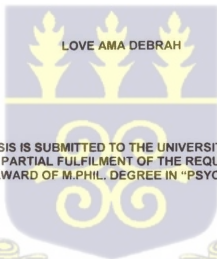


**STANDARDIZATION OF THE MULTIDIMENSIONAL  
APTITUDE BATTERY (MAB) IN GHANA**

**BY**



**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA,  
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THE AWARD OF M.PHIL. DEGREE IN "PSYCHOLOGY"**

**INTEGRI PROCEDAMUS**

**DEPARTMENT OF PSYCHOLOGY  
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LEGON**

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Dedicated to the memory of my father Benjamin Debrah. Proverbs 22:6 is true!

### DECLARATION

This thesis "Standardization of the Multidimensional Aptitude Battery (MAB) in Ghana is a study undertaken and submitted to the Department of Psychology for the award of the Master of Philosophy (M.Phil.) Degree in Clinical Psychology. Except for any references duly cited, it represents an original study, which has not yet been presented anywhere for the award of any degree.



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*Were the whole realm of nature mine  
That were an offering far too small  
Love so amazing so divine  
Demands my soul, my life, my all.*

*Love Ama Debrah*

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## ABSTRACT

This study reports an analysis of the performance of 449 non-clinical individuals on the Multidimensional Aptitude Battery (MAB). These were students ranging between the ages of sixteen (16) and thirty-four (34) years drawn from selected secondary and tertiary institutions in the Greater Accra Region of Ghana. The purpose of undertaking this work was first to provide Ghanaian norms for the Multidimensional Aptitude Battery (MAB). Further, to investigate the possible influence of age, and sex on each of the ten subtests of the MAB, the Verbal Scale, the Performance Scale and Full Scale. The results revealed that age and sex had an effect on performance on the MAB. Older subjects obtained significantly higher scores on Vocabulary, Comprehension, Verbal Scale and Full Scale. These are tests which relied more on experience and a vast store of knowledge. The findings support Cattell's theory that on tasks requiring fluid intelligence as opposed to crystallized intelligence, older people are at an advantage. Overall, the females obtained significantly higher scores than males. Males performed significantly better than females on the Spatial subtest, supporting previous findings. The observed difference between the performance of the Ghanaian and normative sample on the MAB confirm the fact that cultural issues affect psychological testing to a large extent. The general overall improvement in performance on the modified MAB and the subsequent formulation and generation of Ghanaian norms for the MAB have tremendous implications for clinical psychological practice in Ghana, and also in prediction of performance on the job and also for research in Ghana.

CHAPTER ONE  
INTRODUCTION

1. (1) Psychological Testing in Ghana

Since behaviour therapy was introduced in Ghana in 1972 (Danquah, 1982), the importance of the use of psychological tests has been on the increase. From a simple Form Board used to assess spatial ability, today various kinds of tests are used in psychological assessment in Ghana. Some of these are the Bender Visual Motor Gestalt Test, commonly known as the Bender-Gestalt Test, the Raven's Progressive Matrices (RPM), and the Wide Range Achievement Test (WRAT) among others. These play an increasingly important role in the daily practice of clinical and counselling psychologists in Ghana just like it is in all parts of the world where psychological practice is well-developed.

However there is a drawback in relying on these tests. Majority of the tests were developed in a different social environment, mainly the West. There is an absence of local norms in Ghana and the norms are most of the time not applicable. It can be argued that tests should be developed in Ghana with Ghanaian norms. The development of a new test involves a lot of work, money and time. It will therefore be unsafe for those who provide and benefit from psychological services in Ghana to wait till a purely Ghanaian test is developed. The way to address this problem in the interim therefore is to standardize existing tests with adequate psychometric properties. This is a

safer step to take as opposed to using tests that have not been standardized in the Ghanaian culture. For efficient use in Ghana therefore, psychological tests need to be standardized for the Ghanaian population. Ghanaian clinicians will then have full confidence in using these tests in their day to day practice.

Some tests have been standardized for Ghanaians. These include the Raven's Progressive Matrices (RPM) for children (Anum, 1996) and the Wechsler Intelligence Scale for Children-Revised (WISC-R) (Edwin, 2002). This is a good start and more work needs to be done to make psychological testing procedures more effective and culturally sensitive here in Ghana.

#### **1. (2) Historical Overview of Psychological Testing**

The fact that people differ in cognitive abilities, personality characteristics and behaviour, and that these differences can be evaluated in some way has been recognized since the dawn of human history. Plato and Aristotle wrote about individual differences nearly 2500 years ago, and even they were preceded by the ancient Chinese (Bowman, 1989; Doyle, 1974). As early as 2200 B.C., a civil service examination system was instituted by the Chinese emperor to determine if government officials were fit to perform their duties.

In the early part of the nineteenth century, individual differences in sensorimotor and mental abilities were viewed generally by scientists as more of a nuisance than anything else. Stimulated by the writings of Charles Darwin

on the origin of species and by the emergence of scientific psychology, interest in the study of individual differences grew during the latter half of the nineteenth century. During the last quarter of the nineteenth century Gustav Fechner, Wilhelm Wundt, Herman Ebbinghaus and other experimental psychologists demonstrated that psychological phenomena could be described in quantitative terms. Events occurring in France and the United States were also important to psychological testing. The research of French psychiatrists and psychologists on mental disorders influenced the development of clinical assessment techniques and tests, and the increased attention given to written examinations in American schools resulted in the development of standardized measures of scholastic achievement (see Aiken, 2000).

As is true of the history of any field, many people in a number of countries played significant roles in the pioneering phase of mental measurement in the late 1800s. These included Francis Galton, James Mc Keen Cattell and Alfred Binet. It was Alfred Binet who in 1905 developed the first mental abilities test later to be called intelligence tests. Since then many psychological tests have been developed. These tests serve many useful purposes in psychological practice. Since the 1920s, the field of psychological testing has grown rapidly and hundreds of tests are now produced and distributed commercially all over the world. In clinical practice for instance psychological tests play a very integral role. A diagnosis for a client is usually made after adequate assessment has been undertaken by a clinician. The assessment process usually involves the administration of a psychological test. Assessment is

undoubtedly one of the solid blocks of work in the field of Clinical Psychology, and since psychological tests are one of the main tools used in the assessment process, their importance cannot be overlooked.

Anastasi and Urbina (1997) defined a psychological test as "an objective and standardized measure of a sample of behaviour". As Davison and Neale (2001) pointed out, psychological tests are standardized procedures to measure a person's performance on a particular task or to assess his or her personality. They can be classified as standardized or non-standardized, individual or group, speed or power tests, objective or non-objective, cognitive or affective, or according to the task or content presented to examinees. There are different types of psychological tests. There are personality tests, intelligence tests, aptitude tests, achievement tests, and interest tests among others.

### 1. (3) The Role of Psychological Testing

The main purpose of psychological testing is to evaluate behaviour, cognitive abilities, personality traits and other individual or group characteristics in order to assist in making judgments, decisions and predictions about people. In clinical practice, psychological testing provides supplementary information in arriving at a diagnosis in particular, where the results of a diagnostic interview are inconclusive. Psychological tests may enhance the process of assessment. More specifically, tests are used for the following purposes.





- (i) To screen applicants for jobs and educational training programmes
  - (ii) To diagnose and prescribe psychological and physical treatments in clinics
  - (iii) To evaluate cognitive, interpersonal and intrapersonal changes due to educational, psychotherapeutic and other behaviour intervention programmes
  - (iv) To classify people in educational and employment contexts
  - (v) To counsel and guide individuals for vocational, educational and personal counselling purposes
  - (vi) To retain or dismiss, promote and rotate students or employees in educational and training programmes and on-the-job situations
  - (vii) To conduct research on changes in behaviour over time and evaluate the effectiveness of new programmes or techniques.
- (Aiken, 2000).

Because of the widespread nature of its use, psychological tests need to possess certain qualities so that test users can derive the maximum benefits out of them. Before a test can be used with some assurance that it is an accurate measure of the psychological construct that it is supposed to measure, it must be both reliable and valid (Anastasi & Urbina, 1997). Therefore, before any test can be administered, its psychometric properties must be verified.

The reliability of a test is the extent to which that test measures anything consistently. A reliable test is relatively free from errors of measurement, so

the scores obtained on the instrument are close in numerical value to the true scores of examinees. There are four types of reliability. These are test-retest reliability, alternate forms reliability, split-half reliability and internal consistency reliability. Test-retest reliability reveals the extent to which scores on a particular test can be generalized over different occasions. According to Anastasi and Urbina (1997) repeating the identical test on a second occasion is the most obvious method for finding the reliability of test scores. High reliabilities mean that test scores are less likely to be affected by random daily changes in the condition of the test takers or of the testing environment. Alternate-form reliability assesses the extent to which two different forms of the same test yield similar results (Walsh & Betz, 1995). The use of alternate forms of a test is one way to avoid problems of test-retest reliability. A test qualifies to be an alternate form of another only if it is truly parallel in every way. There must be equivalence in the number of items, time limits, instructions, range and level of difficulty, type of content, examples, format, and expression of items.

Split-half reliability involves the division of a test into two equal halves and examining the relationship between the two-half scores. It is a relatively simple method of assessing the degree to which test items are measuring an attribute in a relatively consistent manner. This approach is conceptually similar to alternate forms. For best results, one must ensure that the test items in both halves are similar. The reliability of each half test is given by the correlation between the two half-scores. According to Cureton (1965), the more items in a test, the more reliable it will be. Internal consistency

reliability/inter-item consistency /homogeneity is the extent to which an individual's performance on one item is related to his responses on all other items in the test.

The validity of a test is the extent to which it measures what it was designed to measure. Validity can be assessed in several ways: by analysis of the test's content (content validity), by relating scores on the test to a criterion (predictive and concurrent validity), and by a more thorough study of the extent to which the test is a measure of a certain psychological construct (construct validity).

A test's construct validity is the extent to which it measures a particular construct, or a psychological concept such as achievement, motivation, anxiety, or intelligence. Many different kinds of information contribute to establishing the construct validity of a psychological instrument. This may be from rational or statistical analyses of the variables assessed by the instrument, and studies of its ability to predict behaviour in situations where the construct is known to be operating. An instrument possessing construct validity should correlate highly with other measures or methods measuring the same construct (convergent validity) and have low correlations with measures of different constructs (Campbell & Fiske, 1959).



#### 1. (4) Standardization of Psychological Tests

Before any psychological test developed for a particular set of people is administered on people with a different culture, it must first of all be standardized. Any standardized test has standard instructions for administration and scoring that should be followed closely, leaving little room for personal interpretation or bias. Standardization of a test involves administering the test to a large sample of people (the standardization sample) selected as representative of the target population of persons for whom the test is intended. This representative of the target population must have the characteristics of the target population to qualify to be used as the standardization sample. The raw scores obtained from this testing are converted to some form of standard scores or norms which are then used as reference anytime the test is used. Norms are a list of scores and the corresponding percentile ranks, standard scores, or other transformed scores of a group of people on whom a test has been standardized. Examples of such norms are Wechsler's (1981) norms for the WAIS—R and Jackson's (1984) norms on the MAB. Without standardization, comparison of the scores of people taking a test on different occasions is unfair, and without norms, it is impossible to tell if a score is high, low or average.

#### 1. (5) Intelligence Testing

Many definitions of the term "intelligence" have been offered. Some expert psychologists attending a symposium sponsored by the *Journal of Educational Psychology* in 1912 gave different definitions for this term. Some

of the definitions that are reported by Rybash, Roodin, & Hoyer (1995) are "the ability to carry on abstract thinking", "the ability to give true or factual responses", and "the capacity to acquire new abilities". These definitions were given by Terman, Thorndike and Woodrow respectively. (See Rybash, Roodin, & Hoyer, 1995:127) Other definitions given later are "the ability to learn and profit from experience" and "the ability to think or reason abstractly" (Stenberg, 1981, 1992). "the application of cognitive skills and knowledge to learn, solve problems and obtain ends that are valued by an individual or a culture" (Gardner, 1983). In general, it is a term for a person's abilities in a wide range of tasks, including vocabulary, numbers, problem solving, and concepts. It may also include the ability to profit from experience, to learn new information, and to adjust to new situations (Aiken, 2000). Stimulated to a large extent by progress in computer technology and research on artificial intelligence, some other psychologists have conceptualized intelligence in terms of attentiveness, information processing and planning (Das, Naglieri and Kirby 1994). Intelligence may therefore be defined generally as the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment (Wechsler, 1958).

Measuring psychological qualities such as intelligence remains controversial. Many psychologists have attempted to provide methods by which intelligence can be measured. In 1908, Binet developed the concept of Mental Age (MA)—derived by comparing a person's test score with the scores of others within different specific age groups, and Chronological Age (CA)—a person's actual age. A few years later, William Stern, a German psychologist

developed a formula to avoid the fractions that arose when comparing a person's Mental Age and Chronological Age in months. This yielded a score he called intelligent quotient (IQ). Stern's formula— $(MA/CA) \times 100 = IQ$ —gave a rough index of how bright or dull any child was in comparison with his/her peers.

Using IQ as a type of norm has however virtually disappeared in modern times. Other forms of norms such as age norms (as given in the Wechsler scales), grade norms (as in the Bender Visual Motor Gestalt Test), and percentile norms (as in the RPM), are now used depending on what an examiner is looking out for, and also the type of comparison that is to be made. For the purposes of determining one's level of intelligence however, the term IQ is used on a few occasions in this work.

According to the Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition (DSM-IV) of the American Psychiatric Association (1994), a person's adaptive functioning (for example, the ability to dress, and work) is also considered in evaluating mental retardation. Thus, it is obvious that measuring intelligence can be a real cumbersome task (DSM-IV, 1994, Kamphaus, 1993). The first component of the DSM-IV definition requires a judgement of intelligence. This component is 'Learning Disorders' under which is listed Reading Disorder, Mathematics Disorder and Disorder of Written Expression. According to Robert Glasser, we should remember that tests are "limited tools for limited purposes" (see Coon, 1995, 469).

### 1. (6) Theories of Intelligence

A number of psychologists have in the past postulated some theories to explain what intelligence is all about. Notable among these are Spearman's Two Factor Theory of intelligence and Cattell's theory of intelligence. Spearman (1927) proposed that intellectual abilities comprise two factors. These are the general or common ability known as the 'g' factor, and the group or specific ability known as the 's' factor unique to the particular task.

The 'g' factor has the following characteristics:

- (i) it has universal inborn abilities,
- (ii) it is general mental energy,
- (iii) it is constant in that for any individual, in respect of all the correlated abilities, it remains the same.
- (iv) amount of 'g' differs from individual to individual.
- (v) it is used in everyday life activity and the greater the 'g' in an individual, the greater the success in life

The 's' factor on the other hand is learned and acquired in the environment. It varies from activity to activity in the same individual, and individuals differ in the amount of 's' ability.

### 1. (7) Statement of the Problem

Clinical Psychologists continue to do assessment daily during the course of their practice. The cultural background of the person taking a test is very important in psychological testing (Dana, 1995). In order to yield results that will best reflect a person's ability, test items must reflect a test taker's social,

economic and cultural background/setting (Anum, 1996). A standardized test with Ghanaian norms is therefore needed here in Ghana. This will ensure that people are not judged unfairly/wrongly when tests are administered to them.

#### **1. (8) Major Objective of the Study**

The main objective of the study is to collect and provide normative data on the Ghanaian population for the Multidimensional Aptitude Battery (MAB) (Jackson, 1984).

#### **1. (9) Aims of the Study**

This standardization work of the MAB in Ghana is principally to provide a readily-available cognitive assessment tool which covers all areas of intellectual functioning incorporating both verbal and performance scales in one. This will give psychologists, especially clinical psychologists in Ghana more options of assessment tests and especially, a test whose results can be reliable and valid within the Ghanaian population. This work also aims at examining the effect of age and sex on performance on the MAB.

#### **1. (10) Justification for the study**

The cross-cultural issues in test use makes this study ultimately necessary in this period when the practice of Psychology is gaining firmer and firmer

grounds in the country. At least two major issues should be considered in the use of cross-cultural tests.

The first one is that when testing people whose culture is different from that of a particular test, the possible influences of different cultures on both test performance and the meanings of various attributes and behaviours must be considered. Tests of behavioural capabilities and personality may be of particular concern because they inevitably involve assumptions about appropriate or psychologically healthy versus less appropriate behaviours and characteristics. For example, the behaviour of assertiveness in some cultures might be viewed as inappropriate vis-à-vis at least some other people (for example, one's elders), yet to be considered appropriate in other cultures, especially in the typical Ghanaian culture. A second issue is whether or not a test has been translated to other languages or cultural usages, for example, making sure a test developed in America is revised to incorporate English language usages common in Ghana.

There is a lot of discrimination against minority through cultural bias which is manifest in three ways (Walsh & Betz, 1995). These are content bias, bias in the internal structure of a test, and selection bias. Some tests also have gender bias. Content bias is when the content of a test favours people of one culture than another. Bias in the internal structure of a test occurs when the internal structure of a test and the behaviour of items in relation to each other (that is, internal consistency) differ across cultural groups. This is because the test will then be measuring different things across the different groups of test

takers. Selective bias is when a test has different predictive validities across groups. For example, "just because SAT predicts the performance of white middle class students does not mean it predicts the performance of blacks or lower class individuals" (see Walsh et. al., 1995: 410) Some critics (Garcia, 1979; Weinberg, 1989) are of the view that IQ tests and other standardized tests such as the SAT are designed to justify the perpetuation of social inequality.

#### 1. (11) Relevance of the Study

It is obvious that the best way to assess a person to come out with reliable diagnostic or predictive results, is to use a test that has norms based on a population possessing characteristics which are the same or similar to that of the test taker. It is therefore necessary to standardize a test to be used in Ghana. There are many tests that have been used world-wide and that have proven over the years to have good psychometric properties—the basic ones being reliability and validity. Therefore, instead of going out to design a new test all together—an event which will invariably take a long time, not to talk of the risk of still using unstandardized tests while we wait—it will be a wise decision to standardize an already-existing test so the assessment process can still continue with minimal hindrances. Subjects taking the MAB will be familiar with the context thereof and this familiarity alone will set them at ease as they work through the sessions. This will place test takers in a position to give their best unlike when the context of the test is not familiar.



The successful completion of this standardization work will provide psychologists in Ghana with a fully standardized cognitive and intellectual assessment tool which will be useful not only to clinical psychologists, but all psychologists who do any form of cognitive and intellectual assessment. A standardized group test for employee selection as well as for research will also be available in the country

## CHAPTER TWO

### LITERATURE REVIEW

It has been established that psychological testing has come a long way in helping psychologists render effective and efficient services worldwide over the years. It has also been established that these test do not stand alone, but contribute greatly to a complete assessment. It follows that there is also the possibility of a great risk in relying solely on test data for diagnosis, to answer referral questions or to predict a person's future performance. This is because individuals differ in many ways, and there are other cohort factors that affect one's performance on a test. Some of the issues that affect people's performance on standardized tests are culture, gender, level of education and age. These are discussed in this chapter.

#### **2. (1) Cultural Factors in Psychological Testing**

The term "culture" refers to the values, behaviours, attitudes and products of a particular group of people (Rybash, Roodin & Hoyer, 1995). The culture of Ghana, South Africa and Korea for instance represent different belief systems, languages, dialects, rituals and daily life. Intelligence may be culturally defined. If the function of intelligence is to help individuals manage the tasks they confront in their lives, then intelligent behaviour is likely to vary cross-culturally, since the circumstances that confront members of one society differ markedly from those of another. For instance the Spanish

equivalent of intelligence is 'istura' but Guatemalan parents who consider children 'isto' or intelligent use the term to describe attributes such as high physical ability and independence, as well as alertness, good memory and verbal skills (Klein, Freeman, Spring, Newlove, & Yarborough, 1976).

Cultures guide their members in efficient ways of solving everyday problems, and these strategies become part of the way individuals think (Vygotsky, 1978; Wertsch & Kanner, 1992). The attributes a culture considers intelligent are not arbitrary. The personal qualities, skills and cognitive style a culture values tend to be integrally related to that culture's ecological context, modes of subsistence and social structure (Mistry & Rogoff, 1985).

Western views of intelligence emphasize verbal skills (such as ability to comprehend a written passage) and the kinds of mathematical and spatial abilities useful in engineering or manufacturing, which makes sense in a literate, technologically developed capitalist society (Westen, 1996). In most African cultures however, intelligence tends to be defined in terms of practical abilities and competences (Serpell, 1989). For instance, observers have commented on the almost encyclopaedic knowledge of animal behaviour possessed by some members of the !Kung ethnic group of Africa's Kalahan Desert, which is adaptive for the people who must hunt and avoid dangerous animals (Blurton-Jones & Konner, 1976). Cultural groups who depend on the sea for their livelihood often show an extraordinary ability to remember relevant landmarks or calculate locations in navigating the ocean (Gladwin, 1970).

Is intelligence then a property of individuals, or is it simply a social construction or value judgment? To put it another way: is intelligence solely 'in the eye of the beholder'? Probably not. Some attributes such as mental quickness or the ability to generate solutions when confronted with novel problems, are valued in any culture. Moreover, among cultures at a similar level of technological development, concepts of intelligence tend to have shared elements because demands on individuals are similar.

For people from culturally different backgrounds, assessment in which a test has unfamiliar/unfavourable cultural context provides a dramatic underestimate of potential levels of performance that could be achieved under more favourable circumstances (Brown & Campione, 1986). López Grover, Holland, Johnson, Kain, Kael and Mellins, (1989) found out that majority of students in doctoral programmes are not trained to administer tests using culturally-acceptable styles of delivery that is suitable for ethnic minority clients. Failure to incorporate culture-specific tests into the assessment curriculum has further reduced the likelihood that acceptable services will be provided to minorities. This implies cultural incompetence. This results in not only faulty diagnosis, but also as Dana (1995) puts it "caricature and distortion of personality description by minimizing differences and stereotyping client behaviours". He identified four major conditions that prevail when test results are interpreted based on a variety of non-verbalized expectations and preconceptions for client responsibility to the standard assessment process and tests. These are what he termed 'distortion', 'pathologization', 'caricature' and 'dehumanization'.

'Distortion' involves the unwitting distortion of information contained in test protocols that may occur on the basis of an often acknowledged belief that all persons should be assimilated as Americans so that historic differences and ethnicity are blurred "in the melting pot of the United States". 'Pathologization' is the interpretation that renders a person being assessed more disturbed than he actually is. 'Caricature' is a distortion of a person's personality and/or psychopathology that occurs as a result of stereotypy. For example co-dependence which may be an evidence of disturbance by Anglo-Americans may simply be an allocation of responsibility to others other than an unwillingness or inability to assume personal responsibility by many others (Li Repac, 1980). 'Dehumanization' is the application of personality theory developed in one culture to persons in another culture. A culture-fair test should therefore have both content and mode of administration favouring the particular culture of the person being tested.

Since the days of the Army Alpha in the early eighteenth century, intelligence tests have undergone a lot of revision to eliminate cultural bias (Westen, 1996). Some psychologists argue that intelligence tests and aptitude tests continue to favour the dominant white middle class (Darou, 1992; Elliott, 1988; Schiele, 1991). IQ is strongly correlated with socioeconomic status (Anum, 1996). This means poor and lower class people tend to receive lower scores than those who are wealthier. Since IQ scores are used to place students in different academic tracks, to determine what school one will attend, such tests may "legitimize the process of keeping the privileged privileged while closing the door to the disadvantaged" (Westen, 1996: 305).

Tests that may seem culture-free often carry hidden biases. An example is the task of categorizing geometric stimuli according to colour and shape, which appears frequently in standardized intelligence tests. This task requires no language and hence seems not to depend on familiarity with cultural artefacts that are typically North American. It can however be quite confusing to non-literate Liberians for instance, who have no experience with abstract geometrical figures taken out of context and reproduced on paper (Irwin & McLaughlin, 1970). North American undergraduates on the other hand, asked to categorize leaves according to whether they come from vines or trees perform much more poorly than non-literate Liberians (Cole, Gray, Glick & Sharp, 1971).

Another area of hidden bias is in the use of timed tests. Intelligence and achievement tests impose strict time limits on answering questions. Although this may tap a universal feature of intelligence, namely, how quickly a person can think, it also reflects the cultural emphasis on speed characteristic of the advanced capitalist societies that created intelligence testing. The ability to work fast is of great importance to a manufacturing economy where profit margins depend on rapid production (Anastasi & Urbina, 1997). On the contrary, many traditional cultures place less value on quick and independent thinking and rather prefer slow deliberation and collective decision making (Berry, Poortinga, Segall & Dasen, 1992)

Also, in assessing subcultures within multicultural societies, such as the US and Canada, intelligence tests may pose some problems. This is because

many questions rely on knowledge that is more familiar to some groups than others (Stewart, 1969).

Do we therefore conclude that intelligence tests are totally useless, invalid or dangerous? Certainly not. Comparing the scores of members of different subcultures may be problematic; but comparing the scores of members of a similar background has proven quite helpful in achieving the aims of psychological testing. For example, IQ and SAT scores are just as predictive of school success within African-American samples as within white samples. This is to say that an African-American with a high score will most probably perform better than one with low scores (Anastasi, 1988), and the same goes for whites.

Despite their biases, intelligence tests do evaluate areas of intelligence that are needed by a literate industrial society. Some of these areas are "the ability to think abstractly, to reason with words, and to perceive spatial relations quickly and accurately" (See Westen, 1996: 307). In choosing and administering tests, as well as interpreting test results therefore, one must take into consideration all the cultural issues that could potentially affect a person's performance on psychological tests.

## 2. (2) Sex Differences in Cognition

It has been observed that the performance of males and females on cognitive tasks differ remarkably. According to Halpern (1992), developers of psychological tests do their best to eliminate any possibility of gender differences in tests. This however does not suggest that there is no difference in cognitive performance of males and females. Maccoby and Jacklin (1974) in their review of literature on sex differences, identified three kinds of cognitive abilities that appear to show reliable gender differences. These are verbal abilities, visual-spatial abilities and quantitative abilities. Males tend to be superior in mechanical reasoning, spatial ability and mathematical ability while females are superior in language ability, Home Economics, typing and the like. In a recent cross-sectional cross-cultural study on visual-spatial performance, the overall male superiority in spatial tasks was confirmed by Amponsah (2000), which also corroborated the basic findings of Linn and Petersen (1985).

Given such differences, are there biological differences in the central nervous system that produce sex differences in the ability to perform particular intellectual tasks? Halpern (1992) found that there is no overall difference in the intelligence of males and females as measured by intelligence tests. When processing abilities are examined more closely however, there are some small differences. When differences are found in verbal ability—that is word fluency, grammatical competence, spelling skills, reading, vocabulary and oral comprehension, females display a slight advantage. Dysfunctions in verbal abilities such as stuttering and dyslexia are identified more frequently in

males. Verbal impairment following a stroke is also more likely for males than females (Halpern 1992). Hyde and Linn (1988) reviewed many studies (165 of them) on differences in verbal abilities in males and females using meta analysis and pointed that the effect size of the difference between the scores of males and females in verbal ability (mean  $d = .10$ ) is negligible, hence concluded that there is no gender difference in verbal abilities. In this work however, gender differences in verbal abilities will be addresses as a matter of interest and also, the effect size will be compared to that of Hyde and Linn's (1988) review.

There have been many attempts at explaining why males and females differ in cognitive abilities. At the centre of it all is the age-old nature-nurture debate. One school of thought attributes these differences to nature/biological factors, that is to say, sex differences in cognitive ability are biologically determined. They believe that these differences are inherited and that males and females are genetically predisposed to different cognitive abilities, therefore nurture or the environment plays a little role in accounting for these differences. The biological factors are those that talk about females being more genetically predisposed to perform better in verbal tests than males.

The other school of thought attributes the differences to nurture, that is to say, these differences are caused by a person's experience in life, his environment and learning (Serbin, Zelkowitz, Doyle & Gold, 1990). Other studies such as those by Alington, Leaf and Morgan, (1992), Halpern, (1992) believe that sex roles are manifest in society as a result of the different socialization

experiences that males and females undergo, hence nature plays a little role in accounting for sex differences in cognitive ability.

The observed sex differences in spatial performance for instance can be explained by gender-based socializations, practice, experience, and efficacy beliefs. Practice with spatial tasks is linked to spatial task performance (Baenninger & Newcombe, 1989) and the experience that provides such practice is common for boys (Stericker & Le Vesconte, 1982). For example, leisure practice in woodworking and model building may lead males to academic courses that necessitate employment of such skills. This leads to male-dominated professions where they can further use their special aptitude (Newcombe, Bandura & Taylor, 1983; Voyer, Voyer & Bryden, 1995).

Parents' conceptions of gender-related abilities of men and women and their consequent gender-linked beliefs about their children serve as mechanisms by which children come to understand and learn how to behave. Females therefore tend to perceive themselves as not being as efficient in the performance of spatial tasks as males (Eagly, 1987; Johnson & Lewman, 1990, Jacobs & Eccles, 1992).

Halpern (1992) summarised the theories used to explain the potential causes of sex differences in cognition. These are the biological theories and the psychosocial theories. The biological theories attribute these differences to the menstrual cycle, sex hormones, and the fact that males have more clearly lateralized brains than females do. The psychosocial theories state that males

and females are treated differently from the moment they are born. Then parents, television, teachers, and the members of one's community all contribute to stereotyping.

### 2. (3) Age and intelligence

The effect of age on intellectual functioning is a very important issue to most people because most people desire to remain 'in control' all their lives, even through old age, till they die. Many studies have been done and there are still on-going researches into the influence of age on intellectual performance (Hom, 1982b; Schaie, 1983, 1991, 1994). Gerontologists have found that the overall decline in intelligence scores with age is very small. They estimate that only 25% of old people's disability is medically based, 75% is social, political and cultural (See Coon, 1995). Longitudinal studies of intelligence indicate some increase in IQ scores at least through the 20s and no actual decline till about age 60. Scores however increase among better-educated people (Bray & Howard, 1983; Cunningham & Owens, 1983; Schaie, 1983).

Schaie (1994) has suggested that although fluid abilities (those requiring speed or rapid learning) may decline with age, many crystallized abilities, for example vocabulary and stored up knowledge actually improve—at least into the 60s. This therefore means that people's scores on tests of vocabulary and knowledge of information improves systematically as a function of age. Clarke and Gardner (1990) found that older subjects (sixty years and above) are slower than younger subjects, but not necessarily error-prone.

According to Schaie (1994), the probability that one can remain mentally alert in old age is very high if one remains healthy, has a flexible personality, is married to a smart spouse, maintains one's perceptual speed, lives in a favourable environment (have education, an intact family) and is involved in intellectually-stimulating activities (for example, reading, travel, cultural events, continuing education, clubs, professional associations, and the like). Those above sixty-five (65) years score high on intellectual tasks matching the average for men under thirty-five (35) years. This, according to him, means that a great number of elderly people have at least the same mental ability as the average young adult.

Closely linked with the effect of age on performance on cognitive tests is one's level of education. Several studies (e.g. Feuerstein et al., 1980, Haywood et al., 1982, Messerer et al., 1984) have shown that extended in-depth training in thinking skills can increase tested intelligence. The study of Reynolds, Chastain, Kaufman and Mc. Lean (1987) concluded that the amount of school varies with IQ scores. College students have higher IQ scores than those only graduated from high school and high school graduates have higher mean IQ scores than non-graduates. According to Schaie (1983), the number of years in school is positively related to the level of measured general intelligence. The more education a person gets, the higher his initial scores and these scores increase throughout life, compared with those of his peers. As the years go by, most young people have more education than their parents and grandparents. When they therefore attain their grandparents' ages their respective IQ scores will still be higher.

## 2. (4) Conclusion

The use of intelligence tests as a means of predicting performance on the job and in school, diagnosing and formulating treatment plans and in research has been of great importance in the practice of psychology. The use of such tests has however been criticized by many psychologists because of the fact that they are saddled with problems that are related to culture (Dana 1995), interpretation, socioeconomic status, sex, and age among others. Some of these factors have been discussed in this chapter. The issues raised under these factors have led to the formulation of hypotheses for this work, which aims at testing some of these issues

## 2. (5) Hypotheses

The following hypotheses are formulated for the study.

1. Performance of Ghanaian subjects on the MAB will differ from that of MAB's published norms.
2. (a) Female subjects will perform significantly better on the verbal subtests of the MAB than male subjects.
2. (b) Male subjects will perform significantly better on the performance subtests—especially the spatial subtest—than female subjects

- 3 Performance on the MAB will improve consistently with age at different age levels.

## CHAPTER THREE

### METHODOLOGY

#### 3. (1) Design

The design was a 3 (age groups) x 13 (measures) multifactorial design. There were three age groups—16-19 years, 20-25 years and 26-34 years—reflecting adolescents, young adults and adults respectively; and thirteen dependent measures—Information, Comprehension, Arithmetic, Similarities, Vocabulary, Digit Symbol, Picture Completion, Spatial, Picture Arrangement, Object Assembly, Verbal Scale, Performance Scale, and Full Scale (these are the subscales and Full Scales of the MAB). Analysis involved Multivariate Analysis of Variance (MANOVA) and some follow-up univariate statistics. The sample was divided into males and females for comparison.

#### 3. (2) School Selection

The subjects used in the study were students between the ages of sixteen (16) and thirty-four (34) years (since the MAB is an adult test with the minimum age of sixteen years). Subjects were from selected secondary and tertiary institutions in the Greater Accra region of Ghana. This was the best way to conveniently get the sample within the age range meant for the research. Subjects between the ages of sixteen (16) and nineteen (19) were selected from the secondary institutions and those between the ages of

twenty (20) and thirty-four (34) were selected from the tertiary institutions. A list of the schools that were involved in the study is presented in Appendix 2.

### 3. (3) Sampling Method

Subjects falling between the ages of sixteen and thirty-four years were selected for the study. At each institution visited, a section of students were randomly selected and told about the study. Those consenting students who fell within the age range were then chosen to participate in the study. All the subjects in the study had no proven mental handicap.

### 3. (4) Sample Size

Five hundred and seventy-five (575) subjects took part in the study. Eighty (82) of these were used for the pilot study, and four hundred ninety-three (493) for the actual study. Out of this number, 44 subjects representing approximately 10%, did not take the entire test because they were either absent during the second administration or had to leave somewhere along the line during the course of administration. The responses of four hundred forty-nine (449) subjects—232 male and 217 female—representing approximately 90% of the subjects were therefore used in the analyses. The male subjects formed 51.9% of the total sample size with a mean age of 22.39 years, (SD=4.81), and the females, forming 48.3% of the total sample size had a mean age of 21.72 years, (SD=5.40). Subjects from the secondary institutions were 209 in all, with a mean age of 17.62 years and a minimum of thirteen

(13) years of schooling or formal education. Subjects from the tertiary institutions were 240 in number and they had a mean age of 25.94 years and a minimum of seventeen (17) years of schooling, formal education.

### 3. (5) Measures

The Multidimensional Aptitude Battery (MAB) was the instrument used in the study. The two booklets making the two subtests—the Verbal and Performance subtests were used. The ten MAB subtests—Information, Comprehension, Arithmetic, Similarities, Vocabulary, Digit Symbol, Picture Completion, Spatial, Picture Arrangement and Object Assembly; and three total scores—Verbal Scale, Performance Scale and Full Scale—were the dependent measures. The Multidimensional Aptitude Battery is reviewed in detail in the next chapter—Chapter Four

### 3. (6) Scoring and Analyses

All data were scored and analyzed on computer using SPSS 10.0 for Windows (a statistics programme used in the analysis of research data). All the responses were coded (a=1, b=2, c=3, d=4, e=5) and entered on the SPSS programme. The correct answers were fed into the computer and the responses were subsequently scored.

To make testing for sex and age possible, an omnibus test—Multivariate Analysis of Variance (MANOVA)—was the main statistical technique used.

MANOVA is an analysis of variance in which there is more than one dependent variable. It was therefore used since the study had two dependent variables—age and sex. Follow-up analyses using the independent sample *t* test were also carried out. Analysis of Variance (ANOVA) was used to calculate the mean differences between the scores obtained on the various subtests; and post hoc analysis using Tukey's Honestly Significant Difference was done to determine the exact nature and direction of the differences that were suggested by the ANOVA. An internal consistency reliability estimate (Cronbach's  $\alpha$ ) was computed for each subtest. Pearson Product Moment correlations (*r*) were also done to determine the intercorrelations between the scores of the subtests. The general statistical significance level was set at 5%. However, in order to reduce the probability of Type 1 error as a result of multiple comparisons, the Bonferroni correction formula was carried out on some of the analyses in order to obtain a more conservative alpha level.

### 3. (7) Pretesting

A pilot study was done on eighty-two (82) subjects using the original MAB. After the responses were scored and analyzed, changes were made where those items that were found not to be culture-fair were replaced with items that suit the Ghanaian culture and setting. This was determined by observing and analyzing the responses of subjects in the pilot study and also by discussing with a team of supervisors and graduate students of the Department of Psychology, University of Ghana. The reliability coefficients

(using Cronbach's  $\alpha$ ) of the subtests after the changes ranged between .58 and .88.

### 3. (7) 1. Modifications to the MAB

Changes had to be made to the MAB to adapt to the Ghanaian setting. According to Dana (1995), in order for a test to be used in a particular setting, it must reflect the cultural orientation of the people. Some of the changes made were in the words used, unit of measurement and currency

The American currency signs - dollars (\$) and cent signs—were changed to the Ghanaian currency signs—cedis (¢) and pesewas (p) signs. All measurements in miles, yards, feet and inches were changed to meters and kilometres (the metric system). Test items that had language use different from that used in Ghana were changed. For example, "candy" was changed to "toffee", and "pants" was changed to "trousers". Items depicting the idea of winter for instance were also changed since winter is not experienced in our part of the world. Questions like "The government promotes the use of public transportation....." and "On hot days people close their windows and shut their curtains in order to ....." were changed since these are not applicable in our part of the world. (See Appendix 1 for the inserted modified version).

The time limit for each subtest was also increased from seven minutes to ten minutes. This was necessary since the test is in English which is the second

language of the subjects, hence it will invariably take a longer time to complete the test since subjects needed time for coding from their first language. Further, research shows that traditional cultures do not place as much emphasis on speed in daily life (Knapp, 1960). People who belong to these cultures (of which Ghana is a part) do not have the motivation to hurry since much value is not attached to rapid performance in these cultures (Wormer, 1972).

### **3. (8) Language of instruction**

The language of instruction used throughout the test was English. This is because the test is a paper and pencil test in English and can therefore be taken only by those who have had formal education.

### **3. (9) Procedure**

At each institution visited by the researcher, the administration was contacted and a letter of introduction from the Department of Psychology introducing the researcher and the research topic was presented to the appropriate authorities. Lecturers, teachers, school authorities and subjects were all told of the nature and purpose of the study. Students were randomly selected from the classes which fell within the age range of subjects to be used in the study. Consenting subjects were asked to take part only if they were between the ages of 16 and 34 years. A convenient time for administration was arranged

between either the students and the researcher, or between the teachers and the researcher, depending on which was more appropriate.

The modified version of the MAB was then administered to the sample selected for the study. The time limit for each subtest was also increased from seven (7) minutes to ten (10) minutes. This was necessary since the test is in English which is not the first language of majority of Ghanaians. Subjects were given the answer grids suitable for the test and their responses were shaded thereon.

The maximum number of subjects tested at a time was fifty (50). Research assistants were employed and trained to help the researcher with the administration of the test. Both the verbal and performance sections of the MAB were administered to subjects on the same day. Where this was not possible, one section of the test was taken on one day and the other section taken on another day convenient for the students. As a way of assuring subjects of confidentiality, subjects were not required to write their names on the answer grids. Each subject was given a number code that was repeated on both answer grids so that each subject's Verbal scale could be matched with his Performance scale. Participation was voluntary and any subject who wished to discontinue in the testing process was free to do so.

Adequate measures were taken to obtain a quiet testing environment with very minimal or no distractions either from fellow students or teachers/lecturers. After each testing, subjects were briefly debriefed. They

were also given the opportunity to ask questions which were duly answered. Subjects' comments and suggestions on the test were also noted

### 3. (10) Ethical Considerations of the Study

The study was approved by the Board of Examiners of the School of Graduate Studies, University of Ghana. The test used in the study—the MAB is a psychological test standardized and used in many countries world-wide. First of all, a pilot study was conducted on a sample of students who fall within the age range of respondents for the test. Informed consent was obtained from the appropriate authorities and students concerned before the whole work was undertaken. Subjects were adequately debriefed after the testing sessions. The subjects found the test interesting though time consuming, and later visits to the schools showed that taking the test had no adverse effects on the subjects. On the whole, the code of conduct as prescribed by the American Psychological Association (APA's) Ethical Principles of Psychologists and Code of Conduct was adhered to.

## CHAPTER FOUR

### THE MULTIDIMENSIONAL APTITUDE BATTERY (MAB)

Having realized the absence of a standardized adult cognitive assessment tool that covers all areas of a person's intellectual functioning in Ghana, this study will focus on providing one such test by standardizing the Multidimensional Aptitude Battery (MAB) constructed by Douglas N. Jackson (1984). The MAB is thus reviewed in detail in this chapter

#### 4. (1) Nature and Purpose of the Multidimensional Aptitude Battery

The MAB is a group test designed to provide a convenient objectively-scorable measure of general aptitude or intelligence in adults in the form of a profile containing five verbal and five performance subtests. Its origins date back to the origins of intelligence testing, as far back as 1905 when Alfred Binet and Theodore Simon published their first findings on French children. It is however immensely indebted to the pioneering and widely acclaimed efforts of Wechsler in measuring adult intelligence beginning with the Wechsler-Bellevue Form I (Wechsler, 1939) through to the popular Wechsler Adult Intelligence Scale-Revised (WAIS-R).

Because the Wechsler scales have been successful and are used worldwide as a result of their effectiveness, any new test to measure general intellectual ability should correlate highly with them, and the MAB is one of such tests that

correlates highly with the WAIS-R. The correlation coefficient between the MAB and the WAIS-R is .91 & .87 for the Full Scale, .94 and .82 for the Verbal Scales, and .79 and .82 for the Performance Scales (Jackson, 1984).

In spite of its advantages, the WAIS-R has one drawback when it is to be applied more widely. That has got to do with the mode of administration and scoring. It requires individual administration and scoring by a specially-trained professional. Certain occasions require individual administration so the clinician can observe test behaviour. Some mentally handicapped and psychotic patients also require individual administration. However, when the clinician requires an estimate of people's intellectual functioning, individual administration is not really obligatory and where there are large numbers of people, it becomes time-consuming and costly. In such cases, a group test is preferred over an individual test. In Matarazzo's (1972) study reported by Jackson (1984), individually administered tests were found to show no advantage in yielding higher predictive validities when compared with group tests of intellectual ability.

Jackson (1984), in designing the MAB aimed at evaluating the degree to which it is possible to incorporate some of the widely-acknowledged positive features of individually-administered multi-scale tests, such as the WAIS-R, into a structured format permitting group administration, automated administration and convenient hand or machine scoring.

#### 4. (2) General Characteristics of the MAB

##### 4. (2) 1. Intended uses

The MAB is designed for wide-range intellectual assessment of adolescents and adults. As with many other measures of intellectual ability, it may also be used for a wide variety of purposes in a variety of contexts, for example educational and career counselling settings, business and industry, clinics and mental health facilities, and basic research. For adequate research one needs to possess language skills to be able to understand written directions and to comprehend spoken directions. Even though it is not recommended in most cases for use in cases of suspected mental handicap or for individuals whose psychiatric processes might severely interfere with understanding or complying with instruction, Jackson's (1984) experience is that majority of psychotic patients are capable of purposefully completing the MAB. The MAB can also be administered to the deaf and dumb, and withdrawn people since it involves answering the questions on an answer sheet and not to the examiner sitting in front of the examinee

##### 4. (2) 2. Nature of scales

The MAB consists of two types of scales—verbal and nonverbal. Five "Verbal" subtests are contained in one booklet and five nonverbal "Performance" subtests in a second booklet. This test is available in English, French and Spanish. The Verbal subscales are Information, Comprehension, Arithmetic, Similarities and Vocabulary. The Performance subscales are Digit Symbol, Picture Completion, Spatial, Picture Arrangement and Object Assembly. The

Verbal tests tap a person's general knowledge and information, vocabulary, expression of everyday skills, mathematical ability and interpretation. The Performance tests tap intelligence through a person's ability to put pictures into logical order, assemble a cut-up picture of an object, find the missing part on a picture, mentally rotate geometric objects and code numbers into symbols. (See Appendix 1 for examples of each subtest).

The Verbal and Performance sections each have separate answer sheets, which may be scored either manually or by machine. Although nine of the ten MAB subtests have the same scale names as those of the WAIS-R subtests & other Wechsler scales, the MAB is different in format and shares no items in common with any of the Wechsler scales. Digit Span on WAIS-R, which historically has shown the smallest association with Full Scale scores, has no counterpart in the MAB. Spatial ability, measured by Block Design on the Wechsler scales is appraised by the spatial subtest—a test involving the recognition of two-dimensional rotated figures.

#### 4. (2) 3. Question format

The MAB employs five-choice multiple-choice items for all subtests. Although item content ranges over verbal, numerical, pictorial, and figural content, in every case the task of the respondent is to identify, among five choices, the one best or most nearly correct answer. This item format makes it easy for respondents to record their answers, and also makes structured scoring

possible, hence professional judgment is not required. The MAB therefore has automated presentation, scoring, interpretation.

#### 4. (2) 4. Unique features of the MAB

The first and most notable aspect of MAB scale development is that it underwent several revisions prior to publication (Jackson, 1984). It was begun fourteen years before it was finally published and that was when it took on most of its present form, if not item content. In the following year it underwent in-depth item analyses, and subsequently, substantial revisions. After that, two further item analyses, revisions and field testings were undertaken. In item selection, particular attention was directed at identifying content that would have a fair level of generality across diverse groups, including those classified in terms of gender, nationality, age, and culture. It was standardized on both clinical and non-clinical subjects.

A second feature of the MAB scale development was the intention to provide an instrument not only possessing desirable psychometric properties, but also the features of ease of use and interpretation. The examiner's instructions are standardized so it can be administered by tape recorder, video cassette, or computer. It is therefore easy to administer and interpret.

The method of norming of the MAB equates the interpretation of the Verbal, Performance and Full Scale IQ's to a well-known anchor test, the WAIS-R.

This method, according to Cureton (1965) yields standard scores conforming to a widely accepted standard; hence eliminating the systematic differences that occur when norming samples are drawn at different times using different methods.

#### **4. (3) Administering and scoring the MAB**

The MAB has a standardized testing procedure set out in the manual. It is extremely important to carefully follow the prescribed instructions and time limits during administration of the MAB as failure to do this may render the results uninterpretable. The instructions may be read from the manual or followed from a cassette. The use of the cassette makes semi-automated group and individual administration possible. For group administration, the maximum number of respondents to one supervisor is 25. Each additional 25 respondents or a fraction thereof require an additional supervisor. The examiner should always be in the testing room during individual administration.

The entire battery takes approximately one hundred minutes to complete—each half takes fifty minutes. All subtests are strictly timed at seven minutes each. Both halves of the test could either be taken on separate days or on the same day with a short break in-between the two halves. The respondents are presented with answer sheets corresponding with the particular test being taken and they are required to shade the correct answers.

The MAB can be scored either manually or by computer. Manual scoring is undertaken by the use of templates. There are two templates each for the Verbal and Performance scales. These are colour coded to match the colours in which each test is presented. In hand scoring, the appropriate template is placed over the answer sheet and the correct answers are then counted. The scores for each subtest known as "Raw Scores" are then converted to scaled (T) scores. The T scores for the five subscales of the Verbal and Performance scales are then summed and recorded. The "Verbal Scale" and "Performance Scale" are then obtained, the sum of which yields a "Full Scale" of total scaled scores. Verbal IQ, Performance IQ and Full Scale IQ are obtained by consulting the tables corresponding to the appropriate age group using the summed scaled scores.

Where it is not possible for all the five subtests in either the Verbal or Performance scales to be taken, and the examiner wishes to estimate Verbal, Performance or Full Scale IQs or standard scores, the scores of the subtests taken are prorated. For each test—either Verbal or Performance, this is done by dividing the total number of subtests (this is always 5) by the number of subtests taken, and then multiplying the result by the total scaled scores of the subtests taken. The letter "p" is put in parenthesis by a score to show it is a prorated score.

Tables are available in the test manual to enable examiners express an individual's performance on each test in terms of IQ, Scaled Scores or Standard Scores. Computer scoring, IQs and standard scores for the Verbal,

Performance, and Full Scale batteries, as well as subtest scale scores, age-correlated scale scores, and a narrative report of the scores and their interpretation, may be obtained from the computer-scoring service of Sigma Assessment Systems—the test administrators.

#### 4. (4) Psychometric properties of the MAB

According to the original standardization sample the MAB possesses an internal consistency reliability of between .94 to .97 for the Verbal Scale, .95 to .98 for the Performance Scale and .96 to .98 for the Full Scale. The stability of MAB scales was established by test-retest correlations. Individual subtest Verbal Scale test-retest reliabilities ranged from .83 to .97 with a median of .90 while that of the Performance Scale ranged from .87 to .94 with a median of .93. The test-retest reliabilities for Verbal, Performance and Full Scales were .95, .96 and .97 respectively (Jackson, 1984).

Correlations between the MAB and the WAIS-R for the Verbal Scale, Performance Scale and Full Scale were .94, .79 and .91 respectively. The results of factor analyses of scores on the subtests indicate that, like the WAIS-R, the MAB measures a general intelligence factor as well as separate verbal and performance factors (Carretta, Retzlaf, Callister & King, 1998, Jackson, 1984). Intercorrelations between scales showed that the subscales have high internal consistency.

#### 4. (5) Evaluating the use of the MAB

Just like any other psychological test, there have been a number of criticisms levelled against the MAB (Kranzler, 1991). One of these is that it is unsuitable to use the Verbal subtests as a measure of a client's verbal ability if it is in the client's second language. This criticism invariably applies to all tests in a client's second language. This necessitated the increase in time for each subtest from 7 minutes to 10 minutes in the Ghanaian standardization sample. No literature on how designated groups performed on the MAB is available. Research (McShane & Berry, 1988) shows that various Aboriginal groups perform less well on the verbal versus visual and spatial components of aptitude measures.

Another criticism is that, because all the instructions are written (as in the paper and pencil or computer test) those who cannot read and write the language in which it is presented cannot take it. One has to possess language ability to be able to take the MAB. It can therefore not be administered to illiterates or people who are foreign to the language the test is in.

To date, there are very few studies that explored the psychometric properties of the MAB (Callueng, 2001). Carless (2000) and Kranzler (1991) noted that evidence on the construct validity of MAB is sparse and inconclusive since they were mostly based on US samples. Intercorrelations of MAB subtests were found substantial and significant. Specific subtests correlated to their hypothesized construct of either Verbal or Performance scale. Notably,

correlations of the subtests to full scale were significant, ranging from moderate to high magnitudes (Callueng, 2001)

## CHAPTER FIVE

### RESULTS

#### 5. (1) Overview

The study aimed at collecting and providing normative data on the Ghanaian population for Jackson's (1984) Multidimensional Aptitude Battery (MAB). It also aimed at examining the performance of Ghanaian subjects between the ages of 16 and 34 years on the MAB. In order to test for the effects of sex (gender) and age, subjects were categorized into two main groups—male and female; and also into three age groups—16-19 years, 20-25 years and 26-34 years representing teenagers, young adults and adults respectively.

The design was conceptualized as a multi-factorial design. There were two within group factors—sex and age as criterion variables—by thirteen dependent measures—as performance scores on the ten subtests of the MAB. (i.e. total scores for the Verbal scales, scores for the Performance scales and the Full Scale score). The hypotheses of the study were stated in relation to age and sex on performance on the MAB. There was also a hypothesis comparing the scores of Ghanaian subjects with that of the normative sample. Due to the multivariate nature of the study, an omnibus test—multivariate analysis of variance—was carried out to determine the main effects and the relevant interactions among the variables used in the study. These variables were sex by age—being the independent variables—with the

scores of the 10 MAB subtests and the three total scores as dependent variables.

The analyses revealed a statistically significant main effect for age  $F(20,434)=13.83$ ,  $p < .001$ , Wilks' Lambda=.55; and for sex  $F(10,434)=16.11$ ,  $p < .001$ , Wilks' Lambda=.73, partial eta squared=.27. To make the results more conservative due to the number of t-tests performed, the Bonferoni correction formula was applied. The results showed that for computations based on sex, five tests out of thirteen reached statistical significance. These were Digit Symbol, Spatial, Similarities, Vocabulary and Verbal Scale (total scores on the Verbal Subtests). For computations based on age, six tests reached statistical significance using a Bonferoni adjusted alpha level of .004. These were Picture Arrangement, Comprehension, Arithmetic, Vocabulary, Verbal Scale and Full Scale. Attaining statistical significance even at the conservative alpha level of .004 suggests a reliably high level of significance for the subtests in question. The  $F$  values with their associated degrees of freedom, levels of significance and effect sizes are presented in Appendix 3.

An examination of the mean scores on sex indicated that females scored higher than males on Digit Symbol, Similarities, Vocabulary and Verbal Scales. Male subjects however scored higher on Spatial than female subjects. The mean scores on age revealed that performance increased with age on Comprehension, Vocabulary, Verbal Scale and Full Scale. Performance however decreased with age on Picture Arrangement. On Arithmetic, subjects in Age Group 3 (the adults) scored highest, followed by those in Age Group 1

(the adolescents) and then those in Age Group 2 (young adults). The overall results are presented in Table 1 below

Table 1—Sex Differences on MAB Subtests

Test	Male		Female		t	Effect Size	
	Cronbach's $\alpha$	M	SD	M			SD
<b>Verbal Subtests</b>							
Information	.87	14.35	5.22	14.92	5.33	-1.14	.05
Comprehension	.76	14.56	4.12	15.73	4.38	-2.91*	.14
Arithmetic	.77	10.43	2.64	9.84	2.39	2.47	.12
Similarities	.81	15.82	4.77	19.35	4.95	7.70**	.34
Vocabulary	.88	16.19	7.49	17.74	7.43	-2.20	.10
Verbal Scale	.94	71.35	19.05	77.58	19.80	-3.40**	.16
<b>Performance Subtests</b>							
Digit Symbol	.81	23.96	5.10	26.04	5.01	-4.36**	.20
Picture Completion	.82	10.76	4.66	11.37	4.81	-1.37	.06
Spatial	.87	21.48	9.50	17.76	9.30	4.19**	.94
Picture Arrangement	.80	7.07	2.53	7.69	2.69	-2.53	.12
Object Assembly	.79	7.51	3.40	6.88	3.48	1.92	.09
Performance Scale	.93	70.78	17.71	69.75	17.68	.613	.03
Full Scale	.95	142.13	29.41	147.33	32.14	-1.79	.08

\* $p < .01$ ; \*\* $p < .001$ 

N=449

Male=232

Female=217

## 5. (2) Hypotheses Testing

### 5 (2) 1 Comparison between Ghanaian and Normative Sample

Hypothesis 1 stated that Performance of Ghanaian subjects on the MAB will differ from that of MAB's published norms. A comparison of the means of the two samples using  $t$  test for independent samples at the .004 significance level revealed statistically significant differences in the performance of the two

samples in all the thirteen measures, with all  $p$ s < .001. The effect sizes range from -.04 on Comprehension to .45 on Picture Completion, mostly signifying a small difference in the scores of the two groups. The means and  $t$  values of the two groups are presented in Table 2 below. Data on the normative sample presented in the manual for the MAB however does not include comparisons on age and sex. Comparisons with the normative data on these variables are therefore not possible at this time.

Table 2 -Differences between the Ghanaian and Normative Sample.

Test	Ghanaian Sample (n=449)		Normative Sample (n=1600)		$t$	Effect size
	M	SD	M	SD		
<b>Verbal Subtests</b>						
Information	14.63	5.27	22.20	6.70	22.10	.18
Comprehension	15.12	4.28	14.46	4.14	-2.87	-.04
Arithmetic	10.14	2.52	13.45	3.11	20.72	.37
Similarities	17.53	5.16	22.12	4.75	17.75	.20
Vocabulary	16.94	7.50	20.78	4.31	13.88	.14
Verbal Scale	74.36	19.65	97.96	20.96	21.37	.10
<b>Performance Subtests</b>						
Digit Symbol	24.96	5.16	22.84	3.26	-10.56	-.15
Picture Completion	11.05	4.74	22.84	5.26	42.86	.45
Spatial	19.69	9.58	29.77	7.60	23.37	.18
Picture Arrangement	7.37	2.62	10.10	2.49	20.74	.43
Object Assembly	7.21	3.45	12.50	4.61	22.60	.28
Performance Scale	70.28	17.68	101.34	17.76	32.78	.10
Full Scale	144.64	30.83	200.73	33.45	31.93	.05

### 5. (2) 2 Sex Differences on Verbal Subtests

Hypothesis 2 (a) stated that female subjects will perform significantly better on the verbal subtests of the MAB than male subjects. Female subjects performed significantly better than male subjects on two Verbal subtests of the MAB. These are Comprehension  $t(449) = -2.91, p < .01$ ; Vocabulary  $t(449) = 7.70, p < .001$ ; and Verbal Scale  $t(449) = -3.40, p < .001$ . The effect sizes of .14 and .10 respectively were however small, meaning that though the difference is significant, it's negligible. These results support the hypothesis of female superiority in the Verbal tests and the effect size supports the assertion of Hyde and Linn (1988) that gender differences in verbal abilities are negligible. The means of the subjects, together with their  $t$  values are presented in Table 1.

### 5. (2) 3 Sex Differences on Performance Subtests

Hypothesis 2 (b) stated that male subjects will perform better on the Performance subtests—especially the Spatial subtest—than female subjects. Male subjects actually performed significantly better on the Spatial subtest:  $t(449) = 4.19, p < .001$ . The hypothesis that male subjects will perform higher on the Spatial subtest than female subjects was thus supported. The effect size, representing the magnitude of the difference between males and females was very high (.94). This means that gender differences in Spatial ability on the MAB is far from negligible. Female subjects however performed better than the males on Digit Symbol  $t(449) = -4.36, p < .001$  which is also a performance test. According to the mean and standard deviations obtained,

male subjects obtained a higher score on the Performance Scale (Mean=70.78, SD=17.71) than female subjects (Mean=69.75, SD=17.60) but this was not statistically significant (See Table 1 above)

#### 5. (2) 4 Age and Performance on MAB scales

Hypothesis 3 stated that performance on the MAB will improve consistently with age at different age levels. A one-way between-groups Analysis of Variance (ANOVA) was conducted to explore the effect of age on the 10 subtests and 3 total scores of the MAB. The only Performance subtest to reach statistical significance at the .004 level (Bonferroni adjusted alpha) with age here was Picture Arrangement  $F(2,443) = 10.86, p < .001$ ; partial eta squared = .05. On this test, scores of subjects declined systematically as a function of age across the three age groups. The means obtained are Mean=8.06, SD=2.44, Mean=6.94, SD=2.69, and Mean=6.79, SD=2.58 for Age Groups 1, 2 and 3 respectively. The Verbal subtests to reach statistical significance on age are Comprehension:  $F(2,443) = 13.70$ , partial eta squared = .06, Arithmetic:  $F(2,443) = 10.52$ , partial eta squared = .05, and Vocabulary:  $F(2,443) = 86.01$ ; partial eta squared = .28, and Verbal Scale:  $F(2,443) = 29.41$ , partial eta squared = .12; all  $p$ s < .001. Statistically significant differences in age were also recorded for Full Scale:  $F(2,443) = 6.842, p < .001$ ; partial eta squared = .03. The means of the subjects according to the three age groups are presented in Table 3 below.

Table 3 → Performance difference by Age on the MAB

Test	Age groups					
	16-19 years (Adolescents)		20-25 years (Young Adults)		26-34 years (Adults)	
	Mean	SD	Mean	SD	Mean	SD
	<b>Verbal Subtests</b>					
Information	13.83	5.04	14.89	5.51	15.59	5.15
Comprehension	14.10	3.80	15.35	4.62	16.54	4.15
Arithmetic	10.05	2.39	9.62	2.32	11.01	2.83
Similarities	16.97	5.13	17.67	5.26	18.25	5.02
Vocabulary	12.91	5.52	17.70	7.59	22.65	6.11
Verbal Scale	67.87	17.35	75.24	20.25	84.05	18.27
	<b>Performance Subtests</b>					
Digit Symbol	25.81	5.07	24.82	5.21	23.75	5.02
Picture Completion	10.51	5.01	10.86	4.52	12.20	4.07
Spatial	20.20	10.67	20.22	8.50	18.09	8.91
Picture Arrangement	8.06	2.44	8.94	2.69	6.79	2.58
Object Assembly	6.96	3.56	7.40	2.96	7.36	3.87
Performance Scale	71.54	19.60	70.24	15.34	68.23	17.23
<b>Full Scale</b>	<b>139.41</b>	<b>32.52</b>	<b>145.48</b>	<b>29.93</b>	<b>152.27</b>	<b>27.53</b>
N=449						
16-19=186						
20-25=152						
26-34=111						

Post-hoc comparisons using the Tukey Honest Significant Difference revealed differences between the performance of adolescents (Age Group 1) and adults (Age Group 3) on all the 13 measures but Spatial, Object Assembly and Performance Scale. Significant differences were observed between the scores of adolescents and young adults on Comprehension and Vocabulary. Significant differences were also observed between young adults and adults only on Vocabulary and Verbal Scale. Spatial and Performance Scale revealed no significant difference among any of the three age groups.

The figures obtained here for the ANOVA and Tukey Honest Significance Difference are presented in Appendix 3

The following differences were observed on examining the means scores of the subjects even though these differences did not reach statistical significance. Younger subjects performed better on Digit Symbol, and on the total Performance Scale than older subjects. The order of performance was 1→2→3, meaning subjects in Age Group 1 (16-19 years) scored highest, followed by subjects in Age Group 2 (20-25 years) and then subjects in Age Group 3 (26-34 years). Older subjects performed better than younger subjects on all the Verbal tests and also on the Full Scale score across all the three age groups. The order was always 3→2→1. On the Spatial and Object Assembly subtests, subjects in Age Group 2 (young adults) performed best, followed by those in Age Group 1 (adolescents) and then Age Group 3 (adults)

### **5. (3) Other Analyses**

#### **5. (3) 1 Interrelation of Subtests**

Pearson Product Moment Correlations were computed between the raw scores for the MAB scales for all the subjects to assess the degree of interrelation between subtests. All correlations were positive ranging from .03 to .59 on the ten subtests and between .36 and .85 on the three total scores. The results obtained showed that Verbal scales correlated more highly with other Verbal scales and Performance scales also correlated more

highly with other Performance scales. This was the same trend observed by Jackson (1984) and Calluang (2001) in their correlation on the MAB subscales. This means that the abilities used in completing the Performance subtests are similar, if not the same, and those used in completing the Verbal subtests are also closely related.

The correlation figures for the Verbal scales (between  $r=.29$  and  $r=.62$ ) was however significantly higher than that of the Performance scales (between  $r=.22$ ,  $p<.01$ , and  $r=.54$ ,  $p<.01$ ). The highest correlation recorded was between Information and Comprehension ( $r=.65$ ,  $p<.05$ ). Similarities also correlated highly with Vocabulary ( $r=.57$ ) and Comprehension ( $r=.57$ ) all  $ps<.01$ . Vocabulary and Information also had a high correlation coefficient ( $r=.57$ ,  $p<.01$ ). On the Performance scales, the highest correlation coefficient was between Picture Completion and Object Assembly ( $r=.54$ ,  $p<.01$ ). See Appendix 3 for the intercorrelation matrix for the subtests.

Correlations based on age and sex were also computed on the mean scores. The figures obtained are shown in Table 4 below.

Table 4—Correlation between age and MAB Subtests  
N=449

	DS	PC	Spa	PA	OA	Inf	Co	Ar	Sim	Voc	V	P	F
Age	-.19*	.17*	-.10*	-.23**	.02	.14*	.23**	.14*	.13*	.54**	.35**	.11*	.16**

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

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

### 5. (3) 2. Correlation for Age

The correlation coefficients between age and performance on the MAB in Table 6 above show a positive correlation (.54) between age and Vocabulary. This high correlation further supports the statistically significant effect of age on Vocabulary found on the MANOVA and also on the mean scores for this variable.

Verbal Scale had a medium positive correlation ( $r=.35$ ) with age on the MAB. Comprehension and Arithmetic recorded low correlations with age even though they also reached statistical significance with age ( $r=.23$  and  $r=.14$  respectively).

### 5. (3) 3. Intercorrelation for males and females

Correlation coefficients were calculated for the sexes to see how the scores on the subtests correlated there as well. This is shown in Appendix 3.

In order to determine whether there were differences in the correlation coefficients of males and females, Fisher's  $z$  transformation of correlation coefficients ( $r_s$ ) were computed. An independent-sample  $t$ -test was performed on the transformed values. The results revealed a statistically significant difference between the scores for males (Mean= 30, SD=.20), and females (Mean= 38, SD=.18),  $t(88) = -2.03, p=.05$ . The magnitude of the differences in the means (-.043) was however very small. This means that the relationship between subscales of the MAB (test measures) were similar for both males



and females. The magnitude of the difference (effect size) was obtained using Cohen's  $d$  formula which is the difference between independent means of males and females divided by their within-group standard deviation.

## CHAPTER SIX

### DISCUSSION

#### 6. (1) Overview

The aim of the study was to gather data for reference norms in Ghana to be used by psychologists—especially Clinical Psychologists—in their practice. This study was undertaken because it was realized that there are too few standardized tests for use in Ghana, and particularly because of the fact that there was no standardized cognitive adult group test with Ghanaian norms. The study examined the extent to which performance on the MAB was influenced by age and also by sex. The level of intercorrelation between performance on the subtests of the MAB on age and sex were also investigated. The four main hypotheses that were tested in the study are

1. Performance of Ghanaian subjects on the MAB will differ from that of MAB's published norms
2. Female subjects will perform significantly better on the verbal subtests of the MAB than male subjects;
3. Male subjects will perform significantly better on the Performance subtests—especially the Spatial subtest—than female subjects.
4. The scores of older subjects in the study will significantly differ from those of younger subjects.

The results revealed a difference in the performance between the Ghanaian and the normative samples on the MAB. There was also a statistically significant difference in the performance of male and female subjects, and older and younger subjects as well.

Female subjects had significantly higher scores on the Verbal Scale (total score for all Verbal subtests). This supports the second hypothesis that female subjects will perform significantly better on the Verbal subtests than male subjects. They also recorded statistically significant scores on Similarities and Vocabulary (two of the Verbal subtests).

Male subjects actually had significantly higher scores than female subjects only on the Spatial subtest. This supported the hypothesis that male subjects will perform significantly better on the Spatial subtest than female subjects. Amponsah's (2000) finding that males were superior in spatial tasks was also confirmed. Just like Lubinski and Humphreys (1990) found, male subjects performed better than female subjects on Arithmetic. Even though the mean scores showed that males performed better on the Performance Scale (the total score for all Performance subtests), this difference was not statistically significant.

Age was also found to significantly affect performance on four subtests of the MAB. This confirmed earlier work by Siegler (1983) and Rybash et al. (1995). Performance improved with age on Comprehension and Vocabulary and reduced with age on Picture Arrangement.

Age and sex had a greater influence on performance on the Verbal subtests than on the Performance subtests. Performance on three out of the five Verbal subtests was influenced by age. These are Comprehension, Arithmetic and Vocabulary. Only one Performance subtest—Picture Arrangement—was influenced by age. Sex significantly affected performance on two Performance subtests. These are Digit Symbol and Spatial. Performance on two Verbal subtests—Similarities and Vocabulary—and the Verbal Scale (total score on all the Verbal subtests) were affected by sex.

#### **6. (2) Differences between Ghanaian and Normative Sample**

The difference in performance between the Ghanaian and normative samples confirms cultural issues in psychological testing that have been reviewed earlier. There were similarities in the performance on some subtests. The similarity in the scores on Comprehension for instance is largely due to the modifications that were made. No changes were made to the items on Digit Symbol because coding numbers into symbols can be said to cut across cultures. The negative effect size of the difference in the means of these two groups means the performance of both groups was almost the same, implying that the intelligence level of both the Ghanaian and normative sample on this test is almost the same. Very remarkable differences were observed between the scores on Information, Picture Completion, Spatial, Object Assembly and Performance Scale. This implies that cultural differences affected the scores. On the whole, the performance subtests showed greater differences than

verbal subtests. This, to a large extent can still be explained by cultural issues.

### 6. (3) Sex differences in performance

Similarities, Vocabulary and Verbal Scale were the three Verbal subtests to show significant gender differences on verbal ability. In Similarities, the respondent is asked to identify how two successive pairs of nouns are alike (see Appendix 1) and in Vocabulary the respondent is asked to find from the alternatives, the word nearest in meaning to the given word (see Appendix 1). These two subtests tap basically a person's knowledge of vocabulary. This explains the relatively high positive correlation ( $r = .57$ ) that exists between them. It therefore follows that performance on the two subtests, and the variables that affect them will be similar—if not the same. Verbal Scale is the total score of all the verbal subtests. A statistically significant difference on this scale supports earlier findings (Fishbein, 1990; Bolla, Bonaccorsy & Bleecker, 1990). Female subjects performed better on them than males. This supports the findings of Bleecker (1980) and Halpern (1992) that females display a slight advantage over males in verbal ability, that is, word fluency, grammatical competence, spelling skills, reading vocabulary and oral comprehension. It must however be noted that the negligible effect size which is comparable to the findings of Hyde & Linn (1988) takes the emphasis off gender differences in verbal ability. This female superiority in verbal ability could be caused by many factors. The "nature-nurture" debate on sex differences still continues. Petersen (1980) has an interactionist explanation

to this issue—referred to as the Biopsychosocial perspective. He is of the view that it is impossible to attribute differences in verbal competence of males and females to the influence of only biological factors or only psychosocial factors, but a combination of both.

The psychosocial factors can be accounted for by sex role stereotypes and sex-role socialization. Our culture has “sex-appropriate” behaviours for male and females (Parke and Slaby, 1983) and this contributes to sex-role stereotyping. It is not unusual for male a child to say he wants to be a doctor or an engineer in future and for a female child to say she wants to be a nurse or a teacher in future. Any girl who said she wanted to be a mechanic or an engineer in future is either thought of as “strange”, a “tom-boy” or is discouraged outright from keeping that desire. Any boy who ever said he wanted to be a flight attendant in future is thought of as not being a “man”. This invariably has an influence on how people perceive things and hence the expectation of our society tunes the minds of both male and females in specific directions where career is concerned. This in a way sometimes suppresses people’s inner abilities and leads them to pursue careers that are “acceptable” in the society but against their wishes.

The biological factors are those that talk about females being more genetically predisposed to perform better in verbal tests than male. The Genetic Theory (e.g. Bock & Kolakowski, 1973), the Brain Lateralization Theory (e.g., Mc Glone & Davison, 1973), the Hormonal Theory (e.g. Silverman & Phillips,

1993) and the Maturation Hypothesis (Waber, 1976) all explain sex differences in cognition.

Considering the arguments advanced explaining sex differences by biological and psychological factors, it can be concluded that it is a "safer" stand to take, to say that the observed superiority of female in the named Verbal subtests is due to an interaction of both psychosocial and biological processes.

The observed male superiority in the Arithmetic and Spatial subtests can also be explained by Biopsychosocial factors. Biologically, males are said to have a greater ability for mathematical ability than female do. They are superior in mechanical reasoning, spatial ability and mathematical ability because of sex-role socialization. In school, boys are encouraged to study mathematics and science whilst girls are encouraged to take English, home science, typing, and other related subjects. Halpern (1992) found that females are elementary school teachers, nurses, secretaries whilst males are engineers and scientists. Male superiority in Spatial could also be explained by Serbin and Connor's (1979) assertion that extracurricular activities with certain types of toys, for example, playing with wooden blocks, computer games, and the like could influence the growth of spatial ability. This inadvertent by-product of sex-role socialization on stereotypes has led to males' superior performance in spatial tasks than females.

#### 6. (4) Age differences in performance

The results show that four MAB subtests Picture Arrangement, Comprehension, Arithmetic and Vocabulary had statistically significant differences in mean scores on the variable of age. Of these, performance improved with age on Comprehension and Vocabulary. Performance however reduced with age on Picture Arrangement. On Arithmetic, subjects in the oldest age group scored highest, next was those in the youngest age group and those in the middle age group.

Comprehension and Vocabulary are two Verbal subtests with a correlation coefficient of .59. Performance on these subtests improved with age because of the nature of the abilities that they test. The number of years spent in school could also account for this. The more the number of years a person spent in school, the better his performance here. This supports Reynolds et al.'s (1987) findings that the more the number of years spent in school, the better a person's performance on intelligence tests. The Vocabulary subtest tests the respondent's store of vocabulary and the Comprehension subtest tests the respondent's general knowledge. This supports the findings (Horn, 1970, 1982a, 1982b; Horn & Donaldson, 1976; Schaie, 1994) that although fluid abilities—that is, those requiring speed or rapid learning—may decline with age, many crystallized abilities, for example vocabulary and stored up knowledge actually improve at least into the 60s

Younger subjects performed better than older subjects on Arithmetic because of the fact that it required speed and precision. Research (Schaie, 1994,

Siegler, 1983; Wechsler, 1958, 1982) has shown that younger people perform better on speed tests and this is due to the fact that the reaction time slows down as a person ages. Given a lot of time however, performance of older people could be the same as that of younger people.

Although this work focused on culture, age and sex as affecting performance on intelligence tests in general, and on the MAB in particular, several researchers have proposed socio-economic status (Fischbein, 1990; Anum, 1996) and other environmental factors, such as urbanization (Sharma & Ahuja, 1990), parental nutrition (Lynn & Hattori, 1990), examiner expectations and interactions with test taker (Rosenthal, 1994), and type of school attended (Anum, 1996), to account for performance on intelligence tests.

## CHAPTER SEVEN

### SUMMARY AND CONCLUSION

The results of this study “Standardization of the MAB in Ghana” confirm the earlier work of researchers that age and sex affect performance on psychological tests of cognitive functioning. It also confirms the fact that different types of tests—that is, tests that evaluate different abilities and capabilities in individuals—yield different results and propose different levels of performance in individuals. Above all, the improvement in performance of the subjects after the modifications were made to the original MAB supports the importance of standardization of tests which are developed in different cultures to the culture of potential test takers.

The modifications made on the MAB yielded several advantages. The change in time limit from seven minutes to ten minutes per subtest afforded subjects tested on the modified version an opportunity to answer more questions, hence perform better than subjects used in the pilot since they had the seven minute time limit. Performance also improved as a result of the replacement of culturally-unfamiliar test items with items that were familiar to Ghanaians.

#### **7. (1) Implications for Clinical Practice and Research and Job Selection**

This complete work also introduces a cognitive assessment tool with Ghanaian norms, which incorporates both verbal and non-verbal subscales in

one. The norms represent the Ghanaian population. The modified MAB can therefore be used in clinical practice to aid in the assessment process and also in the diagnosis of various sorts of mental disorders and deficiencies. According to Brody (1992), intelligence test scores are reasonably good predictors of performance in a variety of occupations. It can also be used as an effective tool for personnel selection for applicants into various jobs, to predict people's performance on the job, in school, and other related fields. This work also presents an effective Ghanaian tool for research in the field of Psychology, especially in the area of cognition.

#### **7. (2) The use of gender sensitive tests**

The results of the study show that intelligence tests have the tendency to favour certain particular people depending on what the context is. The female superiority observed in the verbal tests against male means that testing people with only verbal tests as a means of assessing intelligence or selecting people for a job or for any other selective purpose will invariably give females a big advantage over males. The male superiority in spatial tasks and also on mathematical and geometrical tasks on the other hand gives males an upper hand if a test comprises only such items.

This means that for a particular test to be 'gender-fair' those who construct or administer tests must ensure a balance in both verbal and non-verbal sessions in their tests so that deficiencies of one sex in one area will be compensated for in the other area where they have the advantage. This will

therefore yield a fair representation of a person's intellectual abilities and not a lopsided evaluation.

### **7. (3) Age-related tests**

The results also show that tests can also favour some ages over others. Older subjects' overall superior performance on the Verbal subtests implies that tests must be balanced in context so one age group is not favoured over the other. Younger subjects' superiority over older subjects where the Spatial subtest for instance is concerned means that where a person wants to test speed, or where there is a job that requires speed, the Spatial subtest can be used to identify those testees who will be able to perform creditably on the job.

### **7. (4) Limitations of study and recommendations for future research**

The present study had a couple of shortcomings which are worth mentioning. The first was to do with the sample. As a result of financial and time constraints, the researcher could sample only 449 subjects. This is somewhat too small for a standardization sample. However, since this is to serve as the beginning of a greater work on standardization of the MAB, future researchers should consider using larger standardization samples. Still to do with the sample, even though both rural and urban dwellers were represented in the sample, the sample used in the study was drawn mainly from only the Greater Accra Region of Ghana. This is the capital city of the country. The sample

was therefore made up of only those in the urban centre. The rural dwellers in Accra happen to have some exposure to city life and therefore their responses would reflect that to some extent. Future researchers should however consider including a pure rural sample to ensure that the MAB can also be confidently used on rural folks as well

The second issue is that of comparing the norms of a similar test with Ghanaian norms to that of a standardized test. The researcher could undertake no such comparison since there exists no such test in Ghana at the moment. The era of standardization of psychological tests in Ghana has just begun. Future researchers could undertake more projects on standardization to make comparisons possible since this will impute more psychometric power on psychological tests standardized in the country

Above all, nothing will be as perfect and as acceptable as a test constructed primarily for the Ghanaian population! Psychologists in the country should consider constructing tests right here in Ghana.

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**APPENDICES**

## Appendix 1.1

**MULTIDIMENSIONAL  
APTITUDE BATTERY****VERBAL****GENERAL INSTRUCTIONS**

This booklet contains a number of different tasks. For each task you will be given instructions. These instructions will tell you what you are supposed to do. There are also sample problems. When you have read the instructions and gone over the sample problems, you will have an opportunity to ask questions about anything that is not clear. After this, the examiner will give the signal to start. You should then turn the page and begin working.

You are allowed seven minutes for each section. It is unlikely that you will be able to finish each test in the time allowed. You should work quickly and complete as many questions as you can. When seven minutes have passed the examiner will say "Stop". You should then put down your pencil.

Begin each test only after the examiner has given the signal to begin. Work on the test only in the specified time. Do not go back and work on previous tests at any time.

Record your answers on the separate answer sheet by filling in the space provided. Do not record your answers or make any marks on this question booklet.

For accurate scoring of your answers, please pay close attention to the following directions.

- Fill in the spaces on the answer sheet for your name and the other information requested.
- On the answer sheet, be sure that the section you are marking is the same as the test on which you are working. Tests are identified both by name and by a large number in the upper right corner.
- Observe carefully each question number and be sure that it is the same as the number you are answering on the answer sheet.
- Find the answer space around one of the five letters, A, B, C, D, or E, that is the same as the answer you chose and blacken it with a medium hardness pencil (No. 2 or HB).
- Make no stray marks on the answer sheet.
- If you wish to change your answer, erase the old answer completely.

Your score on each section will be the number of questions answered correctly. Answers in the wrong place or those left out will be counted as wrong.

When the examiner gives the signal, turn the page to the Practice Problems.

## PRACTICE PROBLEMS

Read the following questions and mark the answers on your answer sheet where it says Practice Problems. The first problem has been done for you.

Arithmetic — Solve the following problem

- 1 If it costs £8 for two students to go to the theatre, how much will it cost for three students?
- A. £10    B. £16    C. £12    D. £4    E. £6

The answer is C, £12, therefore one should mark C.

Vocabulary — Choose the alternative from A to E that is nearest in meaning to the word given

- 2 simple
- A. hard  
B. easy  
C. example  
D. the same  
E. useful

The correct answer is B, easy, so B should be marked

Information — Choose the letter that goes with the correct answer

- 3 What body of water lies between North America and Europe?
- A. Indian Ocean  
B. Lake Ontario  
C. Sea of Japan  
D. Pacific Ocean  
E. Atlantic Ocean

The correct answer is E, the Atlantic Ocean, so E should be marked

# MULTIDIMENSIONAL APTITUDE BATTERY

## INFORMATION

of the following 40 questions is followed by five possible answers from A to E. Choose the answer that is correct and darken the appropriate letter on the separate answer sheet.

at these examples:

What is the capital of France?

- A. Rome
- B. London
- C. Washington
- D. Ottawa
- E. Paris

The correct answer is E, Paris, therefore one should mark E.

How many days are there in a week?

- A. sometimes 6, sometimes 7
- B. always 6
- C. always 7
- D. always 5
- E. 5, 6, or 7

The correct answer is C, always 7, therefore one should mark C.

imilar manner, answer each of the following questions by indicating on the answer sheet one of the five choices is the most appropriate. Remember, if more than one answer appears correct, choose the best answer.

ot begin until the examiner gives the signal. You have ten minutes. Continue working until time is called. Do not continue to the next section of the test.

WAIT FOR THE SIGNAL

## MULTIDIMENSIONAL APTITUDE BATTERY

### COMPREHENSION

In this section, you are asked what should be done or what is required in a given situation. You are to choose the best answer available, or that which most generally applies to the question.

Look at these examples.

What should you do if you find a \$1000 note in the lift of your apartment building?

- A. Say, "That's a stroke of luck," and keep it.
- B. Leave it where it is and continue on your way.
- C. Keep it and leave your name and number with the superintendent in case the loss is reported.
- D. Spend it as soon as you can before somebody finds out.
- E. Share the good fortune with your neighbor.

Answer C is the correct course of action since it is the fair and just thing to do.

Dictionaries are useful

- A. to look up origins of words
- B. to do crossword puzzles.
- C. to look up opposites of words
- D. to find word meanings
- E. to look up medical terms

The correct answer is D, to find word meanings. Answers A and B are true, but they are not the most important ways in which a dictionary can be used. Answer C is not generally true, and answer E is not the most general answer available.

In a similar manner, answer each of the following questions by indicating on the answer sheet which one of the five choices is the most appropriate. Remember, if more than one answer appears correct, choose the best answer.

Do not begin until the examiner gives the signal. You have ten minutes. Continue working until time is called. Do not continue to the next section of the test.

WAIT FOR THE SIGNAL.

## MULTIDIMENSIONAL APTITUDE BATTERY

### COMPREHENSION

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Answer C is the correct course of action since it is the fair and just thing to do.

Dictionaries are useful

- A. to look up origins of words
- B. to do crossword puzzles.
- C. to look up opposites of words
- D. to find word meanings.
- E. to look up medical terms

The correct answer is D, to find word meanings. Answers A and B are true, but they are not the most important ways in which a dictionary can be used. Answer C is not generally true, and answer E is not the most general answer available.

In a similar manner, answer each of the following questions by indicating on the answer sheet which one of the five choices is the most appropriate. Remember, if more than one answer appears correct, choose the best answer.

Do not begin until the examiner gives the signal. You have ten minutes. Continue working until time is called. Do not continue to the next section of the test.

WAIT FOR THE SIGNAL.

**MULTIDIMENSIONAL  
APTITUDE BATTERY****ARITHMETIC**

In this section, you are asked to solve arithmetic problems. Five possible answers follow each question, only one of which is correct.

Look at these examples.

If one apple costs 10 pesewas, how many pesewas will two apples cost?

A 15    B 10    C 90    D 20    E 5

The correct answer is D, 20 cents

If Tim had 6 times as much money as John, he would have \$24. How much money does John have?

A. \$4    B. \$8    C. \$6    D. \$12    E. \$3

The correct answer is A, \$4

Read each question carefully and decide what needs to be done in order to solve the problem. Use a piece of scrap paper for figuring. If you do not have a piece of paper to use, ask the examiner for one. Choose the correct answer and mark it on the answer sheet.

Do not begin until the examiner gives the signal. You have ten minutes. Continue working until time is called. Do not continue to the next section of the test.

WAIT FOR THE SIGNAL

# MULTIDIMENSIONAL APTITUDE BATTERY

## SIMILARITIES

Listed below are pairs of words. You are to decide in what way they are the same and then mark the answer which best describes how they are alike.

Look at the following example.

How are a knife and spoon alike?

- A they have different shapes
- B a knife is more dangerous than a spoon
- C they are both used to eat soup
- D they both weigh less than a pound
- E both are used for eating

The correct answer is E. Answers A and B are not similarities; answer C is not generally true. Answer D is true, but it is not the most important way in which a knife is like a spoon.

As soon as the examiner gives the signal, turn the page and begin. Mark your choices on the answer sheet. You have ten minutes. Continue working until time is called, working only on this section of the test.

WAIT FOR THE SIGNAL.

# MULTIDIMENSIONAL APTITUDE BATTERY

## VOCABULARY

This is a test of how many words you know. On the separate answer sheet mark the one alternative that is nearest in meaning to the word given.

Here are two examples.

quick
A. fast
B. slow
C. walk
D. lethal
E. run

fast is correct, so A should be marked.

crave
A. destroy
B. insane
C. desire
D. short
E. bend

desire is correct, so C should be marked.

Do not begin until given the signal. You will have ten minutes. Continue working on the Vocabulary test until time is called. Do not go back to any other section of the test.

WAIT FOR THE SIGNAL.

# MULTIDIMENSIONAL APTITUDE BATTERY

## VOCABULARY

This is a test of how many words you know. On the separate answer sheet mark the one alternative that is nearest in meaning to the word given.

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fast is correct, so A should be marked.

crave  
A. destroy  
B. insane  
C. desire  
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E. bend

desire is correct, so C should be marked

Do not begin until given the signal. You will have ten minutes. Continue working on the Vocabulary test until time is called. Do not go back to any other section of the test.

WAIT FOR THE SIGNAL.

# MULTIDIMENSIONAL APTITUDE BATTERY

## PERFORMANCE

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### GENERAL INSTRUCTIONS

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When the examiner gives the signal, turn the page to the Practice Problems.

**PRACTICE PROBLEMS**

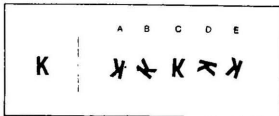
Read the following questions and mark the answers in your answer sheet where it says Practice Problems.

**Picture Completion** — Choose the letter that begins the word describing the missing part of the picture.



The answer is Light, so A should be marked.

**Spatial** — Choose one figure to the right of the vertical line which is the same as the figure on the left. One figure can be turned to look like the figure on the left, the others would have to be flipped over.



The correct answer is A, so A should be marked. The others BCDE would have to be flipped over.

**Object Assembly** — Choose the parts to which these parts should be added to form the object.



When the examiner gives the signal, turn the page to Test 1—Digit Symbol.

# MULTIDIMENSIONAL APTITUDE BATTERY

## DIGIT SYMBOL

This test measures your ability to match symbols to numbers. Look at this example:

1	2	3	4	5	6	7	8	9
∧	=	/	X	\	+	-		Γ

1	∧	+
A	1	6
B	6	1
C	1	4
D	4	6
E	9	6

The correct answer is A, since ∧ and + are paired with 1 and 6.

Using the number-symbol key given above, try these questions:

2.	=	Γ
A	1	3
B	2	9
C	5	6
D	9	2
E	2	7

The correct answer is B, because = stands for 2 and Γ stands for 9.

3	=	/	X
A	1	2	3
B	4	3	2
C	5	6	7
D	2	3	4
E	6	1	4

The correct answer is D, because the symbols = / X are associated above with numbers 2 3 4, in that order.

Remember that the number-symbol pairs will remain the same for the whole test.

If you have any questions about the task, ask the examiner to explain it more fully.

When the examiner gives the signal, turn the page and begin. You will have ten minutes. Do not continue to the next section of the test.

WAIT FOR THE SIGNAL.

# MULTIDIMENSIONAL APTITUDE BATTERY

## DIGIT SYMBOL

This test measures your ability to match symbols to numbers. Look at this example:

1	2	3	4	5	6	7	8	9
$\wedge$	$=$	$/$	$\times$	$\backslash$	$+$	$-$	$\parallel$	$\Gamma$

1	$\wedge$	$+$
A	1	6
B	6	1
C	1	4
D	4	6
E	9	6

The correct answer is A, since  $\wedge$  and  $+$  are paired with 1 and 6.

Using the number-symbol key given above, try these questions:

2	$=$	$\Gamma$
A	1	3
B	2	9
C	5	8
D	9	2
E	2	7

The correct answer is B, because  $=$  stands for 2 and  $\Gamma$  stands for 9.

3	$=$	$/$	$\times$
A	1	2	3
B	4	3	2
C	5	8	7
D	2	3	4
E	6	1	4

The correct answer is D, because the symbols  $=$   $/$   $\times$  are associated above with the numbers 2 3 4, in that order.

The number-symbol pairs will remain the same for the whole test.

If you have any questions about the task, ask the examiner to explain it more fully.

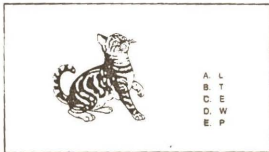
As soon as the examiner gives the signal, turn the page and begin. You will have ten minutes. Do not continue to the next section of the test.

WAIT FOR THE SIGNAL.

**MULTIDIMENSIONAL  
APTITUDE BATTERY****PICTURE COMPLETION**

In each of the following pictures there is an important part missing. Below each picture are the first letters of five possible missing parts. You are to look at the five choices, A, B, C, D, and E, and mark the correct one on your answer sheet.

Look at the following example



In this picture of a cat, the important missing part is the EAR. The correct choice is C, because it gives an E, and the first letter in the word EAR is an E. You would therefore mark C on the answer sheet.

As soon as the examiner gives the signal turn the page and begin working. You will have ten minutes. Continue working until time is called, working only on this section of the test.

**WAIT FOR THE SIGNAL.**

# MULTIDIMENSIONAL APTITUDE BATTERY

## SPATIAL

The purpose of the next test is to find out how well you can see differences in figures.

Each problem in this test consists of one figure on the left of a vertical line and five figures on the right. You are to decide which of the five figures on the right is the same as the figure on the left.

Work at question Y.

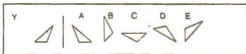
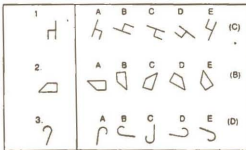


Figure B is the same as the Figure on the left, so you would black out the space next to B on your answer sheet. Figure B can be made to look like the figure on the left by turning it to a different position on the page. Figures, A, C, D, and E are not the same. They cannot be made to look like the figure on the left by turning them on the page. They would have to be flipped over.

Practice on the following sample problems. The correct answer is indicated to the right of each problem.



When marking your answers on the answer sheet, be sure that the number of the question you have just read is the same as the number on the answer sheet.

As a signal from the examiner, turn the page and begin with the first question. Continue if time is called. Work quickly.

WAIT FOR THE SIGNAL

## MULTIDIMENSIONAL APTITUDE BATTERY

### PICTURE ARRANGEMENT

Here are some sets of pictures for you to arrange. In each case, they are mixed up and you are to put them in the right order so that they make the most sensible story.

Look at these pictures. Put them in the right order so they will tell a story.

Choose the correct one of the following possible orders:



- A. 1 2 4 3  
B. 2 3 1 4  
C. 1 4 3 2  
D. 4 1 3 2  
E. 4 3 2 1



The correct order is (C), 1 4 3 2. In frame 1, the mother puts her son's trousers in his boots. Second, in 4, the boy begins to take his trousers out of his boots. In the third scene, frame 3, two girls from school admire his bell-bottoms, and in the final scene, frame 2, as he arrives home, his mother is upset because of his wet and dirty trousers.

For each question, mark the correct choice on your answer sheet. Do not begin until the examiner gives the signal. You will have ten minutes. Continue until time is called.

WAIT FOR THE SIGNAL.



Table 1 -Distribution of Subjects by Age Groups and Sex

SCHOOL-LEVEL CENTER  
ADDRESS

PLEASE COMPLETE THIS INFORMATION ON THE BACK OF BOX

**MULTIDIMENSIONAL BATTERY**  
DOUGLAS

NAME

AGE

SEX

THE USA 1980  
Research No.  
P.O. Box  
Post Office

DATE

IDENTIFICATION NUMBER

THE CANCER  
Research No.  
P.O. Box  
London, Ont.  
M6A 1G5

38  
40  
41  
42  
43  
44  
45  
46



**Table 1 -Distribution of Subjects by Age Groups and Sex**

	Male	Female	Total
Age Group			
1 - (16-19 years)	84	102	186
2 - (20-24 years)	89	63	152
3 - (25-34 years)	59	52	111
Totals	232	217	449

**Table 2 -Distribution of Subjects by Schools and Sex**

Name of School	Sex of Subject		
	Male	Female	Total
Accra Academy	50	0	50
Saint Mary's Secondary School	0	41	41
Accra Girls' Secondary School	0	41	41
Methodist University of Ghana	12	20	32
University of Ghana	24	61	85
West Africa Secondary School	52	25	77
Accra Training College	53	11	64
Accra Workers' College (External Degree - University of Ghana)	41	18	59
Total	232	217	449

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1 → (15-19 years)	84	102	186
2 • (20-24 years)	89	63	152
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<b>Totals</b>	<b>232</b>	<b>217</b>	<b>449</b>

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<b>Total</b>	<b>232</b>	<b>217</b>	<b>449</b>



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Name of School	Sex of Subject		
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Accra Academy	50	0	50
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Methodist University of Ghana	12	20	32
University of Ghana	24	61	85
West Africa Secondary School	52	25	77
Accra Training College	53	11	64
Accra Workers' College (External Degree - University of Ghana)	41	18	59
<b>Total</b>	<b>232</b>	<b>217</b>	<b>449</b>



Table 3 - Distribution of Subjects by Schools, Age Groups, and Sex

Name of School	Age Group	Sex of Subject		Total
		Male	Female	
Accra Academy	1	46	0	46
	2	4	0	4
	3	0	0	0
	Total	50	0	50
Saint Mary's Secondary School	1	0	41	41
	2	0	1	1
	3	0	0	0
	Total	0	41	41
Accra Girls' Secondary School	1	0	41	41
	2	0	1	1
	3	0	0	0
	Total	0	41	41
Methodist University of Ghana	1	0	0	0
	2	0	11	11
	3	12	9	21
	Total	12	20	32
University of Ghana	1	0	0	0
	2	16	34	50
	3	8	27	35
	Total	24	61	85
West Africa Secondary School	1	37	21	58
	2	15	4	19
	3	0	0	0
	Total	52	25	77
Accra Training College	1	1	1	2
	2	46	9	55
	3	6	1	7
	Total	53	11	64
Accra Workers' College (External Degree - University of Ghana)	1	0	0	0
	2	8	3	11
	3	33	15	48
	Total	41	18	59
<b>Total</b>		<b>232</b>	<b>217</b>	<b>449</b>

Appendix 3

Table 4 -MANOVA Output on MAB

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squ
Sex	Digit Symbol	383.516	1	383.516	14.457	< .001	
	Picture Completion	38.032	1	38.032	1.725	.190	
	Spatial	1370.981	1	1370.981	15.602	< .001	
	Picture Arrangement	22.215	1	22.215	3.443	.046	
	Object Assembly	46.152	1	46.152	3.888	.049	
	Information	45.721	1	45.721	1.686	.198	
	Comprehension	235.092	1	235.092	13.677	< .001	
	Arithmetic	43.004	1	43.004	7.031	.008	
	Similarities	1518.982	1	65.472	65.472	< .001	
	Vocabulary	471.701	1	11.656	11.656	< .001	
	Verbal Scale	5810.625	1	17.332	17.332	< .001	
	Performance Scale	192.486	1	192.486	.614	.434	
	Full Scale	3887.962	1	3887.962	4.199	.041	
Age	Digit Symbol	251.276	2	125.638	4.997	.007	
	Picture Completion	220.051	2	110.027	1.992	.007	
	Spatial	394.107	2	197.054	2.242	.107	
	Picture Arrangement	140.100	2	125.638	10.856	< .001	
	Object Assembly	14.268	2	7.134	.601	.549	
	Information	251.065	2	125.548	4.573	.011	
	Comprehension	463.906	2	231.953	13.695	< .001	
	Arithmetic	128.654	2	64.327	10.517	< .001	
	Similarities	203.604	2	101.802	4.388	.013	
	Vocabulary	6961.139	2	3480.569	86.006	< .001	
	Verbal Scale	19720.970	2	9860.485	29.412	< .001	
	Performance Scale	778.438	2	389.219	1.242	.290	
	Full Scale	12669.824	2	6334.912	6.842	< .001	
Error	Digit Symbol	11139.069	433	25.145			
	Picture Completion	9764.503	433	22.042			
	Spatial	38927.612	433	87.837			
	Picture Arrangement	2858.611	433	6.453			
	Object Assembly	5257.998	433	11.869			
	Information	12161.125	433	27.452			
	Comprehension	7502.913	433	16.937			
	Arithmetic	2709.575	433	6.116			
	Similarities	10277.813	433	23.200			
	Vocabulary	17927.685	433	40.469			
	Verbal Scale	148514.921	433	335.248			
	Performance Scale	138621.675	433	313.367			
	Full Scale	410174.360	433	925.901			

p < .004, using the Bonferroni adjusted alpha level (to control for Type 1 error).

## Appendix 3

Table 4 -MANOVA Output on MAB

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Parti Squ
Sex	Digit Symbol	363 516	1	363 516	14 457	< 001	0
	Picture Completion	38 032	1	38 032	1 725	190	0
	Spatial	1370 981	1	1370 981	15 602	< 001	0
	Picture Arrangement	22 215	1	22 215	3 443	046	0
	Object Assembly	46 152	1	46 152	3 888	049	0
	Information	45 721	1	45 721	1 686	198	0
	Comprehension	235 092	1	235 092	13 877	< 001	0
	Arithmetic	43 004	1	43 004	7 031	008	0
	Similarities	1518 982	1	65 472	65 472	< 001	1
	Vocabulary	471 701	1	11 656	11 656	< 001	0
	Verbal Scale	5810 625	1	17 332	17 332	< 001	0
	Performance Scale	192 486	1	192 486	614	434	0
	Full Scale	3887 962	1	3887 962	4 199	041	0
Age	Digit Symbol	251 276	2	125 638	4 997	007	0
	Picture Completion	220 051	2	110 027	1 992	007	0
	Spatial	394 107	2	197 054	2 242	107	0
	Picture Arrangement	140 100	2	125 638	10 856	< 001	0
	Object Assembly	14 268	2	7 134	601	549	0
	Information	251 095	2	125 548	4 573	011	0
	Comprehension	463 906	2	231 953	13 695	< 001	0
	Arithmetic	126 654	2	64 327	10 517	< 001	0
	Similarities	203 604	2	101 802	4 388	013	0
	Vocabulary	6961 139	2	3480 569	86 006	< 001	2
	Verbal Scale	19720 970	2	9860 485	29 412	< 001	1
	Performance Scale	778 438	2	389 219	1 242	290	0
	Full Scale	12699 824	2	6334 912	6 842	< 001	0
Error	Digit Symbol	11139 069	433	25 145			
	Picture Completion	9764 503	433	22 042			
	Spatial	36927 612	433	87 837			
	Picture Arrangement	2858 611	433	6 453			
	Object Assembly	5257 998	433	11 869			
	Information	12161 125	433	27 452			
	Comprehension	7502 913	433	16 937			
	Arithmetic	2709 575	433	6 116			
	Similarities	10277 813	433	23 200			
	Vocabulary	17927 685	433	40 469			
	Verbal Scale	148514 921	433	335 248			
	Performance Scale	138621 675	433	313 367			
	Full Scale	410174 360	433	925 901			

$p < .004$  using the Bonferroni adjusted alpha level (to control for Type 1 error)

Table 5 --ANOVA Output on MAB

Measure		Sum of Squares	df	Mean Square	F	Sig.
Digit Symbol	Between Groups	301.237	2	150.618	5.780	.003
	Within Groups	11622.193	446	26.059		
	Total	11923.430	448			
Picture Completion	Between Groups	216.214	2	108.107	4.903	.008
	Within Groups	9834.503	446	22.050		
	Total	10050.717	448			
Spatial	Between Groups	375.550	2	187.775	2.057	.129
	Within Groups	40705.171	446	91.267		
	Total	41080.722	448			
Picture Arrangement	Between Groups	154.701	2	77.350	11.815	.000
	Within Groups	2919.927	446	6.547		
	Total	3074.628	448			
Object Assembly	Between Groups	19.976	2	9.988	.838	.433
	Within Groups	5317.761	446	11.923		
	Total	5337.737	448			
Information	Between Groups	231.981	2	115.990	4.233	.015
	Within Groups	12220.906	446	27.401		
	Total	12452.886	448			
Comprehension	Between Groups	426.670	2	213.335	12.204	.000
	Within Groups	7796.345	446	17.481		
	Total	8223.016	448			
Arithmetic	Between Groups	125.697	2	62.848	10.181	.000
	Within Groups	2753.181	446	6.173		
	Total	2878.878	448			
Similarities	Between Groups	118.600	2	59.300	2.237	.108
	Within Groups	11823.355	446	26.510		
	Total	11941.955	448			
Vocabulary	Between Groups	6720.896	2	3360.448	81.200	.000
	Within Groups	18457.599	446	41.385		
	Total	25178.494	448			
Verbal Scale	Between Groups	18375.418	2	9187.709	26.517	.000
	Within Groups	154534.408	446	346.490		
	Total	172909.826	448			
Performance Scale	Between Groups	765.642	2	382.821	1.226	.294
	Within Groups	139260.999	446	312.244		
	Total	140026.641	448			
Full Scale	Between Groups	11660.205	2	5830.103	6.277	.002
	Within Groups	414220.779	446	928.746		
	Total	425880.984	448			

Table 8--Tukey's Honestly Significant Difference (HSD) following significant ANOVA on MAB--Age (Multiple Comparisons)

Dependent Variable	(I) 3 age groups	(J) 3 age groups	Mean Difference (I-J)	Std. Error	Sig.
Digit Symbol (ds)	1	1			
		2	1.00	.56	.175
		3	2.06*	.61	.002
	2	1	-1.00	.56	.175
		2			
		3	1.07	.64	.215
	3	1	-2.06*	.61	.002
		2	-1.07	.64	.215
		3			
Picture Completion	1	1			
		2	-.36	.51	.767
		3	-1.73*	.56	.006
	2	1	.36	.51	.767
		2			
		3	-1.37	.59	.060
	3	1	1.73*	.56	.006
		2	1.37	.59	.060
		3			
Spatial	1	1			
		2	-.0128	1.04	1.000
		3	2.11	1.15	.155
	2	1	.0128	1.04	1.000
		2			
		3	2.13	1.19	.175
	3	1	-2.11	1.15	.155
		2	-2.13	1.19	.175
		3			
Picture Arrangement	1	1			
		2	1.12*	.28	.000
		3	1.27*	.31	.000
	2	1	-1.12*	.28	.000
		2			
		3	.15	.32	.888
	3	1	-1.27*	.31	.000
		2	-.15	.32	.888
		3			
Object Assembly	1	1			
		2	-.44	.38	.467
		3	-.40	.41	.593
	2	1	.44	.38	.467
		2			
		3	.04.1	.43	.995
	3	1	.40	.41	.593
		2	-.041	.43	.995
		3			
Information	1	1			
		2	-1.06	.57	.152
		3	-1.76*	.63	.014
	2	1	1.06	.57	.152
		2			
		3	-.70	.65	.532
	3	1	1.76*	.63	.014
		2	.70	.65	.532
		3			

Table 6 (Continued)

Dependent Variable	(I) 3 age groups	(J) 3 age groups	Mean Difference (I-J)	Std. Error	Sig.
Comprehension	1	1	-1.25*	48	.017
		2	-2.44*	50	.000
		3	1.25*	48	.017
	2	1	-1.19	52	.058
		2	2.44*	50	.000
		3	1.19	52	.058
Arithmetic	1	1	.42	27	.264
		2	-.98*	30	.004
		3	-.42	27	.264
	2	1	-1.38	31	.000
		2	.98*	30	.004
		3	1.38	31	.000
Similarities	1	1	-.70	68	.430
		2	-1.20	62	.086
		3	.70	68	.430
	2	1	-.68	64	.638
		2	1.28	62	.096
		3	.68	64	.638
Vocabulary	1	1	-4.79*	70	.000
		2	-6.73*	77	.000
		3	4.79*	70	.000
	2	1	-4.94*	80	.000
		2	6.73*	77	.000
		3	4.94*	80	.000
Verbal Scale	1	1	-7.38*	2.04	.001
		2	-16.18*	2.23	.000
		3	7.38*	2.04	.001
	2	1	-8.90*	2.32	.000
		2	18.18*	2.23	.000
		3	8.90*	2.32	.000
Performance Scale	1	1	1.31	1.93	.777
		2	3.32	2.12	.281
		3	-1.31	1.93	.777
	2	1	2.01	2.21	.833
		2	-3.32	2.12	.281
		3	-2.01	2.21	.633
Full Scale	1	1	-6.07	3.33	.162
		2	-12.88*	3.66	.001
		3	6.07	3.33	.162
	2	1	-6.79	3.80	.178
		2	12.88*	3.66	.001
		3	6.79	3.80	.178

\* The mean difference is significant at the .05 level.

Table 7 --MAB Intercorrelation Matrix—Ghanaian Sample  
N=449

Scale	Inf	Com	Ar	Slim	Voc	DS	PC	Spa	PA	OA	V	P	F
Information	..												
Comprehension	.62*	..											
Arithmetic	.42**	.35**	..										
Similarities	.55**	.57**	.29**	..									
Vocabulary	.57**	.59**	.38**	.57**	..								
Digit Symbol	.25**	.17*	.16**	.22**	.03	..							
Picture Completion	.53**	.47*	.30**	.36**	.44**	.22**	..						
Spatial	.13**	.09	.15**	.08	.03	.22**	.35**	..					
Picture Arrangement	.31**	.24*	.19**	.27**	.05	.34**	.45**	.27**	..				
Object Assembly	.32**	.30*	.31**	.24**	.22**	.23**	.54**	.34**	.45**	..			
Verbal Scale	.82*	.80*	.54	.79*	.68*	.19*	.53*	.10*	.25*	.34*	..		
Performance Scale	.39*	.32*	.30	.29*	.19*	.58*	.69*	.04*	.59*	.65*	.36	..	
Full Scale	.75**	.69**	.51	.67**	.66**	.46**	.75**	.53**	.50**	.59**	.85**	.81**	..

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

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

Male=232

Female=217

Table 7 --MAB Intercorrelation Matrix—Ghanaian Sample  
N=449

Scale	Inf	Com	Ar	Sim	Voc	DS	PC	Spa	PA	OA	V	P	F
Information	..												
Comprehension	.82*	..											
Arithmetic	.42**	.35**	..										
Similarities	.55**	.57**	.29**	..									
Vocabulary	.57**	.59**	.38**	.57**	..								
Digit Symbol	.25**	.17*	.16**	.22**	.03	..							
Picture Completion	.53**	.47*	.30**	.36**	.44**	.22**	..						
Spatial	.13**	.09	.15**	.08	.03	.22**	.35**	..					
Picture Arrangement	.31**	.24*	.19**	.27**	.05	.34**	.45**	.27**	..				
Object Assembly	.32**	.30*	.31**	.24**	.22**	.23**	.54**	.34**	.45**	..			
Verbal Scale	.82*	.80*	.54	.79*	.88*	.19*	.53*	.10*	.25*	.34*	..		
Performance Scale	.39*	.32*	.30	.29*	.19*	.56*	.69*	.04*	.59*	.65*	.36	..	
Full Scale	.75**	.69**	.51	.67**	.66**	.46**	.75**	.53**	.50**	.59**	.85**	.81**	..

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

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

Males= 232

Females=217

Table 8 -Correlation matrices for males and females on MAB—  
Ghanalan Sample

Scale	Male Scores													Female Scores												
	Inf	Com	Ar	Sim	Voc	DS	PC	Spa	PA	OA	V	P	Inf	Com	Ar	Sim	Voc	DS	PC	Spa	PA	OA	V	P		
Information	—	.61*	.48**	.56**	.60**	.32**	.56**	.17*	.34**	.34**	.83*	.45*	.62*	—	.44**	.55**	.49**	.45*	.25**	.32**	.40**	.24**	.28*	.62*	.82*	
Comprehension	.39**	—	.44**	.55**	.62**	.26**	.48*	.11	.22*	.32**	.61*	.36*	.67*	.12	—	.43**	.39**	.13	.05	.19**	.22**	.30**	.33**	.21*	.81*	
Arithmetic	.53**	.31**	—	.43**	.37**	.24**	.37**	.23**	.22**	.24**	.56**	.40**	.67*	.26**	.23*	—	.29**	.22*	.19**	.22**	.28**	.37**	.37**	.28*	.60*	
Similarities	.58**	.57**	.29**	—	.61**	.25**	.46**	.27**	.28**	.25**	.81*	.45*	.68*	.32**	.32**	.25**	—	.25**	.24**	.21**	.48**	.37**	.39*	.64*	.86*	
Vocabulary	.55**	.55**	.42**	.53**	—	.11	.50**	.11	.06	.25**	.84*	.28*	.82*	.32**	.32**	.25**	—	.06	.24**	.34**	.48**	.39*	.39*	.64*	.86*	
Digit Symbol	.17*	.04	.14*	.08	-.08	.11	.26**	.11	.40**	.24**	.28*	.62*	.82*	.17**	.17**	.08	—	.11	.24**	.30**	.40**	.24**	.28*	.62*	.82*	
Picture Completion	.49**	.45*	.25**	.32**	.39**	.17**	—	.31**	.38**	.54**	.61*	.67*	.87*	.49**	.45*	.25**	.32**	—	.24**	.30**	.40**	.24**	.28*	.62*	.82*	
Spatial	.12	.13	.05	.01	-.01	.24**	.42**	.11	.30**	.33**	.21*	.81*	.87*	.26**	.23*	.19**	.22**	.02	.25**	.50**	.30**	.30**	.21*	.81*	.87*	
Picture Arrangement	.26**	.23*	.19**	.22**	.02	.25**	.50**	.30**	.30**	.37**	.28*	.60*	.87*	.31**	.32**	.25**	.24**	.21**	.26**	.55**	.34**	.37**	.28*	.60*	.87*	
Object Assembly	.32**	.29*	.25**	.24**	.21**	.26**	.55**	.34**	.48**	—	.39*	.64*	.87*	.32**	.32**	.25**	.24**	.21**	.26**	.55**	.34**	.37**	.28*	.60*	.87*	
Verbal Scale	.32**	.29*	.25**	.24**	.21**	.26**	.55**	.34**	.48**	.33*	.39*	.64*	.87*	.32**	.32**	.25**	.24**	.21**	.26**	.55**	.34**	.37**	.28*	.60*	.87*	
Performance Scale	.34*	.29*	.21*	.19*	.12	.55*	.76*	.82*	.60*	.61**	.28*	.82*	.87*	.34*	.29*	.21*	.19*	.12	.55*	.76*	.82*	.60*	.61**	.28*	.82*	
Full Scale	.74**	.67**	.46**	.61**	.63**	.37**	.75**	.54**	.50**	.61**	.82**	.76**	.82**	.74**	.67**	.46**	.61**	.63**	.37**	.75**	.54**	.50**	.61**	.82**	.76**	

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

\* Correlation is significant at the 0.05 level (2 tailed).

Correlation above diagonal for females.

Correlation below diagonal for males.



Appendix 5  
Standard Scores for MAB—Ghanaian Sample

Age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
16	38	48	39	50	38	175	57	30	33	41	32	193	368
16	46	38	42	46	42	168	62	26	38	45	32	203	371
16	39	45	45	40	44	174	64	35	52	48	32	231	405
16	45	41	51	48	42	182	62	33	33	37	34	199	381
16	55	52	57	62	57	228	53	35	41	45	34	208	436
16	44	50	45	47	52	194	44	24	47	41	36	192	386
16	49	43	54	52	44	193	75	33	31	45	36	220	413
16	37	40	45	55	43	183	71	22	62	48	36	239	422
16	39	53	48	56	43	200	69	27	44	48	38	226	426
16	45	50	42	54	45	191	66	27	38	56	38	225	416
16	40	41	54	43	41	179	84	29	56	30	40	219	398
16	48	40	45	55	43	183	48	33	56	30	40	205	388
16	34	41	45	51	41	178	55	26	49	34	40	204	382
16	50	48	57	38	47	190	44	24	52	41	40	201	391
16	45	47	48	44	47	186	62	35	47	56	40	240	426
16	41	43	54	52	46	196	44	27	24	30	42	167	362
16	49	45	51	52	43	191	53	22	31	37	42	185	376
16	51	50	45	58	50	203	55	30	35	48	42	210	413
16	49	48	42	58	52	200	75	32	52	50	42	251	451
16	52	50	48	55	54	207	78	32	56	56	42	264	471
16	39	50	45	50	46	191	44	26	32	28	44	172	363
16	40	53	45	44	47	189	62	27	33	45	44	211	400
16	41	52	51	54	46	203	62	32	58	48	44	244	447
16	51	47	51	54	46	198	50	44	58	48	44	244	442
16	54	59	63	55	54	231	64	37	46	50	44	241	472
16	39	43	48	43	44	178	55	24	51	50	44	224	402
16	45	52	39	60	64	216	64	41	40	56	44	245	460
16	40	45	48	52	42	187	23	29	42	48	46	188	376
16	35	48	42	44	41	175	64	27	49	48	46	234	409
16	49	43	48	54	45	190	53	35	40	59	46	233	423
16	45	50	48	42	46	186	57	29	56	34	48	224	410
16	39	40	45	43	47	175	48	26	38	37	48	197	372
16	44	47	48	55	52	202	78	56	61	48	48	291	493
16	41	50	48	43	48	189	67	33	30	56	48	234	423
16	45	43	51	52	50	196	75	43	48	58	48	270	466
16	54	41	45	54	46	186	73	32	51	48	49	253	439
16	43	48	60	56	40	204	80	29	55	48	49	261	466
16	57	57	66	51	56	230	75	52	62	50	49	288	518
16	54	52	60	60	49	221	78	46	60	58	49	289	510
16	52	47	60	60	52	219	71	48	65	56	49	289	508
16	48	47	51	51	47	196	89	26	53	45	52	245	441
16	44	45	39	40	37	161	55	38	36	50	52	234	396
16	56	57	57	56	52	224	62	42	66	56	52	278	502
16	55	52	48	54	56	210	66	51	64	50	54	285	496
16	57	55	51	58	57	221	50	40	46	58	54	246	467
16	46	47	42	54	46	189	71	29	33	45	56	234	423
16	54	60	60	58	65	243	71	38	51	56	56	272	516

Appendix 5  
Standard Scores for MAB—Ghanaian Sample

Age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
16	38	48	39	50	38	175	57	30	33	41	32	193	368
16	46	38	42	46	42	168	62	26	38	45	32	203	371
16	39	45	45	40	44	174	64	35	52	48	32	231	405
16	45	41	51	48	42	182	62	33	33	37	34	199	381
16	55	52	57	62	57	228	53	35	41	45	34	208	438
16	44	50	45	47	52	194	44	24	47	41	36	192	386
16	49	43	54	52	44	193	75	33	31	45	36	220	413
16	37	40	45	55	43	183	71	22	62	48	36	239	422
16	39	53	48	56	43	200	69	27	44	48	38	226	426
16	45	50	42	54	45	191	66	27	38	56	38	225	416
16	40	41	54	43	41	179	84	29	56	30	40	219	398
16	48	40	45	55	43	183	46	33	56	30	40	205	388
16	34	41	45	51	41	178	55	26	49	34	40	204	382
16	50	48	57	38	47	190	44	24	52	41	40	201	391
16	45	47	48	44	47	186	62	35	47	56	40	240	426
16	41	43	54	52	46	195	44	27	24	30	42	167	362
16	46	45	51	52	43	191	53	22	31	37	42	185	376
16	51	50	45	58	50	203	55	30	35	48	42	210	413
16	46	48	42	58	52	200	75	32	52	50	42	251	451
16	52	50	48	55	54	207	78	32	56	56	42	264	471
16	39	50	45	50	46	191	44	26	32	28	44	172	363
16	40	53	45	44	47	189	62	27	33	45	44	211	400
16	41	52	51	54	46	203	62	32	58	48	44	244	447
16	51	47	51	54	48	198	50	44	58	48	44	244	442
16	54	56	63	55	54	231	64	37	48	50	44	241	472
16	39	43	48	43	44	178	55	24	51	50	44	224	402
16	45	52	39	60	64	216	64	41	40	56	44	245	460
16	40	45	48	52	42	187	23	29	42	48	46	188	375
16	35	48	42	44	41	175	64	27	49	48	46	234	409
16	49	43	48	54	45	190	53	35	40	59	46	233	423
16	45	50	48	42	46	186	57	29	56	34	48	224	410
16	39	40	45	43	47	175	48	26	38	37	48	197	372
16	44	47	48	55	52	202	78	56	61	48	48	291	493
16	41	50	48	43	48	189	67	33	30	56	48	234	423
16	45	43	51	52	50	196	75	43	48	56	48	270	466
16	54	41	45	54	46	186	73	32	51	48	49	253	439
16	43	48	60	56	40	204	80	29	55	48	49	261	465
16	57	57	66	51	56	230	75	52	62	50	49	288	518
16	54	52	60	60	49	221	78	46	60	56	49	289	510
16	52	47	60	60	52	219	71	48	65	56	49	289	508
16	48	47	51	51	47	196	69	26	53	45	52	245	441
16	44	45	39	40	37	161	55	36	36	50	52	234	395
16	56	57	57	58	52	224	62	42	66	56	52	278	502
16	55	52	48	54	56	210	66	51	64	50	54	285	495
16	57	55	51	58	57	221	50	40	46	56	54	246	467
16	46	47	42	54	48	189	71	29	33	45	56	234	423
16	54	60	60	58	65	243	71	38	51	56	56	272	515

Appendix 5  
Standard Scores for MAB—Ghanaian Sample

Age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
16	38	48	39	50	38	175	57	30	33	41	32	193	368
16	46	38	42	46	42	168	62	26	38	45	32	203	371
16	36	45	45	40	44	174	64	35	52	48	32	231	405
16	45	41	51	48	42	182	62	33	33	37	34	199	381
16	55	52	57	62	57	228	53	35	41	45	34	208	438
16	44	50	45	47	52	194	44	24	47	41	36	192	386
16	49	43	54	52	44	193	75	33	31	45	36	220	413
16	37	40	45	55	43	183	71	22	62	48	36	239	422
16	39	53	48	56	43	200	69	27	44	48	38	226	426
16	45	50	42	54	45	191	66	27	38	56	38	225	416
16	40	41	54	43	41	179	84	29	56	30	40	219	398
16	48	40	45	55	43	183	48	33	56	30	40	208	388
16	34	41	45	51	41	178	55	26	49	34	40	204	382
16	50	48	57	38	47	190	44	24	52	41	40	201	391
16	45	47	48	44	47	186	62	35	47	58	40	240	426
16	41	43	54	52	46	196	44	27	24	30	42	167	362
16	49	45	51	52	43	191	53	22	31	37	42	185	376
16	51	50	45	58	50	203	55	30	35	48	42	210	413
16	49	48	42	58	52	200	75	32	52	50	42	251	451
16	52	50	48	55	54	207	78	32	56	56	42	264	471
16	39	50	45	50	46	191	44	26	32	28	44	172	363
16	40	53	45	44	47	189	62	27	33	45	44	211	400
16	41	52	51	54	46	203	62	32	58	48	44	244	447
16	51	47	51	54	46	198	50	44	58	48	44	244	442
16	54	59	63	55	54	231	64	37	48	50	44	241	472
16	39	43	48	43	44	178	55	24	51	50	44	224	402
16	45	52	39	60	64	218	64	41	40	56	44	248	460
16	40	45	48	52	42	187	23	29	42	48	46	188	376
16	35	48	42	44	41	175	64	27	49	48	46	234	409
16	49	43	48	54	45	190	53	35	40	59	46	233	423
16	45	50	48	42	46	186	57	29	56	34	48	224	410
16	39	40	45	43	47	175	48	26	38	37	48	197	372
16	44	47	48	55	52	202	78	56	61	48	48	291	493
16	41	50	48	43	48	189	67	33	30	56	48	234	423
16	45	43	51	52	50	196	75	43	48	56	48	270	466
16	54	41	45	54	46	186	73	32	51	48	49	253	439
16	43	48	60	56	40	204	80	29	55	48	49	261	465
16	57	57	66	51	56	230	75	52	62	50	49	288	518
16	54	52	60	60	49	221	78	46	60	58	49	289	510
16	52	47	60	60	52	219	71	48	65	56	49	289	508
16	48	47	51	51	47	196	69	26	53	45	52	245	441
16	44	45	39	40	37	161	55	38	39	50	52	234	395
16	56	57	57	58	52	224	62	42	66	56	52	278	502
16	55	52	48	54	56	210	66	51	64	50	54	285	495
16	57	55	51	58	57	221	50	40	46	56	54	246	467
16	46	47	42	54	48	189	71	29	33	45	56	234	423
16	54	60	60	58	65	243	71	38	51	56	56	272	515

Age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
16	48	52	48	48	40	188	53	43	55	59	56	266	464
16	44	50	60	54	46	210	71	51	55	63	56	296	506
16	51	53	57	54	66	230	78	62	55	59	58	312	542
16	48	55	45	59	48	207	66	49	60	59	58	292	499
16	65	55	66	55	56	232	59	43	66	56	60	284	516
16	51	59	57	42	62	220	66	46	26	48	62	248	468
17	37	40	36	44	41	161	23	22	33	34	34	146	307
17	38	41	51	52	48	190	57	27	37	37	34	192	382
17	40	41	36	44	41	162	71	29	31	41	34	206	368
17	41	48	45	48	43	184	59	24	37	41	34	196	379
17	49	52	39	56	46	193	55	27	41	41	34	198	391
17	51	43	57	48	48	196	62	29	61	34	36	222	418
17	50	47	48	80	47	202	73	27	31	45	36	212	414
17	35	41	45	47	41	174	55	24	38	56	36	209	383
17	52	53	48	48	46	195	57	27	45	56	36	221	416
17	35	45	36	36	49	166	46	29	39	37	38	189	355
17	46	48	45	51	37	181	48	35	48	37	38	206	387
17	44	41	39	50	43	173	62	30	30	41	38	201	374
17	40	43	48	50	44	185	57	26	28	45	38	194	379
17	49	52	51	42	45	190	50	40	41	48	38	217	407
17	43	52	51	55	51	209	53	26	49	41	40	209	418
17	38	53	51	47	45	196	57	37	66	41	40	241	437
17	43	41	39	50	46	176	57	26	24	45	40	192	368
17	41	33	48	54	42	177	44	30	26	54	40	194	371
17	38	38	48	51	44	181	41	22	42	45	40	190	371
17	44	53	48	62	59	222	66	33	46	48	40	233	456
17	49	52	48	50	45	196	39	41	47	48	40	216	410
17	55	48	48	56	58	210	78	27	38	50	40	233	443
17	57	52	51	55	57	215	71	33	39	50	40	233	448
17	37	36	39	38	38	151	39	24	33	19	42	157	308
17	46	35	51	46	38	170	73	24	35	41	42	216	386
17	40	52	54	42	51	199	25	40	40	45	42	192	391
17	41	45	48	42	46	181	64	33	30	50	42	219	400
17	52	45	54	46	50	195	66	40	39	56	42	243	438
17	51	50	42	56	43	191	66	35	56	41	44	242	433
17	52	55	57	55	52	219	71	38	45	50	44	248	467
17	80	50	57	52	51	210	75	41	54	50	44	264	474
17	41	41	48	46	40	175	64	35	45	48	46	238	413
17	54	57	60	60	61	238	75	49	65	48	46	283	521
17	46	62	63	59	57	241	71	43	45	50	46	255	496
17	45	41	48	51	44	184	57	38	27	54	48	224	408
17	39	52	51	54	43	200	50	37	60	45	48	240	440
17	44	48	42	51	41	182	44	40	66	63	48	261	443
17	43	45	51	43	44	183	57	35	63	37	50	242	425
17	39	50	57	42	40	189	59	30	22	41	50	202	391
17	50	57	42	62	52	213	64	42	62	45	49	262	475
17	46	52	42	51	50	195	66	40	49	48	49	252	447
17	45	50	63	55	48	216	46	40	34	48	52	220	436
17	49	59	60	56	53	228	41	48	53	50	52	244	472
17	46	55	54	47	45	201	48	43	49	56	52	248	449

17	40	38	54	43	41	176	62	30	61	58	52	261	437
17	40	40	42	47	44	173	53	27	30	37	54	201	374
ge	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
17	43	41	48	55	48	192	75	32	75	48	54	284	476
17	54	52	51	62	53	218	62	41	38	50	54	246	463
17	54	57	45	64	51	217	59	52	24	50	54	239	456
17	45	41	51	56	44	192	73	43	67	50	54	287	479
17	34	38	42	42	35	155	68	27	32	58	54	236	390
17	52	62	68	63	57	248	75	43	74	58	54	302	560
17	43	50	54	43	50	197	57	37	54	59	54	261	458
17	51	60	66	55	54	235	80	34	64	48	58	282	517
17	49	53	54	60	50	217	80	41	31	58	58	266	483
17	44	53	57	55	47	212	64	38	39	59	58	258	470
17	50	64	57	58	49	226	82	41	69	50	60	282	508
17	39	41	51	43	41	176	66	46	65	50	62	289	466
18	45	39	48	47	46	180	53	28	36	25	33	175	355
18	40	44	48	51	41	184	80	27	50	58	33	248	432
18	39	39	45	40	46	170	35	28	30	36	35	164	334
18	42	45	54	50	45	194	58	23	34	32	37	184	378
18	43	45	38	43	43	167	48	23	50	36	37	194	361
18	56	49	48	60	47	204	71	34	31	43	37	216	420
18	45	44	38	43	43	166	62	31	58	25	39	215	381
18	45	39	48	39	43	169	64	34	58	25	39	220	389
18	39	45	39	44	34	162	67	27	38	29	39	200	362
18	40	49	38	40	43	168	53	25	24	40	39	181	349
18	38	35	48	43	43	169	46	27	37	40	39	189	358
18	47	51	57	50	45	203	44	27	31	43	39	184	387
18	48	52	60	48	18	178	67	28	46	47	39	227	406
18	40	35	48	39	43	165	44	27	34	32	41	178	343
18	42	47	54	47	41	189	60	28	34	32	41	195	384
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18	43	33	38	40	43	162	69	31	49	47	41	237	389
18	33	37	42	42	38	169	71	28	53	47	41	240	399
18	38	39	42	35	44	160	59	23	30	25	43	180	340
18	32	35	36	40	34	145	64	19	30	29	43	185	330
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18	42	45	42	60	49	196	67	44	35	40	43	229	425
18	43	42	38	43	44	165	73	31	53	43	43	243	408
18	48	51	48	43	43	185	48	33	61	47	43	232	417
18	40	45	42	52	47	186	60	34	62	32	45	233	419
18	49	39	51	51	52	193	58	34	37	36	45	210	403
18	47	54	51	50	63	218	64	30	39	36	45	214	432
18	49	47	48	51	42	188	42	33	26	40	45	186	374
18	50	47	45	44	43	179	46	33	49	43	45	216	396
18	42	44	48	44	44	180	53	31	39	51	45	219	399
18	44	45	48	39	43	175	53	27	35	32	47	194	369
18	38	40	42	43	43	168	44	33	35	32	47	191	369
18	45	49	48	58	51	206	60	39	48	36	47	230	436
18	39	44	45	44	44	177	62	28	63	36	47	236	413

18	42	42	42	50	45	179	56	30	49	43	47	227	406
18	39	39	36	43	43	161	60	34	57	43	47	241	402
18	59	54	51	52	61	218	78	42	37	47	47	251	469
ge	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
18	56	54	57	62	49	222	42	44	50	47	49	232	454
18	45	56	54	55	49	214	55	39	57	51	49	251	465
18	47	45	45	47	49	186	48	36	44	40	49	217	403
18	54	45	54	44	41	184	62	39	70	47	50	268	452
18	39	33	54	46	43	176	69	31	66	51	50	267	443
18	42	37	54	44	43	178	53	34	57	43	53	240	418
18	50	49	48	55	55	207	62	39	57	53	53	264	471
19	27	32	28	30	42	132	42	22	26	32	31	153	285
19	32	40	36	40	40	156	46	30	29	43	31	179	335
19	38	51	48	54	42	196	76	28	42	43	31	220	415
19	38	35	45	39	41	160	44	23	24	21	33	146	305
19	44	33	28	48	44	153	44	36	48	36	35	199	352
19	40	49	42	50	47	188	39	30	42	40	35	186	374
19	43	39	42	47	42	170	48	31	25	53	37	194	364
19	37	37	45	39	46	167	60	20	37	47	37	201	368
19	39	42	42	47	44	175	51	28	53	29	39	200	375
19	36	40	39	48	48	175	51	30	38	43	39	201	376
19	36	40	42	38	43	163	53	30	30	29	41	183	346
19	43	40	48	47	45	180	58	27	43	43	41	212	392
19	40	45	42	52	48	187	51	34	50	43	41	219	406
19	32	44	51	51	45	191	42	27	48	47	41	205	396
19	36	32	45	40	42	159	37	38	52	53	41	221	380
19	40	39	48	52	46	185	53	22	51	29	43	198	383
19	51	54	57	51	48	210	53	22	51	29	43	198	408
19	47	49	54	54	48	203	71	34	39	40	43	227	430
19	43	37	39	43	44	163	58	38	50	51	43	238	401
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19	43	42	51	51	45	189	53	27	35	32	47	194	383
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19	38	39	39	35	44	167	71	34	35	32	47	219	376
19	47	40	48	55	43	186	51	30	58	47	47	233	419
19	49	40	54	52	51	197	64	38	50	51	47	250	447
19	43	47	48	46	49	190	80	33	45	36	49	243	433
19	42	44	48	44	44	180	58	30	34	43	49	214	394
19	44	42	48	58	45	193	60	27	64	62	50	263	456
20	39	38	29	36	37	140	69	29	51	45	41	235	375
19	40	40	46	56	56	200	71	33	58	40	57	259	459
20	39	35	41	43	43	162	51	20	29	27	31	158	320
20	31	35	38	47	35	155	60	20	41	34	33	188	343
20	30	40	47	38	36	161	51	23	55	23	35	187	348
20	38	44	53	47	48	192	56	23	55	23	35	192	384
20	36	45	44	39	52	180	58	25	46	34	35	198	378
20	41	44	47	51	43	185	51	23	29	41	35	179	364
20	31	40	47	49	43	179	54	26	62	41	35	218	397
20	42	49	50	44	47	190	49	25	44	30	39	187	377
20	33	37	41	46	39	163	76	22	43	45	39	225	388
20	33	44	38	41	40	163	49	26	29	30	41	175	338

18	42	42	42	50	45	179	58	30	49	43	47	227	406
18	39	39	36	43	43	161	60	34	57	43	47	241	402
18	59	54	51	52	61	218	78	42	37	47	47	251	469
ge	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
18	56	54	57	62	49	222	42	44	50	47	49	232	454
18	45	56	54	55	49	214	55	39	57	51	49	261	465
18	47	45	45	47	49	186	48	36	44	40	49	217	403
18	54	45	54	44	41	184	62	39	70	47	50	268	462
18	39	33	54	46	43	176	69	31	66	51	50	267	443
18	42	37	54	44	43	178	53	34	57	43	53	240	418
18	50	49	48	55	55	207	62	39	57	53	53	264	471
19	27	32	28	30	42	132	42	22	26	32	31	153	285
19	32	40	36	40	40	156	46	30	29	43	31	179	335
19	38	51	48	54	42	196	76	28	42	43	31	220	415
19	38	35	45	39	41	160	44	23	24	21	33	146	305
19	44	33	28	48	44	153	44	36	48	36	35	199	352
19	40	49	42	50	47	188	39	30	42	40	35	186	374
19	43	39	42	47	42	170	46	31	25	53	37	194	364
19	37	37	45	39	46	167	60	20	37	47	37	201	368
19	39	42	42	47	44	175	51	28	53	29	39	200	375
19	36	40	39	48	48	175	51	30	38	43	39	201	376
19	36	40	42	38	43	163	53	30	30	29	41	183	346
19	43	40	48	47	45	180	58	27	43	43	41	212	392
19	40	45	42	52	48	187	51	34	50	43	41	219	406
19	32	44	51	51	45	191	42	27	48	47	41	206	398
19	36	32	45	40	42	159	37	38	52	53	41	221	380
19	40	39	48	52	46	185	53	22	51	29	43	198	383
19	51	54	57	51	48	210	53	22	51	29	43	198	408
19	47	49	54	54	46	203	71	34	39	40	43	227	430
19	43	37	39	43	44	163	58	36	50	51	43	238	401
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19	43	42	51	51	45	189	53	27	35	32	47	194	383
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19	38	39	39	35	44	157	71	34	35	32	47	219	376
19	47	40	48	55	43	186	51	30	58	47	47	233	419
19	49	40	54	52	51	197	64	38	50	51	47	250	447
19	43	47	48	46	49	190	80	33	45	36	49	243	433
19	42	44	48	44	44	180	58	30	34	43	49	214	394
19	44	42	48	58	45	193	80	27	64	62	50	263	456
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19	40	40	48	56	56	200	71	33	58	40	57	259	459
20	39	35	41	43	43	162	51	20	29	27	31	158	320
20	31	35	38	47	35	155	60	20	41	34	33	188	343
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20	38	44	53	47	48	192	56	23	55	23	35	192	384
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20	42	49	50	44	47	190	49	25	44	30	39	187	377
20	33	37	41	46	39	163	76	22	43	45	39	225	388
20	33	44	38	41	40	163	49	26	29	30	41	175	338

20	39	38	29	38	37	140	89	29	51	45	41	235	375
20	34	40	38	43	41	162	58	34	55	49	41	235	397
20	31	35	38	47	35	165	60	20	41	34	33	188	343
20	38	35	21	32	29	117	74	26	54	20	43	217	334
age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
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20	38	40	47	42	37	166	54	23	29	41	47	194	360
20	44	45	10	51	41	147	69	34	24	45	47	219	366
20	39	35	41	44	37	157	40	23	48	34	49	194	351
20	33	38	41	42	40	161	51	29	48	34	49	211	372
20	36	45	44	39	52	180	58	25	46	34	35	198	378
20	33	38	41	42	40	161	51	29	48	34	49	211	372
20	54	58	59	56	54	225	65	50	61	49	61	286	511
20	33	44	38	41	40	163	49	28	29	30	41	175	338
21	37	37	41	53	50	181	63	18	40	30	33	184	365
21	38	45	47	42	49	183	60	23	39	38	33	193	376
21	43	45	41	53	50	189	63	20	39	23	35	180	369
21	36	40	38	38	36	152	49	20	33	38	35	175	327
21	39	47	44	46	39	176	63	20	39	23	39	184	360
21	34	35	50	35	35	155	65	29	28	41	39	202	357
21	55	56	44	48	39	185	63	34	36	49	39	221	406
21	41	44	35	44	48	169	12	38	55	34	41	178	347
21	34	42	41	55	47	185	47	38	48	49	41	219	404
21	30	32	41	31	32	136	56	22	56	52	41	227	363
21	31	30	38	39	35	142	78	28	58	52	41	253	396
21	34	28	41	31	32	132	60	33	56	52	41	242	374
21	39	59	41	53	50	203	60	39	27	56	41	223	426
21	48	50	44	50	39	183	58	36	21	41	43	197	380
21	34	37	32	49	46	164	58	34	57	41	43	231	395
21	49	56	32	49	46	183	58	31	55	45	45	234	417
21	48	52	38	55	57	202	63	26	26	41	47	203	405
21	34	35	50	38	39	162	45	28	49	45	47	214	376
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21	36	35	47	39	48	169	56	23	48	41	49	217	386
21	38	35	38	42	40	155	54	38	55	45	51	241	396
21	39	19	41	53	50	163	60	36	47	41	53	237	400
22	36	35	44	36	41	156	58	26	46	38	47	215	371
22	45	45	38	52	40	175	58	33	26	45	31	193	368
22	42	56	38	53	50	197	47	40	30	49	41	207	404
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22	21	56	44	48	50	198	79	31	35	34	33	212	410
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22	39	37	41	41	39	158	47	36	28	27	37	175	333
22	45	59	41	53	50	203	47	36	28	27	37	175	378
22	37	40	41	39	38	158	65	26	47	30	37	205	363
22	37	37	38	52	46	173	49	23	28	34	37	171	344
22	34	33	50	35	35	153	56	18	28	38	37	177	330
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22	42	56	38	53	50	197	47	40	30	49	41	207	404

22	50	50	41	53	50	194	49	34	42	45	47	217	411
22	42	44	53	48	46	191	67	34	42	49	41	233	424
22	37	50	41	53	50	194	51	29	41	38	45	204	398
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22	37	50	38	43	46	177	35	34	46	38	47	200	377
age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
22	38	47	47	46	49	189	58	31	42	41	47	219	408
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22	50	50	41	53	50	194	49	34	42	45	47	217	411
22	38	45	41	53	50	189	49	33	43	60	49	234	423
22	47	59	32	49	46	186	63	40	60	49	51	263	449
22	47	52	41	53	50	196	79	31	35	34	33	212	408
23	36	38	38	41	49	166	47	23	38	23	32	163	329
23	44	37	59	46	43	185	67	36	47	38	45	233	418
23	30	38	41	43	35	157	67	25	46	38	35	211	368
23	42	54	44	57	58	213	60	36	34	56	35	221	434
23	33	44	32	48	37	161	33	20	43	34	37	167	328
23	39	45	38	46	43	172	69	23	43	41	37	213	385
23	44	37	59	46	43	185	65	25	47	38	45	220	406
23	47	49	56	53	54	212	63	34	44	41	37	219	431
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23	53	45	44	44	43	176	49	29	47	38	39	202	378
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23	44	52	44	49	48	193	45	34	34	20	41	174	367
23	38	28	35	43	50	166	45	34	34	20	41	174	330
23	34	44	38	41	50	173	49	22	35	23	41	170	343
23	38	35	47	38	43	163	22	18	22	38	41	141	304
23	34	37	35	32	38	140	42	20	12	38	41	153	293
23	41	45	41	43	50	179	47	29	50	27	43	196	375
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23	47	49	56	53	54	212	63	34	44	41	37	219	431
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23	41	45	56	53	54	208	49	29	48	38	45	209	417
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23	50	50	41	53	50	194	49	34	42	45	47	217	411
23	38	35	38	46	40	159	63	28	36	30	49	206	366
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24	42	49	47	51	48	193	74	36	48	41	55	264	447
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24	58	54	38	65	60	226	74	44	46	56	43	263	489
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24	42	49	53	51	47	200	60	28	39	45	45	217	417
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24	39	40	50	43	53	186	45	25	59	34	47	210	396
24	49	54	56	53	54	217	63	47	49	45	51	265	472
Age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
24	47	59	32	49	46	186	63	40	60	49	51	263	449
24	42	49	47	51	46	193	74	36	48	41	55	254	447
24	33	26	35	34	40	135	47	36	49	34	33	199	334
24	58	54	38	65	69	226	74	44	46	56	43	263	489
25	54	50	45	53	62	210	84	47	51	46	52	260	470
25	40	40	39	54	50	183	51	33	45	38	50	217	400
25	57	57	63	47	67	234	64	47	51	46	52	260	494
25	35	42	45	50	37	174	48	25	60	34	49	214	388
25	34	37	36	39	46	158	48	23	38	23	32	164	322
25	34	50	42	49	45	186	62	36	35	20	42	196	381
25	31	37	45	43	38	163	48	23	28	27	42	168	331
25	32	40	33	38	38	149	37	34	48	31	44	194	343
25	31	38	36	50	45	169	53	25	37	38	44	197	366
25	45	52	39	57	52	200	51	34	44	46	44	219	419
25	43	50	45	53	62	210	44	41	56	49	44	234	444
25	35	42	45	50	37	174	46	25	60	34	49	214	388
25	31	37	45	43	38	163	48	23	28	27	42	168	331
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25	40	40	39	54	50	183	51	33	45	38	50	217	400
25	36	37	39	37	43	166	42	27	28	14	30	141	297
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26	45	56	39	43	52	190	69	33	38	46	50	236	426
26	40	47	45	50	43	186	48	34	25	41	36	184	369
26	38	37	48	51	52	188	58	30	28	46	36	198	386
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26	45	44	45	51	54	194	60	27	31	41	44	203	397
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26	32	47	45	50	45	187	53	36	31	58	52	228	416
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27	43	45	51	38	50	184	39	23	26	20	32	140	324
27	40	30	45	34	46	155	62	33	61	27	32	216	370
27	36	30	27	16	38	111	44	38	30	27	34	173	284
27	30	37	36	49	51	173	35	34	31	34	38	172	346
27	41	42	45	39	41	167	73	41	47	41	38	240	407
27	29	38	36	43	40	157	48	31	37	31	40	187	344
27	40	30	45	34	46	165	39	31	40	20	42	172	327

27	31	30	45	41	36	152	55	31	26	34	42	188	340
27	31	42	51	35	43	171	48	34	47	34	44	207	378
27	48	57	54	59	59	229	89	47	51	52	54	273	602
27	36	38	51	50	47	186	53	34	31	60	62	240	426
27	49	50	45	46	39	180	73	45	31	60	62	271	451
28	38	45	39	49	49	182	44	28	31	38	46	187	369
28	42	45	36	51	56	188	42	22	31	27	34	156	344
Age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
28	36	42	51	39	39	171	46	27	27	41	34	175	346
28	35	45	33	43	41	162	51	34	52	41	34	212	374
28	35	44	30	46	41	161	51	34	52	41	34	212	373
28	45	42	39	55	53	189	46	33		38	36	183	372
28	43	42	45	46	48	179	58	30	39	38	36	201	380
28	42	54	66	41	50	211	46	28	44	38	36	192	403
28	38	40	45	47	50	182	64	25	33	20	44	186	368
28	45	44	45	51	54	194	60	27	31	41	44	203	397
28	35	45	33	43	41	162	51	34	52	41	34	212	374
28	38	45	39	49	49	182	44	28	31	38	46	187	369
28	41	45	48	53	50	196	89	34	31	38	46	218	414
28	45	58	39	43	52	190	89	33	38	46	50	236	426
28	32	37	51	37	47	172	78	31	56	38	54	257	429
28	32	37	51	37	47	172	78	41	56	38	54	267	439
28	40	45	57	45	50	197	78	41	56	38	54	267	464
28	48	49	45	53	62	209	58	38	58	49	58	261	470
28	37	42	45	49	52	188	44	42	44	46	62	238	426
29	32	40	42	34	44	160	44	36	53	23	40	196	356
29	42	47	33	46	45	171	64	30	51	38	50	233	404
29	32	40	33	50	48	171	62	25	52	41	34	214	385
29	36	37	33	43	41	164	48	27	52	41	34	202	356
29	49	54	57	54	57	222	21	9	27	27	38	122	344
29	49	54	57	54	57	222	21	28	27	27	38	141	363
29	46	47	42	45	46	180	64	27	34	41	38	204	384
29	32	40	42	34	44	160	44	36	53	23	40	196	356
29	40	49	51	46	53	199	44	36	53	23	40	196	395
29	43	42	54	57	52	205	71	38	55	34	44	242	447
29	49	49	63	57	61	230	62	45	56	38	46	247	477
29	42	47	33	46	45	171	64	30	51	38	50	233	404
29	36	37	33	43	41	154	48	27	52	41	34	202	356
29	34	52	45	49	53	199	39	42	51	38	50	220	419
29	39	45	39	42	52	178	39	46	51	38	50	224	402
30	35	40	48	45	46	179	35	20	40	31	32	168	337
30	35	30	47	42	51	170	58	31	16	38	42	185	355
30	39	38	39	37	39	163	71	31	33	46	42	223	376
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30	35	30	46	42	51	171	55	42	40	49	42	228	399
30	38	45	42	45	48	178	51	34	55	34	44	218	396
30	38	44	39	50	59	192	60	38	55	34	44	231	423
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30	45	58	48	47	29	180	51	38	55	49	49	242	422
30	43	57	68	57	57	237	80	38	37	60	52	267	604
31	31	50	42	45	46	183	64	23	30	38	38	193	376

31	41	49	36	46	46	177	60	38	30	38	38	204	381
31	35	30	48	42	51	171	42	27	37	41	40	187	368
31	57	54	66	53	60	233	60	41	51	49	58	259	492
31	31	47	48	47	49	191	27	31	51	49	60	218	409
32	45	45	57	55	50	207	53	25	20	31	36	165	372
32	31	47	48	47	49	191	53	25	51	31	36	196	387
32	36	45	42	43	45	175	51	31	45	23	38	188	363
32	29	35	30	53	47	165	53	25	27	27	38	170	336
Age	Inf	Co	Ar	Sim	Voc	VS	DS	PC	Spa	PA	OA	PS	FS
32	36	40	45	46	44	175	64	23	30	38	38	193	368
32	41	42	48	47	46	183	69	28	30	38	38	203	386
32	31	44	39	37	39	159	60	30	42	38	38	208	367
32	45	45	57	55	50	207	58	42	35	38	42	215	422
33	32	52	36	41	44	173	48	36	30	27	30	171	344
33	47	57	39	53	56	205	46	30	34	23	36	169	374
33	31	47	48	47	49	191	53	25	51	31	36	196	387
33	49	44	42	54	61	201	58	33	24	27	38	180	381
33	37	52	48	54	54	208	67	30	41	31	40	209	417
33	46	49	12	54	49	164	48	41	41	31	40	201	366
33	54	52	60	46	54	212	60	53	56	60	56	286	497
33	46	50	45	58	52	206	49	49	39	38	58	233	438
33	39	40	45	54	48	187	51	44	34	49	58	236	423
34	32	49	51	45	50	195	53	23	30	27	30	163	358
34	39	45	39	42	55	181	42	23	28	20	36	149	330
34	41	40	39	43	49	171	46	30	34	23	36	169	340
34	39	45	39	51	48	183	51	39	40	41	38	209	392
34	37	35	42	50	45	172	44	30	41	31	40	186	368
34	37	52	48	54	54	208	67	30	41	31	40	209	417
34	46	49	60	58	60	227	53	25	37	34	40	189	416
34	39	50	45	51	50	196	58	30	51	31	42	212	408
34	42	49	51	49	50	199	67	38	51	31	42	229	428
34	49	56	60	56	60	234	58	41	51	31	42	223	457
34	48	45	45	54	49	193	51	44	34	49	58	236	429



