbal Memory	0.53

Results shown from Table 4.1 reveal that some items were removed from the RQCST. This reduced the test items from fifty to thirty-one. Visual Attention/ Concentration, Verbal Attention/ Concentration, Unusual Views, New Learning and Spatial Neglect subtests were removed. Six items were removed from Orientation subscale. Two items were removed from Spatial Orientation. One item each was removed from both Abstract Reasoning (Analogies) and Naming subscales. From Table 4.2, the RQCST currently has one Orientation subscale, four Verbal Test subscale, four Nonverbal Test subscale and three summary scores. Results showed that Orientation subscale is 6 instead of 12, Total Verbal Score is 30 instead of 34, Total Nonverbal Score is 21 instead of 44, and Global score is 57 instead of 90.

Table 4.2: Summary of Modified RQCST

	Verbal Tests	Nonverbal Tests	Summary Scores
Orientation	Arithmetic Vocabulary Naming Abstract Reasoning - Similarities - Analogies Memory- Immediate Delayed	Spatial Neglect Constructional Praxis Spatial Orientation Memory –Immediate - Delayed	Total Verbal Total Nonverbal Global Score

4.2. Reliability

Cronbach alpha values were computed to determine internal consistency of the RQCST items.

Table 4.3: Internal Consistency of Revised QCST Subtests With Multiple Items

Revised QCST Subtest	Number of items	Coefficient α
Orientation	6	.66
Vocabulary	5	.76
Naming	4	.70
Similarities	3	.67
Analogies	3	.60
Spatial Orientation	3	.63
Total Nonverbal	6	.70
Total Verbal	19	.82
Global Score	31	.84

Inter-item consistency reliability method was used to determine the reliability of the RQCST. From Table 4.3, using the subtest scores plus the summary of scores the coefficient alpha was established as .83. The Cronbach's alpha of the individual subtests of the RQCST was computed.

4.3. Effect of Age and Education on the RQCST.

Pearson Product Moment Correlations was computed to verify if age and education were correlated to the RQCST. Results revealed that the RQCST subtests were significantly correlated with age and education ($p < .05$). An Analysis of Covariance (ANCOVA) was conducted for each of the RQCST subtest to investigate whether there are differences among the three groups on age and education before determining group differences on RQCST. The aim was to assess whether controlling age and education would have an effect on these differences. The Diagnosis category

namely; Healthy, Medical and Psychiatry groups was used as the independent variable; the subtests and summary scores of the RQCST were used as dependent variables. Age and education were used as covariates. Results revealed that there was no impact of age and education on the RQCST; thus, MANOVA was conducted without the covariates.

Percentage of Normal Participants Scoring Abnormal Range

To determine the number of healthy participants having lower scores, the data was divided into two main groups namely; Healthy group and Disease Condition group. The Disease Condition group comprised, Medical Group and Psychiatry Group.

Table 4.4: Percentage of participants

Diagnosis	Mean Global Score	Range of scores	Percentage
Healthy Group	51.44 (6.15)	50.61 – 52.26	6.9% within Disease Condition group
Disease Condition Group	45.49 (9.46)	44.14 – 46.83	14.5% within Healthy Group.

According to table 4.4, the mean RQCST global score for the Healthy Group was 51.44 (SD= 6.15). The mean global score for the Disease Condition Group was 45.49 (SD= 9.46). The range of scores for the Healthy group was 50.61 to 52.26 whiles that of the Diseased Condition group was 44.14 to 46.83. Using the frequency scores, of the Healthy group and Medical Condition group, 6.9% of the healthy participants scored in the Disease Condition range whiles 14.5% of the Disease Condition participant's scores in the healthy range.

4.4. Validity

Construct validity of the RQCST was assessed using the Pearson Product Moment Correlations to determine whether the RQCST measured what it is suppose to measure. Within group correlations were computed separately between the Healthy, Medical and Psychiatric Groups on RQCST subtests and RQCST Summary scores**.** This was to establish whether there was significant correlation among the groups.

Table 4.5: Pearson *r* Correlation Coefficients for Revised QCST Subtest Scores

Revised QCST Subtest	*Verbal Score*	*Nonverbal Score*	*Global Score*
Orientation	0.46**	0.35**	0.57**
Arithmetic	0.73**	0.35**	0.63**
Vocabulary	0.79**	0.34**	0.64**
Naming	0.45**	0.34**	0.45**
Similarities	0.77**	0.32**	0.62**
Analogies	0.68**	0.28**	0.55**
Visual Memory Immediate	0.30**	0.76**	0.62**
Visual memory delayed	0.33**	0.79**	0.65**
Spatial Orientation	0.46**	0.50**	0.58**
Spatial Neglect	0.19**	0.57 **	0.45**
Constructional Praxis	0.30**	0.76**	0 .60**
Total Verbal Score	-	0.45**	0 .83**
Total Nonverbal Score	0.45**	-	0.84**
Global Score	0.83**	0.84**	-

** $P < .01$

4.4.1. Correlation of RQCST Subtest with RQCST Summary Scores

Using the Pearson Product Moment Correlations, there were significant correlations between the RQCST subtest scores and the RQCST summary scores. Table 4.5 showed that the RQCST Total Verbal score had significantly higher correlations with the RQCST verbal subtest scores than the RQCST nonverbal subtest scores. The RQCST Total Nonverbal Score had significantly higher correlations with the RQCST nonverbal subtest scores than the RQCST verbal subtest scores. Also, there was significantly correlation between the Global score and the Total Verbal and Nonverbal scores.

4.4.2. Correlation of RQCST Summary Scores with other Standardized Measures

Validity of the RQCST was supported as analysis revealed that there was significant correlation existing between the RQCST summary scores and the other standardized tests. According to Table 4.6, the Global score for the RQCST correlated significantly with Trail Making Test; (r=0.39, p<.01), Digit Span ; (r= 0.41, p<.01) and Similarities;(r= 0.34, p<.01. The RQCST Global score was significantly related to Picture Completion; (r= 0.46, p< .01), Block Design; (r= 0.47, p < .01), Rey Copy immediate; (r= 036, p>.01), Rey Copy Delay; (r= 0.34, p<.01), Rey Copy Recall; (r= 0.42, p< .01), Boston Naming; (r= 0.31, p> .01) and Modified Card Sorting; (r= 0.29, p< .01). The Trail Making Test was negatively associated with the RQCST Global score indicating that participants who score higher on this test had greater cognitive impairment. The table also revealed that

there was no correlation between Rey Copy Delay, Boston Naming Test and Modified Card Sorting Test and Nonverbal Score of the RQCST.

Table 4.6: Pearson r Correlation Coefficients for Revised QCST Summary Scores with Other Measures

Standardized Measure	Verbal Score	Nonverbal Score	Global Score
Trail Making Test (B-A)	-0.38**	-0.25*	0.39**
WAIS- IV Digit Span	0.37**	0.22*	0.41**
WAIS- IV Similarities	0.34**	0.17	0.34**
WAIS-IV Pict. Compl.	0.38**	0.33**	0.46**
WAIS- IV Block Design	0.42**	0.31**	0.47**
Rey Copy Immediate	0.32**	0.25**	0.36**
Rey Copy Delay	0.38**	0.12	0.34**
Rey Copy Recall	0.38**	0.25**	0.42**
Boston Naming	0.43**	0.01	0.31**
Modified Card Sorting Test	0.40**	-0.01	0.29**

$P < .01$, *$P < .05$, **Pict.Compl. = Picture Completion

Hypothesis 1

There will be a statistical significant difference among the Healthy Control Group and the various medical conditions and Psychiatric Groups. Thus the Healthy Group will obtain significantly score than the Medical Group and the Psychiatric Group.

Table 4.7: Multiple Analysis Of Variance of RQCST Subtests

		Sum of Squares	df	Mean Square	F	Sig.
Ori	**Between groups**	**28.86**	**2**	**14.43**	**23.81**	**000**
	Within Scores	**361.85**	**597**	**0.61**		
	Total	**390.72**	**599**			
Arith	**Between groups**	**72.79**	**2**	**36.10**	**32.64**	**.000**
	Within Scores	**660.27**	**597**	**1.11**		
	Total	**732.47**	**599**			
Voc	**Between groups**	**188.58**	**2**	**94.30**	**42.21**	**.000**
	Within Scores	**1333.26**	**597**	**2.38**		
	Total	**1521.84**	**599**			
Nam	**Between groups**	**13.58**	**2**	**6.79**	**9.47**	**.000**
	Within Scores	**427.81**	**597**	**0.72**		
	Total	**441.39**	**599**			
Sim	**Between groups**	**72.54**	**2**	**36.27**	**32.36**	**.000**
	Within Scores	**669.18**	**597**	**1.12**		
	Total	**741.71**	**599**			
Anal	**Between groups**	**19.17**	**2**	**9.59**	**14.65**	**.000**
	Within Scores	**390.63**	**597**	**0.65**		
	Total	**409.80**	**599**			
Spa Ori	**Between groups**	**17.42**	**2**	**8.71**	**19.78**	**.000**
	Within Scores	**262.92**	**597**	**0.44**		
	Total	**280.34**	**599**			
CP	**Between groups**	**23.29**	**2**	**11.65**	**6.73**	**.001**
	Within Scores	**1033.50**	**597**	**1.73**		
	Total	**1056.79**	**599**			

Ori- Orientation, **Ari-** Arithmetic, **Voc-** Vocabulary, **Nam-** Naming, **Sim-** Similarities, **Anal-** Analogies, **Spa Neg-** Spatial Neglect, **Spa Ori-** Spatial Orientation, **CP-** Constructional Praxis,

Table 4.7 Cont'd . Multiple Analysis Of Variance of RQCST Subtests

		Sum of Squares	df	Mean Square	F	Sig.
VM Imm	**Between groups**	**34.36**	**2**	**14.05**	**7.21**	**000**
	Within Scores	**1423.13**	**597**	**0.61**		
	Total	**1457.49**	**599**			
VM Del. Rec	**Between groups**		**2**	**26.07**	**11.34**	**.000**
	Within Scores		**597**	**2.32**		
	Total		**599**			
Verb. Mem. Imm	**Between groups**	**28.11**	**2**	**14.05**	**23.08**	**.000**
	Within Scores	**363.61**	**597**	**0.61**		
	Total	**391.72**	**599**			
Verb. Mem. Del	**Between groups**	**152.17**	**2**	**76.09**	**33.10**	**.000**
	Within Scores	**1372.22**	**597**	**2.30**		
	Total	**1524.39**	**599**			
Tot NonV	**Between groups**	**442.16**	**2**	**221.08**	**8.85**	**.000**
	Within Scores	**14911.49**	**597**	**24.98**		
	Total	**15353.60**	**599**			
Tot Ver	**Between groups**	**2353.38**	**2**	**1176.69**	**55.64**	**.000**
	Within Scores	**12626.11**	**597**	**21.15**		
	Total	**14979.49**	**599**			
Glob Sc	**Between groups**	**4490.68**	**2**	**2245.34**	**33.27**	**.000**
	Within Scores	**40287.24**	**597**	**67.48**		
	Total	**44777.92**	**599**			

VM Del. Rec- Visual Memory Delayed Recall, **Ver Mem Imm-** Verbal Memory Immediate, **Ver Mem Delay-** Verbal Memory Delayed, **Tot NonV**- Total Nonverbal Score, **Tot Ver-** Total Verbal Score, **Glob Sc**- Global Score

A Multivariate Analysis of Variance (MANOVA) was conducted to determine if there were any significant differences among the Healthy, Medical and Psychiatric Groups. Table 4.7 revealed that there were significant differences among the three groups on summary scores of the RQCST. A post hoc test, specifically Tukey's HSD, $p < .05$, was used to identify the significant differences existing between the groups.

Table 4.8: Post Hoc Comparisons of SD and Mean Scores for RQCST

RQCST Subtests	Healthy (n-215)	Medical (n-228)	Psychiatric (n-156)	Different from Healthy
Ori	5.93 (0.03)	5.68[a] (0.83)	5.37[a] (1.10)	Medical / Psychiatric
Arith	3.64 (0.72)	3.01 (1.17)	2.81 (1.24)	Medical / Psychiatric
Voc	4.28 (1.08)	3.32[a] (1.67)	2.92[a] (1.70)	Medical / Psychiatric
Nam	3.76 (0.67)	3.62[a] (0.78)	3.37[a] (1.14)	Psychiatric
Sim	3.68 (0.72)	3.07 (1.14)	2.85 (1.30)	Medical / Psychiatric
Anal	2.84 (0.62)	2.50 (0.86)	2.42 (0.96)	Medical / Psychiatric
Spa Ori	2.92 (0.35)	2.59 (0.77)	2.53 (0.81)	Medical / Psychiatric
CP	4.90 (1.14)	4.52 (1.48)	4.45 (1.29)	Medical / Psychiatric
VM Imm Rec	4.73 (1.43)	4.20 (1.59)	4.29 (1.61)	Medical / Psychiatric

a –Medical Condition significantly different from Psychiatric

Ori- Orientation, **Ari**- Arithmetic, **Voc**- Vocabulary, **Nam**- Naming, **Sim**- Similarities, **Anal**- Analogies, **Spa Neg**- Spatial Neglect, **Spa Ori**- Spatial Orientation, **CP**- Constructional Praxis, **VM Imm Rec**- Visual Memory Immediate Recall

Table 4.8: (Continued) Post Hoc Comparisons of SD and Mean Scores for RQCST

RQCST Subtests	Healthy (n-215)	Medical (n-228)	Psychiatric (n-156)	Different from Healthy
VM Del. Rec	4.63 (1.23)	4.07 (1.67)	3.94 (1.65)	Psychiatric / Medical
Verb. Mem. Imm	4.85 (0.46)	4.41 (0.90)	4.41 (0.89)	Psychiatric / Medical
Verb. Mem. Del	3.57 (0.41)	2.60 (1.57)	2.44 (1.57)	Psychiatric / Medical
Tot NonV	21.05 (4.24)	19.59 (5.38)	18.96 (5.36)	Psychiatric / Medical
Tot Ver	19.91 (3.90)	16.71[a] (4.67)	15.01[a] (5.32)	Psychiatric / Medical
Glob Sc	50.90 (5.97)	46.61[a] (8.46)	44.08[a] (10.25)	Psychiatric / Medical

a –Medical Condition significantly different from Psychiatric

VM Del. Rec- Visual Memory Delayed Recall, **Tot NonV**- Total Nonverbal Score, **Tot Ver-** Total Verbal Score, **Glob Sc**- Global Score

4.4.3. Group Differences on RQCST Summary Scores

According to Table 4.8, post hoc tests showed that the performance of the Healthy Group was significantly different from Medical and Psychiatry Groups on all the summary scores. The Psychiatric Group had significant lower scores on the Total Nonverbal Scores and the Global scores as compared to the Medical group (Tukey, $p < .05$)

4.4.4. Group Differences on the RQCST Subtest Scores

A Multivariate Analysis of Variance (MANOVA) was done to examine if there were any significant differences between subtests scores of the various groups. When significant differences were detected, a post hoc test (Tukey's HSD, $p < .05$) was computed to identify where the differences existed. Table 4.7 revealed that there were significant differences among the three groups on subtest scores of the RQCST. Results from Table 4.8 showed significant differences for all the RQCST subtest scores between the Healthy, Psychiatry and Medical Condition groups.

4.4.5. Post hoc multiple comparisons for Healthy Group and other conditions

Post hoc showed that the Healthy group was significantly different from the Psychiatric group (Tukey, $p < .05$) on all the subtests. Table 4.8 showed that the Healthy group differed from the Medical group (Tukey, $p > .05$) on all the subtests of the RQCST except for Naming and Spatial Neglect.

Hypothesis 2

There will be a statistical significant difference between participants with psychiatric disorders and medical disorders. Thus:

4.4.6. Post hoc Multiple Comparisons among Medical Conditions

From Table 4.8, results showed that the performance of the Healthy group was significantly different from both the Medical and Psychiatric Groups on the subtests; Arithmetic, Vocabulary, Similarities, Analogies, Spatial Orientation, Constructional Praxis, Immediate Visual Memory, and Delayed Visual Memory.

The Psychiatric Group differed significantly lower from the Medical ($p < .05$) group on Orientation, Vocabulary, Naming, Spatial Neglect, Total Verbal Score and Global Score. Overall, the Psychiatric Group performed poorly as compared to Medical Group.

4.5. Receiver Operating Characteristic Curve Analysis

To examine how the RQCST differentiates healthy from impaired persons, the Receiver Operating Characteristic Curve Analysis (ROC curve analysis) was performed to discriminate between the Healthy group and the Disease Condition group. Table 4.8 shows the area under the curve, sensitivity and specificity for ach RQCST subtest and global scores. A cut-off score was chosen as explained by Hajian- Tilaki (2013) as the tendency of a researcher to choose a specific point for a good sensitivity (true positive) and specificity (true-negative rates).The area under the curve is the total measure of discrimination where a perfect discrimination yields an area of 1. When the area under the curve is lesser than or equal to 0.50, it can be concluded that the test has failed in discrimination (Hajian- Tilaki, 2013). According to Hajian- Tilaki (2013) an area under the curve of .70 - .90 has moderate diagnostic effectiveness.

All the subtests of the RQCST had areas under the curve greater than .05. The lowest being Naming .57 and the highest being Total Verbal Score ; .75. Total Nonverbal Score had an area under the curve of .59 whiles that of Global Score was .70. Sensitivities were also high for the various subtests, ranging from .69- .99 and specificity ranging from .52- .89.

According to Table 4.9, all the subtests scores had lower cutoff scores as compared to the original RQCST subtest scores except for Spatial Orientation. Also Table 4.6 revealed that the summary scores are all lower than the American cutoff score of (Mate-Kole et al., 2009); Total

Nonverbal score had an optimal cutoff point of 20, Total Verbal Score was 17 and Global Score was 47.

Table 4.9: ROC Analyses for Revised QCST Subtests

RQCST Subtests	Area Under Curve	95% CI for Area Under Curve	Sensitivity	Specificity	Optimal Cutoff Score
Ori	.58	.54- .63	.94	75	6
Arith	.67	.63-.71	.92	.67	3
Voc	.70	.66-.74	.83	.52	4
Nam	.57	.52-.61	.83	.70	4
Sim	.68	.63-.72	.94	.73	3
Anal	.61	.56-.65	.85	.66	3
Verb Imm	.65	.61-.70	.99	.89	4
Verb Del	.69	.65- .73	.81	.55	3
Spa Ori	.63	.59-.68	.93	.70	3
CP	.58	.53-.62	.74	.58	5
VM Imm Rec	.60	.55-.64	.69	.52	4
VM Del Rec	.60	.55-.65	.84	.68	4
Tot NonV	.64	.59-.68	.70	.57	20
Tot Ver	.73	.69-.77	.87	.58	17
Glob Sc	.71	.67-.75	.84	.53	47

Ori- Orientation, **Ari**- Arithmetic, **Voc**- Vocabulary, **Nam**- Naming, **Sim**- Similarities, **Anal**- Analogies, **Spa Neg**- Spatial neglect, **Spa Ori**- Spatial Orientation, **CP**- Constructional Praxis, **VM Imm Rec**- Visual Memory Immediate Recall, **VM Del Rec**- Visual Memory Immediate Recall, **Tot NonV**- Total Nonverbal Score, **Tot Ver**- total Verbal Score, **Glob Sc**- Global Score.

CHAPTER FIVE

5.0. DISCUSSION

The main aim of the study was to determine the psychometric properties of the Revised Quick Cognitive Screening Test so as to develop norms on African population, specifically Ghana. Secondly, group differences among the Healthy Group, Medical Group and Psychiatric Group on the various RQCST subtests were tested.

Results of this study support the hypothesis that the RQCST can detect cognitive dysfunction in persons suffering from a medical condition, neurological disorders and psychiatric disorder. Differences in the RQCST summary scores and subtest scores were found between the Healthy group, Neurological group, Psychiatric group and Medical group. Results showed that the Healthy group had higher scores on the RQCST than those in the Medical group and Psychiatric group. This suggests that the RQCST was able to differentiate between healthy individuals and individuals with cognitive impairment consistent with previous studies (Mate- Kole et al., 1994; Mate- Kole et al., 2009). Healthy individuals scored higher on all the RQCST's subtests compared to the groups with, medical and psychiatric disorders.

There was a significant difference between the Medical Group and Psychiatric Group on most of the subtests of the RQCST. Results showed that the Psychiatric Group scored significantly lower than the Medical Groups on Orientation, Vocabulary, Spatial Neglect, Total Verbal Score and Global Score. It can therefore be concluded that there is a greater cognitive impairment in the Psychiatric Group as compared to the other groups. These results corroborate the RQCST's specificity and sensitivity in differentiating between the healthy individuals and individuals with

medical and psychiatric conditions. The results suggested that the RQST can discriminate individuals with different cognitive dysfunctions.

The RQCST Global scores were highly correlated with the Trail Making Tests, Digit Span, Similarities, Picture Completion, Block Design, Rey's Copy and Boston Naming and Modified Card. The Trail Making Test was negatively associated with the RQCST Global score. This indicates that participants who score higher on this test had greater cognitive impairment. Findings of this study are consistent with previous studies. Mate-Kole et al. (1994) reported a significant relationship between subtests of Wechsler Adult Intelligence Scale- Revised (WAIS-R), National Adult Reading Test (NART) and the Unconventional (Unusual) Views Tests and the RQCST. In addition, Catayoung et al. (2009) found that the RQCST was significantly correlated with the Alzheimer's Disease Assessment Scale-Cognitive (ADAS- Cog), Mini-Mental State Exam (MMSE), Central Nervous System Vital-Signs (CNSVS), Trail Making Test (A & B), Digit Symbol Coding, Controlled Oral Word Association Test (COWAT) and Category Naming.

Mate Kole et al. (2009) assessed quality of life using Functional Activities Questionnaire (FAQ) and Quality of Life Index and found that there was a negative relationship existing between RQCST and quality of life. This means an individual who scores low on the RQCST would have reduced quality of life and vice versa. The findings of this study that provide evidence to examine if there is a negative relationship existing between cognitive impairment and quality of life were not supported. This could be due to the social support Ghanaians have when they fall sick. In investigating the effect of social support on African- American cognitive functioning, Simms et al. (2012) reported that social support provided emotional support (from families and

friends) and instrumental support (help in daily activities) which serve as a shield in cognitive decline by decreasing physiological arousal to stressful situations. Another study supporting the effect of social support was conducted by Oppong- Asante (2012). He studied the relationship between social support and psychological wellbeing of people living with HIV/AIDS in Ghana. 107 participants were recruited and results revealed that social support was negatively associated with depression, stress and anxiety.

One of the objectives of this study was to identify whether there was a significant difference between the American published norms and the Ghanaian norms developed from this study. There was a significant difference between the total summary scores of the Original RQCST scores and the Modified RQCST for Ghanaians. There was a lower mean scaled score on the Global score in the Ghanaian population. Additionally, the Ghanaian population had a lower mean score on Total Verbal score, Non-verbal score and the Global Score. Differences in the total score for both the original RQCST scores and the modified RQCST for the Ghanaian population could be due to cultural differences. The Ghanaian population was affected by cultural setup as there were test items in the RQCST that did not pertain to the Ghanaian environment. For example, in the Abstract Reasoning: Analogies subtest, one test item states "Spring is to summer as Tuesday is to: "This statement will be difficult to answer if an individual has never travelled to the Western world where there are four seasons whereas Ghana has only two seasons.

After factor analysis was computed, results revealed that the RQCST was to be modified for the Ghanaian population. Instead of the original seventeen subscales, it has to be reduced to only

eleven in Ghana. Originally it had fifty items, but for the Ghanaian setting it will have thirty-one items. Spatial Neglect, Unusual Views, New Learning, Verbal and Visual Attention/ Concentration subscales had to be removed. Some items from both the verbal and nonverbal tests had to be deleted since it did not load on any factor.

5.2. Implications of the Study

The development of Ghanaian norms for the RQCST is very important for clinical practice**.** Nell et al . (1993) in studying neuropsychological assessment of organic solvent effects in South Africa stated that neuropsychological tests that have been standardized in the Western countries may give misleading diagnosis since a test developed in one culture is different from another. Currently there is no standardized cognitive test in Ghanaian hospitals and institutions to assess cognitive functions so as to give health practitioners an idea of a patient's cognition. Ghanaian health professionals are likely to misdiagnose an individual and give inappropriate treatment if the American published norms are used for the Ghanaian population. A sensitive cognitive test can ease the problem of misdiagnosis. A cognitive screening test with a low false negative will detect deficits. Early detection of cognitive deficits will help plan management which will be appropriate for the individual. An effective cognitive screening test will guarantee that time is not wasted assessing cognitive functions that are otherwise not impaired.

As reported by Bartfay et al. (2013), cognitive impairment can go undetected especially subtle ones which are accompanied by medical conditions. Findings from this study show that individuals with disease conditions have some sort of cognitive dysfunction. Owing to this problem, health professionals on the various wards and out-patient department of health

institutions must be trained in assessing patients so as to detect cognitive impairment. This means cognitive screening should be part of the routine care individuals receive in a hospital. On the foundation of the individual's performance on the cognitive test, a decision is made as to whether a patient has cognitive impairment or not. The combination of cognitive screening and medical care will ensure that the patient is receiving a holistic care and also it will upgrade the health professionals' knowledge and skill. The RQCST can also help health professionals in deciding which specialist to refer a patient to when cognitive impairment is detected.

Results of the study suggests that there is the need for Ministry of Health and Ghana Health Service to employ qualified Neuropsychologists and Clinical Psychologists into the health institution so as to help care for a person's psychological issues he/she may be going through during hospitalization.

Findings from this study have suggested that the RQCST is a valid, reliable and sensitive cognitive screening tool. It assesses a wide-range of cognitive abilities and yet it takes a short time to administer. It is simple and comprehensive and does not need extra materials like block and cards to administer. It can be administered and scored by any health professional apart from the neuropsychologist. Due to its shortness, simplicity and conciseness, patients may find it less stressful and less tiring when being assessed. The RQCST is short therefore making it a cost effective screening test. The RQCST has individual subtests, each having its own score, thus, increasing the probability of detecting cognitive impairment associated to a particular cognitive area. This helps plan treatment, management and rehabilitation for the individual. The study revealed that there are some subtests of the RQCST for example Abstract reasoning; Analogies

which are culturally biased to the Ghanaian community. There is therefore a need to modify the RQCST so as to reduce potential cultural unfairness, thus, clinicians are to bear this in mind when interpreting scores.

Also, findings of this study on the age and education on RQCST have implications for clinical practice. Clinicians are to consider these factors when interpreting patient's scores and report writing.

Attention must be taken when using the RQCST as it is only a screening tool. It is not intended to be used in place of a full, comprehensive neuropsychological evaluation administered by a trained specialist. It is to be considered as an initial evaluation tool to detect a cognitive deficit (Mate- Kole, 2009). If it detects a deficit, further investigation is recommended so as to gather more information on the cognitive impairment. This investigation could be in the form of medical intervention or psychiatric treatment.

A limitation of the RQCST is that it is a screening tool and not a diagnostic instrument. Owing to its modification for the Ghanaian setting, some of the items have been removed which may result in some cognitive functions not being assessed in the Ghanaian population.

5.3. Limitations To Current Study

Participants recruited for this study were solely Ghanaians, making it difficult to generalize the results to other African countries.

Stratified sampling technique was the initial technique to be used in this study so as to ensure that the subgroups were accurately represented but unfortunately getting people to volunteer for

the study was difficult as most of the participants were hospitalized due to a medical condition and were either in a hurry to see a doctor or in too much pain to answer question; as such the stratified sampling technique could not be used.

Apart from the subtests of the WAIS-IV, most of the standardized measures had not been validated using the Ghanaian population. This could affect the validity of the RQCST.

5.4. Recommendations for Future Research

- On the basis of the stated limitations, it is recommended that future studies should be conducted using samples from other countries. This will ensure generalization of the results in Africa.
- It is recommended that ecological validity should be investigated using the RQCST where the relationship between cognitive decline and quality of life is studied.
- A direction for future research is to compare the RQCST with standardized measures which have been validated in Ghana
- Since the RQCST is solely in the English language, translation into major Ghanaian languages such as Twi, Ga, Ewe and Hausa is recommended.

5.5. Conclusion

Early detection of cognitive impairment is very important to both the individual and the clinician as appropriate management and treatment could be given so as to slow the progress of the impairment. Ghana does not have any short and effective cognitive screening tool. The aim of this study was to develop norms for the Ghanaian population so as to have a cognitive test which is culturally friendly in the detection of cognitive deficit. Also the study looked at how age and

education affected scores on the RQCST. Additionally, the study investigated the differences existing between Healthy Group, Medical Group and Psychiatry Group. One goal of the study was to identify the relationship between quality of life and RQCST. Analyses were done using a methodical thematic review of literature.

The reliability of the RQCST was confirmed as results showed that the subtests and the summary of score of the RQCST all had high internal consistency. Validity of the RQCST among the Ghanaian population was confirmed when the relationship between the RQCST and the standardized measures were found to be significantly correlated.

The RQCST from the study's findings has proven to be sensitive and specific in detecting and discriminating between healthy persons and persons with disease conditions such as neurological, medical and psychiatric disorders. Amongst the Diseased Group, the people with psychiatric conditions performed the poorest.

The Revised Quick Cognitive Screening Test is a valuable cognitive screening test because it is easy to use, short to administer, cost effective and sensitive to cognitive impairment. Due to its divided cognitive domains, it will make it easy for a clinician to identify cognitive impairment and thus plan for treatment, management and rehabilitation.

It was recommended that the sample size be varied to include other African countries. The possibility of interpreting the RQCST into other languages was recommended. For further studies, measures which have been standardized in Ghana should be used.

The results have implications for the individual as early detection which will lead to early treatment. This study has proven that there is the need to incorporate cognitive screening in the routine management of all patients. The study reinforced the need for Neuropsychologists and Clinical Psychologists to be employed in the health institutions so as to give holistic care. It was emphasized that the Revised Quick Cognitive Screening Test is a screening tool used in detecting cognitive deficit so only to be used as such. When cognitive impairment is identified the individual will have to be assessed using a full neuropsychological test.

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VALIDATION OF THE RQCST IN A GHANAIAN SAMPLE

APENDIX II

UNIVERSITY OF GHANA
DEPARTMENT OF PSYCHOLOGY
SCHOOL OF SOCIAL SCIENCES

PSYC 2/33/03

Ref. No.....

13th September, 2016

The Administrator
Ethics Committee for Humanities (ECH)
Office of Research Innovation and Development
University of Ghana

Dear Sir/ Madam,

LETTER OF INTRODUCTION: TINA FREMPONG-BOAKYE

The above-named student is an M. Phil Clinical Psychology student with index number 10550662 at the University of Ghana, Legon. As part of the requirement, Tina Frempong-Boakye has to write and submit an original thesis. The title of her thesis is "*Validation of the Revised Quick Cognitive Screening Test in A Ghanaian Population*". She is planning to conduct her study in Accra.

She has received approval from the Department of Psychology Graduate Studies Committee.

She is applying to your board for institutional approval /clearance to enable her carry on with her research work.

Yours sincerely,

Dr. Maxwell A. Asumeng
Head of Department

INTEGRI PROCEDAMUS

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APPENDIX III

UNIVERSITY OF GHANA

Official Use only
Protocol number

OFFICE OF RESEARCH, INNOVATION AND DEVELOPMENT
Ethics Committee for Humanities (ECH)

PROTOCOL CONSENT FORM

Section A- BACKGROUND INFORMATION

Title of Study:	**VALIDATION OF THE REVISED QUICK COGNITIVE TEST IN A GHANAIAN POPULATION**
Principal Investigator:	**TINA FREMPONG-BOAKYE**
Certified Protocol Number	

Section B– CONSENT TO PARTICIPATE IN RESEARCH

General Information about Research

You are invited to participate in an academic research project. The purpose is to examine the reliability and validity of the Revised Quick Cognitive Screening Test (RQCST). I am investigating on this to determine the RQCST's adaptability in Ghana, especially in screening cognitive deficits in individuals with neurological conditions. You will also be administered other tests like Trail Making Test, Rey- Osterrieth Complex Figure, Boston naming, modified Card Sorting Test and some sub-tests of the Wechsler Adult Intelligence Scale, Fourth edition (WAIS- IV). All the questionnaires are paper and pencil tests that will require you to recall some items, draw, calculate and name some objects on the paper. It is estimated to take 30-40minutes to complete.

Benefits

There are no benefits for your participation. Results of the study will provide health practitioners with a quick and efficient screening tool to identify cognitive deficits, leading to improved diagnosis.

Risk of the study

Administration of the questionnaire will take between 30-40minutes which may cause you psychology strain. To reduce this psychological strain, you will be taking periodic breaks in the course of test administration to reduce fatigue. Psychological counseling will be offered to you when you feel distress.

Confidentiality

Any information obtained from you during the course of the research will be confidential. No identifiable information such as your name will be attached to the document. Your privacy will be protected. Data collected will not be used for any other purpose except that which is stated here and may be used as part of publications and papers related to cognitive assessment.

Compensation

This study will not include any monetary or gifts as compensation. Verbal appreciation of your valued time and effort will be conveyed.

Withdrawal from Study

Participation in this study is solely on voluntary basis. You can withdraw at any point of the study without any negative consequences.

Contact for Additional Information

In case of any enquiries, questions and/or answers about this research or in situations of research related injuries please contact the researcher on:

Researcher: Tina Frempong-Boakye
Tel: +233(0) 242050883
Email: khutih@gmail.com

Supervisor: Prof. C.C. Mate-Kole
Email: djabatey@hotmail.com

Section C- VOLUNTEER AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."

_____
Name of Volunteer

_____ _____
Signature or mark of volunteer Date

If volunteers cannot read the form themselves, a witness must sign here:
I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

_____
Name of witness

_____ _____
Signature of witness Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____
Name of Person who Obtained Consent

_____ _____
Signature of Person Who Obtained Consent Date

APPENDIX IV A

REVISED QUICK COGNITIVE SCREENING TEST, (RQCST)
(MODIFIED VERSION)

…

Name: _____ ID/No.:

Sex: _____ Handedness: _____ Diagnosis:

Age: _____ Date of birth:

Highest level of education completed:

Occupation:

Date tested: _____ Time tested: _____ AM / PM

Test given by:

General Comments:

Tester's Signature:

ORIENTATION

1. What month is this?
2. What date of the month is this?
3. What year is this?
4. What is your date of birth?
5. What is the name of the President?
6. Who was the President before him/her?
7. Write or say all the days of the week.

ORIENTATION
Total Score (items 1 – 7, one point each) _____ Maximum score 7

SPATIAL NEGLECT

8. Make a stroke through the middle of each line.

SPATIAL NEGLECT
Total Score (item 8, one point per correct marking) _____ Maximum score 4

ARITHMETIC:

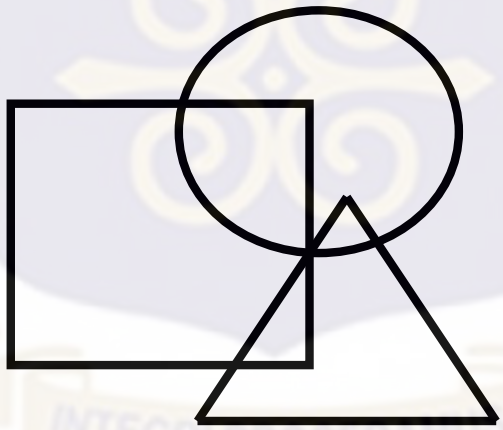
9. Do these arithmetic problems:

113	65	20	$12\sqrt{144}$
+113	-56	x 3	

ARITHMETIC	
Total Score (item 9, one point each) _____	Maximum score 4

CONSTRUCTIONAL PRAXIS

10. Copy this drawing



Scoring: one point for each figure; one point for correct placement of each figure

CONSTRUCTIONAL PRAXIS

MEMORY: IMMEDIATE RECALL (VISUAL)

11. Draw the same figures again.

Scoring: one point for each figure; one point for correct placement of each figure

MEMORY: IMMEDIATE RECALL (VISUAL)	
Total Score (item 11) _____	Maximum score 6

VOCABULARY

Circle the word in the group which means the same as the word in capital letters above the group, as in the example.

Example: **EQUAL**

Excellent Uneven

Average **Same**

Copy

12. **DELICATE**

Flexible Tough

Decompose Fragile

Touch

13. **CAUTION**

Vigil Neglect

Courage Care

Despair

14. **ALLOW**

Permit Forbid

Refuse Help

Fallow

15. **PARTICLE**

Piece Full

Partial Point

Complete

16. **REGENERATE**

Erect General

Live Restore

New

VOCABULARY
Total Score (item 12- 16, one point each) _____ Maximum score 5

VALIDATION OF THE RQCST IN A GHANAIAN SAMPLE

NAMING

Name or write the names of these items:

17 _____

18 _____

19 _____

20 _____

NAMING	
Total Score (items 17- 20-, one point each) _____	Maximum score 4

ABSTRACT REASONING: SIMILARITIES & ANALOGIE

Circle one word or phrase on the right which describes **both** the words on the left.

Example:

Banana & Orange	Round	Color	Taste	**Fruit**	Buy Them
21. **Knife & Fork**	Plate	Out	Spoon	Cutlery	Eat
22. **Ruler & Scale**	Drawing	Cooking	Weighing	Straight	Measuring
23. **Nose & Tongue**	On Face	Taste	Talking	Sense Organs	For eating

Circle the word which completes the sentence.

Example:

Big is to Small as **Large** is to:

Enormous Short Huge Narrow **Little**

24. Spider is to Web as **Bird** is to:

Nest Egg Tree Fly Wing

25. Sun is to Heat as **Lamp** is to:

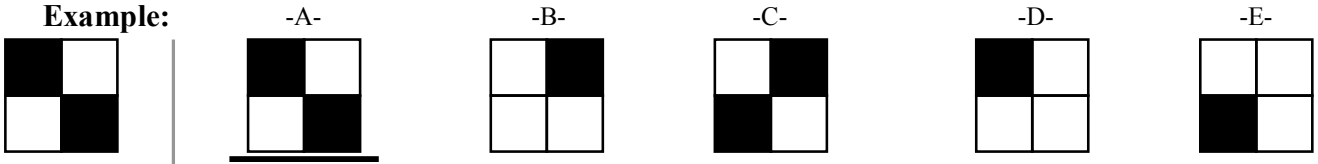
Flower Light Star Shadow Fire

ABSTRACT REASONING: ANALOGIES
Total Score (items 21 -25, one point each) _____ Maximum score 5

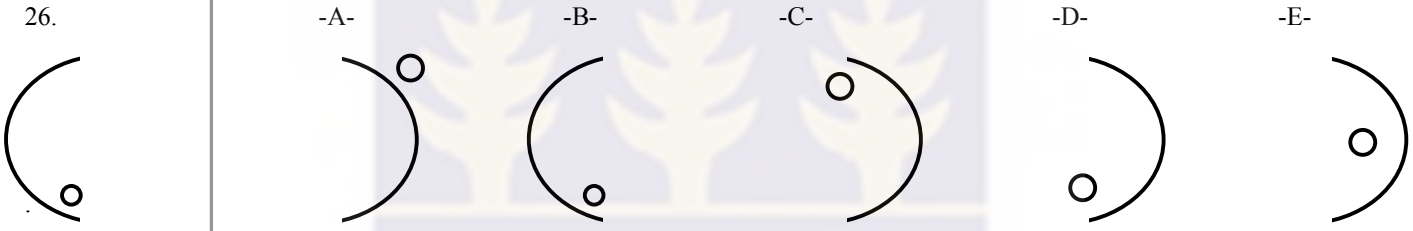
SPATIAL ORIENTATION

Point or underline the design on the right which is the same as the design on the left.

Example:

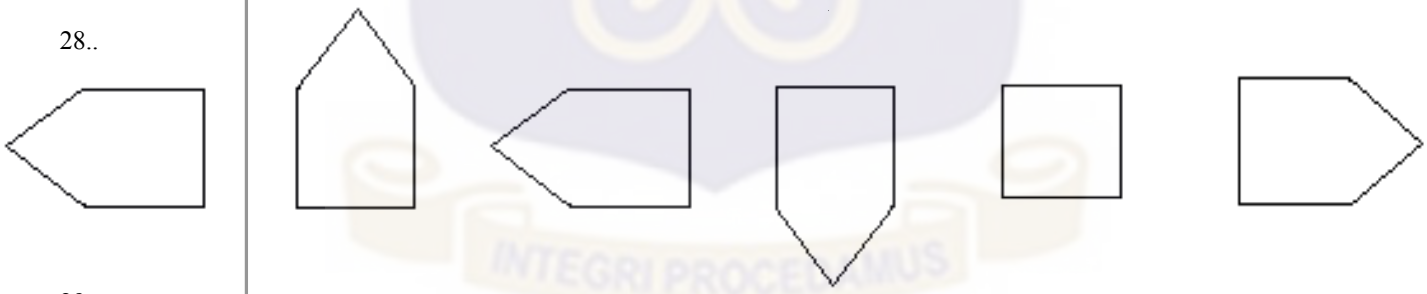


26.

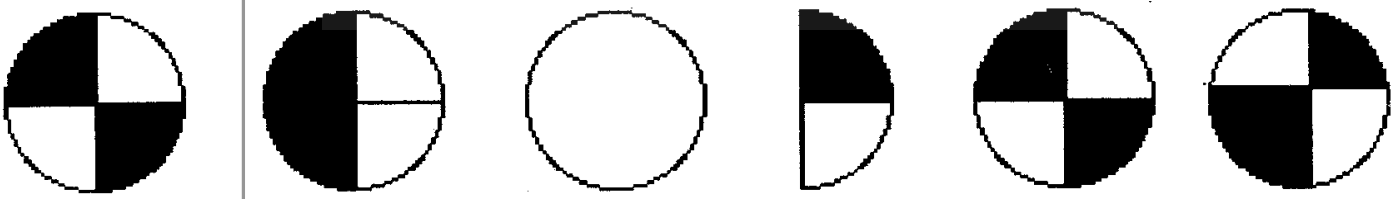


27.

28..



29..



SPATIAL ORIENTATION
Total Score (items 26- 29, one point each) _____ Maximum score 4

DELAYED RECALL (VISUAL)

30. I want you to draw the figures that you drew earlier.

Scoring: one point for each figure; one point for correct placement of each figure.

MEMORY: DELAYED RECALL (VISUAL)	
Total Score (item 31) _____	Maximum score 6

REVISED QUICK COGNITIVE SCREENING TEST, (RQCST)
(Modified Version)

Summary of Scores

Name: _____ ID/No.:

			Healthy Mean Score
Orientation			
1 -7	Orientation	_____ / 7	5.86 (.41)
Verbal Tests			
9	Arithmetic	_____ / 4	3.64 (.72)
12-16	Vocabulary	_____ / 5	4.28 (1.07)
17-20	Naming	_____ / 4	3.16 (.79)
21-25	Abstract Reasoning	_____ / 5	4.12 (.61)
Verbal Score		**_____ / 18**	16.81 (3.05)
Visual / Spatial / Constructional Tests			
8	Spatial Neglect	_____ / 4	2.73 (1.23)
10	Constructional Praxis	_____ / 6	4.90 (1.14)
11	Immediate Recall (Visual)	_____ / 6	4.73 (1.43)
26-29	Spatial Orientation	_____ / 4	3.98 (.47)
30	Delayed Recall (Visual)	_____ / 6	4.63 (1.23)
Visual / Spatial Score		**_____ / 26**	21.93 (3.86)
GLOBAL SCORE		**_____ / 51**	48.44 (6.15)

Tester's Signature: _____ Scoring Date:

REVISED QUICK COGNITIVE SCREENING TEST, (RQCST)

Name: _____ ID/No.:

Sex: _____ Handedness: _____ Diagnosis:

Age: _____ Date of birth:

Highest level of education completed:

Occupation:

Date tested: _____ Time tested: _____ AM / PM

Test given by:

General Comments:

Tester's Signature:

ORIENTATION

1. What time of day is it?
2. What day of the week is this?
3. What month is this?
4. What date of the month is this?
5. What year is this?
6. Where are you now?
7. What is your age?
8. What is your date of birth?
9. What is the name of the President?
10. Who was the President before him/her?
11. Write or say all the days of the week.

12. Write or say your full address.

ORIENTATION	
Total Score (items 1 – 12, one point each) _____	Maximum score 12

3

ATTENTION / CONCENTRATION (VERBAL)

13. I want to see how quickly you can count by threes, beginning with one, like this: 1, 4, 7, etc.

1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40

Errors: circle errors and record actual response.

Scoring: All correct = 2 points. One error = 1 point. Two or more errors = 0 points.

ATTENTION/CONCENTRATION (VERBAL)	
Total Score (item 13) _____	Maximum score 2

ATTENTION / CONCENTRATION (VISUAL)

14. How many dots are there in each set shown?

Number of dots _____

Number of dots

ATTENTION/CONCENTRATION (VISUAL)	
Total Score (item 14, one point each) _____	Maximum score 2

MEMORY: IMMEDIATE RECALL (VERBAL)

15. I am going to name some objects. When I am finished I want you to say them back to me.

pen watch tie car book

I want you to remember these words because I will ask you to repeat them back to me later.

MEMORY: IMMEDIATE RECALL (VERBAL)	
Total Score (item 15, one point each) _____	Maximum score 5

SPATIAL NEGLECT

16. Make a stroke through the middle of each line.

SPATIAL NEGLECT	
Total Score (item 16, one point per correct marking) _____	Maximum score 4

ARITHMETIC:

17. Do these arithmetic problems:

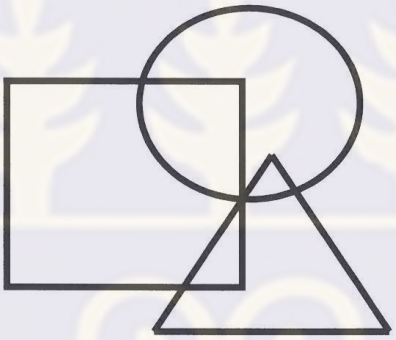
113	65	20	12)144
+ 113	-56	x 3	

ARITHMETIC	
Total Score (item 17, one point each) _____	Maximum score 4

5

CONSTRUCTIONAL PRAXIS

18. Copy this drawing:



Scoring: one point for each figure; one point for correct placement of each figure

CONSTRUCTIONAL PRAXIS	
Total Score (item 18) _____	Maximum score 6

6

MEMORY: IMMEDIATE RECALL (VISUAL)

19. Draw the same figures again.

Scoring: one point for each figure; one point for correct placement of each figure

MEMORY: IMMEDIATE RECALL (VISUAL)	
Total Score (item 19) _____	Maximum score 6

VOCABULARY

Circle the word in the group which means the same as the word in capital letters above the group, as in the example.

Example: **EQUAL**

Excellent Uneven

Average **Same**

Copy

20. **DELICATE**

Flexible Tough

Decompose Fragile

Touch

21. **CAUTION**

Vigil Neglect

Courage Care

Despair

22. **ALLOW**

Permit Forbid

Refuse Help

Fallow

23. **PARTICLE**

Piece Full

Partial Point

Complete

24. **REGENERATE**

Erect General

Live Restore

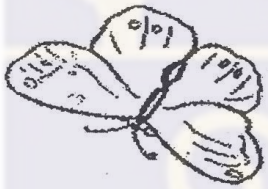
New

VOCABULARY	
Total Score (item 20 - 24, one point each) _____	Maximum score 5

NAMING

Name or write the names of these items:

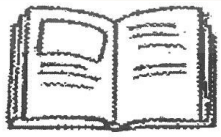
25. _____



26. _____

27. _____

28. _____



29. _____

NAMING	
Total Score (items 25 – 29, one point each) _____	Maximum score 5

ABSTRACT REASONING: SIMILARITIES

Circle one word or phrase on the right which describes **both** the words on the left.

Example:

Banana & Orange	Round	Color	Taste	**Fruit**	Buy Them
30. **Knife & Fork**	Plate	Out	Spoon	Cutlery	Eat
31. **Salt & Sugar**	Drink	Grow	Taste	Smell them	Eat them
32. **Ruler & Scale**	Drawing	Cooking	Weighing	Straight	Measuring
33. **Nose & Tongue**	On Face	Taste	Talking	Sense Organs	For eating

ABSTRACT REASONOING: SIMILARITIES
Total Score (items 30 – 33, one point each) _____ Maximum score 4

ABSTRACT REASONING: ANALOGIES

Circle the word which completes the sentence.

Example:

Big is to Small as **Large** is to:

Enormous Short Huge Narrow **Little**

34. Hand is to Glove as **Foot** is to:

Hat Cold Leg Shoe Coat

35. Spider is to Web as **Bird** is to:

Nest Egg Tree Fly Wing

36. Sun is to Heat as **Lamp** is to:

Flower Light Star Shadow Fire

37. Spring is to Summer as **Tuesday** is to:

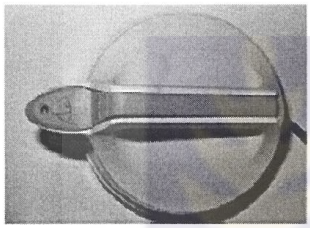
Wednesday Saturday Thursday Monday Friday

ABSTRACT REASONING: ANALOGIES
Total Score (items 34 – 37, one point each) _____ Maximum score 4

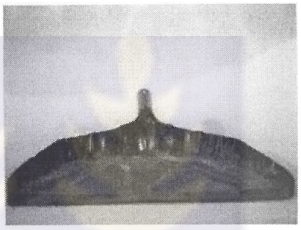
10

UNUSUAL VIEWS

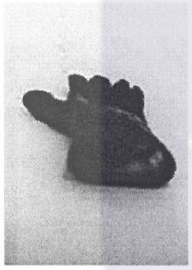
Identify or write the names of these objects:



38. _____



39. _____



40. _____

41. _____

42. _____

UNUSUAL VIEWS	
Total Score (items 38 – 42, one point each) _____	Maximum score 5

11

SPATIAL ORIENTATION

Point or underline the design on the right which is the same as the design on the left.

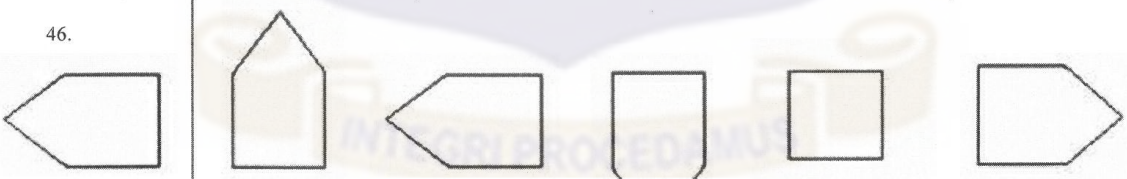
Example:

43.

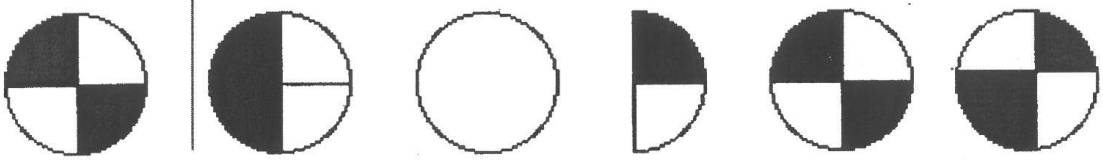
44.

45.

46.



47.



SPATIAL ORIENTATION	
Total Score (items 43 - 47, one point each) _____	Maximum score 5

12

MEMORY: DELAYED RECALL (VISUAL)

48. I want you to draw the figures that you drew earlier.

Scoring: one point for each figure; one point for correct placement of each figure.

MEMORY: DELAYED RECALL (VISUAL)	
Total Score (item 48) _____	Maximum score 6

MEMORY: DELAYED RECALL (VERBAL)

49. I want you to repeat back to me the five objects I named earlier.

MEMORY: DELAYED RECALL (VERBAL)	
Total Score (item 49, one point each) _____	Maximum score 5

13

MEMORY: NEW LEARNING

50. I am going to say a sentence to you. Listen carefully and when I am finished I would like you to repeat the sentence back to me **exactly** as I say it to you.

♦ (Tester Note: Repeat sentence up to 10 trials. Stop if testee obtains exact response.) ♦

"One thing a nation must have to be rich and great is a large secure supply of wood."

Trials:	1	2	3	4	5	6	7	8	9	10	>10
Score:	(10)	(9)	(8)	(7)	(6)	(5)	(4)	(3)	(2)	(1)	(0)

MEMORY: NEW LEARNING
Total Score (item 50) _____ Maximum score 10

REVISED QUICK COGNITIVE SCREENING TEST, (RQCST)
Summary of Scores

Name: _____ ID/No.:

Orientation

1 -12	Orientation	_____ / 12

Verbal Tests

13	Attention / Concentration (Verbal)	_____ / 2
15	Memory: Immediate Recall (Verbal)	_____ / 5
17	Arithmetic	_____ / 4
20–24	Vocabulary	_____ / 5
25–29	Naming	_____ / 5
30–33	Abstract Reasoning: Similarities	_____ / 4
34–37	Abstract Reasoning: Analogies	_____ / 4
49	Memory: Delayed Recall (Verbal)	_____ / 5
50	Memory: New Learning	_____ / 10
Verbal Score		**_____ / 44**

Visual / Spatial / Constructional Tests

14	Attention / Concentration (Visual)	_____ / 2
16	Spatial Neglect	_____ / 4
18	Constructional Praxis	_____ / 6
19	Memory: Immediate Recall (Visual)	_____ / 6
38–42	Unusual Views	_____ / 5
43-47	Spatial Orientation	_____ / 5
48	Memory: Delayed Recall (Visual)	_____ / 6
Visual / Spatial Score		**_____ / 34**

GLOBAL SCORE	**_____ / 90**

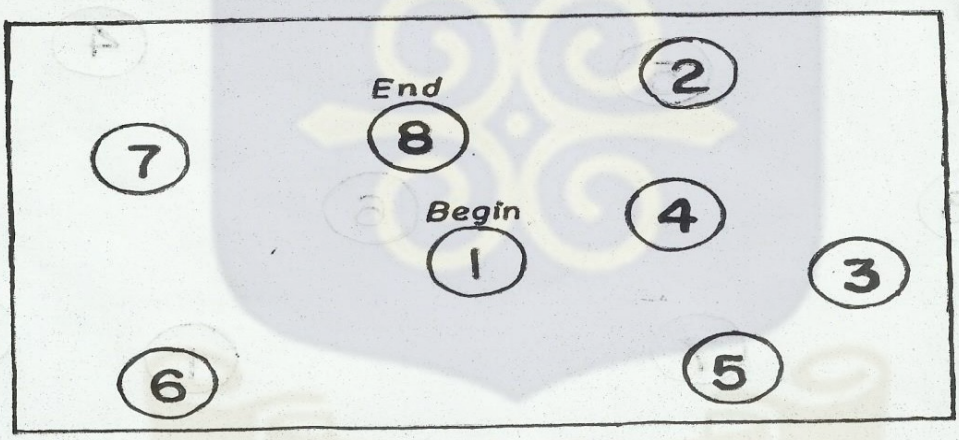
Scorer Signature: _____ Scoring Date:

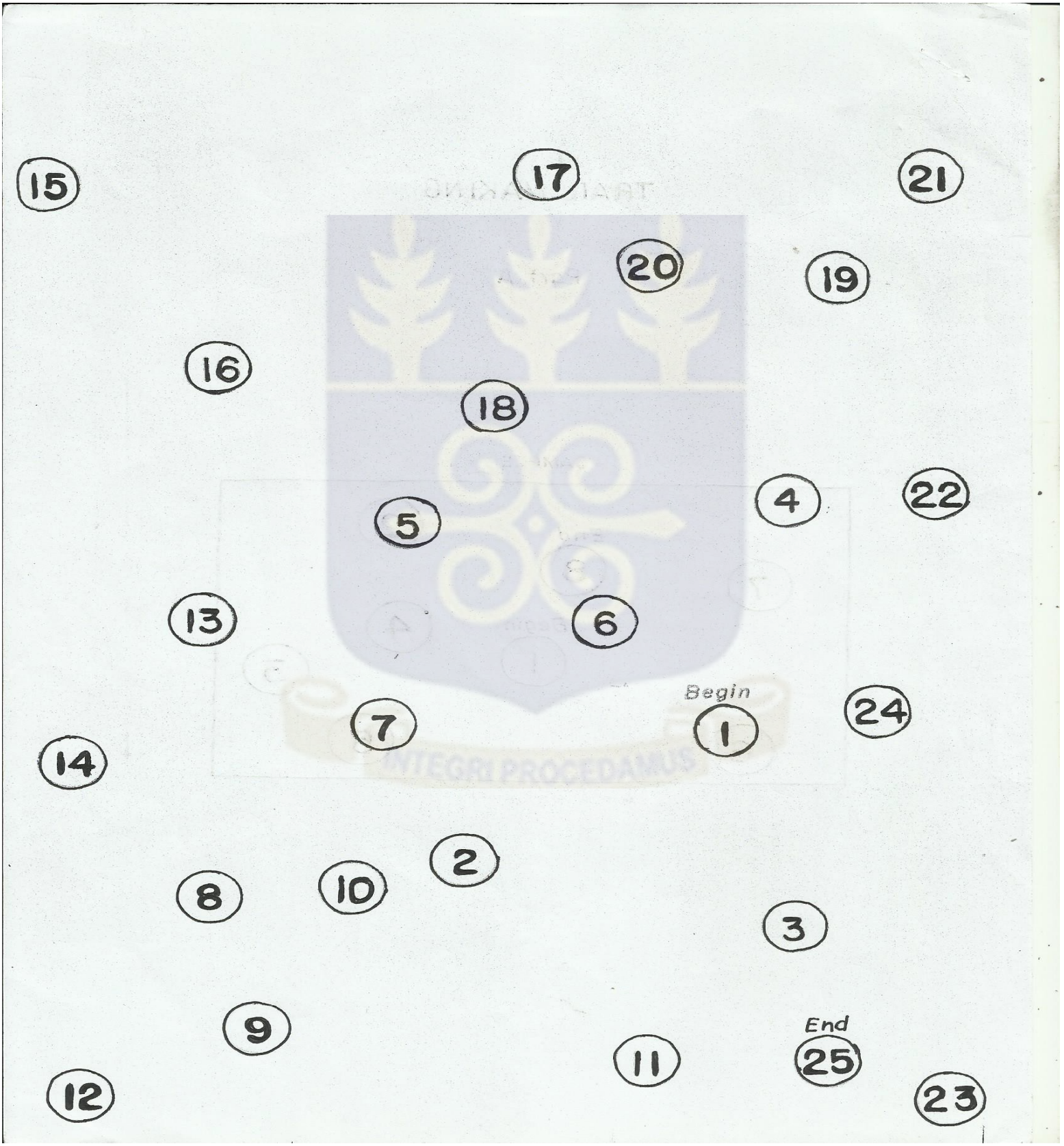
APPENDIX IV B

TRAIL MAKING

Part A

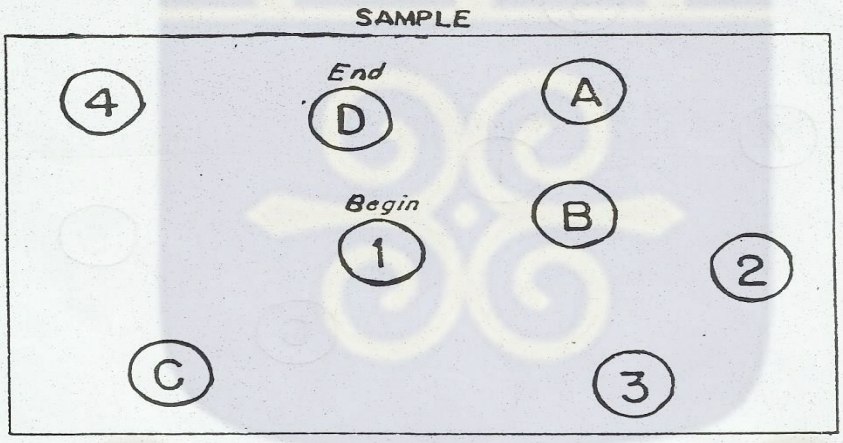
SAMPLE

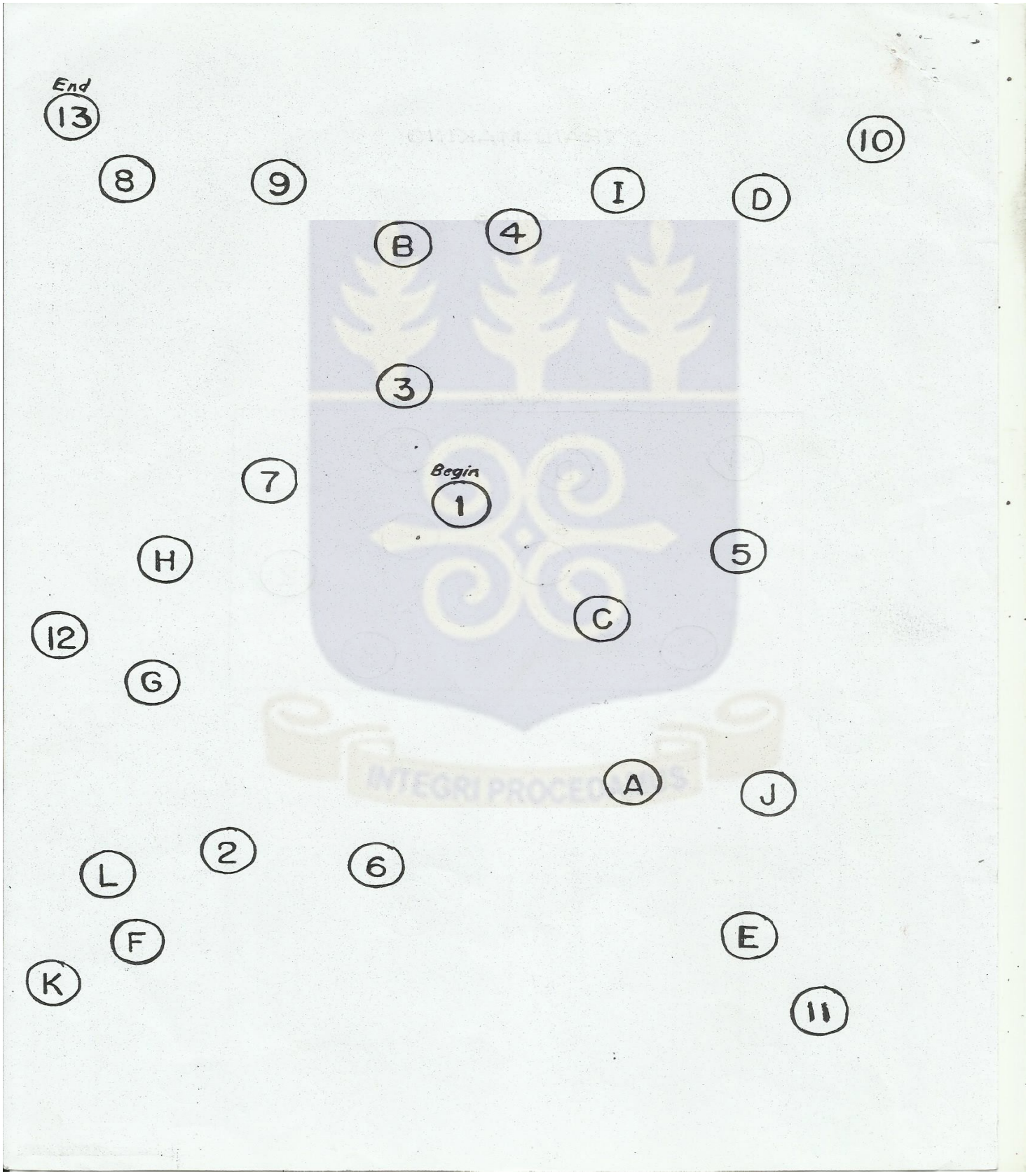




TRAIL MAKING

Part B





2. Similarities

Start
Ages 16–90:
Sample Item, then Item 4

Reverse
Score of **0** or **1** on *either* Item 4 or Item 5, administer preceding items in **reverse** order until two consecutive perfect scores are obtained.

Discontinue
After **3** consecutive scores of 0

Score
Score **0**, **1**, or **2** points.
See the Administration and Scoring Manual for sample responses.

	Item	Response	Score
16–90	S. Two – Seven		
	1. Fork – Spoon		0 1 2
	2. Yellow – Green		0 1 2
	3. Carrots – Broccoli		0 1 2
16–90	†4. Horse – Tiger		0 1 2
	†5. Piano – Drum		0 1 2
	6. Boat – Automobile		0 1 2
	7. Nose – Tongue		0 1 2
	8. Food – Gasoline		0 1 2
	9. Badge – Crown		0 1 2
	10. Bud – Baby		0 1 2
	11. Music – Tides		0 1 2
	12. Poem – Statue		0 1 2
	13. Anchor – Fence		0 1 2
	14. Wish – Expect		0 1 2
	15. Acceptance – Denial		0 1 2
	16. Always – Never		0 1 2
	17. Enemy – Friend		0 1 2
	18. Allow – Restrict		0 1 2

†If the examinee does not obtain a perfect score, provide corrective feedback as instructed in the Administration and Scoring Manual.

Similarities Total Raw Score
(Maximum = 36) ☐

1. Block Design

(Time limit: See item)

Start
Ages 16–90: Sample Item, then Item 5

Reverse
Score of **0** on *either* Item 5 or Item 6, administer preceding items in **reverse** order until two consecutive perfect scores are obtained.

Discontinue
After **2** consecutive scores of 0

Score
Items 1–4: Score **0**, **1**, or **2** points.
Items 5–8: Score **0** or **4** points.
Items 9–14: Score **0**, **4**, **5**, **6**, or **7** points.
BDN
Items 1–4: Score **0**, **1**, or **2** points.
Items 5–14: Score **0** or **4** points.

	Design	Presentation Method	Time Limit	Completion Time		Constructed Design		Score				
16–90	S. Examinee / Examiner	Model and Picture	30"	Trial 1	Trial 2	Trial 1	Trial 2					
	1.	Model and Picture	30"	Trial 1	Trial 2	Trial 1	Trial 2	0	1	2		
	2.	Model and Picture	30"	Trial 1	Trial 2	Trial 1	Trial 2	0	1	2		
	3.	Model and Picture	30"	Trial 1	Trial 2	Trial 1	Trial 2	0	1	2		
	4.	Model and Picture	30"	Trial 1	Trial 2	Trial 1	Trial 2	0	1	2		
16–90	5. Examinee / Examiner	Picture	60"					0		4		
	6.	Picture	60"					0		4		
	7.	Picture	60"					0		4		
	8.	Picture	60"					0		4		
	9.	Picture	60"					0	31–60: 4	21–30: 5	11–20: 6	1–10: 7
	10.	Picture	60"					0	31–60: 4	21–30: 5	11–20: 6	1–10: 7
	11.	Picture	120"					0	76–120: 4	61–75: 5	31–60: 6	1–30: 7
	12.	Picture	120"					0	76–120: 4	61–75: 5	31–60: 6	1–30: 7
	13.	Picture	120"					0	76–120: 4	61–75: 5	31–60: 6	1–30: 7
	14.	Picture	120"					0	76–120: 4	61–75: 5	31–60: 6	1–30: 7

Block Design No Time Bonus (BDN) Total Raw Score (Maximum = 48)

Block Design Total Raw Score (Maximum = 66)

3. Digit Span

Start
Ages 16–90:
Forward: Item 1
Backward: Sample Item, then Item 1
Sequencing: Sample Item, then Item 1

Discontinue
Forward: After scores of **0** on *both trials* of an item
Backward: After scores of **0** on *both trials* of an item
Sequencing: After scores of **0** on *both trials* of an item

Score
Score **0** or **1** point for each trial.
DSF, DSB, and DSS
Total raw score for Forward, Backward, and Sequencing, respectively
LDSF, LDSB, and LDSS
Number of digits recalled on last trial scored 1 point on Forward, Backward, and Sequencing, respectively

Forward

	Item	Trial	Response	Trial Score	Item Score
16–90	1.	9 – 7		0 1	0 1 2
		6 – 3		0 1	
	2.	5 – 8 – 2		0 1	0 1 2
		6 – 9 – 4		0 1	
	3.	7 – 2 – 8 – 6		0 1	0 1 2
		6 – 4 – 3 – 9		0 1	
	4.	4 – 2 – 7 – 3 – 1		0 1	0 1 2
		7 – 5 – 8 – 3 – 6		0 1	
	5.	3 – 9 – 2 – 4 – 8 – 7		0 1	0 1 2
		6 – 1 – 9 – 4 – 7 – 3		0 1	
	6.	4 – 1 – 7 – 9 – 3 – 8 – 6		0 1	0 1 2
		6 – 9 – 1 – 7 – 4 – 2 – 8		0 1	
	7.	3 – 8 – 2 – 9 – 6 – 1 – 7 – 4		0 1	0 1 2
		5 – 8 – 1 – 3 – 2 – 6 – 4 – 7		0 1	
	8.	2 – 7 – 5 – 8 – 6 – 3 – 1 – 9 – 4		0 1	0 1 2
		7 – 1 – 3 – 9 – 4 – 2 – 5 – 6 – 8		0 1	

LDSF (Max = 9)

Digit Span Forward (DSF) Total Raw Score (Maximum = 16)

Backward

	Item	Trial	Correct Response	Response	Trial Score	Item Score
16–90	S.	7 – 1	1 – 7			
		3 – 4	4 – 3			
16–90	1.	3 – 1	1 – 3		0 1	0 1 2
		2 – 4	4 – 2		0 1	
	2.	4 – 6	6 – 4		0 1	0 1 2
		5 – 7	7 – 5		0 1	
	3.	6 – 2 – 9	9 – 2 – 6		0 1	0 1 2
		4 – 7 – 5	5 – 7 – 4		0 1	
	4.	8 – 2 – 7 – 9	9 – 7 – 2 – 8		0 1	0 1 2
		4 – 9 – 6 – 8	8 – 6 – 9 – 4		0 1	
	5.	6 – 5 – 8 – 4 – 3	3 – 4 – 8 – 5 – 6		0 1	0 1 2
		1 – 5 – 4 – 8 – 6	6 – 8 – 4 – 5 – 1		0 1	
	6.	5 – 3 – 7 – 4 – 1 – 8	8 – 1 – 4 – 7 – 3 – 5		0 1	0 1 2
		7 – 2 – 4 – 8 – 5 – 6	6 – 5 – 8 – 4 – 2 – 7		0 1	
	7.	8 – 1 – 4 – 9 – 3 – 6 – 2	2 – 6 – 3 – 9 – 4 – 1 – 8		0 1	0 1 2
		4 – 7 – 3 – 9 – 6 – 2 – 8	8 – 2 – 6 – 9 – 3 – 7 – 4		0 1	
	8.	9 – 4 – 3 – 7 – 6 – 2 – 1 – 8	8 – 1 – 2 – 6 – 7 – 3 – 4 – 9		0 1	0 1 2
		7 – 2 – 8 – 1 – 5 – 6 – 4 – 3	3 – 4 – 6 – 5 – 1 – 8 – 2 – 7		0 1	

LDSB (Max = 8)

Digit Span Backward (DSB) Total Raw Score (Maximum = 16)

continue

15. Picture Completion (Time limit: 20 seconds)

Start
Ages 16–90: Sample Item, then Item 4

Reverse
Score of **0** on *either* Item 4 or Item 5, administer preceding items in **reverse** order until two consecutive perfect scores are obtained.

Discontinue
After **4** consecutive scores of 0

Score
Score **0** or **1** point.
See the Administration and Scoring Manual for sample responses.

Each of the following prompts can be provided ***one time only*** during subtest administration.

If the examinee names the pictured object instead of referring to or pointing to the missing part, say, **Yes, but what is missing?**

If the examinee refers to or points to a part that is off the page, say, **A part is missing in the picture. What is it that is missing?**

If the examinee refers to or points to an unessential missing part, say, **Yes, but what is the most important part missing?**

	Item	Completion Time	Verbal Response	Pointing Response	Score
16–90	S. Comb			PC PX	
	1. Table			PC PX	0 1
	2. Face			PC PX	0 1
	3. Mirror			PC PX	0 1
16–90	†4. Glasses			PC PX	0 1
	†5. Jogging			PC PX	0 1
	6. Knife			PC PX	0 1
	7. Pitcher			PC PX	0 1
	8. Roses			PC PX	0 1
	9. Pie			PC PX	0 1
	10. Cow			PC PX	0 1
	11. Gate			PC PX	0 1
	12. Trees			PC PX	0 1
	13. Lockers			PC PX	0 1
	14. Karate			PC PX	0 1
	15. Barn			PC PX	0 1
	16. Walking			PC PX	0 1
	17. Puddles			PC PX	0 1
	18. Shoes			PC PX	0 1
	19. Tent			PC PX	0 1
	20. Car			PC PX	0 1
	21. Bookshelf			PC PX	0 1
	22. Basket			PC PX	0 1
	23. Plane			PC PX	0 1
	24. Stove			PC PX	0 1

†If the examinee does not give a correct response, provide corrective feedback as instructed in the Administration and Scoring Manual.

Picture Completion Total Raw Score (Maximum = 24) ____

APPENDIX IV D

BOSTON NAMING TEST (SHORT FORM I)

NAME: _____ DATE: _____

	Without Cue	Stimulus Cue	Phonemic Cue
1) bed (a piece of furniture)			
2) pencil (used for writing)			
3) whistle (used for blowing)			
4) comb (used for fixing hair)			
5) saw (used by a carpenter)			
6) broom (used for cleaning)			
7) octopus (an ocean animal)			
8) hanger (found in a closet)			
9) camel (an animal)			
10) pretzel (something to eat)			
11) racquet (used for sports)			
12) volcano (a kind of mountain)			
13) seahorse (an ocean animal)			
14) globe (a kind of map)			
15) beaver (an animal)			
16) harmonica (a musical instrument)			
17) igloo (a type of house)			

18) dominoes _____/_____/_____
(a game)

19) escalator _____/_____/_____
(you go up in it)

20) hammock _____/_____/_____
(you lie in it)

21) pelican _____/_____/_____
(a bird)

22) stethoscope _____/_____/_____
(used by doctors and nurses)

23) funnel _____/_____/_____
(used for pouring)

24) noose _____/_____/_____
(used for hanging)

25) asparagus _____/_____/_____
(something to eat)

26) latch _____/_____/_____
(part of a door)

27) tongs _____/_____/_____
(a utensil)

28) sphynx _____/_____/_____
(found in Egypt)

29) trellis _____/_____/_____
(used in a garden)

30) protractor _____/_____/_____
(measures angles)

1) CORRECT WITHOUT CUE = _____

2) CORRECT WITH STIMULUS CUE = _____

3) CORRECT WITH PHONEMIC CUE = _____

TOTAL CORRECT (1 + 2) = _____/30

APPENDIX IV E

MODIFIED CARD SORTING TEST

#	MATCH		#	MATCH		#	MATCH		#	MATCH	
1			13			25			37		
2			14			26			38		
3			15			27			39		
4			16			28			40		
5			17			29			41		
6			18			30			42		
7			19			31			43		
8			20			32			44		
9			21			33			45		
10			22			34			46		
11			23			35			47		
12			24			36			48		

COMMENTS:

SCORE		2	3	4	5	6	TOTAL
CORRECT RESPONSES							
SURPLUS RESPONSES							
PERSEVERATIVE ERRORS							
NON-PERSEVERATIVE ERRORS							
ERRORS: PERS. & NON-PERS.							
# OF CATEGORIES = _____		% PERSEVERATIVE ERRORS (P/TE x 100) = _____					

APPENDIX IV F

REY-OSTERRIETH COMPLEX FIGURE TEST