

**IS THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN
THIRD EDITION UK (WISC-III^{UK})
APPLICABLE TO GHANA?**

(Standardization of The WISC-III^{UK} For Use In Accra, Ghana)



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*To the most wonderful guy I know. I'm glad I'm spending my life with
you*

DECLARATION

This thesis "Is The Wechsler Scale For Children Third Edition 1 K (WISC-III^A) Applicable To Ghana (Standardisation Of The WISC-III^A For Use In Ghana)" is a study done and presented to the Department of Psychology for the award of the Master of Philosophy (MPhil) Degree in psychology (Clinical). Except for references duly cited, it represents an original study which has not been presented anywhere for any degree.



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Abstract

The study aimed at standardising the Wechsler Intelligence Scale for Children - Third Edition UK (WISC-IIITM) for use with 200 Ghanaian children from selected schools between the ages of 6 years, to 11 years, 11 months. These children were also given the Raven's Coloured Progressive Matrices (RCPM). Subjects were in two groups, private and public schools, distributed into 12 age groups. Comparisons were made based on the private/public dichotomy and the 12 age groups.

The study confirmed that an individual's performance on the WISC-IIITM is influenced by his/her cultural milieu with children from the higher SES schools doing better on the test than those from the lower SES schools. The children from private schools were different from children from public schools on all the WISC-IIITM subtests and the RCPM. There were also significant differences within the two school groups as well as some overlap between one of the private schools and one of the public schools. These findings support and add to the many in the literature, which indicate that differences exist in the performance of different cultural and socio-economic groups.

The results also indicated that males and females did not differ significantly from each other on almost all the subtests and RCPM except on the Mazes subtest. Although increasing age did not show a uniform improvement on scores, generally, children in the upper socio-economic groups did better than children in the lower classes. The performance of the WISC-IIITM also correlated strongly with performance on the RCPM.

I. INTRODUCTION

1.1 Psychological Tests

A psychological test is essentially an objective and standard measure of a sample of behaviour (Anastasi & Urbina, 1997). Although it measures a behaviour sample, rarely, if ever is the measurement of the behaviour sample directly the goal of testing. It is important to examine the relationship between the test items and the behaviour that is being sampled.

The objectiveness of a psychological test depends on a number of factors. In so far as the administration, scoring and interpretation of scores are independent of the subjective judgement of particular examiners, tests can be thought of as being objective. This means that irrespective of who administers the test, any test taker should get the same score. The objectiveness of a test is further enhanced by the determination of the difficulty level of an item or a whole test by means of objective empirical procedures.

In addition to being objective, psychological tests are also standardized. Standardization first implies uniformity of procedure in administration and scoring of the test. Secondly, it refers to the establishment of norms. In order for the scores obtained by different test takers to be comparable, testing conditions must be the same for all. Thus, any test developer must provide detailed directions for administering each newly developed test.

In deriving norms for a particular test, it is important to administer it to a large representative sample of the type of persons for whom the test is designed. This

standardization sample then serves to establish the norms. In addition, a psychological test must be reliable and valid. Reliability refers to the consistency of scores obtained by the same person when retested with an identical or equivalent form of the test. Validity on the other hand is the degree to which the test actually measures what it purports to measure. Since a reliable but invalid test is of no use to anyone, it is imperative to establish the validity of an instrument before it is used.

1.2 History of Psychological Tests

The history of testing dates back to the Mandarin Chinese over 4000 years ago. Even then, they had a well-developed system of testing civil servants, sometimes using test batteries. These early tests included such diverse topics as civil law, military affairs, agriculture, revenue and geography.

The modern era of testing began with renewed interest in the humane treatment of retarded and insane persons in the 19th century. In trying to distinguish the retarded from the insane, a French physician, Esquirol in 1838 concluded that the individual's use of language provides the most dependable criterion of his/her intellectual development. (Anastasi & Urbina 1997). This view is still employed in modern intelligence tests.

Another French physician who also worked with the mentally retarded, Seguin, developed the Form Board as a means of assessing these individuals. A version of Seguin's Form Board is still in use today as a test of spatial ability.

The early experimental psychologists also influenced psychological testing in its early beginnings. Although they were not interested in individual differences, they influenced testing through making clear the need for rigorous control of the conditions under which testing was done. Their adherence to making observations on all experimental participants under standard conditions eventually became one of the special earmarks of psychological tests (Anastasi & Urbina 1997).

Needless to say, the single most important person who launched the testing movement was the English biologist, Sir Francis Galton although he had an elitist approach to eugenics. As a result of his varied interests and research activities, in particular his interests in eugenics, he developed several measuring scales in 1884. These included the Galton bar for visual discrimination of length, the Galton whistle for determining the highest audible pitch and the graduated series of weights for measuring kinaesthetic discrimination (Anastasi & Urbina 1997). He was the first to use free association, the questionnaire and rating methods. He also developed statistical methods for the analysis of data on individual differences.

Another important figure in the early days of testing was the American James McKeen Cattell. In him, the newly established science of experimental psychology and the newer still testing movement were brought together. He was the first to use the term "mental test" in an article he wrote in 1890 (Anastasi & Urbina 1997). In this article, he described a series of tests that were being administered to college students as a means of determining their intellectual level. These tests which were individually administered

included measures of muscular strength, speed of movement, sensitivity to pain, keenness of vision and hearing, weight discrimination, reaction and memory. His work was instrumental in popularising psychological tests in the USA.

The greatest growth of the testing industry was however seen in the 20th century with the use of the first Binet-Simon Scale in 1905. This scale, developed by Alfred Binet, considered for the most part to be the father of modern intelligence testing, and Theodore Simon consisted of 30 problems arranged in ascending order of difficulty and standardized on 50 normal school children. The tests were designed to cover a wide variety of functions with special emphasis on judgement, comprehension and measuring which Binet regarded as an essential part of testing.

With the second revision of the test in 1908 standardized on 300 children, a child's score could be expressed as a mental level corresponding to the age of normal children whose performance he/she equalled. Although no fundamental changes were introduced in the third revision, it was after this that the test was translated by H.H. Goddard and revised and adapted for use in the USA by Lewis Terman and his colleagues at Stanford University in 1916 (Anastasi & Urbina, 1997). Thus was born the famed Stanford-Binet Scale, which added respectability and momentum to the developing testing movement in the USA.

Group testing was developed in 1917 to meet the need of classifying war recruits for the World War I (Anastasi & Urbina, 1997). The tests designed by the army came to be known as the Army Alpha and Army Beta. After the war, these tests were released for civilian use and have served as a model for other group tests.

Since then, and with the development of other instruments, the testing industry has been growing by leaps in the US and elsewhere. It is interesting to note that although testing began in Europe, it was the United States that popularised it and made it what it is today. To date, the majority of tests are developed, published and sold in the US with other countries adapting these tests for use (Anastasi & Urbina, 1997). This is especially so in developing countries where there is a paucity of locally developed tests.

1.3 Uses of Tests

The traditional use of tests has been to measure differences between individuals or between the reactions of the same individual on different occasions.

Test use can be categorised as follows:

1. Clinical Use
2. Educational Use
3. Occupational Use
4. Use in Counselling
5. Use in Research

1. Clinical Use

One of the earliest uses of psychological tests was in the identification of mentally retarded persons. This clinical application is still an important use of tests.

Other clinical uses include assessment of persons with emotional disorders and other types of behavioural problems, neuropsychological assessment (in which tests are used to determine organic damage), identification of specific learning disabilities and in diagnosing and classifying psychopathology such as the Beck's Inventory of Depression (BDI) (Anastasi & Urbina, 1997; Kaplan & Saccuzzo, 1993).

2. Educational Use

Educational use of tests has been in vogue since the first Binet scales. Schools are presently among the major users of tests (Anastasi & Urbina, 1997; Kaplan & Saccuzzo, 1993).



Tests are used to

- Classify children with reference to their ability to profit from different types of school instruction
- Identify outstandingly slow or fast learners
- Identify the mentally challenged and the gifted
- Select applicants for professional schools and counsel students with regards to their education and careers.
- Measure the level of knowledge obtained after instruction

3. Occupational Use

The selection and classification of industrial personnel is increasingly based on psychological tests. From the assembly line operator or filing clerk to top management, there is scarcely a type of job for which some type of psychological test has not proved helpful in matters such as hiring, job assignment, transfer, promotion or termination.

Selection of military personnel is another area of personnel selection. From its simple beginnings with the Army Alpha during World War I, the scope and variety of psychological tests employed in the military have undergone marked changes and phenomenal increase up to date with the tests used becoming more sophisticated (Anastasi & Urbina, 1997; Kaplan & Saccuzzo, 1993).

4. Counseling

From its previous use of a narrowly defined guidance regarding educational and vocational plans, the use of tests in individual counselling has gradually broadened to include an involvement with all aspects of the individual's life. Emotional well-being and effective interpersonal relations have become increasingly prominent objectives of counselling. Various forms of personality inventories have been used to assess this. Tests are also being used to enhance self-understanding and personal development (Anastasi & Urbina, 1997; Kaplan & Saccuzzo, 1993).

5. Use in Research

Diverse research in the field of psychology and health related disciplines use psychological tests as a means of gathering data. Nearly all problems in differential psychology for example require testing procedures as a means of collecting data. References may be made to studies on the nature and extent of individual differences, the organization of psychological traits, the measurement of group differences and the identification of biological and cultural factors associated with behavioural differences. For all such areas of research and for many others, the precise measurement of individual differences made possible by well-constructed tests is an essential prerequisite (Anastasi & Urbina, 1997; Kaplan & Saccuzzo, 1993).

1.4 Conceptions of Intelligence

To begin with, it should be noted that both the general public and various professionals use the unqualified term "intelligence" with a wide diversity of meanings. Although there are various views and conceptions of intelligence, only a few will be discussed.

Spearman, (1927) one of the early intelligence theorists conceptualised intelligence as consisting of multiple factors: one general factor 'g' and the others more specific 's' such as mathematical abilities or verbal competence. He also argued that every measure of intelligence also tapped specific functions that were independent of the general factor.

Thurstone, (1938) on the other hand rejected the concept of general intelligence and emphasised the importance of the specific factors underlying intelligence. He argued instead that intelligence is composed of seven primary abilities: verbal meaning, inductive reasoning, perceptual speed, number facility, spatial relations, memory and verbal fluency. (Thurstone, 1938). Others, like Guilford have hypothesized more than one hundred primary abilities (Guilford, 1967).

Cattell's conception of intelligence is one that is recognized by most psychologists. He differentiated two kinds of intelligence: fluid intelligence and crystallized intelligence (Cattell, 1971). Fluid intelligence reflects reasoning, memory and information processing capabilities while crystallized intelligence is the information, skills and strategies that people have learned through experience and that can apply in problem-solving situations. A third factor, quantitative intelligence is measured in tasks requiring understanding and application of the concepts and skills of mathematics

Whereas the above concepts have focused on the kind of mental abilities that are useful in school, the newer concepts of intelligence address skills for adaptation not just in academic and formal problem-solving settings, but in a wide variety of other contexts as well. Some authors believe that it is important to make a distinction between the kind of intelligence that allows an individual to do well in school and on intelligence tests and the kind of intelligence that enables someone to solve problems in everyday settings. The first can be called 'academic intelligence', the second 'practical intelligence' (Wagner and Sternberg, 1986). The relationship between the two is not clear and a high level of one

does not guarantee a high level of the other. This fact is reflected in Howard Gardner's multiple intelligences theory (Gardner, 1983).

Howard Gardner (1983, 1993) in his theory of 'multiple intelligences' argues that humans have a set of specific intelligences that are biologically determined. He defines 'an intelligence' as "an ability or set of abilities that permits an individual to solve problems or fashion products that are of consequence in a particular cultural setting" (Walters and Gardner, 1986). Thus, each kind of intelligence allows humans to adapt to the many demands and challenges that human societies create.

He has proposed seven types of intelligence that appear basic enough, autonomous enough, and universal enough to be considered intelligences. These are: linguistic intelligence (skill in understanding and using language), musical intelligence (skill in the creation of music), logical-mathematical intelligence (skill in logical thinking and reasoning about quantities), spatial intelligence (skill in understanding how patterns and objects are laid out in space), bodily- kinaesthetic intelligence (skill in anything that involves complex movement of the body), intrapersonal intelligence (skill in understanding one's own feelings and motives), and interpersonal intelligence (skill in understanding the feelings and behaviours of others).

It is worth noting here that only three of Gardner's types of intelligence – linguistic, logical-mathematical and spatial are addressed in traditional intelligence tests. He also believes that contemporary schooling emphasizes linguistic, logical-mathematical and

intrapersonal intelligences to the exclusion of others since schools make little attempt to gauge the strength and weaknesses of students in terms of all their various intelligences.

A final discussion of an intelligence concept is Robert Sternberg's triarchic theory (Sternberg, 1985, 1989, 1990). Whereas Gardner focuses on recognizing the different types of intelligence, Sternberg has analysed the various factors that contribute to making a particular behaviour intelligent. His triarchic theory views intelligent behaviour as governed by three components; componential, experiential and contextual.

Componential intelligence refers to the many information-processing skills that are used to solve problems. It includes what is normally measured on intelligence and achievement tests. Planning, organizing, remembering facts and applying them to new situations are all part of this component.

Experiential intelligence emphasises the role of experience in intelligent behaviour. Sternberg argues that although intelligent behaviour sometimes reflects the ability to deal with novel experiences by drawing upon past ones, it also refers to the ability to deal with familiar situations quickly and efficiently. Thus, intelligent behaviour involves assessing prior knowledge. A person with well-developed experiential intelligence is creative, can see new connections between things and can relate to experiences in insightful ways.

Contextual intelligence highlights the sociocultural context of an individual's life. Intelligent individuals adapt in order to maximize the fit between themselves and their environment. They may also shape their environment to increase the fit, or if a satisfactory

fit is not possible, they select an alternative environment. This form of intelligence is what is known as "street smartness"

1.4.1 Intelligence Tests

Intelligence or IQ tests are renowned for the controversies surrounding them. Many individuals have a greatly inflated notion of what an IQ test is and does. As earlier indicated, the first intelligence tests were developed by Alfred Binet as a means of discriminating between normal and mentally retarded children.

With the Stanford-Binet revision of 1916, Lewis Terman initially described a child's performance in terms of a score called the Intelligence Quotient or IQ. Comparing the child's chronological age with his mental age and multiplying it by 100 computed this score as shown below:

$$\frac{[\text{Mental Age}]}{[\text{Chronological Age}]} * 100$$

Currently however, IQ scores are determined by comparing an individual's performance with the appropriate norms. Most tests have a mean of 100 and a standard deviation of 15.

For the most people however, IQ is not identified with a particular type of score on a particular test. It is often seen as a shorthand designation for intelligence. However, it is important to remember that tested intelligence should be regarded as a descriptive rather than an explanatory concept (Anastasi & Urbina, 1997). An IQ is an expression of an individual's ability level at a given point in time, in relation to the available age norms

(Anastasi & Urbina, 1997). Thus, no intelligence test can indicate the reasons for one's performance on a particular test and to attribute poor performance on a test to "inadequate intelligence" in no way advances our efforts in understanding an individual's handicap (Kaplan & Saccuzzo, 1993; Anastasi & Urbina, 1997).

That is to say, the fact that someone performs poorly on an intelligence test does not necessarily mean that the person has low intelligence. There may be other factors accounting for the poor performance. Thus, if the person's performance is attributed to "inadequate intelligence," these other factors or "handicaps" may be overshadowed.

Intelligence tests and other kinds of tests should not be used to label people. Rather, they should help in understanding them (National Commission on Testing and Public Policy, USA, 1990). In order to help people achieve their maximum level of functioning, the helper will need to start where they are at the time of testing. This should be done by assessing their strengths and weakness and planning accordingly. For example, if a child performs poorly on a mathematical test, that child should not be labelled as being weak in maths and left there. Instead, efforts should concentrate on understanding what makes for the difficulty and teaching the child mathematical concepts in a way that makes it possible for them to learn.

IQ tests are however useful for a number of reasons:

- They predict important outcomes in a person's education (Anastasi & Urbina, 1997).

Typical intelligence tests designed for use with school-age children or adults measure

largely verbal abilities; to a lesser degree, they also cover numerical, abstract and spatial abilities. Since these are the abilities that predominate in school learning, most intelligence tests can therefore be regarded as measures of scholastic aptitude or academic intelligence. The IQ is therefore a reflection of prior educational achievement as well as a predictor of subsequent performance in education.

- They predict achievement in occupations and other activities in life (Anastasi & Urbina, 1997). Due to the fact that functions taught in the educational system are of basic importance in our modern, technological advanced societies, the score on an IQ test is also an effective predictor of performance in some occupations and other activities of daily life in such cultures.
- They lead to better self-understanding. Contemporary testing aims at better self-understanding and personal development. Thus, information provided by tests is being used increasingly to assist individuals in educational and career planning and in making decisions about their own lives. In particular, the increasing emphasis on effective ways of communicating test results attests to the growing recognition of this use of tests.

The most widely used IQ tests include:

1. The Wechsler Intelligence Scales

- The Wechsler Adult Intelligence Scale – Third Edition WAIS-III (1991)
- The Wechsler Intelligence Scale for Children – Third Edition WISC-III (1991)

- The Wechsler Preschool and Primary Scale of Intelligence: Revised WPPSI-R (1991)

2. The Stanford-Binet Test: 4th Edition
3. The Kaufman Assessment Battery for children

Group intelligence tests in common use include:

1. The Otis-Lennon School Ability Test (OLSAT)
2. The cognitive Abilities Test (Cog AT)
3. The Detroit Tests of Learning Aptitude (DTLA)
4. The School and College Ability Tests (SCAT)

1.4.2 Test Bias and Limitations

Bias and limitations of tests are important issues that should be understood by any test

user. Bias can be introduced in tests in a number of ways:

- The content of the test items can tap concepts and experiences more familiar to some groups than others.
- The predictive validity of a test. Some tests may predict educational or other types of success better for some groups than others.

- The normative sample can be another source of bias especially when a test meant for use in a multicultural setting is standardized on persons from only one cultural background.
- A mismatch between the test language and the primary language of the test taker.
- A mismatch between the race/culture of the examiner and the test taker

Traditional IQ tests are limited in the following ways:

- They fail to measure underlying competence. An IQ test score cannot tell whether a child has some specific underlying capacity.
- IQ scores are not etched in stone. Although they tend to stabilize in late childhood, individual children can and do shift, particularly in response to any stress in their lives.
- More importantly, traditional IQ tests simply do not measure a whole host of skills that are likely to be highly significant for getting along in the world. Because they were designed to measure only the specific range of skills that are needed in school, they do this quite well. However, they do not tell us how good a particular person may be at other cognitive tasks requiring skills such as creativity, insight or street smartness (Goleman, 1996).

- There are other important psychological functions that intelligence tests have never undertaken to measure adequately. Mechanical, motor, musical and artistic aptitudes are obvious examples. Although motivational, emotional and attitudinal variables are important determinants of achievement in all spheres, they are hardly measured in tests of intelligence.

1.5 Standardization and Norms of Psychological Tests

For any test to be standardized, it must be administered with directions under uniform conditions to a sample of examinees that are representative of the population for which the test is intended. The major purpose of any standardization procedure is to determine the distribution of raw scores in the standardization or norm group. The obtained raw scores are then converted to some form of derived scores or norms, which may be age equivalents, grade equivalents, percentile ranks, or standard scores. Examinees' standings on a test are then evaluated by referring their raw scores to the norm table appropriate for their particular groups. Norms thus serve as a frame of reference for interpreting raw scores. They indicate an examinee's standing on a test relative to the distribution of scores obtained by other people of the same age, grade, sex etc (Aiken, 1988)

Test norms are not absolutes, neither are they the most desirable results. They are a reflection of the performance distribution in a target population. Any norm is restricted to the particular population used and the time frame within which they were derived.

To serve effectively in the interpretation of scores, norms must be appropriate to the group or individual being evaluated. It is important to note that whenever an individual's raw score is converted by reference to a table of norms; a note must be made of the nature (age, sex, ethnic group, educational and socio-economic status, geographical region) of the particular norm group and to include this information in all communications regarding that person's test performance. The time period during which the norms were obtained should also be considered because norms can easily become outdated, especially with rapid social change.

When standardizing a test for the purpose of developing norms, it is important to clearly define the target population. A representative sample of the target population is then selected as the test standardization sample. The importance of standardizing a test on a representative sample of the target population cannot be overemphasized as this gives credibility to the interpretation of subsequent test results.

1.6 Justification of the study

Psychological testing is becoming increasingly more acceptable in Ghana with children and adolescents forming the greater proportion of those referred for assessment. Cognitive assessment is the major reason for referral. Since many childhood problems are related in part to the child's cognitive functioning, information regarding a child's skills and capabilities can determine whether a child's inappropriate classroom behaviour is a sign of boredom or a sign of learning disability. In this regard, the role of individualized core intelligence tests such as the Wechsler Intelligence Scale for Children cannot be overemphasized.

As a measure of general intellectual ability, the Wechsler Intelligence Scale for Children – Third Edition UK (WISC-III^{UK}) is useful and appropriate for a number of purposes (Wechsler, 1991).

These include:

- Psychological assessment contributing to educational planning, resource provision and placement decisions
- Identification of unusual cognitive profiles relating to exceptional ability or learning difficulties among school-aged children
- Clinical and neuropsychological assessment
- Research tool.

The issue however is this: Is the WISC-III[®] standardized in the UK applicable to Ghana? Although it is a great psychological tool, its use in Ghana has been limited by the unavailability of local norms.

All behaviour is affected by the cultural milieu in which a person is raised. Since psychological tests are samples of behaviour, cultural influence will and should be reflected in test performance. It is therefore futile to design a culture-free test. Tests used in Ghana, however, must be culture fair. One of the ways in which this can be done is to develop a test within Ghana and standardize it for use on a representative sample of the target population.

A second approach is to standardize or derive local Ghanaian norms for an already existing test in use elsewhere. This approach ascertains the cultural distance between groups and the individual's degree of acculturation to a particular culture and his/her readiness for education and vocational activities that are culture specific. In line with this second approach, this study has been designed to standardize and derive local Ghanaian norms for the WISC-III[®] so that its use as well as interpretation of test results from it can be done more confidently.

2. LITERATURE REVIEW

2.1 Introduction

It has long been accepted that an individual's intellectual development is a function of both nature and nurture. The 'nature' refers to his genetic make up or genotype, which is fixed at birth for every individual. The 'nurture' on the other hand refers to environmental factors such as socio-economic status (SES), effects of schooling, family influences, peer influences, personal beliefs about potential, and gender, among others (Anastasi & Urbina, 1997; Sroufe, Cooper & Dehart, 1996).

A useful way of conceptualising this interaction of heredity and environment is the concept of reaction range. The basic idea is that genes establish some range of possible reactions; upper and lower boundaries of functioning. Where a child's IQ will fall within those boundaries will be determined by environment.

According to Richard Weinberg (1989), the reaction range is about 20 to 25 points based on work that he has done. That is, given some specific genetic heritage, each child's actual test performance may vary depending on the richness or poverty of the environment in which she grows. When a child's environment is changed for the better, she will move closer to the upper end of her reaction range and vice-versa. The problem with specifying the limits of the reaction range as Weinberg has done is that although the concept itself is reasonable, there is still a lot of controversy surrounding it.

On the other hand, some theorists (Turkheimer and Gottesman, 1991) have argued that within the normal range of environment, IQ scores may largely be a function of

Development cannot therefore be understood without allowing for these giant leaps in understanding.

According to him, all children go through the same stages of cognitive development in the same order and at about the same age. He maintained that the acceleration of this process by training was limited because the individual pieces of knowledge and skill that were acquired through training had to be organized within broader cognitive structures before the next step in cognitive development could be taken.



Information Processing Theory:

Information processing theorists on the other hand seek to understand human cognition by drawing an analogy between a person's thought process and the workings of a computer (Sroufe, Cooper and Dehart 1996). Like a computer, a person receives input (information from the environment) and processes it by making comparisons, adjustments and judgements and drawing on information already stored in memory.

These theorists are particularly interested in changes with age in problem-solving skills. In their opinion, the different responses of two-year olds and four-year olds is explained in terms of the amount of experience they have in solving problems and the particular skills they have available to deal with a situation as well as the ease and flexibility with which they can apply those skills.

Information processing theorists see cognitive development in terms of gradual improvements in attention, memory and thinking that lead to greater skill in interpreting

events and understanding and a wider range of problem-solving strategies. They emphasize cognitive development but are as interested in how children process social information as in how children solve intellectual problems.

2.3 Cultural Background and Intelligence

The relation of cultural background to intelligence and school achievement is one that has sparked feuds in journals and courtrooms for decades. The basic finding that has given researchers and theorists the most difficulty is that in the USA, African-American children consistently scored lower than white children on measures of IQ. This difference in order of 12 IQ points is not found on infants tests of intelligence but becomes apparent by the time children are two or three years old (Brody 1992).

While scientists like Jensen have argued that these findings reflect basic genetic differences between the races (Jensen 1980), others, even granting that IQ is highly heritable point out that the 12-point difference falls well within the presumed reaction range (Brody 1992). They emphasize that there are sufficiently large differences in the environments in which African-American and Caucasian children are typically raised to account for the average difference in score.

When psychologists began to develop instruments for cross-cultural testing in the first quarter of the twentieth century, they had this romantic notion that it would at least be theoretically possible to measure "hereditary intellectual potential" independent of the

impact of cultural experiences (Anastasi & Urbina, 1997). The thinking then was that the individual's behaviour was overlaid with a sort of cultural veneer whose penetration became the object of what were then called "culture-free" tests (Anastasi & Urbina, 1997). Unfortunately, subsequent developments in both psychology and genetics have not supported this idea.

What is now known is that both heredity and environment operate jointly at all stages of an individual's development and that their effects are inextricably intertwined in the resulting behaviour. For humans, culture permeates all the individual's environmental contacts. Since all behaviour is thus affected by the cultural milieu in which an individual is raised and psychological tests are samples of behaviour, cultural influences will and should be reflected in test performance. It is therefore futile to try and design "culture-free" tests.

In Anastasi's discussion on cultural diversity, (Anastasi & Urbina, 1997), she further states that when this notion of "culture-free" was found to be futile, the object in multicultural testing shifted to constructing tests that presuppose only experiences that are common to different cultures. Thus, terms such as "*culture-common*", "*culture-fair*" and "*cross-culture*" replaced the earlier "*culture-free*" label. However, it is important to note that no single test can be universally applicable or equally "fair" to all.

According to Anastasi, IQ differences between the cultures are primarily a reflection of the fact that the tests and the schools are designed by the majority culture to promote a particular form of intellectual activity (Anastasi and Urbina, 1997). In this case, Sternberg's componential intelligence, and that many blacks or other minority people raise their

children in ways that do not emphasize this particular set of skills. In actual fact, Sternberg has argued that in black subcultures, it is contextual intelligence that is particularly emphasized and trained (Sternberg & Suben 1983). The kind of abilities that makes an individual streetwise.

According to Sattler (1988), responsible test use and interpretation of cognitive assessment instruments requires the proper validation of the test's psychometric properties within the population for which it is to be used otherwise improper usage of these instruments can lead to scapegoating and the casting out of impoverished and minority groups.

Furthermore, Steele et al, indicate that research has found evidence that knowledge about existing stereotypes may affect some test takers in their motivation and attitudes toward the test through distraction, self-concept, reduced effort and low expectation of successful performance (Steele, Spencer and Aronson 1995). This reaction has been called *stereotype vulnerability* and has been found to influence test scores in both gender and ethnic comparisons.

In testing diverse cultural groups, it is important to differentiate between factors that affect both test and criterion behaviour and those whose influence is restricted to the test (Anastasi & Urbina, 1997). It is the test-related factors such as previous exposure to tests, motivation to perform well on tests, rapport with the examiner and undue emphasis on speed that reduce validity. It is important that these "confounding variables" are

brought to the barest minimum when testing persons from different cultural backgrounds or persons with disabilities.

Specific test content may also influence test scores in ways that are unrelated to the ability the test is designed to measure. For example, in a test of arithmetic reasoning, the use of names or pictures of objects unfamiliar in a particular cultural setting would represent a test-restricted handicap, for example, "if I cut an apple in half how many pieces will I get?" In a more subtle way, specific test content may spuriously affect performance through the test taker's emotional and attitudinal responses. Anastasi (Anastasi & Urbina, 1997) argues that stories or pictures portraying typical or suburban scenes, for example may alienate a child raised in a low-income inner-city home. The snack time, house fire, ducks crossing, walking the dog and snow scenes in the Picture Arrangement Subset and the bathtub, the piano, thermometer, trellis and supermarket scenes in the Picture Completion Subtest and "why do cars have seat-belts?" are examples of this. This emphasises the fact that IQ tests have items familiar to some cultures but unfamiliar to others.

In the Argentinean adaptation of the WISC for instance, some items in the comprehension subtest turned out to be too difficult due to the fact that the required information was less frequent in that environment (Sans, 1984).

In particular, the validity of the Picture Completion test in assessing African children raises a lot of questions due to research done in Africa in the 1960s and 1970s on picture perception by several investigators. Hudson (1960, 1962a, b) tested the perception of depth in pictures and postulated that Negro Africans had a problem with depth perceptions. His hypothesis led to extensive experimentation and subsequent conclusion that the difficulties experienced by Negroes in pictorial depth perception were due to cultural and possibly genetic factors, the most important of cultural factors being the lack of exposure to pictorial material. The existence of such difficulties was confirmed by Winter (1963), who asked Negro subjects to interpret safety posters.

Littlejohn (1963), on the other hand, suggests on the basis of his study of the Temne concept of space, that this concept, which differs markedly from the Western concept, might be responsible for the difficulty, while Du Toit (1966), suggests that the difficulty may be due to the structure of the Bantu languages of the Bantus he tested.

Deregowski (1968) investigated whether the difficulties described above occur equally frequently with all types of drawings as the above theories imply and whether a prolonged exposure to an urban westernised environment leads to a significant increase in the frequency of 'westernised' responses. His findings showed that domestic servants were found to be more often two-dimensional perceivers than school boys and that the daily exposure of the servants to a pictorially rich environment did not affect their responses. Deregowski's findings casts doubts on the suggestion by Littlejohn (1963) that

misconception of depth cues in pictures is a result of a different concept of space, unless one concedes that a different concept of space affects only pictorial material representing meaningful objects, but has no effect when other drawings are used.

Writing on the "Skill of Pictorial Perception", Serpell and Deregowski (1980), discussed the implications of pictorial perception not only to the psychology of artistic representation but also to the study of basic processes in vision such as pattern recognition and depth perception. They construed pictorial perception as a functionally specialised skill whose pervasive importance in modern education derives from the proliferation of pictorial materials in Western culture. By drawing on cross-cultural research, they identified the major components of the skill as (1) detection of appropriate contexts for its application, (2) selection of a limiting frame of reference, (3) use of conventional criteria of fidelity to recognise depicted items, (4) sensitivity to impoverished depth cues, (5) an expectation of finding in the picture most of the information necessary for its disambiguation and (6) various assumptions about the range of cognitive inferences that may legitimately be made 'beyond the information given'. Serpell and Deregowski indicated that the skill of pictorial perception can be enhanced through guided experience.

Comparing a group of Scottish schoolchildren on a task intended to measure the effect of implicit-shape constancy to those obtained from African samples, Deregowski (1976) found that both groups were influenced by the implicit-shape constancy although the influence was less in the African sample. In an earlier work, (1968) Deregowski had

found that populations of relatively low pictorial sophistication was affected by implicit-shape constancy, which is an important phenomenon associated with perception of pictorial depth. He defined 'implicit-shape constancy' as a constancy phenomenon where both the shape subject to constancy judgement and the elements affecting such a judgement are in the form of pictorial cues.

Deregowski's conclusions were based on responses of schoolboys in Cote D'Ivoire and Kenya who were required to recognise simple geometrical patterns drawn on faces of a depicted cube. He hypothesised that there will be no difference in the extent to which the implicit-shape-constancy effect influences responses between subjects coming from a more carpentered and pictorially more sophisticated environment and those subjects coming from a less carpentered and pictorially less sophisticated environment. His findings when this hypothesis was tested agreed well with the reported cross-cultural differences, both in perception of pictorial material and in perception of geometric illusions (Deregowski, 1976).

Oftentimes, pictures do not communicate the message intended by the artist. For example, the study by Haaland (1976) with illiterate rural villagers in Nepal shows that pictures attempting to convey expressions and messages often fail to do so. Previous experience of the subject with pictures, level of literacy, social and cultural factors and the nature and relevance of pictorial subject matter are some of the factors, which influence the way people perceive pictures (Haaland, 1984).

A socio-cultural approach to development assumes that children's development is fundamentally social (Andersson, 1995). The life of a child is thus embedded in a social context. What this means is that "individual development means that environmental demands and development tasks are not pre-programmed; they vary with and depend on the concrete cultural and historical context" (Stetsenko, 1996 p. 149) According to Vygotsky (1962), skills in mental functioning develop through immediate social interaction. Information about cognitive tools, skills, and interpersonal relations are transmitted through direct interaction with people. Through the organization of these social interactional experiences embedded in a cultural backdrop, children's mental development matures. This Vygotskian approach suggests that cultural artefacts, which are the signs and tools of a particular culture are given a central role as transmitters of human experience from one generation to the other. In a variety of practical, shared activities then, the adult's role is to provide culturally patterned artefacts, which serve as means for the child when dealing with the world.

In addition, instead of analysing forms of mental processes as existing across cultures, the socio-cultural approach is based on the assumption that mental functioning reflects the specific settings in which it occurs. According to Wertsch and Kanner (1992 p.329) instead of attempting to provide accounts of individuals or mental processes as if they exist in cultural, historical and institutional vacuum, such approaches begin with the

assumption that context must be built into a theoretical framework at the most fundamental level.

For example, the process of socializing young children lies in the caregiver's transfer of cultural knowledge to the child. Rogoff (1991 p. 35) states that Vygotsky's theory was built on the premise that individual intellectual development cannot be understood without reference to the social milieu in which the child is embedded. Vygotsky (1978) himself has suggested that such a transfer is social and that the child is reconstructing such knowledge while internalising it. This is a kind of apprenticeship where the caregiver is taking the role of a cultural expert who is more familiar with the intellectual tools and skills of the society in which they live.

In Vygotsky's view, cognitive development takes place when the child's problem solving is guided by more competent members of the society, that is, when children are provided with tasks that they are not quite able to solve independently. Children need social guidance from more skilled partners working in the zone of proximal development. Experience with cultural tools in joint problem-solving activities will therefore aid development of the child's mental functioning.

Against this backdrop, the importance of the socio-cultural context in cognitive development and testing cannot be overemphasised. It stands to reason that a better approach to testing will be the use of tools developed within a particular socio-cultural

framework that determines how a child growing up in that environment will be able to perform. It is therefore unfair to use a tool developed primarily with the dominant socio-cultural group in mind to assess another group of children from a different socio-cultural group and label them in a way that affects them negatively. For example, although the Wechsler Intelligence Scale for Children, Third Edition (WISC-III) predicts school achievement for children regardless of ethnic background (Kaplan & Saccuzzo, 1993), the issue of the clear superiority in IQ scores for Caucasians when compared with African-American and other culturally different groups had not been confronted in this edition. This results in a selection bias with African-American children being overselected for mentally retarded classes and underselected for gifted programs. As a result of such selection bias in standardized tests such as the WISC, such tests have been banned in the state of California in the USA as a means of determining mental retardation and special education placement for African-American children (Kaplan & Saccuzzo, 1993).

In another development, the higher performance of Chinese and Japanese children on achievement tests, particularly Mathematics and Science tests has been explained as not due to genetic differences in capacity, but as due to differences in cultural emphasis on the importance of academic achievement, number of hours spent on homework and the differences in quality of the Math and Science instructions in the schools (Stevenson, H W., & Lee, S. 1986).

This brings up an interesting point of view in which interpretations of cultural differences in IQs are subject to who is at the receiving end. Thus, the need to interpret test

scores with respect to the individual's cultural background and upbringing cannot be overemphasised. Another variable affecting performance on tests is the socio-economic background the individual is coming from and this will be discussed in the next section.

2.4 Socio-economic Status and Intelligence

The fact that children from poor socio-economic backgrounds do not do as well in school and on IQ tests as children from middle class families is well established (Biehler, R.F. & Snowman, J 1982). Explanations given include the fact that children from poor backgrounds live in crowded conditions, have poorer health care, are not exposed to middle-class experiences such as books, have lower career aspirations and may not know how to succeed in school. Such children become less advanced cognitively. This leads to failure, which sets up a vicious circle. Failure leads to lack of interest and motivation, which then leads to more failure.

Some of these generalisations however, are now being challenged. White (1982) found that correlations between socio-economic status (SES) and academic achievement, though positive, ranged from 0.1 to 0.8. This correlation can only explain on the average about 5% of the final results in academic achievement.

The traditional indicators of SES are occupational level, education and income, but many studies add factors such as the size of the family, educational aspirations, ethnicity, the presence of reading material at home and mobility. These measures of home

environment correlate more highly with academic achievement than with any single or combined groups of the traditional indicators of SES.

White's findings lead to two important conclusions:

First, although SES and achievement or intelligence quotients are related, the strength of the relationship should not be generalized to the individual student. As he notes "when the student is the unit of analysis, SES and academic achievement are only weakly correlated" (1982, p472).

Second, efforts should be concentrated on how home factors affect academic achievement. Many poor families promote academic achievement in their children; e.g. parents read to their children, help them with their homework, take them to the library and expand on their language

If we know that these home variables are more predictive of academic and intellectual achievement, then they should be the unit of analysis. Moreover, these factors can be changed more readily than socio-economic status. By concentrating on home environments, rather than SES, attention will be turned away from any particular group to particular parent-child relationships, home variables and child rearing strategies. Concentrating on SES may mask the truly important variables that predict academic achievement and intellectual functioning level.

Various studies have discussed the relationship between poverty, cognitive development and academic failure (Birch, 1970; Jencks, 1972; Ramey, & Campbell, 1981; White, 1982) and in Ghana, this divide between children from deprived backgrounds who

score lower on standardised individual and group measures of intelligence than children from middle-class families is especially amplified on rural-urban differences in school achievement. This gap increases with age.

Children from the rural and lower social class come to school invariably without the necessary skills for coping with the first year curricula; their language development both written and spoken in English when it is the official but not native language, is relatively poorer, and their auditory and visual discrimination skills are not well developed in intelligence test (Anum, 1996). According to some investigators (Deutsch, 1967; Lesser, Fifer, & Clarke, 1985), such children are reported to be behind their better placed peers an average of two years and by the sixth year are likely to drop out from school.

In Anum's work with the Raven's Coloured Progressive Matrices (RCPM), (Anum, 1996) his results showed highly significant differences between the urban and rural children. His findings confirmed an earlier finding of Sigmon, (1983) whose study on the performance of American school children on the PCPM revealed that SES variables are important factors in determining the performance on the RCPM. There is also evidence to show that children from different socio-economic and cultural backgrounds will perform differently on the RCPM with the economically disadvantaged group performing poorly.

Anum argues that the large difference between the rural and urban groups may therefore be a true reflection of difference in performance between the two groups. Thus, when cultural and economic groups are age-matched, there is a large difference in the mean score of the RCPM in the distribution of scores. An interesting finding in Anum's work

is that despite the large difference in performance between the two groups, performance among the very young, i.e. between ages 6 and 8 years was very similar across the two groups of rural versus urban children. However, the difference widened as the children aged. His explanation was that the similarity in performance among the very young suggests that rural disadvantaged children may not have cognitive impairments as their scores suggest. The most likely reason according to him may be that the process of cognitive development may be considerably slower for the rural children and the reason for this may be found in the deprived environments within which they live and learn.

Although Anum's explanation may hold in some cases, the question is whether one would consider a 6 or 8-year-old child who is able to go to the market and buy what she is asked to without a list, as well as sell and look after her younger siblings as having a slower cognitive development? The tasks of remembering what to buy, selling, which involves arithmetic so the right amount of change can be given to the customer and looking after younger children including feeding them all require well developed cognitive processes.

It may well be that the tasks required to do well on a cognitive test such as the RCPM are generally not well developed in younger children. However, as children age, even though they may have all developed these cognitive abilities, the type of school attended greatly influences the performance of children on such cognitive tests.

Although some of these children in rural areas have been exposed to some form of formal education in English, the intellectual stimulation they get from these schools is grossly inadequate due to a number of factors including lack of trained preschool teachers,

lack of educational materials including audiovisuals and too many children in one class and thus poor supervision.

The effect of SES and schooling are closely related. Anum, (1996) found that children from lower SES backgrounds from both the urban and rural areas demonstrated lower performance on both the spelling and arithmetic components with an increasing gap between low and high SES even among the higher classes (classes 5 and 6, aged 10-12 years). Children from lower SES are unusually disadvantaged when the medium of instruction is English. In trying to explain this difference in school learning, researchers have come up with a number of explanations. According to some such as Maqsud, (1983), children from high SES backgrounds have a more favourable attitude toward school and academic excellence. Maqsud (1983) reported that there is a significant relationship between SES and school achievement among Nigerian students.

Although SES is closely related to the type of schooling with most people in the higher SES sending their children to the good schools, based on the school's performance on examinations, while those in the lower SES send their children to the not too good schools, the two are not always related since one often comes across instances of people in the lower SES who even though not highly educated, understand the benefit of education and sacrifice and send their children to better schools. Thus, in such instances, the dominant factor affecting intellectual development is the type of schooling not SES per se and in the next section, this will be reviewed.

2.5 Relationship Between Formal Education and Intelligence Testing

An important setting in which children's cognitive abilities develop and are evaluated is the school environment. As indicated earlier, IQ scores are relatively good predictors of success in school. In as much as the success of an individual in academic work depends on the individual's genetic makeup, and the motivation to study, the school environment plays a major role. Each school has its own atmosphere, with some being orderly while others are disorderly, bordering on the chaotic. With basic education being compulsory in many places, schools are an important part of many children's lives.

Some schools are doing their jobs much better than others. Although just what characterises an effective school is controversial, some factors have been suggested. These include a safe and orderly environment, an understanding of the goals of the school, administrative leadership, a climate of high expectations, allocation of time to instructions in the basic skills, the system of education and frequent monitoring of student progress (Lezotte, 1982; Cohen, 1982).

In the early grades and in schools where students require remedial work, smaller classes are an advantage (Rutter, 1983). One difficulty in labelling one school as effective and another as poor is the variation in achievement among children in different classrooms within the same school. While children in one class may be doing well, those in the class next door may be doing poorly.

Several investigators have attempted to discover what attributes form the personality or abilities of superior teachers but no one pattern dominates. Some have

emphasized the importance of flexibility, the ability to personalize teaching, the ability to empathise with students, the willingness to try out new approaches, the skill in asking questions, knowledge of the subject areas, being appreciative of positive student behaviour and using informal easy going styles (Hamachek, 1969). Other studies find that effective teachers are task-oriented, businesslike, responsible, enthusiastic, imaginative and well organized (Centra & Potter, 1980). Another aspect of teaching that is well related to effective learning is the amount of time spent in direct instruction (Davis 1983; Brophy 1982).

In summary, research indicated that certain schools and teachers are more successful than others. A number of instructional approaches are successful, but most involve spending time and effort on direct instructions in the basics. In addition, monitoring student progress and providing remedial work when necessary are important.

2.5.1. Age, Formal Education and Intelligence

The effect of formal education as opposed to chronological age on intelligence test is not clear as a result of inadequate empirical investigation. Most studies on this issue have relied on natural variation in exposure to school among school children of the same age, thus confounding differences in schooling with differences in other intelligence related variables (Cahan & Cohen 1989).

This difficulty can be overcome by a quasi-experimental paradigm involving comparison between children who differ in both chronological age and schooling. In a study using this paradigm, Cahan and Cohen (1989) estimated the independent effects of age and schooling in grades five and six on raw scores obtained on a variety of general ability tests. The sample included all students in Jerusalem's Hebrew language state-controlled elementary schools. The results unambiguously pointed to schooling as the major factor underlying the increase in test scores as a function of age and to the larger effect which schooling had on verbal than non-verbal tests.

These results contribute to our understanding of the causal model underlying intelligence development and call for a reconsideration of the conceptual basis underlying the definition of deviation IQ scores. This is important because in the determination of deviation IQ scores, the individual's score is determined from the sum of scaled scores and these scaled scores are age dependent. However, if the evidence points to the fact that schooling is a major determinant of performance on IQ tests and not just age, then it stands to reason that if a 9 year old boy who has just started school is tested and his IQ determined the usual way, he is likely to get a score that will earn him a label of being retarded. A better alternative then would be to use grade dependent scales, especially since IQ tests are more predictive of school achievement than innate intellectual ability

In another research, Morrison, Smith, & Dow-Ehrensberger (1995) assessed the impact of schooling with age held constant. They compared the ability of first graders and kindergartners to recall pictures of nine common objects. The first graders were on the

average, only a month older than the kindergartners, and at the start of the school year, the performances on the two groups were virtually identical. At the end of the school year however, the first graders almost doubled the number of pictures they could remember and they were seen to engage in active rehearsal. One year of schooling had clearly brought about a change. Similar results were obtained for such diverse skills as the ability to analyse the sound components of words, a cognitive skill that seems to be promoted by reading instruction, and to solve a variety of cognitive tasks that are often included in IQ tests.

In a study by Bisanz, Morrison, and Dunn, (1995), an interesting exception to the above was found. After testing children's responses to a number of standard Piagetian tests of number conservation, and addition of small numbers, they found that performance on the conservation task improved largely as a consequence of age, but mental arithmetic improved almost exclusively as a consequence of schooling. Bisanz's work emphasise the effect of age on Piaget's cognitive stages. Conservation tasks are tasks that are not school related or limited to schoolwork.

In reality, most of the information that children gather about conservation is through interaction with parents and siblings. Many parents have had to explain to an aggrieved child that she has not been cheated just because her sibling's drink looks more than he/she has. Even when the child is taking through an exercise where the two drinks are put in identical containers and then later poured back into the first container, they still

insist that they the one with a higher liquid level albeit in a narrow container is more. The fact that the standard Piagetian tasks are age related therefore supports Piaget's views.

While Piaget's theory of cognitive development does not give room for the improvement of conservation tasks through education and training, some developmentalists do not believe that Piaget was entirely correct in his estimate of when children's conservation skills emerge. For example, Rochel Gelman (1969) has shown that by improving the child's attention to relevant aspects of the conservation task, the child is more likely to conserve. Goleman believes that conservation appears earlier than Piaget thought and that the process of attention is especially important in explaining conservation. The conclusion to the effect of schooling on Piagetian tasks is that although by and large they are age and not school dependent, some form of training, such as improving the child's attention to detail shows that these skills appear earlier than previously thought.

According to Bisanz, Morrison, & Dunn, (1995) formal education also enhances the development of other cognitive skills such as lexical organization, (where lexicon is the total number of words in a person's vocabulary), memory and metacognition (the ability to describe one's own mental activities and the logic underpinning one's attempts to solve problems), and metalinguistic awareness (the ability to think about your own language-using skills).

Work done in Africa in the 1960s and 1970s also point to the effect of schooling on tasks that are even thought of as non-verbal (Deregowski, 1968; Deregowski, 1972;

Deregowski, 1974; Deregowski, 1976). In a discussion on "Pictorial Perception and Culture", Deregowski (1974a) argues that because the ability to recognize objects in pictures is so common in most cultures, it is often taken for granted that such recognition is universal in humans. This assertion is reflected in the fact that most tests of cognitive abilities, be they verbal or performance tests have some items that will require pictorial perception and recognition. If pictorial perception is universal, then pictures should offer us a lingua franca for intercultural communication. However, evidence from work by anthropologists and missionaries such as Robert Laws and Mrs Donald Fraser points in the opposite direction (Deregowski 1974a). Deregowski indicates that the laborious way that some of the Africans pieced together a picture suggests some form of learning is required to recognize pictures. Such learning takes place mostly in formal school settings with educational programs structured along western lines.

Deregowski's (1968) earlier work with African Zambian servants living and working in a pictorially richer environment compared to Zambian schoolboys living in a not so pictorially rich environment supports the idea of picture perception being a learnt skill. The school children performed better on the tasks of pictorial perception than the servants.

Sefa-Dedeh, Dua and Allen, (1997) assessed perception of pictures relevant to health education materials for school-aged children. They found that picture perception improved with increased exposure to education. The children they tested had difficulty understanding abstract symbols, following picture sequences and relating pictures. The

findings indicated that perspective was also a difficult concept, which appears to be grasped in the later years. Anatomical drawings featuring x-ray type drawings were only comprehensible to children in the upper primary school and confusing to those in the lower primary school.

Sefa-Dedeh et al also found that the ability to take in multiple details was also limited to the higher classes with too much detail posing problems for the lower classes. They also found that the ability of children to comprehend cause-effect relationships improved with the level of education, confirming the findings of Serpell and Deregowski on pictorial perception (Serpell & Deregowski, 1980).

As part of Anum's thesis on the RCPM (Anum, 1996), he gave the modified Wide Range Achievement Test (WRAT) to both urban and rural children in Ghana. His results showed that the urban school children did much better on both the arithmetic and spelling components of the test, although on the arithmetic component the difference between the two groups diminished with increase in number of years spent in school ($p < .001$). He also found that among the urban subjects, there was a significant difference between children from private schools and children from public schools with a larger difference observed on the spelling component than on the arithmetic component. There were also significant differences in grades ($p < .001$) on the spelling and arithmetic components of the test respectively. According to him, these differences are not surprising since it is thought that

with increase in number of years, it is expected that children will improve on their word knowledge thereby performing better on the spelling.

The effect of type of schooling is seen especially in the differences between the private and public schools. Private schools in urban areas have facilities such as libraries stocked with relevant books. Most of the children in the private schools have textbooks available to them. Compared to public and urban schools, children in private schools learn in environments that are stimulating and conducive to learning.

Children in rural areas on the other hand learn under highly deprived conditions (Anum, 1996). The school environment does not allow privacy for independent schoolwork and teaching. For some schools, two different classes share a classroom and sometimes are taught by one teacher. These and many other lack of facilities in the public school system, especially in the rural areas contribute to poorer performance of children in such schools.

Another important factor that affects performance on cognitive tasks and has received a lot of attention in both academic and non-academic settings is gender and intelligence and this is reviewed below.

2.6 Gender and Intelligence

Although no sex differences exist in intelligence, girls perform better than boys on measures of reading, spelling and verbal activities while boys, at least in the later elementary school years, do better in maths and problems involving spatial analysis (Busch-Rossnagel and Vance, 1982; Burstein et al, 1980)

The mechanisms underlying observed sex differences are poorly understood. Genetic (Willerman, 1979), hormonal (Burstein, Bank & Jarvik, 1980, Christiansen & Knussmann, 1987; Collaer & Hines, 1995), neuroanatomical (Lacoste-Utamsing & Holloway, 1982), and environmental (Petersen & Wittig, 1979) models have all been proposed. What is not clear is how and when these sex differences emerge. According to Maccoby & Jacklin (1974), one possibility is that sex differences in verbal learning are minimal or nonexistent during elementary school years, emerging only after puberty when hormonal and psychosocial influences increase the gap between boys and girls. On the other hand, if sex differences are present in fairly young children, it would be important to determine if these differences between boys and girls remain constant or if they fluctuate as a function of age or environmental factors.

Although it is difficult to draw firm conclusions about early sex differences in the literature, girls do appear to outperform boys on other verbal tasks such as rapid automated naming (Denckla & Rudel, 1974) and verbal fluency (Benton & Hamsher, 1978). Studying gifted 4th, 7th and 10th graders, O'Tuel (1989) reported that girls scored significantly higher than boys on measures of verbal creativity and ability. However,

reported male-female differences are often small, (Kaulmann & Wang, 1992), and, on some verbal indexes, e.g., the Wechsler Intelligence Scale for Children - Revised (WISC-R) and the Wechsler Preschool and Primary Scale of Intelligence - (WPPSI-R) boys may score significantly higher than girls (Quereshi & Seitz, 1994).

Studies of adolescents point to a female superiority on verbal memory tasks. In a study involving high school students in China, Huang (1993) found that females obtained higher scores than their male counterparts on verbal memory. A similar finding was obtained in a study of South African high schoolers, where girls achieved higher mean scores on memory for meaning (Owen & Lynn, 1993).

The literature on younger children is relatively small and inconclusive. Ardilla and Rosselli (1994) evaluated 233 children in Colombia and found sex differences on recall of the Rey-Osterneth Complex Figure but not on a sequential verbal memory test. Forrester and Geffen (1991) administered the Rey Auditory Verbal Learning Test to 10 boys and 10 girls in each of four age groups, the youngest being 7-8 years old and the oldest being 14-15 years old. The dependent variables included recall, recognition, serial position effects, and indexes reflecting proactive interference, retroactive interference, forgetting, and retrieval efficiency. Although age effects were present on several of the variables, they found no effect for sex. In contrast, Cox and Waters (1986) studied elementary school-aged children and reported that, in general, girls were more likely than boys to use semantic organization strategies during list recall. These discrepancies between studies

may be related to differences in sample size. Sex differences can be quite small, and large samples may be necessary to detect a small effect (Collaer & Hines, 1995)

In research studying developmental sex differences in verbal learning, Kramer, Delis, Kaplan, O'Donnell & Priteria (1997) administered the California Verbal Learning Test Children's Version to 401 boys and 410 girls between the ages of 5 and 16 years. They found sex differences at all age levels. Girls performed better than boys on all of the immediate and delayed recall trials and on the delayed recognition trial. Girls were also more likely than boys to use a semantic clustering strategy and displayed more effective long-term memory mechanisms. In addition, boys made more intrusion errors and displayed greater vulnerability to interference between the two test lists. According to the authors, because boys had higher mean scores on the Wechsler Intelligence Scale for Children - Revised Vocabulary, the observed female superiority in verbal learning could not be attributed to sex differences in overall word knowledge.

In his work on the RCPM in Ghana, Anum (1996) found significant gender bias in the performance of children on the test in line with the findings of Sigmon (1983), with boys performing slightly better than girls. The one area of cognitive ability that has continued to show consistent sex differences is visual-spatial relations and perceptual speed and visual memory (Anum, 1996). He argues that the consistent difference between males and females on the RCPM across all socio-economic groups may indicate that the abilities in this area are being determined by some factors that may be gender biased.

It is important to note that not all studies continue to report gender differences on both psychological and cognitive abilities. In Ghana, for example, the Primary Elementary Project (PREP) mid-term report (Anum, 1996) stated that the performance of boys was not significantly better than that of girls, though girls on average have higher drop out rates. In follow-up to this report, it was reported that less than 50% of girls ever go to school and only 23% go on to the university (Anum, 1996). One of the most important reasons accounting for this is the low priority that had until recently been given to educating girls in Ghana, especially among those with low education. As a result, boys may be more motivated than girls to perform better in school, and on other academic related tasks.

Teacher bias is another strong incentive for boys to always outperform girls in school. There is a strong notion that boys are generally brighter than girls and therefore it is expected that they come out tops all the time while girls on the other hand are discouraged from some subjects because "they are too difficult". Contrary to the general belief that women obtain higher means in verbal tests than men, Lynn and Dai (1993) found that in China, as generally in the US and Scotland, women obtained lower means than men on some verbal scales.

Slate and Fawcett (1996) investigated gender differences in Wechsler performance scores of school age children who are deaf or hard of hearing. WISC-III and WISC-R performance IQs and subtests and WRAT-R scores of 47 deaf or hard of hearing school-age children were analysed to determine whether differences in scores were present as a function of gender. Mean IQ differences were present on the WISC-III and WISC-R

Performance IQs with boys scoring almost a full standard deviation higher than girls on the Performance subtests. The boys also scored significantly higher on four of the six WISC-III subtests and four of the five WISC-R subtests. There were no mean differences on the achievement scores. Discriminant and regression analysis indicated differences between boys and girls in subtests most predictive of the Performance IQ. The hypotheses put forward by the authors to explain the gender differences were a) the factor structure of the IQ measure was different for boys and girls and b) differential teacher referral patterns were present (Slate & Fawcett, 1996)

Slate and Fawcett argued that there is not sufficient evidence to infer that as a population, girls who are deaf or hard of hearing are less intelligent than the population of boys who are deaf or hard of hearing. Their main reasons are that first, IQ tests are not measures of innate intelligence, (Anastasi, 1988; Kamphaus, 1993), rather they assess developed abilities predictive of scholastic achievement. Second, if these girls are less intelligent than their male counterparts, then their achievement scores recorded in their study should have been lower as well but this was not the case. Their findings parallel that of Slate, Little, Prince & Blasko (1995) who found gender differences among IQ measures for children with Attention Deficit Hyperactivity Disorder (ADHD) but not for achievement measures.

One possible explanation Slate and Fawcett gave for the gender difference in IQs is that the structure of intelligence as measured by the WISC-III Performance subscales differs for boys and girls who are deaf or hard of hearing, and therefore provides different scores

as a result. Their discriminant and regression analyses were suggestive of such a difference in that they indicate that for boys, two of the performance subsets are good predictors of Performance IQ whereas for girls, a sole subset explains a very high percentage of the variance in Performance IQ. The likelihood that this hypothesis is correct is found in the fact that no differences were found on the achievement tests.

The second explanation they gave was the differential teacher referral patterns in that teachers were more likely to refer girls who are deaf or hard of hearing for evaluation only when their behaviours and classroom performance interfere with success in the classroom. They argued that it might be that girls who are deaf or hard of hearing and have IQs similar to those of boys who are deaf or hard of hearing are better able to cope in the classroom settings. Consequently, only those girls with lower IQs who are not able to cope in classroom settings are referred.

The findings of Slate and Fawcett support the consistent findings of gender differences for clinical and non-clinical samples alike found on the WISC-R. Numerous studies of clinical samples including individuals with characteristics such as ADHD (Slate, Little, Prince & Blasko 1995), learning disabilities (Eno & Woehlke, 1980), intellectual giftedness (Hall, 1980) and mental retardation (Vance, 1979) as well as studies of non-clinical samples (Born & Lynn, 1994; Carvajal, Roth, Holmes & Page, 1992; Kaufmann & Doppelt, 1976; Lynn & Mulhern, 1991; Smith, Edmonds & Smith, 1989), have shown that with the exceptions of Coding and Digit Span, whether in clinical or non-clinical samples, boys consistently score significantly higher on the WISC-R IQ tests and subtests than girls,

regardless of whether the boys are clinical or non-clinical samples. The only subtest of the WISC-R on which girls in clinical and non-clinical samples consistently score significantly higher than boys is the Coding subtest (Slate & Fawcett, 1996; Phelps & Ensor, 1987; Sisco, 1982; Vonderhaar & Chambers, 1975).

With regards to arithmetic, although some of these differences have been getting smaller in the US, SAT arithmetic scores in the USA shows that the average score for boys has consistently been higher than that of girls for more than three decades (Brody, 1992; Jacklin, 1989). In addition, among children who test as gifted in mathematics, boys are considerably more common (Davis, 1988). On tests of spatial visualization, boys also have higher average scores. A great deal of overlap occurs though, with some girls performing better than boys in mathematics and some boys reading better than girls. Several attempts have been made to explain this finding, but in essence, both biological and environmental factors have been used. Biological influences have been most often argued in the case of sex differences in spatial abilities, where there may be both genetic differences and more speculatively, differences in brain functioning resulting from prenatal variations in hormones.

In contrast, environmental explanations have been prominent in the discussions of the sex differences in mathematical or verbal reasoning. Especially in the case of mathematics, there is considerable evidence that girls' and boys' skills are systematically shaped by a series of environmental factors:

- i) Boys take more mathematics courses than girls do. When the amount of mathematics exposure is held constant, the sex difference becomes much smaller.
- ii) Parental attitudes about mathematics are markedly different for boys than girls. Parents are more likely to attribute a daughter's success in maths to effort or good teaching while a poor performance is attributed to lack of ability. In contrast, parents attribute a boys' success to ability and his failure to lack of application (Parrons, Adler & Deczala 1982).
- iii) Girls and boys have different experiences in math classes. On elementary school, teachers pay more attention to boys during math instruction and more attention to girls during reading instruction. In high school, math teachers direct more of their questions to boys, even when girls are outspoken in class.

In summary, gender differences on the Wechsler scales or for that matter on any measure of intelligence used in diagnostic processes are problematic and have the potential to lead to "a confoundment of test scores" (Phelps & Ensor, 1987, p. 210), especially when the gender of the person referred for evaluation is not considered a relevant assessment factor. Whereas some early researchers such as Kaufman & Doppelt (1976) contended that these gender differences in IQ and subtest scores were not practically significant, other researchers such as Smith, Edmonds & Smith (1989) have suggested that test publishers consider developing separate norms for boys and girls.

Other equally important factors that affect performance on an intelligence test or any test for that matter are the test examiner and situation under which testing takes place.

2.7 Examiner and Situational Variables in Testing

Although testing most of the time concentrates on the subject, the clinician and the environmental situation under which testing occurs are equally important. Several investigators have looked at these variables (Lutey & Copeland, 1982; Masing, 1960; S.B. Sarason, 1954; Sattler, 1970, 1981; Sattler & Theye, 1967). Most of the data on such effects have been obtained with either projective techniques or individual intelligence tests. In general, the more unstructured and ambiguous the stimuli, or the more novel and difficult the task, the more likely these extraneous factors are likely to operate. Children in particular, are more susceptible to examiner and situational influences than adults and in the examination of preschool children the role of the examiner is especially crucial. Emotionally disturbed and insecure persons of all ages are more likely to be affected by such factors than well-adjusted individuals (Anastasi & Urbina, 1997).

The fact that test results may be influenced by the examiner's behaviour immediately preceding and during test administration has been clearly demonstrated (Exner, 1966; Masing, 1959). For example, controlled investigations have yielded significant differences in intelligence test performance as a result of a "warm" versus a

"cold" interpersonal relation between examiner and examinees, or a rigid and aloof versus a natural manner on the part of the examiner

In addition, there may also be significant interactions between the examiner and the subject characteristics in the sense that the same examiner characteristics or testing manner may have a different effect on different subjects as a function of the subject's own characteristics. Similar interactions may occur with task variables such as the nature of the test, the purpose of the testing and the instructions given to the subjects or the test takers. Dyer (1973) has added more variables to this list; in particular, he has called attention to the possible influence of the test givers' and the test takers' diverse perception of the functions and goals of testing.

The examiner's own expectations may also inadvertently affect the subjects response. A number of findings support this special instance of a self-fulfilling prophecy (Harris & Rosenthal, 1985; Rosenthal, 1966; Rosenthal & Rosnow, 1969). Masling (1965) conducted an experiment to demonstrate this effect. The subjects were 14 graduate student volunteers, seven of whom were told, among other things, that experienced examiners elicit more human than animal responses, while the other seven were told that experienced examiners elicit more animal than human responses. Under these conditions, the two groups of examiners (i.e. the subjects) obtained significantly different ratios of animal to human responses from their examinees. According to Masling, these differences occurred despite the fact that neither examiners nor test takers reported awareness of any

influence attempt. Although the sample size of 14 is quite low, this finding buttress the point on examiner expectations that has been known to occur under testing conditions.

Another important examiner variable that affects test results is user qualification. The American Psychological Association's (APA) *Ethical Principles of Psychologists and Code of Conduct's* principle on competence states that psychologists "provide only those services and use only those techniques for which they are qualified by education, training or experience", (APA, 1992 p. 1599). With regard to tests, the requirement that only appropriately qualified examiners use them is one step toward protecting the test taker against the improper use of tests (Anastasi & Urbina, 1997). What is proper qualification obviously depends on the type of test. While individual intelligence tests and most personality tests require a relatively long period of intensive training and supervised experience, much less specialized psychological training is needed for tests of educational achievement or job proficiency.

The benefits to the subject of having a well-trained examiner are numerous. They choose tests that are appropriate for both the particular purpose for which they are testing and the persons to be tested. They are cognizant of the available research literature on the chosen test and are able to evaluate its technical merits with regards to norms, reliability and validity. In administering the test, they are sensitive to the many conditions that may affect test performance. Well-trained examiners draw conclusions or make recommendations only after considering the test score(s) in the light of other pertinent information about the individual. Most importantly, well trained examiners are sufficiently

knowledgeable about the science of human behaviour and as such, are able to guard against unwarranted inferences in their interpretations of test scores (Anastasi & Urbina, 1997).

In situations when individuals not fully qualified such as graduate students or psychological technicians or persons lacking adequate professional training give tests, it is imperative that an adequately qualified psychologist be available to provide the needed perspective for a proper interpretation of test performance (APA, 1992).

Apart from the examiner, other aspects of the testing situation may significantly affect test performance. The activities of test takers immediately preceding the test, especially when such activities produce emotional disturbance, fatigue or other handicapping conditions are particularly liable to affect test results. For instance, Gordon & Alf (1960) report that military recruits tested shortly after induction (their third day) perform significantly lower than those tested during their ninth day at their Naval Training Centre.

In an earlier study by Reichenberg-Hackett (1953) with school children, children who had a gratifying experience involving the successful solution of an interesting puzzle followed by a reward of toys and candy, showed more improvement in their test scores on a Draw-a-Man Test than those who had undergone neutral or less gratifying experiences. Davis (1969a, 1969b) had similar results with college students. The students' performance on an arithmetic reasoning test was significantly poorer when preceded by a failure experience on a verbal comprehension test than it was in a control group given no

preceding test and in one that had taken a standard verbal comprehension test under ordinary conditions.

The review of the literature on examiner and situation variables illustrates the wide diversity of test-related variables that may affect test scores. In the majority of well-administered testing programs, the influence of these variables is negligible for practical purposes. Nevertheless, the skilled examiner is the one who is constantly on guard to detect the possible operation of such variables and to minimize their influence. When circumstances do not permit the control of these conditions, the conclusions drawn from test performance should be qualified. Despite the primacy of IQs in certain settings, since a high IQ score does not automatically lead to success in life, the next section will review other variables that make a difference in an individual's life whether the person has a high IQ or not.

2.8 Emotional Intelligence

One of psychology's open secrets is the relative inability of grades and IQ scores, despite their popular mystique, to predict unerringly who will succeed in life (Goleman, 1996). Although there is a relationship between IQ and life circumstances with many people with high IQs having better paying jobs than those with low IQs, this is not always the case (Goleman, 1996). A high IQ score is no indication of being successful in life. Goleman further indicates that IQ contributes about 20% to the factors that determine life success, which leaves 80% to other forces. Howard Gardner (1995) also said that the vast majority

of one's ultimate niche in society is determined by non-IQ factors, ranging from social class to luck.

Other writers, even those who talk about the primacy of IQ such as Herrnstein and Murray (1994) acknowledge the other factors at work in one's life by stating that "perhaps a freshman with an SAT math score of 500 had better not have his heart set on becoming a mathematician, but if instead he wants to run his own business, become a US senator or make a million dollars, he should not put aside his dreams... The link between test scores and those achievements is dwarfed by the totality of other characteristics that he brings to life. "

Longitudinal studies of groups of highly intelligent people (Vaillant, 1977; Felsman & Vaillant, 1987) have consistently shown that individuals with the highest test scores in college were not particularly successful compared to their lower scoring peers in terms of salary, productivity or status in their field. In addition, they did not have the greatest life satisfaction, nor the most happiness with friendships, family and romantic relationships. Abilities like how to handle frustrations and how to get on with other people rather made the major difference.

Psychology and its sister sciences are now at a stage where information abounds challenging those who had hitherto subscribed to the notion that IQ is a genetic given that cannot be changed by life experiences and that our destiny in life is largely fixed by these aptitudes. In an intriguing book on "Emotional Intelligence," Goleman (1996) argues that the question we should be concerning ourselves with is "what can we change that will help

our children fare better in life?" What factors are at play for instance when people of high IQ flourish and those of modest IQ do surprisingly well? He argues that the difference lies in the abilities called *emotional intelligence*, (the other characteristics) which includes self-control, zeal, persistence and the ability to motivate oneself. When children are taught these skills, it gives them a better chance to use whatever intellectual potential they have been endowed with.

The importance of IQ not being the sine qua non of success in life gives hope to both parents and educators alike. Even when using tests developed within a particular cultural setting for a particular group, there will always be those who will be labelled as having low IQ. However, instead of such people being relegated to the background, being armed with the information that IQ contributes roughly to about only 20% of later achievement in life, a lot of emphasis can be place on identifying the strengths of the individual child and helping him along the way by teaching those characteristics Goleman (1996) refers to as emotional intelligence which are equally if not more important than the IQ.

Such programs are being carried out in some parts of the world. Notable among them is Project Spectrum, a curriculum that intentionally cultivates a variety of kinds of intelligence. According to Howard Gardner, the brain behind this project, "the time has come to broaden our notion of the spectrum of talents. The single most important contribution education can make to a child's development is to help him toward a field where his talents best suit him, where he will be satisfied and competent. We've completely

lost sight of that. Instead, we subject everyone to an education where, if you succeed, you will be best suited to be a college professor. And we evaluate everyone along the way according to whether they meet that narrow standard of success. We should spend less time ranking children and more time helping them identify their natural competencies and gifts and cultivate those. There are hundreds and hundreds of ways to succeed and many, many different abilities that will help you get there" (Goleman, 1996).

Gardner's theory of multiple intelligences (see introduction) offers a richer picture of a child's ability and potential for success than the standard IQ. When Spectrum students were evaluated on the Stanford-Binet Intelligence Scale, once the gold standard of IQ tests and again by a battery designed to measure Gardner's spectrum of intelligences, there was no significant relationship between children's scores on the two tests (Gardner, 1993). The five children with the highest IQs (From 125 to 133) showed a variety of profiles on the ten strengths measured by the Spectrum test. These strengths were scattered: four of these children's strengths were in music, two in the visual arts, one in social understanding, one in logic and two in language. None of the five high-IQ kids were strong in movement, numbers or mechanics, movement and numbers were actually weak spots for two of these five.

Gardner's conclusion was that "the Stanford-Binet Intelligence Scale did not predict successful performance across or on a consistent subset of Spectrum activities" (Goleman, 1996). On the other hand, what the spectrum does is that it gives parents and teachers clear guidance about the realms that these children will take a spontaneous interest in and

where they will do well enough to develop the passions that could one day lead beyond proficiency to mastery.

2.9 The Wechsler Intelligence Scale for Children – Third Edition UK (WISC-III^{UK})

The WISC-III^{UK} is an individually administered clinical instrument for assessing the intellectual ability of children aged 6 years through to 16 years 11 months. This instrument is widely used in cognitive assessment of children and adolescents and repeatedly has been demonstrated to have sound psychometric properties. The WISC-III^{UK} is the second revision of the WISC. Although it retains the essential features of earlier editions, the WISC-III^{UK} provides updated test materials, test content and administrative procedures and current normative references based on a UK validation programme.

It consists of several subsets, each measuring a different facet of intelligence. The child's performance on these various measures is summarized in three composite scores: the Verbal, Performance and Full Scale IQ scores which provide estimates of the individual's intellectual abilities. In addition, the WISC-III^{UK} provides four optional factor - based index scores.

Wechsler's conception of intelligence is not a particular ability but rather an aggregate and global entity, the "capacity of the individual to act purposefully, think rationally and to deal effectively with his or her environment" (Wechsler 1992). Consistent with this concept

of intelligence, the subtests of WISC-III[®] have been selected to tap many different mental abilities; which are assumed to indicate a child's general intellectual ability. Some subtests require the child to reason abstractly, some focus on the child's memory, others call for certain perceptual skills and so forth. These abilities are valued to different degrees by different cultures and all relate to behaviour that is generally accepted as intelligent in one way or the other.

Although scores on an intelligence scale summarize a child's performance on a particular sample of tasks, they are not the only ones that can serve this purpose. Important to Wechsler's conception is not that a particular set of tasks always be used, but that an intelligence scale should sample broadly from the full array of cognitive abilities and thus reflect the multi-faceted characteristics of intellectual ability.

Although intellectual ability tests such as the WISC-III[®] provide a considerable amount of information about an individual's cognitive strengths and weaknesses in a relatively short amount of time, the clinician must take other factors into account. Matarazzo (1990) has reminded the clinician of the necessity of considering an individual's life history (e.g. social and medical history, linguistic and cultural background) as part of any good assessment.

Although tests, behavioural observations and life history are critical sources of information in any diagnostic assessment, it must be remembered that the clinician is the cornerstone of assessment. If intellectual ability is only one aspect of intelligence, (Wechsler, 1979), those responsible for interpreting the results of intelligence testing must

be careful to distinguish between test scores or IQs on the one hand and intelligence on the other

Psychometric Properties of the WISC-III[®]

The psychometric properties of a scale determine the precision of the scores obtained and the nature and quality of test score interpretation. Confidence in the WISC-III[®] is based on the extensive US standardisation study and the UK validation study (Golombok & Rust, 1992).

Reliability

The reliability of a test refers to its consistency of measurement and to the stability of test scores over time. Several statistics are useful for describing a test's reliability. Some of these are reliability coefficients, standard errors of measurement, and confidence intervals of the test. These statistics reported in the WISC-III[®] manual are based on the US standardization of 2200 children with 200 in each age group ranging from 6 to 16 years. The reliability coefficients of the subtests except Coding and Symbol Search was estimated by the split-half method ranged from .60 to .89. For the Coding and Symbol Search stability coefficients were used as reliability estimates because of the inappropriateness of measures on internal consistency for speeded tests. It ranged from 0.70 to 0.82 (Golombok & Rust, 1992). For the three IQ scales and four factor-based scales, reliability coefficients were computed according to a formula for the reliability of a composite of

several tests (Nunnally, 1978, p. 246) and were generally higher than that for the individual subtests ranging from 0.80 to 0.97 (Golombok & Rust, 1992).

The standard error of measurement (SE_M) is an important index of precision for test scores since it provides an estimate of the amount of error, due to unreliability, in an individual's observed test score. It is inversely related to the reliability coefficient, the less the SE_M the more confidence one may have in the accuracy or precision of the observed scores. The SE_M of the subtests are less than those of the IQ and index scores and ranged from 0.90 to 1.87 while that of the IQ and index scores ranged from 2.60 to 6.36 (Golombok & Rust, 1992). This does not mean that the subtests are more precise measurements; rather the difference is due to the different standard deviations of the scores

The confidence intervals also provide another means of expressing the precision of test scores and assist in test interpretation by providing a range of scores in which the child's true score is likely to fall. They also serve as reminders that the observed score contains some amount of measurement error. The confidence interval is usually between 90% and 95% (Golombok & Rust, 1992).

The test re-test stability was assessed in a separate study of 353 children who were tested twice. The sample was drawn from six age groups in the US standardisation group 6, 7, 10, 11, 14, and 15 years. The intervals between the testings ranged from 12 to 63 days with a median re-test interval of 23 days. The sample consisted of 48% females and 52% males made up of 63% whites, 15% blacks, 13% Hispanics, and 3% children of

other race / ethnic origin. The stability coefficients ranged from 0.60 to 0.82 for the subtests and from 0.74 to 0.92 for the IQs and index scores (Golombok & Rust, 1992).

The interscorer agreement on all subtests excluding Similarities, Vocabulary, Comprehension and Mazes averaged in the high 0.90s (Golombok & Rust, 1992) while that for the Similarities, Vocabulary, Comprehension and Mazes were determined separately by four scorers. Interscorer reliabilities were as follows: 0.94 for Similarities; 0.92 for Vocabulary; 0.90 for Comprehension; and 0.92 for Mazes (Golombok & Rust, 1992).

Validity

Unlike reliability, validity cannot be reduced to a single measure such as a correlation coefficient. The following evidences the validity of a test

- The test measures the constructs intended by its design
- It is significantly related to similar measures
- It discriminates among special populations of children

The work on the validity of the WISC-IIISM is predominantly American and this is supported by the fact that there are only minor differences between US and UK editions as well as the fact that there is a very close correspondence between the patterns of data obtained from the US and UK administrations of WISC-III with any observed differences being systematic and defining a clear relationship between the two sets of data (Golombok & Rust, 1992).



The internal validity of a test, which indicates whether there is empirical evidence for the structure of its scores, can be determined by the correlations of its subtests with each other and with groups of subtests. The studies on the internal validity of the WISC-III reveal that

Verbal subtests generally correlate more highly with each other than with Performance subtests and that Performance subtests generally correlate more highly with each other than with Verbal subtests (Golombok & Rust, 1992). This pattern of correlations provides evidence of convergent validity (Campbell and Fiske, 1959). Evidence of discriminant validity on the other hand is indicated by lower correlations of Verbal subtests with performance subtests. These intercorrelations is best summarised by the results of factor analyses.

Factor analytical studies suggest a four-factor solution for the WISC-III. The first two factors, Verbal Comprehension and Perceptual Organisation are identical to those found in the WISC-R. The Verbal Comprehension factor consists of Information, Similarities, Vocabulary and Comprehension subtest. The Perceptual Organisation factor consists of Picture Completion, Picture Arrangement, Block Design and Object Assembly subtests. The third factor although still known as freedom from distractibility is slightly different from that of the WISC-R and consists of the Arithmetic and Digit Span subtests. The Coding subtest, which loaded on this third factor in the WISC-R, loads on a fourth factor, the Processing Speed factor, with the new Symbol Search subtest.

In determining the correlation of the WISC-III with WISC-R, the WISC-III and the WISC-R were administered in counterbalanced order to a sample of 206 children aged 6-16 years (median = 11 years). The sample consisted of 55% female and 45% male children with 70% Whites, 19% Blacks, 8% Hispanics and 3% of other race / ethnic origin. The intervals between testing ranged from 12 to 70 days (median = 21 days). The high correlations obtained between the VIQ scores and between the FSIQ scores approach the reliabilities of the scales: 0.90 and 0.89 respectively. The correlation of the PIQ ($r = 0.81$), although lower was still substantial. The magnitude of these correlations provide evidence that the WISC-III measures essentially the same constructs as does the WISC-R, (Golombok & Rust 1992).

The WISC-III and the WAIS-R were administered in counterbalanced order to a sample of 189 sixteen year olds consisting of 55% female and 45% male children with 71% Whites, 10% Blacks, 16% Hispanics and 3% of other race / ethnic origin. The testing intervals ranged from 12 to 70 days (median = 21 days). The correlations between the WAIS-R and the WISC-III IQ scores are very high (0.90 for VIQ, 0.80 for PIQ and 0.86 for FSIQ) suggesting that the two tests measure very similar constructs (Golombok & Rust 1992).

The WISC-III and the WPPSI-R were administered in counterbalanced order to a sample of 188 six year olds consisting of 53% female and 47% male children with 67% Whites, 12% Blacks, 14% Hispanics and 7% of other race / ethnic origin. The testing intervals ranged from 12 to 62 days (median = 21 days). The correlations between the

PIQ scores ($r = 0.73$) is slightly lower than that between the VIQ scores ($r = 0.85$) and the FSIQ scores ($r = 0.85$). Given that the two Performance scales differ slightly and the fact that the WISC-III and the WPPSI-R have less item similarity than the WISC-III and the WISC-R, the PIQ score correlations are substantial. In addition, the magnitude of the correlation between the FSIQ scores suggests that the two tests measure very similar constructs overall (Golombok & Rust 1992).

In a similar study, Shahim (1992) determined the relationship between the WISC-R and the WPPSI in Iran by giving the two tests to 40 six year old Iranian children (20 boys and 20 girls). Correlations done indicated that the relationships between the WISC-R and the WPPSI IQs and between scaled scores on corresponding subtests were significant. The comparison of mean IQs and scaled scores indicates that the WISC-R yielded a significantly higher VIQ and higher scores on Information, Vocabulary, Comprehension and Picture Completion than the WPPSI. The mean difference between corresponding Verbal and Full Scale IQs was reported as not significant. Shahim concluded that the results suggest that the scores on the two instruments correlated well for the 6 year old Iranian children and the content on which IQs for the WISC-R and the WPPSI are based are related.

The correlation of the Differential Ability Scales (DAS) (Elliot, 1990a), a US revision and standardisation of the British Ability Scales (BAS) (Elliot, 1983) with the WISC-III was determined by giving the DAS and the WISC-III to 12 children between the ages of 7-14 years (median = 9 years) in the US. The sample consisted of 30% female and 70% male children with 55% Whites, 19% Blacks, 26% Hispanics. The WISC-III FSIQ score correlated

very highly with the DAS General Conceptual Ability (GCA) score ($r = 0.92$). The WISC-III VIQ score correlated highly with the DAS Verbal Ability Score ($r = 0.87$). The WISC-III PIQ score correlated highly with the DAS Nonverbal Reasoning (NVR) was ($r = 0.78$) and the Spatial Ability ($r = 0.82$). In addition, the DAS Speed of Information Processing subtest score correlated highly ($r = 0.67$) with the WISC-III processing Speed Index score (Golombok & Rust, 1992). The sample size of 12 is too small and thus makes one suspicious of the results of the study.

Since neuropsychological assessments often include the Wechsler scales, the correlations of the WISC-III with neuropsychological tests is of special interest. In one study, a sample of 30 US children was administered the WISC-III, the Tactile Performance Test (TPT), Trails A and B and Finger Tapping Test from the Halstead-Reitan Neuropsychological Battery (Reitan and Wolfson, 1985); and the Revised Visual Retention Test (Benton, 1974). The children tested were white males between the ages of 8 and 12 years (median = 10 years) and described as having specific learning difficulties and or Attention Deficit Hyperactivity Disorder and with a mean WISC-III FSIQ score of 106.8 (SD = 13.6).

Correlations of the PIQ scale with the neuropsychological measures are in the expected range of 0.36 to 0.64 (positive or negative depending on the measure) as observed in other studies (e.g. Warner, Ernst, Townes, Peel and Preston, 1987). Specifically, the WISC-III PIQ score correlation with the TPT Total Time is 0.64 and with the TPT Memory and Localisation scores, 0.45 and 0.42 respectively. The WISC-III VIQ score

are usually lower and non-significant. The WISC-III FSIQ score tends to be lower than those with the PIQ score and higher than those with the VIQ score. The Perceptual organisation, Freedom from Distractibility and Processing Speed index scores also tend to have higher correlations with the neuropsychological measures than does the Verbal Comprehension Index score (Golombok & Rust, 1992).

Regarding achievement scores, scores on the Wide Range Achievement Test Revised (WRAT-R) (Jastak and Wilkinson, 1984) were obtained for 23 White males aged 8-12 years (median = 10 years) who were administered the WISC-III as part of the validity studies with special groups. The sample consisted of 57% children with learning disabilities and 43% hyperactive children. (Golombok & Rust, 1992).

Significant correlations were obtained for the WISC-III Processing Speed Index (PSI) score with the WRAT-R Arithmetic scores ($r = 0.73$) and for the WISC-III Freedom from Distractibility Index (FDI) score with both the WRAT-R Reading score ($r = 0.67$) and Arithmetic scores ($r = 0.68$). The lowest correlation was for the WISC-III Perceptual Organization Index (POI) score with the WRAT-R Spelling score Arithmetic scores ($r = 0.09$).

In a later study by Vance and Fuller, (1995) in which the relation of scores on WISC-III and WRAT-3 were compared in a sample of 60 (40 boys and 20 girls) referred children, the positive correlations obtained between the cognitive domains of the WRAT-3 indicate that the tests measure similar types of skills. The correlations which were as follows WISC-III FSIQ & WRAT-R Arithmetic, $r = 0.82$; WISC-III VIQ & WRAT-R Arithmetic, $r = 0.79$; WISC-III

PIQ & WRAT-R Arithmetic, $r = 0.73$, were not unlike those summarised by Sattler (1988) who used scores on the WISC-R and the WRAT-R. Vance and Fuller's study indicate that the relationships obtained provide clear support for concurrent validity and use of WRAT-3 as a measure of achievement for their sample.

With group-administered achievement test, scores were obtained for 358 children aged 6-16 years (median = 11 years) consisting of 54% female and 46% male children with 76% Whites, 10% Blacks, 12% Hispanics and 2% of other race / ethnic origin. The children were administered the WISC-III and one of the following tests: the Comprehensive Tests of Basic Skills, Form U, (CTBS) (CTB/McGraw-Hill, 1987) $n = 160$; the Iowa Tests of Basic Skills, Form G (Hieronymus and Hoover, 1986) $n = 104$; the California Achievement Test, Form E (CTB/McGraw-Hill, 1988) $n = 49$; the Metropolitan Achievement Test, Sixth Edition, Form L (Prescott, Balow, Hogan and Farr, 1986) $n = 23$; and the Stanford Achievement Test, Edition 7 Plus, Form E $n = 22$. WISC-III FSIQ score and Total Achievement ($r = 0.74$). The WISC-III VIQ score correlates highly with the Reading Achievement score ($r = 0.70$), while the PIQ scores correlated moderately with the achievement scores. Substantial correlations were also obtained for the index scores (Golombok & Rust, 1992).

Correlation with teacher ratings were obtained for 617 children from the United States of America aged 6-16 years (median = 12 years) consisting of 54% female and 46% male children with 77% Whites, 9% Blacks, 12% Hispanics, and 2% of other race / ethnic origin. The WISC-III FSIQ score correlated moderately ($r = 0.47$) with the estimated

grade point average (Golombok & Rust, 1992). These correlations are consistent with that of Matarazzo's (1972).

Grados and Russo-Garcia (Grados & Russo-Garcia, 1999) compared the Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1990) and the Wechsler Intelligence Scale for Children Third Edition (WISC-III; Wechsler, 1991) in 35 economically disadvantaged African-American youth presenting for treatment in a mental health setting. Significant strong correlations, $r = 0.86$ were found between K-BIT Composite and WISC-III Full Scale IQ scores supporting the construct validity of the K-BIT and its value as a brief screening measure. The results also revealed significant differences between K-BIT and WISC-III scores; K-BIT Composite and Matrices mean scores were found to be 6 and 11 points higher than respective WISC-III Full Scale IQ and Performance IQ mean scores. Grados and Russo-Garcia found no significant differences between K-BIT Vocabulary and WISC-III Verbal IQ scores. The authors recommend the use of the Matrices subtest alone with African-American youth from economically disadvantaged backgrounds (Grados & Russo-Garcia, 1999).

Comparing the correlations between scores on the Wechsler Intelligence Scale for Children Third Edition and the General Purpose Abbreviated Battery of the Stanford-Binet IV (Carvajal, Hayes, Lackey, Rathke, Weibe & Weaver, 1993), the authors found that the Pearson correlation of .74 (corrected to .82) for the Composite Standard Age Scores on the Binet IV General Purpose Abbreviated Battery and the WISC-III Full Scale IQs compares

favorably with the correlations of .82 (Wechsler, 1991) and .83 (Thorndike, Hagen, & Sattler, 1986b) between the 1974 WISC-R and the Binet IV reported in the WISC-III manual and the Binet IV technical manual. The authors indicate that the complete version of the Binet IV may yield an even higher correlation with the WISC-III. In an earlier study of the correlations between the scores of the General Purpose Abbreviated Battery of the Stanford-Binet IV and the 1974 WISC-R Full Scale IQ using children from the same school, the correlation between the two total scores was .78 (Carvajal & Weyand, 1986).

Graf and Hinton (1997) determined the correlations between the Visual Motor Integration Test, (Beery, 1989) and the WISC-III by obtaining scores on these two instruments from 99 boys and 46 girls ranging in age from 6 to 16 years. In particular, since performance on both the Coding subtest of the WISC-III and Beery's revised test requires fine motor skills as well as visual perception of abstract stimuli, the low correlation of $r = 0.34$ may be a reflection of the presence of timing and speed required in Coding or of visual serial memory which is more important in coding than in the Visual Motor Integration Test.

Thus, according to Graf and Hinton (1997), given the low correlations between the scores, it seems likely that a classroom teacher's observations regarding a student's suspected problems with visual-perceptual-motor activities, e. g., copying from the blackboard, letter and number reversals, handwriting etc., may be just as useful an

indicator as using a single screening device even if it is combined with the WISC-III (Graf and Hinton, 1997).

Several studies have looked at the use of the WISC-III in special groups. In one, the test was administered to 38 children aged 7 to 14 (median = 10 years) who were identified gifted by independent evaluations. The mean FSIQ score of about 129 is within the expected range for a sample of gifted children while that for the VIQ and PIQ are about 128 and 125 respectively (Golombok & Rust, 1992).

In another, the WISC-III was administered to 43 children aged 6 to 16 (median = 11 years) who were diagnosed as having moderate learning difficulties. The sample consisted of 37% females and 63% males of which 30% were White, 51% Blacks and 19% Hispanics. The mean WISC-III VIQ, PIQ and FSIQ scores of the group are approximately 56, 59 and 56 points respectively. As would be expected, there was little variability in the performance of this group. (Golombok & Rust, 1992).

In an interesting twist, this group obtained the highest mean score on the Processing speed scale (mean of 70.2), the likely reason being that the subtests that make up this scale, Coding and Symbol Search are not as highly related to general intellectual ability as most other subtests. Another explanation is related to Sternberg's contextual processing. Contextual processing is involved in practical intelligence; the kind of processing needed to be street-smart and to get out of trouble. It is most likely therefore

that although these children, the majority of whom are black, are supposed to be having moderate learning difficulties, their ability to deal with their environments on a day to day basis requires them to be street smart as well as be able to process information very quickly. Thus, having learnt the need for quickly processing information, it stands to reason that the highest mean score is on the Processing Speed Index.

With specific learning difficulties, the mean Verbal IQ (VIQ) score is slightly less than the mean Performance IQ (PIQ) score as expected (Sattler, 1988) for a sample of 65 children aged 6 to 14 years (median = 10 years) who were diagnosed as having moderate learning difficulties. The sample consisted of 12% females and 88% males of which 89% were White, 3% Blacks and 5% Hispanics and 3% Asian. 66% of the children had unspecified learning problems, 26 % had both writing and reading difficulties, and 5% had arithmetic problems while 3% had developmental writing difficulties. The specific learning difficulties sample had an even larger difference in the same direction between the Verbal Comprehension Index (VCI) and Perceptual Organisation Index (POI) scores with the POI score being greater than the VCI score (Golombok & Rust, 1992).

68 hyperactive children (diagnosis based on the Diagnostic and Statistical Manual of Mental Disorders, Third Edition - Revised) between the ages of 7 to 17 years (median = 10 years), with 60% between 9 and 11 years were also tested. The sample consisted of 9% females and 91% males with 90% being White, 1% Black and 3% Asian. All the IQ mean scores were near the normative range, but the scores on the Processing Speed and

Freedom from Distractibility indices were low (Golombok & Rust, 1992). This finding is as expected since hyperactive children are unable to sustain their attention on a particular task for a long period of time. As such, their performance will be impaired on any task that requires speed and concentrated effort.

In a group of 26 male students (27% Whites, 65% Blacks and 8% Hispanics) aged 11 to 15 years (median = 13) diagnosed with severe emotional and behavioural difficulties and tested with the WISC-III, the mean IQ scores were low as expected given the educational history and background of these children. The mean scores on the VIQ, PIQ and FSIQ scales were 77.9 (SD = 10.5), 82.2 (SD = 15.7), and 78.1 (SD = 13.5) respectively (Golombok & Rust, 1992).

The WISC-III was also given to 20 children aged 6 to 16 years (median = 12 years) with epilepsy drawn from a tertiary care facility. The sample consisted of 35% females and 65% males with 65% White and 35% Black. 50% of the sample was diagnosed with partial-complex seizures, 40% with generalised tonic-clonic seizures and 10% with absence seizures. The mean FSIQ score was 74.3 (SD = 22.4), the mean VIQ score was 77.4 (SD = 20.5), and the mean PIQ score was 75.0 (SD = 21.4). The highest mean index score was for the VCI with a mean of 78.9 (SD = 20.4) while the lowest mean index score was for the PSI with a mean of 72.8 and an (SD = 16.1). Although the low mean scores exhibit a consistent pattern that is not unexpected given that children with epilepsy tend to score about one standard deviation below average, the large standard deviations

suggest considerable variability among the individuals in the sample (Golombok & Rust, 1992).

With regards to profiles of the WISC-III in brain injury, several studies have shown that the severity of traumatic brain injury (TBI) in children is associated with intellectual impairment (Donders, 1997; Donders & Warschausky, 1997; Jaffe, Brink, Hays & Chorazy, 1990). Many studies have found that nonverbal measures of intelligence are more likely than verbal measures to be impaired after TBI (Fletcher, Levin, & Butler, 1995). Chadwick, Rutter, Brown, Shaffer & Traub (1981) found that severely injured patients had striking deficits in PIQ results with much smaller deficits in VIQ. The four-factor structure of the WISC-III allows more precise study of vulnerability and differential rates of recovery of intelligence domains.

This four-factor structure has been confirmed in children with TBI (Donders & Warschausky, 1996a). In a cluster analysis of WISC-III factor index scores with paediatric TBI patients, four clusters emerged (Donders & Warschausky, 1997). Being low in the Perceptual Organisation-Processing Speed (PO-PS) cluster was associated with neurological findings such as injury severity or lesion location suggesting that these deficits in Perceptual Organisation and Processing Speed were related specifically to the consequences of TBI.

Significant differences occur on PIQ, PS and PO scores based on injury severity as determined by the Glasgow Coma Scale and neuroimaging findings (Donders, 1997a). Children with severe TBI scores significantly lower on PIQ, PS and PO than did mildly and moderately injured children. The PS factor is the index most correlated with length of coma in children with severe TBI (Donders & Warschausky, 1996a). None of the VIQ, VC and FD scores were related either to injury severity or length of coma (Donders, 1997a).

In summary, Golombok & Rust assert that the factor analytic studies and the correlations with other measures of intellectual ability and academic achievement provide support for the construct validity of the instrument, while the data on a variety of special groups provide evidence of the usefulness of the WISC-III[®] in diagnostic assessment (Golombok & Rust, 1992).

Profile analysis of the Wechsler scales is something that has been done by a number of clinicians for some years now, in particular, since all the subtests are expressed in directly comparable standard scores. From the outset, Wechsler described a number of diagnostic uses of his scales (Anastasi & Urbina, 1997). Since then, several clinicians have recommended additional techniques, and profile analysis has been applied with other instruments as well (Delaney & Hopkins, 1987; Elliot, 1990b; Kaufmann, 1990, 1994; Matarazzo, 1972; Sattler, 1988, 1992). Most profile analysis employ three major procedures.

The first involves an evaluation of the amount of scatter, or the extent of variation among the individual's various scores. The second procedure consists of analysing the

salient features of an individual's profile in the light of base rate data about the frequency or rarity of such features within the normative group. The third approach is based on score patterns associated with particular clinical syndromes such as Alzheimer's disease, learning disabilities or anxiety states. Wechsler and other investigators (Kaufmann, 1990; Matarazzo, 1972) have described patterns of low and high subtest scores as well as subtest combinations characterizing these and other disorders.

Despite this assertion, a note of caution is necessary. The WISC has construct validity in measuring school related tasks or academic achievement. Several decades of research on the various forms of pattern analysis with the Wechsler scales have provided little statistical support for their diagnostic value. At one point or another, critics of this have attacked almost every aspect of this approach (F. C. Goldstein & Levin, 1985; Kavale & Forness, 1984; Macmann & Barnett, 1994a, 1994b; McDermott, Fantuzzo & Glutting, 1990).

1.9.1 Uses and Criticisms of the WISC-III™

As a measure of general intellectual ability, the WISC-III™ is useful and appropriate for a number of purposes:

- a. Psychological assessment contributing to educational planning, resource provision and placement decision.
- b. Identification of unusual cognitive profiles relating to exceptional ability or learning difficulties among school-aged children.

- d. descent and other minority groups in countries such as the USA and the UK has not been confronted in this latest revision resulting in a selection bias (Kaplan & Saccuzzo, 1993).

2.9.2 Standardization of the WISC-III^{UK}

Development of the WISC-III^{UK} follows a tradition of adaptation and Anglicisation established with previous Wechsler scales for their use in the UK. However, for the first time, the WISC-III^{UK} was developed and standardized simultaneously as the WISC-III in the USA. The third edition of the Wechsler Intelligence Scale for Children has been developed with the following goals in mind:

1. Updating norms
2. Maintaining the basic structure and content
3. Enhancing the factor structure
4. Improving subtest content, administration and scoring rules.

The UK standardization project was established at the Clinical and Health Psychology Research Centre, City University of London, under the directorship of Dr. S.Golombok. The norms WISC-III^{UK} presented in the manual were derived from a validation sample representative of the UK population of Children. A stratified random sampling plan was used to ensure that representative proportions of children from each demographic group would be included in the validation data.

The validation sample targeted 814 cases representing 37 boys and 37 girls for each of 11 age groups ranging from 6 to 16 years. The race/ethnicity were in four categories:

- i) Indian, Pakistani or Bangladeshi
- ii) West Indian or African
- iii) White
- iv) Other

Each child was categorized by his/her parents as belonging to one of these categories. The

UK was divided into 12 geographical regions:

- i) Wales
- ii) Scotland
- iii) Northern Ireland
- iv) The North of England
- v) Yorkshire and Humberside
- vi) The East Midlands
- vii) East Anglia
- viii) South East London (excluding Greater London)
- ix) Greater London
- x) South West England
- xi) The West Midlands
- xii) The North East

Children were targeted in accordance with the proportion of all people living in each region in 1989.

The sample was stratified within each region on the basis of the 1989 Labour Force survey, data on social class of heads of households. The categories used were:

- i) Professional
- ii) Intermediate
- iii) Skilled Non-Manual
- iv) Skilled Manual
- v) Partly Skilled Manual
- vi) Unskilled
- vii) Long-term unemployment.

The sampling procedure was as follows:

A matrix of the seven socio-economic status levels by the twelve geographical regions for each combination of sex, age and race/ethnicity formed the basis of the sampling plan. 38 Local Education Authorities (LEA) were invited to participate in the WISC-III[®] validation. Within each LEA, several schools were sampled to include children of both primary and secondary age and to represent the rural/suburban/urban mix of the local authority area. 2390 parental consent forms were sent with 2026 returned.

Each child was assigned to one of 91 examiners, usually an Educational Psychologist who had experience in administering individually administered tests or who had demonstrated proficiency in administering the WISC-R[®] or WISC-III[®]. Testing for almost

all (N=740) examinees was carried out in April and May 1991. Exceptions were Outer London (N=19), which participated in piloting for the overall procedures in November 1990, the Isle of Wight (N=22, March 1991) and some secondary sampling, (N=43, July 1991).

In all, the total sample size was 824 children from 59 schools. A series of training workshops were held all over the UK to familiarize examiners with the test procedures and the particular requirements of the project. Completed WISC-III[®] forms were scored by the examiners using an established procedure to indicate any responses that had been difficult to score. Subtest scores were entered on the front of the scoring sheet. An independent assessor also scored all the response forms and re-checked any, where a discrepancy arose. The final discussion was that of the independent assessor in these cases. Determination of starting points and discontinuation rules were based on the US standardization.

2.9.3 Short Form of the WISC-III

Due to the length of time it takes to administer the full-length test, (90-120min), a short form of the WISC-III has been considered in order to ensure efficiency in testing. In order to calculate the four factor index scores, one has to administer all but the maze subtest. If the same four factor index scores could be obtained with fewer subtests,

significant timesavings could be made and in situations where time constraints are an issue, this will prove advantageous (Donders, 1997b).

Short forms have been developed for almost all previously published Wechsler Intelligence Scales (Silverstein, 1990; Watkins, 1986). In addition, Sattler (1992) also provided a variety of short-form diads, triads, tetrads, and pentads for the WISC-III, although these only allowed calculation of a FSIQ estimate. Since the four-factor model is an important tool in assessing the relative strengths and weaknesses of children tested on the WISC-III, a short form that will maintain the desirable psychometric properties of the full WISC-III, (in terms of reliability and validity of the instrument) has been considered desirable. It is in this regard that Donders (1997b) undertook his project.

Donders used the 2,200 children from the WISC-III standardization sample in the USA. The purpose of the investigation was to evaluate the reliability, validity, and factor structure of a short form of the WISC-III that was based on eight subtests selected for theoretical and practical reasons. These subtests were Similarities and Vocabulary as measures of Verbal Comprehension (VC), Picture Completion and Block Design as measures of Perceptual Organization (PO), Arithmetic and Digit Span for Freedom from Distractibility (FD), and Coding and Symbol Search for Processing Speed (PS). Donders work followed all of Silverstein's (1990) recommendations in that:

- a) The original scale was abbreviated by using selected subtests,
- b) The standardization sample was used,

- c) Deviation quotients were estimated by linear scaling.
- d) Detailed information was provided about both the reasons for selection of subtests and the psychometric properties of the short form.

Donders findings provide potential users with a clear alternative to existing WISC-III short forms (Donders, 1997b). If the only purpose of giving the WISC-III to a child is for research or brief screening purposes, and maximizing time is a predominant concern, then Sattler's (1992) short forms may suffice. However, because Donders' short form allows the calculation of the four factors, this form may be more appropriate for clinical situations where the assessment of aspects of children's cognitive strengths and weaknesses is an integral part of the referral question.

Donders further recommends that based on previous findings (Donders & Warschausky, 1996a; Roid, Prifitera & Weiss, 1993) that provide strong support for the four factor WISC-III model over any competing models, clinicians should focus on the factor index scores and not on the traditional Verbal and Performance IQ scores, something that his short form allows (Donders, 1997b).

Razavieh and Shahim (1992) used data from the standardization of the WPPSI in Shiraz, Iran, (193 girls, 203 boys; 4-6.5 yr. olds) to develop a short form of the WPPSI. Four subtests, Vocabulary, Arithmetic, Picture Completion and Block Design were selected on the basis of their high correlations with Full Scale IQs. The validity coefficients were high and significant with the two verbal subtests Vocabulary, Arithmetic having an average

correlation coefficient of 0.91 with the Verbal IQ while the two performance subsets Picture Completion and Block Design had an average correlation coefficient of 0.87 with the Performance IQ. This short form classified correctly about 73% of the subjects by category of intelligence but tended to underestimate the IQs of subjects of high intelligence while overestimating the IQs of subjects of low intelligence. Whereas Razavieh and Shahim defined low intelligence as IQ below 80, they give no definition of what they mean by high and assume that their readers know what cut-off values they are referring to.

2.9.4 Adaptation of the Wechsler Intelligence Scales to other cultures

In this review, the adaptations found were with the WISC-R rather than the WISC-III. The WISC-R has been a widely used intelligence scale for children and by the end of 1974, 12 translated editions had been recognised by the authors and publishers of the WISC-R (Dan, Yu, Vanderberg, Yuemei & Caihong, 1990).

In the US, the Spanish Version of the WISC-R was standardized on 532 Cuban-Americans. Factor analysis of the Spanish WISC-R (Escala de Inteligencia para Niños - Revision, EIGN R) (Gass, Demsky & Martin, 1998) supported a two-factor solution across age groups, roughly corresponding with Wechsler's verbal and performance dimensions. The existence of a meaningful third factor, which has empirical support in the WISC-R literature failed to emerge for the EIGN-R.

The Chinese translation of the WISC-R was administered to 660 children (ages 6 through 16) in the city of Shanghai (Dan, Vanderberg, Yuemei & Caihong, 1990). Although the authors participated in the work of constructing national norms for the WISC-R, they considered it necessary to reflect on the developmental level of children's intelligence in the large city of Shanghai, because Shanghai is an economic and cultural centre in China and has its own unique characteristics.

Since the main purpose of their study was the formulation of norms, after analysis of data, Shanghai norms were formulated. They constructed Scaled Score Equivalents of Raw Scores for each age group and IQ Equivalents of Sums of Scaled Scores. The obtained norms represented children's intelligence levels in big cities where the economic and cultural development is advanced. The reliability and validity of the norms indicate that the WISC-R is suitable for use with school-age children in China. The conclusion of Dan et al was that although the WISC-R was developed in the USA, it is also a good tool in measuring intelligence of children in other countries after trial studies and formal revisions, as well as estimating currently the reliabilities and validities. To them, the Shanghai norms formulated in their studies provide a criterion for educational and psychological experimental studies and clinical diagnosis (Dan et al., 1990).

In a paper on the "Adaptation of the Wechsler Intelligence Scales for Children (WISC) to Argentinean subjects (Sans, 1984), some objections were made regarding the order in which the elements in the WISC subsets for children were introduced, as it may prove wrong for Argentinean children. The sample consisted of 100 pupils belonging to

different social and cultural levels attending the highest grade in primary school with ages ranging from twelve to thirteen years. The pupils were given a translated adapted version of the WISC. Some words in the Information and Vocabulary subtests were too insensitive to the subjects' cultural differences while in the Comprehension subtest, some questions turned out to be too difficult due to the fact that the required information was less frequent in that environment.

The Wechsler Adult Intelligence Scale-Revised (WAIS-R) has been adapted with minor revisions for use in China and standardized on a sample of 179 adults. Sex differences on the subtests were similar to those in the United States, with women obtaining higher means on the Digit Symbol subtest and men obtaining higher means on the Information and Arithmetic subtests. Overall, men obtained higher Verbal, Performance and Full Scale IQs. The factor structure was also similar to those obtained in the Wechsler tests in the US and Scotland (Lynn & Dai, 1993)

In Iran, the WISC-R was restandardized on a representative sample of 1400 children between the ages of 6 and 13 years who were stratified on the basis of age, sex, and occupation of father according to the 1986 census of Iran (Shahim, 1990). Razavieh & Shahim (1992) also standardized the Wechsler Preschool and Primary Scale on 193 girls and 203 boys (aged 4 to 6.5 years) in Shiraz. The sample was stratified on the basis of age, sex, and occupation of father according to the 1986 census of Iran. The subtests were first translated into Persian and some items were eliminated for clear lack of congruence

with Iranian culture. The eliminated items were replaced by similar items of apparently equal difficulty. A pilot study was conducted to assess the applicability of the adapted items and to establish the difficulty for each item. Four trained female examiners administered the battery.

Razavieh and Shahim however did not mention any of the specific changes they made and this is a limitation to their readers' understanding and judging for themselves whether the eliminated items were replaced by items of equivalent level of difficulty as they indicate.

2.10 The Raven's Coloured Progressive Matrices

According to Raven (Raven, Raven, & Court, 1995), the core abilities tapped by the RPM include visual-perceptual processing, abstract reasoning, and concept formation. Carpenter, Just & Shell (1990) include induction of abstract relations and a large working memory for problem solving. The few factor analytical studies done have found two factors: the ability to disassemble a part from its whole and the ability to manipulate objects perceptually (Paul, 1986).

There have been suggestions over the past twenty years to use the RPM as an alternate or supplementary measure to identify gifted and talented children, and especially, those children who do not do well on traditional IQ tests (Baska, 1986; Matthews, 1988).

In this regard, the question has been “what exactly is the RPM measuring?” and how does it compare to other tests assessing intellectual abilities?

The RPM according to Raven, was designed primarily as a measure of Spearman’s factor *g* or general intelligence (Raven, Raven, & Court, 1995). Thus, in keeping with Spearman’s theoretical analysis of *g*, this test requires chiefly, the education of relations among abstract items. While the easier items require accuracy of discrimination, the more difficult items involve analogies, permutations and alternations of patterns, and other logical relations. According to Llabre (1985), the RPM was designed to measure the ability to form perceptual relations and to reason by analogy regardless of verbal ability or academic achievement.

Whether the RPM provides a better estimate of *g* than traditional measures is still pending. What is known is that there is an overlap between the RPM and other traditional measures of intelligence with correlations between the Wechsler and Stanford-Binet scales and the RPM ranging from moderate to high (0.4 & 0.86) depending on the form of the test and the age of the group studied (Paul, 1986; Matthews, 1988).

Discussing his findings on the RCPM in Ghana, although Anum (1996) had hypothesized that there will not be significant correlation between the RCPM and his criterion measures - Digit Span, the modified WRAT Spelling and Arithmetic, and Socio-

economic status, his findings did not support it. Most of his correlations were significant at $p < .001$.

The RPM has a number of advantages. Its relative ease and simplicity of administration and scoring allows the possibility of group testing by technical or clerical staff (Samuelson, 1987), thereby resulting in a more efficient and cost-efficient assessment. Its popularity can be understood from a number of perspectives. First, the RPM is a nonverbal measure that was designed to de-emphasize cultural and academic content and as a result, it is considered to be one of the most culture-fair tests (Jensen, 1980) and is recommended for use with individuals who may be at a disadvantage on tests that rely heavily on verbal and / or academic skills (Jensen, 1980; Llabre, 1985).

Second, because the RPM is usually untimed, it is useful with individual's who do not respond quickly due to physical handicap (Llabre, 1985); brain damage (Botwinick, 1978); or emotional / motivational difficulties. Untimed tests, such as the RPM are also preferred with individual's whose cultural groups do not necessarily value speed in work (Jensen, 1980).

Third, proof of its efficacy as a measure of intelligence has been demonstrated by its correlation to the widely used Wechsler tests (Burke, 1958).

In a study estimating Age-Stratified WAIS-R IQs from scores in the Raven's Standard Progressive Matrices (O'Leary, Rusch & Guastello, 1991) total scores of the

Raven's Standard Progressive Matrices (SPM) were correlated with Wechsler Adult Intelligence Scale Revised Full Scale IQs (WAIS-R FSIQ) in order to obtain age-stratified estimates of the WAIS-R FSIQ in a sample of 308 adults (151 male and 157 female). The results showed a significant positive correlation between age-stratified WAIS-R FSIQ and SPM in all age groups except those 65 years and older and between educational level and SPM for all age groups except the very young (16 to 24 years), the 55 to 64 year olds, and the elderly (65 years and above). Their conclusion was that SPM could be used as an estimate of WAIS-R FSIQ.

Like any other instrument or tool, the RPM has had its share of criticisms. Inadequate standardization with dated norms has been a major criticism and limitation to its use (Matthews 1988). Apart from it being less reliable and valid than traditional tools, its main advantage of trying to measure general intelligence through one modality can misfire. Children who for one reason or the other are incapable of doing figural-reasoning tasks can be incorrectly assessed. To correct this, Raven, (1983) indicates that supplementing the progressive matrices with a vocabulary test has proved a more effective way of assessing children.

As a result of the criticism with its norms being outdated, Anum's "Normative Study of the Raven's Coloured Progressive Matrices among School Children in Ghana" (1996) had the objective of investigating the usefulness of the RCPM, which has been used in Ghana for several years.

When Anum compared his findings with the published norms in the test manual, it was evident that abilities on the RCPM differed between Ghanaian pupils and those reported in the test manual. However, the difference between the published norms and that of the urban school pupils in Ghana were comparable. His explanation for this was that urban children have characteristics similar to the sample that must have been used for the standardization. The major difference he found was between the norms for rural children and that of the published norms with the results indicating a 3 to 4 year difference in performance on the RCPM.

The authors of the RCPM indicate that above the age of eight years, children should understand the concept of matrices, however, in Anum's work, he found out that this was not so (Anum, 1996). With both the rural and urban children in Ghana, he found very little difference at about ages 6 to 7 years. The expectation that most 8-year-old children, having reached the stage of concrete operations should be able to solve the problems in the set 'Ab' of the RCPM was not so. At 10 years, most rural children could still not solve these matrices.

The important consideration is this: does this mean that the capacity to reason by analogy as measured by matrix reasoning may not have developed as expected? Although Anum argued that for rural children, this capacity may simply be delayed, this is debatable. First of all, as he states (Anum, 1996), matrix reasoning is only one of the methods of measuring reasoning by analogy. Secondly and more importantly, matrices are very foreign

to children in Ghana, especially rural children whose only contact with them may be in school if they are lucky. As such, it is not sufficient to say that low scores on the matrices implies poor abstract reasoning or a delay in cognitive development. It is more likely that the problem is the tool being used rather than the fact that these children have poor abstract reasoning. These children may be able to analyse analogy in other respects, as such, there is the need to develop a tool in Ghana that can tap this ability.

2.11 Aim/Goal of the Study

The major goal of the study is to derive local norms for the WISC-III^{RM} in Ghana.

2.12 Objectives of the Study

1. To investigate whether the WISC-III^{RM} is applicable to the Ghanaian child
2. To establish the correlation between the WISC-III^{RM} and the Raven's Coloured Progressive Matrices (CPM)
3. To determine the influence of formal education on test performance
4. To determine the differences, between the performance of girls and boys on the WISC-III^{RM}

2.13 Hypotheses

Ghanaian schoolchildren will perform poorer on the WISC-III[®] than their British counterparts.

ii) The type of school (public versus private) attended will significantly influence performance on the WISC-III[®]

iii) There will be significant differences in performance between males and females on verbal and spatial tasks.

a) Females will do better on verbal tasks

b) Males will do better on spatial and mathematical tasks

iv) Test performance will improve with increasing age

v) Performance on the WISC-III[®] will correlate strongly with performance on the Raven's Coloured Progressive Matrices (CPM)

3. METHODOLOGY

3.1 Design

This is a 2 (groups) x 12 (age groups) x 2 (measures) multifactorial design to derive local norms for the WISC-III[®] in Ghana as well as compare the performance of the subjects on the WISC-III[®] to their performance on the Coloured Progressive Matrices (CPM). There are two major groups: private (school group1) and public (school group2) schools. There two schools in each group distributed into twelve age groups (6:0 - 6:5, 6:6 - 6:11, 7:0 - 7:5, 7:6 - 7:11... 11:0 - 11:5, 11:6 - 11:11), numbered age groups 1 through 12, and two measures: the WISC-III[®] and the RCPM.

3.2 School Selection

The schools in Accra were grouped into Grade I schools, Grade II schools and Grade III schools based on factors such as the fees paid, facilities available and performance on Basic Education Certificate Examination (BECE). The selection of schools was based on locale within the educational submetropolitan areas in Accra, the capital of Ghana. The availability of a quiet testing environment in the form of a school library or a vacant office was also influential in the selection of schools.

GRADE I SCHOOL

Alyd Academy

This is a private school in Dzorwolu typically known for being among the top private schools in Accra. Almost all the children are dropped and picked up after school by their parents or

drivers coming from all over the metropolis. Facilities available include a library, a computer lab and a science lab. BECE results have been excellent with the pupils from this school gaining admission to top secondary schools in Ghana. Testing took place in the school library in a quiet and conducive environment.

GRADE II SCHOOL

St Paul's Lutheran School, Kanda

A private and church owned school established recently with most of their pupils coming from other schools. Since most of the children tested in this school had just transferred from other schools in the year of testing (1999/2000 academic year), the performance of the children was a reflection of middle SES schools in Accra. This is because most of the children came from other middle class schools. The class one pupils were the only ones who truly reflected the performance of the school. Facilities available include a canteen, a computer lab and a library under construction at the time of testing. Most of the children come to school by cars from the various residential areas in Accra. Testing took place in a staff room specially vacated for testing of the children. Noise level was minimal although every now and then, some curious children had to be shooed away.

GRADE III SCHOOLS

South La Estates Primary School

The Home School, although a Public school, has been renowned in the past for producing students for top secondary schools in the past. Although that is no more the case, it still is better than a lot of public schools in Accra in terms of the pupils performance on the BECE

with a few children dropped and picked up by their parents. Most of the children come from La in Accra and its environs. The facilities included a library, which was not in use because of its sorry state and a canteen. Testing was done in the headmistress' office with moderate noise levels

Sempe NO. 5 Primary (school 4)

This is a public school in Sempe, Accra, with most of the children coming from Mamprobi, Laterbiokoshie and other surrounding areas with almost all of the children walking to school or coming by public transport (Trotro). The school has a library and during the testing period (June 2000), a community computer project was commissioned although the school children had not started using the computers. The primary school runs a shift with the JSS. The fee at the beginning of the 1999/2000 academic year was 4000.00 Cedis. Testing was done in the circuit officer's office with minimal noise level.

3.3 Subject Selection

3.3.1 Criteria for Subject selection

Subjects were selected from the school register through random selection using the table of random numbers. Exclusion criteria included ill children, mentally retarded children and children with poor understanding and usage of English.

3.3.2 Sample Selection and Size

A total of eight children, four girls and four boys for each age group (6 years to 11years 11months) giving 48 children per school (24 girls, 24 boys) were selected from all the schools with the exception of Alsyd Academy where for classes 1& 2, eight children were selected while for classes 3 to 6, ten children per class, five girls and five boys were selected, giving a total of 56 children. In all, a total of 200 children were selected and tested.

3.4 Measures

3.4.1 WISC-III[®]

Organization of the Scale

The WISC-III-[®] comprises the 12 subtests retained from its predecessor the WISC-R [™] and a new subtest, symbol search. The subtests in order of administration are:

1. Picture completion:

A set of colourful pictures of common objects and scenes each of which has an important part missing. The child identifies this missing part. This measures long-term visual memory, visual alertness, and ability to differentiate between essential and non-essential details. It is influenced by concentration, visual acuity and cognitive style.

2. Information:

A series of orally presented questions that tap the child's knowledge about common events, objects, places and people. It taps fund of knowledge. Scores are influenced by educational and cultural opportunities and outside interests.

3. Coding:

A series of simple shapes (coding A) or numbers (coding B) each paired with a simple symbol. The child draws the symbol in its corresponding shape (coding A) or under its corresponding number (coding B), according to a key. Coding A and B are included on a single perforated sheet in the Record Form. It measures visual motor speed and accuracy, short-term visual memory and ability to follow directions. It is influenced by distractibility, anxiety and visual acuity.

4. Similarities:

A series of orally presented pairs of words for which the child explains the similarity of the everyday objects or concepts they represent. It measures logical abstract thinking and ability to form verbal concepts. It is influenced by cultural opportunities and outside interests.

5. Picture Arrangement:

A set of colourful pictures presented in mixed-up order, which the child rearranges into a logical story sequence. It measures temporal visual sequence, social awareness, non-verbal reasoning and planning ability. It is influenced by cultural background, exposure to comics and visual acuity.

6 Arithmetic:

A set of arithmetic problems the child solves mentally and responds orally. It measures computational skills computational skills and numerical reasoning and is influenced by anxiety, ability to concentrate, distractibility and school experiences.

7 Block Design:

A set of modelled or printed two-dimensional geometric patterns, which the child replicates using two-coloured tubes. It measures non-verbal concept formation, ability to analyse a whole into parts and visual-spatial organization. It is influenced by cognitive style and visual motor speed. In particular, the Block Design subtest of the Wechsler Scales is widely viewed as a clinically rich test assessing constructional, perceptual, and organizational abilities, with many authors drawing attention to its suitability for qualitative analysis (Kaplan, 1983; Lezak, 1995).

By noting where patients begin their constructions, the directions in which they work, where errors are made, and the frequency of certain types of errors, clinicians can infer a great deal about the nature of a particular patient's cognitive impairment and the location of focal brain lesions. For example, stimulus-bound errors, in which patients focus excessively on the most perceptually salient features of the model, suggest poor executive skills and raise the possibility of anterior neuropathology.

Kaplan and her colleagues (Kaplan, 1983) have also suggested that block design performance can be analysed with respect to both detail and configural levels. The significance of this is that it is thought that left-hemisphere-damaged patients have more

difficulty with internal details while right hemisphere-damaged patients are more likely to distort overall configuration (Akshoomoff, Delis & Keifer, 1989; Ben-Yishay, Diller, Mandelberg, Gordon & Gerstman, 1971; Kaplan, Morris, Fein & Delis, 1991; Wilde, Sherer & Boake, 1995). This tendency for right hemisphere damaged patients to distort the overall configuration is consistent with the well-established finding that the right hemisphere is superior for analysing global aspects of spatial information (Robertson & Delis, 1986; Robertson and Lamb, 1991).

Despite its many strengths, the WISC-III Block Design has some limitations for studying visuospatial ability. The designs do not appear to be systematically varied along any particular dimension. In addition, the discontinuation rule introduces variability in the numbers and types of designs administered (Kramer, Kaplan, Share & Huckleba, 1999).

8. Vocabulary:

A series of words presented orally, which the child defines. It measures general word knowledge and language development and is influenced by educational background, cultural experiences and outside reading and interests.

9. Object Assembly:

A set of jigsaw puzzles of common objects, each presented in a standardized configuration, which the child assembles to form a meaningful whole. It measures anticipation of part-whole relationships, ability to use sensory-motor feedback, visual-motor speed and coordination. It is influenced by cognitive style and motor speed.

10. Comprehension:

A series of orally presented questions that requires the child to solve everyday problems and / or show understanding of social rules and concepts. It measures practical common sense, awareness of social rules and mores and ability to use past information and experiences. It is influenced by cultural opportunities and moral development.

11. Symbol Search:

A series of paired groups of symbols; each pair consisting of a target group and a search group. The child scans the two groups and indicates whether or not a target symbol appears in the search group. Both levels of the subtest are included in a single response booklet. It measures processing speed.

12. Digit Span:

A series of orally presented number sequences, which the child repeats verbatim for Digit Forwards and Digit Backwards. It measures short-term auditory memory and is influenced by attention span, anxiety and distractibility.

13. Mazes:

A set of increasingly difficult mazes printed in a response booklet, which the child solves with a pencil. It measures visual planning, ability to follow a visual pattern, visual-motor coordination and foresight. It is influenced by experience with solving mazes.

The subtests are organized into two groups, the Verbal and the Performance subtests.

The Verbal subtests are:

- Information (INF)
- Similarities (SIM)
- Arithmetic (ARI)
- Vocabulary (VOC)
- Comprehension (COM)
- Digit Span (DS)

The Performance subtests are:

- Picture Completion (PC)
- Coding (COD)
- Picture Arrangement (PA)
- Block Design (BD)
- Object Assembly (OA)
- Symbol Search (SS)
- Mazes (MAZ)

The child's performance yields three composite scores:

- iii) The scores on the verbal and performance combine to yield the Full Scale IQ (FSIQ)

The digit span and mazes are supplementary tests and not used to calculate the various IQs. However, the Digit Span may substitute for a verbal subtest and Mazes for a performance subtest if one of the standard subtests cannot be given. Using these scores, analysis show that the mean scaled score remains stable, fluctuating by only 0.1 – 0.3 points. Although the supplementary tests are not used in IQ calculations, if they are substituted for one or two standard tests, their score is included in the IQ computation. The Symbol Search however, is an optional test and cannot substitute for any of the standard subtests. In order to calculate factor-based indexes, however, Digit Span and Symbol Search must be administered.

The factor based index scores calculated are:

- i) Verbal Comprehension Index (VCI) derived from the Information, Similarities, Vocabulary and Comprehension subtests.
- ii) Perceptual Organization Index (POI) from the Picture Completion, Picture Arrangement, Block Design and Object Assembly subtests.
- iii) Freedom from Distractibility Index (FDI) from the Arithmetic and Digit Span subtests.
- iv) Processing Speed Index (PSI) from the Coding and Symbol Search subtests.

These factor based scales, like the IQs have a mean of 100 and a standard deviation of 15. Although this four-factor structure has been criticized by some authors, (Little, 1992; Sattler, 1992), it has received considerable support in independent replication studies with normal children and children with neurological impairment (Donders, 1997)

While the utility of the first two factors (VCI & POI) is relatively uncontroversial, in part because they have remained essentially unchanged across test revisions (Little, 1992), the FDI and PSI however, have received less empirical support. According to Anastopoulos, Spisto & Maher (1994) the concern in this is because educators and clinicians frequently use scores on the FDI in making the diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) despite conceptual warnings against doing so (Barkley, 1994; Little, 1992; Naegleri & Das, 1990).

Reinecke, Beebe & Stein (1999) examined the ecological validity, construct validity and diagnostic utility of the third factor of the WISC-III, the Freedom from Distractibility Factor (FDI). A sample of 200 children, aged 6 to 11 years with ADHD completed the WISC-III, the Wide Range Achievement Test-Revised and the Test of Variables of Attention. Objective parent and teacher report measures of attention and hyperactivity were completed. Their findings indicated that although children with ADHD tend, as a group, to receive lower scores on the third factor of the WISC-III than on the VCI and POI factors of the measure, FDI is not useful, by itself, for diagnosing ADHD. It may be useful though as part of an evaluation of cognitive strengths and limitations among children with ADHD and

may offer a focus of educational intervention. Their data provided limited evidence for the construct, concurrent, divergent or ecological validity of FDI as a measure of inattention or ADHD

Changes to the Scale

Due to their irrelevance and other factors, some items were replaced by others as indicated below

Information subtest:

1.2 *What is the capital of Greece? was changed to what is the capital of Egypt?*

The underlying assumption is that since in testing British children, the test makers asked a question about a country pivotal in European history, it was only fair that in testing Ghanaian children, a question should be about a country pivotal in African history.

1.3 *How far is it from London to Edinburgh (Republic of Ireland, how far is it from Dublin to Cork) was changed to how far is it from Accra to Kumasi.*

Arithmetic

Questions involving pounds and pence were changed to cedis, e.g.

18. *If you buy 2 dozen pencils at 45 pence a dozen, how much change should you get back from £1? was changed to if you buy 2 dozen pencils at 450 cedis (local currency in Ghana) dozen, how much change should you get back from a 1000 cedis?*

3.4.2 The Raven's Coloured Progressive Matrices (RCPM)

It is customary to establish the construct validity of a cognitive test through comparison with other full measures of cognitive ability. In this regard, the Progressive Matrices (RPM), a nonverbal individually or group administered test of reasoning ability based on figural materials was selected. The RPM as a tool has been widely used by examiners for several years in Ghana. In addition, local norms are available (Anum, 1996). The test measures ability to form comparisons, to reason by analogy, and to organise spatial perceptions into systematically related wholes.

The book form of this test was used for the study. The right responses were scored 1 and 0 for wrong responses for all the 36 problems under the various sections A, AB and B. Each section was scored over 12 and an aggregate of these scores was taken as the score for the RCPM. The highest possible score is 36.

3.5 Procedure

The test items were all administered by the candidate herself. The instructions given in the WISC-III[®] manual were followed in administering the test items. The items were scored according to the criteria in the WISC-III[®] manual using the starting and discontinuation rules.

English was used throughout the study. Subjects came into the testing room one at a time for the administration of the WISC-III[®] test starting with the six year olds. After they had all finished with the WISC-III[®], they were tested in groups of six on the RCPM. The researcher helped a few of the six year olds who were having difficulties writing their answers on the RCPM answer sheet.

4. RESULTS

The study, aimed at investigating whether the WISC-III® is applicable to Ghanaian children from selected schools between the ages of 6 years, 0 months to 11 years, 11 months on the WISC-III® and the RCPM. Subjects were in two groups, private and public schools, distributed into 12 age groups. Comparisons were made based on the private/public dichotomy and the 12 age groups.

The norms for the Ghanaian sample was established by scaling it to the level of the UK norms. For each of the 13 subtests, the distribution of raw scores for each age group was converted to a scale with a mean of 10 and a Standard Deviation (SD) of 3 as was the case with the British data. This was done by converting the raw score for each age group to a z score and then converting the z score to the scaled score by multiplying the z score by 3 and adding 10. Table 17 shows the scaled score equivalents of the raw scores. The values have been extrapolated to include values below the minimum and above the maximum for this group.

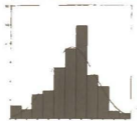
The sums of scaled scores (Verbal, Performance and Full Scale) were determined by summing each child's actual scaled scores on the relevant subtests, excluding the supplementary and optional subtests. An ANOVA revealed no statistically significant variation by age in the mean scores for each scale. Bartlett's test of homogeneity of variance applied across the 12 age groups indicate that the SDs did not differ significantly by age. Therefore, the age groups were combined (N = 200) to construct the table of IQ score equivalents of sums of scaled scores (Table 18).

For each of the three scales, the Verbal IQ (VIQ), the Performance IQ (PIQ) and the Full Scale IQ (FSIQ), the distribution of sums of scaled scores was converted to a scale with a mean of 100 and SD of 15. This was done by converting the sum of scaled scores to a z score and then converting the z score to the IQ equivalent by multiplying the z score by 15 and adding 100. The tables were extrapolated below the minimum and above the maximum for this group. The construction of Tables for the four index scores, the Verbal Comprehension Index (VCI), the Perceptual Organisation Index (POI), the Freedom from Distractibility Index (FDI) and the Processing Speed Index (PSI), followed the same general procedures as that of the IQ tables. The Ghanaian norms were thus scaled to the level of the UK norms. The raw scores of the RCPM were also converted to an IQ equivalent scale with a mean of 100 and SD of 15.

Various correlations such as subtest correlations with each other and the RCPM as well as with the various IQ and Index scores were done.

Before analysis, tests of normality were done to determine whether the data conformed to a normal curve. The graphs below represent the distribution of the raw scores of the Ghanaian sample on the WISC-III[®] subtests scores and the RCPM. In the graphs below, the ordinate (y) axis represents the number of subjects while the abscissa (x) axis represents the means for each test.

Graph of distribution of raw scores for Picture Completion subtest



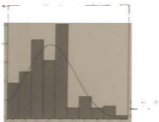
Graph of distribution of raw scores for Information subtest



Graph of distribution of raw scores for Coding subtest

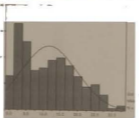


Graph of distribution of raw scores for Similarities subtest



100%

Graph of distribution of raw scores of Picture Arrangement subtest

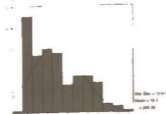


100%

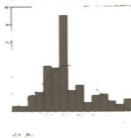
Graph of distribution of raw scores of Arithmetic subtest



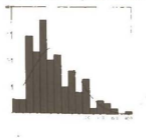
Graph of distribution of raw scores of Block Design subtest



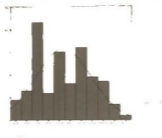
Graph of raw scores distribution of Vocabulary subtest



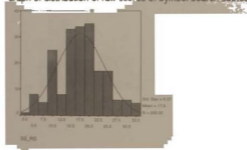
Graph of distribution of raw scores of Object Assembly subtest



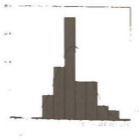
Graph of distribution of raw scores of comprehension subtest



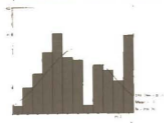
Graph of distribution of raw scores of Symbol Search subtest



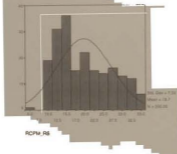
Graph of distribution of raw scores of Digit Span subtest



Graph of distribution of raw scores of Mazes subtest



Graph of distribution of raw scores of RCPM test



With the above graphs, one can say that the distributions of the raw scores of the Ghanaian sample were approximately normal.

Hypotheses Testing

The experimental design was a multi-factorial design with three independent variables (school group: (private – public), age groups and sex) by two dependent variables (WISC-III-R and RCPM). The first dependent variable was further divided into its 13 component subtests. The procedure for analysis was the ANOVA at the .05 alpha level followed by *post hoc* tests of means with the Newman-Keuls Multiple Range Test .01 level. A summary of means, standard deviations (SD) and ANOVAS (F) of the raw scores (RS) are presented in Tables 1- 5 below.

Table 1. Means, SD of and ANOVA (F) values of the WISC-III-R subtests and RCPM raw score of the Ghanaian children tested by schools

School	PC		INF		COD		SIM		PA		ARI		BD		VOC		OA		COM		SS		DS		MAZ		RCP			
	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	M	-RS		
St. Paul's Luth. n=48	Mean	14.0	10.0	38.5	8.6	11.8	13.9	18.3	17.9	14.8	12.7	17.7	16.4	15.0	21.4															
	SD	5	4.0	10.4	5.5	7.0	2.5	11.8	5.7	6.8	5.6	5.9	3.5	7.5	6.6															
Alysd Academy n=56	Mean	16.2	11.8	39.4	11.9	17.1	14.8	26.4	22.7	19.0	15.5	21.7	18.3	20.5	25.2															
	SD	5	3.6	10.4	4.3	7.6	2.0	13.0	7.3	8.7	5.1	6.0	3.7	6.5	6.8															
S.L.E.P n=48	Mean	14	8.1	34.9	6.3	10.8	12.6	18.7	13.0	11.3	9.5	16.4	15.1	13.3	17.5															
	SD	5.2	3.5	7.6	3.4	8.0	3.4	12.7	4.7	7.0	5.5	5.3	2.9	7.2	6.1															
Ncompe No 5 n=48	Mean	9.3	6.8	26.8	3.7	5.5	10.6	12.5	9.5	8.4	5.2	14.1	13.2	10.5	14.0															
	SD	4.9	2.6	8.4	2.3	5.3	4.2	8.2	4.0	4.7	3.8	5.8	3.3	7.6	3.9															
F		21.9	20.7	18.9	38.3	23.4	16.7	12.6	52.4	21.8	39.5	16.0	21.2	18.2	33.1															
Significance level (P)		.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001											.001	.001	.001	.001	.001

RS = Raw Scores

Class	PC		INF		COD		SIM		PA		ARI		BD		VOM		OA		COM		NS		DS		MAZ		CFM			
	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS	RS	-RS		
One	Mean	8.4	5.3	33.7	3.9	6.9	8.3	10.7	7.1	6.2	15.7	13.0	7.6	13.7																
n=32	SD	4	2.0	7.9	2.8	4.9	3.5	4.3	5.1	4.8	5.5	3.1	5.0	3.7																
Two	Mean	4.5	6.8	35.8	5.1	7.2	11.6	11.8	8.9	7.4	16.0	14.0	11.1	16.1																
n=32	SD	4.5	7.7	13.5	3.6	6.3	3.0	5.4	4.6	4.8	7.4	2.6	6.1	5.6																
Three	Mean	13.0	9.7	30.6	7.9	12.6	13.4	15.8	13.0	10.3	15.4	15.9	15.2	19.2																
n=34	SD	5.4	4	5.8	3.9	7.1	2.2	5.8	6.8	6.0	5.0	3.9	6.4	5.9																
Four	Mean	11.9	10.6	31.2	8.9	13.2	14.6	17.1	16.6	12.2	16.5	16.7	18.0	21.7																
n=34	SD	3.8	3.5	9.1	4.3	8.2	1.5	8.0	8.4	5.8	5.0	3.9	7.9	6.7																
Five	Mean	14.7	11.6	37.2	9.8	14.6	15.1	19.4	18.1	13.8	20.0	18.1	19.4	22.9																
n=34	SD	3.3	3.2	10.7	5.7	6.4	1.4	6.2	7.8	4.9	5.8	3.4	7.6	7.6																
Six	Mean	17.6	13.4	44.2	12.7	20.0	16.7	23.8	19.8	17.6	23.7	18.2	21.1	27.1																
n=34	SD	4.0	3.4	10.3	5.6	6.3	1.5	7.9	6.4	4.1	5.5	2.8	6.8	5.8																
F		19.8	38.8	7.8	18.9	22.8	43.7	19.2	19.7	21.6	10.0	13.6	20.6	21.6																
Significance level (P)		.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001																

Hypothesis 1: Ghanaian schoolchildren will perform poorer on the WISC-III[®] than their British counterparts.

Tables 6- 9 compares the mean IQs of the Ghanaian children tested using the British IQ norms tables in the WISC-III[®] manual (indicated by the prefix *B* such as BVIQ) and the derived Ghanaian norm Tables (with a prefix such *G* such as GVIQ). This is done by school, school group, age group and sex. The norms established for the Ghanaian sample were scaled to the level of the UK norms. The results consistently show that the mean IQs using the derived Ghanaian norms tables are higher than the British equivalents except for the Freedom from Distractibility Index (FDI), which had the Ghanaian values being lower than the British values. This supports the hypothesis that Ghanaian schoolchildren will perform poorer on the WISC-III[®] than their British counterparts.

For Tables 6- 9,

BVIQ, BPIQ, BFSIQ, BVCI, BPOI, BFDI and BPSI represent the IQ and Index values of the tested Ghanaian sample determined by using the British UK norms of the WISC-III[®].

GVIQ, GPIQ, GFSIQ, GVCi, GPOI, GFDI and GPSI represent the IQ and index values of the tested Ghanaian sample determined by using the derived Ghanaian norms of the WISC-III[®] (see appendix)

Table 6. British versus Ghanaian IQ and Index scores by schools

School		BVIQ	GVIQ	BPIQ	GPIQ	BFSIQ	GFSIQ	BVCI	GVC I	BPOI	GPO I	BFDI	GFDI	BPSI	GPSI
St Paul's Luth.	Mean	84.8	106.2	77.5	104.2	79.2	105.8	83.9	105.9	75.0	103.5	107.1	105.1	94.4	103.2
	SD	12.4	12.3	11.5	11.5	10.9	11.3	12.8	12.7	11.8	12.5	11.3	12.0	12.8	12.9
Ailsyd Acad.	Mean	75.9	113.8	86.8	111.8	90.7	114.0	95.8	114.1	85.7	112.4	113.7	110.1	100.4	109.4
	SD	12.8	10.2	13.8	12.7	12.8	10.5	12.3	9.9	14.7	14.1	14.0	12.8	15.4	13.9
St. EP	Mean	93.4	93.4	69.7	95.9	68.2	94.1	71.2	93.0	67.7	95.2	98.5	96.2	37.7	97.5
	SD	9.6	10.6	9.3	10.5	8.1	10.0	9.3	10.6	10.5	11.5	11.34	10.9	11.0	11.8
Sempe No. 5	Mean	84.4	84.4	70.7	86.1	58.6	83.8	62.0	84.8	60.3	86.8	87.4	86.8	79.3	88.4
	SD	8.1	8.1	8.0	9.1	6.1	8.0	5.7	7.5	9.2	10.3	12.8	12.5	12.8	12.3

Table 7. British versus Ghanaian IQ and Index scores by private / public schools

School group		BVIQ	GVIQ	BPIQ	GPIQ	BFSIQ	GFSIQ	BVCI	GVC I	BPOI	GPO I	BFDI	GFDI	BPSI	GPSI
Private	Mean	90.7	110.3	82.5	108.3	85.4	110.2	90.3	110.3	80.8	108.3	110.7	107.8	97.6	106.5
	SD	13.8	11.8	13.6	12.7	13.2	11.6	13.8	12.0	14.4	14.0	12.7	12.7	14.5	13.7
Public	Mean	88.9	88.9	65.2	91.0	63.4	88.9	66.6	88.9	64.0	91.0	92.9	91.5	83.5	93.0
	SD	11.4	10.5	9.7	11.0	8.6	10.4	9.0	10.0	10.3	11.6	13.3	12.6	12.9	12.9

Table 9. British versus Ghanaian IQ and Index scores by sex

Sex	BVRQ	GVIQ	BPIQ	GPIQ	BFSQ	GFSQ	GCSI	GVC1	BPOI	GPOI	BFI	GFI	BPSI	GPSI
Female														
Mean	79	98.8	72.3	97.3	73.0	98.2	75	99.0	70.3	97.3	101	98.4	91.5	100.0
SD	7.6	15.9	15.8	15.1	16.8	15.9	17.4	15.7	16.3	16.2	15	15.3	17.5	16.2
N=100														
Male														
Mean	76	101.1	75.9	101.7	76.4	101.5	80.1	100.9	74.9	102.3	102.9	101.3	97	100.0
SD	16.3	15.0	15.3	13.9	14.6	14.7	16.1	15.1	13.9	14.8	14.5	14.7	13.5	13.8
N=100														

Hypothesis II Type of school attended will significantly influence performance on the WISC-

III[®] (See Tables 1 & 2 above)

Table 2 shows the mean raw scores by schools. The results indicate that all the four schools were different from each other on many of the subtests. Table 2 shows that the private schools differed significantly $p < .001$ from the public schools on all the subtests of the WISC-III[®] and the RCPM. The greatest differences between the private and public schools were seen on the Vocabulary, Comprehension and Similarities subtests of the WISC-III[®] and the RCPM. The least difference was observed on the Block Design subtest. Post hoc analysis of means with the Newman-Keuls Multiple Range test shows that Alysdy Academy had the highest means on all the subtests of the WISC III[®] and the RCPM. Except for the Coding and Arithmetic subtests, it also differed significantly from School St Paul's Lutheran School.

The post hoc analysis further showed that apart from the Information, Symbol Search and Mazes subtests, the two public schools, South Labadi Estates Primary (SLEP) and Sempe No. 5 differed significantly with SLEP having the higher means on all the WISC-III[®] subtests and the RCPM. However, on the Arithmetic, Block Design, Symbol Search, Digit Span and Mazes subtests, schools St Paul's Lutheran School and SLEP, a private and public school respectively, did not differ significantly. The data therefore largely supports the second hypothesis that the type of school attended will significantly influence

performance on the WISC-III[®] with children from private Schools doing better than those from lower SES schools.

Hypothesis III: There will be significant differences in performance between males and females on verbal and spatial tasks.

- *Females will do better on verbal tasks*
- *Males will do better in spatial and mathematical tasks*

Table 3 (See above) shows that apart from the Mazes subtest, there was no significant difference in performance on any of the other subtests and the RCPM. Thus, the above hypothesis was not supported.

Hypothesis IV: Test performance will improve with increasing age

Tables 4 and 5 above show the distribution of means by age and class respectively. Although the age groups differ significantly ($p < .001$) from each other, there are discrepancies in the distribution of scores in Table 4 in that you have lower age groups having higher means on some subtests than higher age groups. The class distribution (Table 5) on the other hand, shows a more consistent picture of significant differences ($p < .001$) between the classes with the older classes doing better than the younger classes except on the Picture Completion subtest when those in class 4 did slightly better than those in class 5.

On the coding subtest, those in classes 1 and 2 did better in an ascending order than the rest, which subsequently followed in an ascending order.

Post hoc analysis showed extensive overlap in the age group distribution on all the subtests and the RCPM. The class distribution on the other hand was more uniformly distributed. On the Picture Completion, Similarities and Picture Arrangement subtests, classes 1 and 2 were in one group, classes 3 to 5 were in another group while class 6 was in a third group. On the information subtest, all the classes differed from each other except classes 4 and 5. The Arithmetic subtest was the only one that indicated that classes 1 and 2 were in different groups. Classes 3 and 4 were in another group while class 5 and 6 were in a different group with some overlaps. The other subtests followed a similar pattern in addition to classes 1 and 2 being in one group.

The greatest overlap occurred with the Coding and Symbol Search Subtests. Overall, test performance improved with increasing age and cognitive development, with class being a more reflective indicator of cognitive development than chronological age

Hypothesis V: Performance on the WISC-III^R will correlate strongly with performance on the

RCPM

Table 10 shows the intercorrelations of the IQ equivalents of the RCPM with the various IQs and Index scores. The strongest correlation of .875 was with the POI while the weakest correlation of .829 was with the FSIQ.

Table 10. Correlation of IQ equivalents of RCPM with IQ and Index scores of the Ghanaian sample

	RCPMIQ	VIQ	PIQ	FSIQ	VCI	POI	FDI	PSI
RCPMIQ	1.000	.833*	.852*	.829*	.838*	.875*	.851*	.852*
VIQ		1.000	.993*	.997*	.999*	.994*	.982*	.992*
PIQ			1.000	.997*	.997*	.997*	.958*	.995*
FSIQ				1.000	.996*	.993*	.982*	.994*
VCI					1.000	.994*	.975*	.990*
POI						1.000	.984*	.994*
FDI							1.000	.991*
PSI								1.000

Correlation is significant at the .01 level (2-tailed)

Table 11 (below) shows the correlation matrix of the subtests raw scores, IQs, Index scores and RCPM raw scores. The correlation of the RCPM with the WISC-III^{UK} subtests show a significant Pearson Correlation of .57 and above except for the Coding ($r = .35$) and the Symbol Search subtests ($r = .46$). The highest correlation was with the Block Design subtest ($r = .71$)

These two Tables (10 & 11) show that generally, the subtests correlate well with each other as well as with the IQs and index scores.

Table 11. Correlations matrix of subtests raw scores, IQs, Indexs and RCPM of the Ghanaian sample

	PC	INF	COD	SIM	PA	ARI	BD	VOC	OA	COM	SS	DS	MAZ	CPM	VIQ	PIQ	FSIQ	VCI	POI	FDI	PSI
PC	1.0	.6*	.26*	.60*	.63*	.66*	.60*	.68*	.64*	.62*	.46*	.53*	.65*	.67*	.52*	.62*	.61*	.51*	.65*	.42*	.33*
INF		1.00	.27*	.78*	.63*	.72*	.62*	.79*	.59*	.73*	.44*	.61*	.60*	.67*	.63*	.42*	.57*	.64*	.41*	.44*	.30*
COD			1.00	.31*	.34*	.29*	.27*	.40*	.32*	.38*	.53*	.30*	.32*	.35*	.39*	.55*	.50*	.37*	.36*	.38*	.78*
SIM				1.00	.62*	.64*	.56*	.83*	.63*	.73*	.43*	.59*	.58*	.64*	.72*	.49*	.66*	.74*	.48*	.49*	.34*
PA					1.00	.61*	.65*	.68*	.66*	.65*	.47*	.55*	.64*	.67*	.49*	.64*	.60*	.48*	.64*	.40*	.38*
ARI						1.00	.60*	.67*	.60*	.65*	.41*	.60*	.60*	.57*	.56*	.41*	.53*	.48*	.39*	.60*	.31*
BD							1.00	.55*	.73*	.52*	.45*	.51*	.62*	.71*	.34*	.59*	.49*	.33*	.62*	.31*	.30*
VOC								1.00	.65*	.77*	.44*	.66*	.58*	.67*	.75*	.57*	.72*	.76*	.54*	.57*	.39*
OA									1.00	.61*	.43*	.53*	.64*	.70*	.45*	.65*	.59*	.44*	.67*	.37*	.35*
COM										1.00	.44*	.60*	.55*	.65*	.70*	.51*	.66*	.72*	.49*	.50*	.37*
SS											1.00	.36*	.48*	.46*	.39*	.50*	.47*	.39*	.45*	.33*	.76*
DS												1.00	.52*	.57*	.51*	.43*	.51*	.49*	.40*	.76*	.34*
MAZ													1.00	.66*	.38*	.50*	.47*	.38*	.49*	.33*	.39*
RCPM														1.00	.50*	.60*	.59*	.50*	.59*	.41*	.38*
VIQ															1.00	.17	.55*	.91*	.74*	.76*	.50*
PIQ																1.00	.14	.74*	.96*	.60*	.67*
FSIQ																	1.00	.75*	.65*	.52*	.17
VCI																		1.00	.83*	.36*	.48*
POI																			1.00	.23*	.51*
FDI																				1.00	.13
PSI																					1.00

* Correlation is significant at the .01 level (2-tailed)

Further Analysis

Other analyses were done and Table 12 below compares the general class average results of the RCPM obtained in this study to that obtained by Anum in his work (Anum, 1996).

Table 12 comparing RCPM raw scores and percentile ranking obtained in this study to that obtained by Anum

Class		EDWIN'S RCPM -RS	Percentile Rank	ANUM'S RCPM -RS	Percentile Rank
One	Mean	13.7	75 ^a	13.4	75 ^a
	N= 32				
Two	Mean	16.1	>75 ^a	14.9	75 ^a
	N=32				
Three	Mean	19.2	>75 ^a	16.1	75 ^a
	N=34				
Four	Mean	21.7	>75 ^a	17.6	75 ^a
	N=34				
Five	Mean	22.9	>50 ^a	20.9	>50 ^a
	N=34				
Six	Mean	23.4	>75 ^a	22.3	>50 ^a
	N=34				

^a 75 and 50 refers to the RCPM scores obtained in this study, while Anum's RCPM -RS refers to that obtained by Anum.

The major goal of the study was to derive local Ghanaian norms for the WISC-III^{RM}

Tables 14 and 15 (see appendix) show the scaled score equivalents of the raw scores and the IQ / Index score equivalents of sums of scaled scores respectively. Other analysis done were determining the subtests on which the Ghanaian children performed relatively better and those subtests on which they did relatively worse as compared to the British children. This comparison was done by subtracting the scaled score equivalents derived using the Ghanaian data, the New Scaled Scores, (NSS) and the Scaled Scores (SS) obtained by using the British norms in the WISC-III[®] manual. The results are in Tables 13 A to 13C.

Table 13 A showing scaled score equivalents using Ghanaian norms

School	PC		INF		COD		SIM		PA		ARI		BD		VOC		OA		COM		SS		DS		MAZ	
	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS
Private Mean	113	117	111	111	116	112	115	112	115	112	115	112	114	112	114	116	110	112	112	112	110	112	112	112	112	112
n=104 SD	26	26	28	26	26	27	24	29	21	28	24	29	21	28	24	27	26	26	26	26	27	26	26	26	26	26
Public Mean	83	88	88	82	82	86	86	86	86	86	86	86	86	86	86	83	89	86	87	86	83	89	86	87	86	87
n=96 SD	3	3	28	19	19	23	25	11.2	19	20	20	20	19	20	20	26	25	24	24	24	26	25	24	24	24	24

Table 13 B showing scaled score equivalents using British norms

School	PC		INF		COD		SIM		PA		ARI		BD		VOC		OA		COM		SS		DS		MAZ	
	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS	SS	NSS
Private Mean	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
n=104 SD	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Public Mean	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
n=96 SD	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28

Table 13 C showing the difference (DF) between Ghanaian and British norms i.e NSS - 55

School	PC-		INF		COD		SIM		PA-		ARI		BD-		VOR		OA-		COM		SS-		DS-		MAZ		
	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	DF	-DF	
Private	31				1.9	3.6	4.5				3.1										1.2						
Public	37	31			2.3	4.5	4.6		2.4	1.2	4.4		5.4		5.2		1.5		2.5							2.1	
Total	3.4	2.9			2.1	4.1	4.6		2.3	2.4	4.2		5.3		4.5		1.4		3.0							1.2	

The results in Tables 13A to 13 C show that children's performance from worst to best is as below with the worst performance on the Object Assembly subtest while the best was on the Digit Span subtest:

1. Object Assembly
2. Picture Arrangement
3. Comprehension
4. Vocabulary
5. Similarities
6. Picture Completion
7. Information
8. Block Design
9. Arithmetic
10. Coding
11. Symbol Search
12. Mazes
13. Digit Span

Summary of results

The results indicate that the individual's performance on the WISC-III[®] is influenced by his/her cultural milieu with children from the private schools doing better on the test than those from the public schools. Children from private and public schools form two distinct groups and were statistically different from each other on all the WISC-III[®] subtests and the RCPM. There were also significant differences within the two school groups as well as some overlap between one of the private schools and one of the public schools (i.e. St Paul's and SLEP).

The results also indicated that males and females did not differ significantly from each other on almost all the subtests and RCPM except on the Mazes subtest. Although increasing age did not show a uniform improvement on scores, generally, children in the upper classes did better than children in the lower classes. Class was therefore a better reflection of cognitive development than chronological age. The performance of the WISC-III[®] correlated strongly with performance on the RCPM.



5. DISCUSSION

5.1 Background

The primary objective of the study was to derive local Ghanaian norms on the WISC-III[®] for educational and clinical purposes. Tests are needed for the maximum utilization of human resources in a developing country such as Ghana. Our expanding educational facilities require testing not only for admission but for counselling as well. With increasing industrialization and the expansion of the work force, the demand for tests in the selection and placement of personnel cannot be overemphasized. The importance of this study lies in the fact that although cognitive assessment is the major reason for referral, an individualized core intelligence test such as the Wechsler Intelligence Scale for Children has had limited use in Ghana because of the fact that no reference norms on Ghanaian school children is available.

To make the WISC-III[®] appropriate for use in Ghana, this study was designed to standardize and derive local Ghanaian norms for the WISC-III[®] so that its use as well as interpretation of test results from it can be done more confidently. The study explored a number of factors on test performance such as cultural background, socio-economic status and type of school attended and gender. It also explored the correlation between the WISC-III[®] and RCPM. The following were the major hypotheses tested:

- Ghanaian schoolchildren will perform poorer on the WISC-III[®] than their British counterparts.

- * Type of school attended will significantly influence performance on the WISC-III[®]
- There will be significant differences in performance between males and females on verbal and spatial tasks
 - Females will do better on verbal tasks
 - Males will do better on spatial and mathematical tasks
- Test performance will improve with increasing age.
- Performance on the WISC-III[®] will correlate strongly with performance on the Raven's Coloured Progressive Matrices (RCPM)

5.2 Major Findings

The results indicate that the individual's performance on the WISC-III[®] is influenced by the type of school attended with children from the private schools doing better on the test than those from the public schools. Children from private and public schools form two distinct groups and were statistically different from each other on all the WISC-III[®] subtests and the RCPM. There were also significant differences within the two school groups as well as some overlap between one of the private schools and one of the public schools (i.e. St Paul's and SLEP).

The results also indicated that males and females did not differ significantly from each other on almost all the subtests and RCPM except on the Mazes subtest. Although increasing age did not show a uniform improvement on scores, generally, children in the

upper classes did better than children in the lower classes. Class was therefore a better reflection of cognitive development than chronological age. The performance of the WISC-III[®] correlated strongly with performance on the RCPM.

5.2.1 Differences between the Ghanaian and the British norms

Table 5.1 compares the mean IQs of the children tested using the British IQ tables and the derived Ghanaian Tables by school, school group, age group and sex. The results consistently showed that the mean IQs using the derived Ghanaian tables are higher than the British equivalents except for the Freedom from Distractibility Index (FDI), which had the Ghanaian values being lower than the British values. This supported the hypothesis that Ghanaian children will perform poorer than British children. It can be seen that cultural background definitely affects performance on the WISC-III[®] with some items on the performance subtests being more strongly affected by culture than items on the verbal subtests. The wide differences in scores on the WISC-III[®] justify the need for the development of local norms for the WISC-III[®].

The Ghanaian schoolchildren did better on the FDI derived from the Arithmetic and Digit Span subtests. Very early in their formal schooling, starting from the lower primary classes, schoolchildren in Ghana learn a lot through rote learning. In particular, learning their multiplication tables and doing mental arithmetic hones in their numerical reasoning ability, attention span and auditory memory. They however did not do as well as expected on the Arithmetic subtest, probably due to the fact that mental arithmetic is

not rigorously taught in the schools as used to be the case some years ago. Thus, these children are not used to computing arithmetic, thus accounting for the lower than expected performance.

However, they still did much better on the FDI score compared to their British counterparts. This finding is supported by Anum (1996) who reported this when he used the Digit Span test in Ghanaian children. He did not find any significant differences among both urban and rural schools while the present study found significant differences between the private and public schools ($p < .001$), the finding that all the children he tested did well on this test is significant. Although there appears to be little cognitive processing on Digit Span, the fact that requires mental alertness means that this ability is almost uniformly developed among the children.

A significant correlate to the Digit Span results is what Anum found regarding the correlations of the Digit Span to other factors. His findings were that the Digit Span had a low correlation with school performance scores as well as the WRAT scores (Anum, 1996). Although familiarity with numbers is important, his conclusion is that it is the abilities involved, short term auditory memory, encoding and attention that one is certain will not be affected by the type of school attended. If this tenet is true, then the Digit Span subtest is a measure that can be used to test children in Ghana, irrespective of the type of school attended. Barring any lack of exposure to numbers and impaired memory or gross inattention, a poor performance on this subtest in a Ghanaian child may then

serve as a window into more intellectual or cognitive problems and not school related work.

The other differences were expected given the diverse variation in the cultural backgrounds of Ghanaian and British children. Although performance subtests are supposed to be more culture fair than verbal tests, the scores on the verbal subtests, though not too good themselves were better than scores the performance subtests. Several things account for this. Verbal tests are more related to schoolwork than performance tests. Ghana's colonial past is closely tied to its educational system. Until 1951, control of educational policy and development were in the hands of the British (Addae-Mensah, Djangmah & Abgenyega, 1973) with most of the educational materials being similar to what is available in Britain.

Thus, the questions on the verbal subtests were things some of the children had been exposed to. This is especially true of the children in the private schools such as who have a more western type of education than children from the public schools. However, as stated earlier, they did not perform as well as their British counterparts. For example, on the Comprehension, Vocabulary, Similarities and Information subtests, which are influenced by cultural interests, exposure to certain social norms and expectations and reading interests, the performance of the Ghanaian children was much lower than that of their British counterparts. The likely explanations for these findings are several. For instance, the Similarities subtest measuring abstract reasoning and the ability to form verbal concepts is influenced by cultural interests and outside opportunities thus,

children in a different cultural setting may not do as well on this task as children in the setting in which the test was designed. In particular, the familiarity of the actual items one is to form a concept to affects the scores if one is not familiar with the items or their uses. Take the example of 'in what way are a piano and guitar alike?' The Ghanaian child who is familiar with a piano is most likely to have a concept of something used in church and not a musical instrument or any such answer. Another is the question is 'in what way are milk and water alike?' Even the child who has milk everyday does not drink milk, rather, she is likely to use it in her beverage or porridge in small quantities and as such the concept of both milk and water being liquids or quenching thirst is unlikely to come to the child. These are just two examples of the effect of familiarity of items on concept formation. Unfamiliarity of items thus becomes a confounding variable in testing concept formation.

Performance on the Vocabulary subtest, which measures general word knowledge and language development, is influenced by educational background, cultural experiences and reading. Whereas most children elsewhere, such as in the UK and the USA are exposed to reading very early, this is not the case in Ghana. The majority of Ghanaian children have not acquired reading habits. In addition, since English is a second language for most children in Ghana, and as such most of the children do not have a good command of the language because they have not been taught it, it is not surprising that they did not do as well as their British counterparts majority of whom speak English as a first language.

The comprehension subtest is supposed to measure understanding of social rules and concepts as well as practical commonsense, awareness of social rules and mores and ability to use past information and experiences. As such, it is influenced by sociocultural exposure and moral development. What is the norm in one society is the abnormal in another society. Asking children from one sociocultural background such as Ghana to respond in ways that children from another background such as the UK are expected to answer is grossly unfair. Ghanaian children are socialized differently than British children and even in those from the upper social classes who have a more Western-oriented way of life, this is so.

For example one question that almost all of the children got wrong (only one person got it right) is "why do we put stamps on letters?" Is the reason they got it wrong because they are not exposed to letter writing and stamps compared to previous generations because of faster means of communication or is it because children at this age (less than 12 years) do not write letters and as such don't know much about stamps? One of the likely explanations may be because most children start writing letters in secondary schools and as such this was an unfair question to ask children of this age. Another more important explanation is cultural unfamiliarity. Whereas children in other cultures are exposed to writing letters, letter writing is not a common habit in Ghana even among the middle and upper social classes be they adults or children.

Another example is the question "why are names in the telephone book listed in an alphabetical order?" Although telephones are not rare in Ghana especially with the

opening up of communication centres, the majority of Ghanaians, even in urban centres do not have access to them. How then will they know the importance of a telephone book, let alone why the names are in alphabetical order when most of them have probably not seen a telephone book before?

More importantly, the different responses of the children from the private schools as opposed to the public schools on this subtest demonstrates that even within the dominant culture in any country, subcultural values which are usually related to social class also play a role in the mores and values of people. For instance while almost all the children tested in the private schools knew why cars have seatbelts because most have them, have parents and relatives who have their own cars, virtually none of the children in tested in public schools knew the importance of seatbelts. On another question, "what are you supposed to do if you find someone's wallet or purse in a shop?" while majority of the children in the private schools gave a response indicating giving it to the owner or to the shopkeeper, most of those in the public schools either said they will leave it there or keep it until the owner asked for it although a few said they will have it for keeps. These few examples emphasize the cultural loading on the comprehension subtest and this loading is confirmed by the fact that the worst performance of the children on the verbal subtests was on the comprehension subtest.

With regards to the performance subtests, exposure to items or the lack of exposure to some items influenced the performance of the school children. Although scores on most of the performance tests were low as indicated above, in particular, the

Object Assembly, the Picture Arrangement, Block Design and Picture Completion subtests had the lowest scores. The poor performance on the Picture Completion test confirms the findings of several authors on the marked differences in the perception of pictures by persons in different cultures and the difficulty of pictorial perception in Africans (RJ Miller, 1973; Hudson, 1960; Deregowski, 1968a, 1968b, 1974; Sergell & Deregowski, 1972; Segall, Campbell and Herskovits, 1966, RJ Miller, 1973;). In Ghana, earlier work by Mundy-Castle, (1966) and Sefa-Dedeh et al, (1997) have also had similar findings. On the other hand, even though a lot of Ghanaian children may not be exposed to solving Mazes, the performance on this test was significantly higher ($p < .01$) than that of their British counterparts.

In explaining these findings, the use of pictorial representation in the Picture Arrangement (PA) subtest as well as the Picture Completion (PC) subtest may itself be unsuitable in cultures unaccustomed to representative drawing. Obviously, since a two-dimensional reproduction of an object is not an exact replica of the original, but simply presents certain cues which, as a result of past experience lead to the perception of the object, if cues are highly reduced, such as in a picture of a head to represent a whole person, interpretation by children in different cultures will be affected leading to lower scores (Anastasi & Urbina, 1997)

However, a more important explanation may be the unfamiliarity of the themes themselves as well as the social circumstances depicted in the picture. For example, one of the sets of pictures on the PA subtest depicts a young girl refusing an umbrella from

her father even though it is about to rain and running back home for it when she gets drenched. In the Ghanaian culture where obedience and respect for elders especially fathers is emphasized, a child dares not refuse such an offer from the father. Thus, this setting is one that is likely to affect the way the child arranges this set of pictures and in fact, was one of the sets which very few children got right.

In order to read a picture well, in addition to familiarity of content, a pictorial perception skill is needed (Serpell & Deregowski, 1980). According to these authors, this skill comprises a number of components: a) Detection of appropriate contexts for its application, b) Selection of a limiting frame of reference, c) Use of conventional criteria of fidelity to recognise depicted items, d) Sensitivity to impoverished depth cues, e) An expectation of finding in the picture most of the information necessary for disambiguation and f) Various assumptions about the range of cognitive inferences that may legitimately be made beyond the information given. These components are culturally restricted. An important issue to consider is whether the components of this perceptual skill are not dependent on verbal abilities rather than performance abilities?

Serpell and Deregowski (1980) in their study on "The Skill of Pictorial Perception an Interpretation of Cross-Cultural Evidence" also talked about not knowing of any scientific evidence which would enable them to dismiss the possibility that cross-cultural differences in pictorial perception have genetic origins. However, their analysis suggested that in certain cultural contexts, the skill of pictorial perception is learned. Since pictorial perception is increasingly becoming part of normal school work as well as

health education, looking at how these skills are acquired in other cultures and teaching these skills to Ghanaian and African children will go a long way. The most likely reasons according to Serpell & Deregowski (1980) are looking at and reading illustrations in books and magazines and experimentation with drawing and this can be applied in other areas.

A number of studies have attempted to enhance this skill of pictorial perception. Dawson (1967), Duncan, Gourley and Hudson (1973) encouraged their subjects to adopt an analytic approach to pictures and photographs by means of various types of reduction screen for dimensional scenes with a pictorial attitude. Nicholson, Seddon and Worsnop (1977) instructed Nigerian secondary school students to compare pictures with the three dimensional scenes or objects they represent and these techniques gave rise to measurable changes in performance on tests of picture perception. Serpell and Deregowski (1972) obtained similar results when they taught pictorial depth perception in a classroom of Zambian schoolchildren.

These principles can thus be applied in Ghana and elsewhere to enhance pictorial perception in our children. The better performance on the PC subtest can be explained by the fact that recognizing the missing part of an object is easier than arranging a series of pictures to tell a story.

The worst performance on the Object Assembly test are also culturally related and although most of the items comprising a girl, a car, a horse, a football and a face are familiar with the exception of the horse, the fact that it is a speeded test may have

affected the performance. Other factors such as the picture of 'the girl' and 'the face' both being Caucasian may have contributed to this. Support for this comes from work done by Shepherd, Deregowski and Ellis (1974) who found out that not only do white Europeans find difficulty in recognizing black faces, but also black African subjects cannot recognize white faces with quite the facility that they recognize black faces. If these difficulties exist, then it stands to reason why the children tested found it particularly difficult putting the Caucasian face together because without initially being able to recognise it, assembling it becomes guesswork.

The Block Design subtest is another one on which the children tested did not do very well. This finding is supported by work done by other investigators.

Deregowski (1972a) for instance found that difficulties in Kohs-type patterns were significantly more frequent in his Zambian samples than in a sample of Icelandic school children. Shapiro (1960) and Jahoda (1968) have both reported difficulties with spatial relations in African cultures. These findings were most likely obtained because children in Africa in general and Ghana in particular are not as exposed to blocks and other such objects as their counterparts in the western world and so again, cultural factors such as unfamiliarity with objects and limited time influenced the performance of the Ghanaian children. This effect is most seen when the better performance of the children in the private schools most of whom have been exposed to legos and other such block like figures from their childhood are compared to the worse performance of children in the public schools most of whom have not been so privileged.

The relationship between cultural background and intelligence has received a lot of attention in the media and academic settings. The differences in performance of the order of 10 to 20 points is similar to that found in the US between performance of African-American and white children with African-American children scoring consistently lower (Brody 1992).

It is certainly arguable that these differences do not necessarily reflect a basic genetic difference between the races as Jensen will have it (Jensen 1980), but rather, it is a reflection of what is emphasised as intelligent behaviour in a particular cultural setting. IQ differences between the cultures are primarily a reflection of the fact that the tests and the schools are designed by the majority culture to promote a particular form of intellectual activity, in this case, Sternberg's componential intelligence. However, many blacks or other minority people rear their children in ways that do not emphasize this particular set of skills.

In actual fact, Sternberg has argued that in black subcultures, it is contextual intelligence that is particularly emphasized and trained (Sternberg,1984). Sternberg's argument holds to an extent in the Ghanaian setting especially, in the rural peri-urban and rural areas where contextual intelligence, the type of intelligence that highlights the socio-cultural context of an individual's life is emphasized. Intelligent individuals in this context are those who are able to adapt in order to maximize the fit between themselves and their environment. They may also shape their environment to increase the fit, or if a

satisfactory fit is not possible, they select an alternative environment. Simply put, intelligent individuals are those who are street-smart.

In this regard then, the children in the private schools who were unable to mention any two types of coins they knew and are unlikely to find their way back home if left alone in a forest but were able to perform more complex designs on the Block Design subtest may not be any more intelligent than their counterparts in public schools who were able to mention the coins and are more likely to find their back home from a forest but were unable to do the block designs.

An interesting correlate to Sternberg's argument is the response of the children in the private schools to those of the public schools to some of the questions on the Comprehension subtest. For instance, in answering, "what is the thing to do if a boy (girl) much smaller than yourself starts to fight with you?" while most of the children from the private schools answered correctly according to the manual, quite a number of children from the public schools said they will fight or beat the younger person to teach him/her to respect his/her elders. This is not unusual given the sort of street-smartness pertaining to this group of children. The subcultural values in the children from the public schools support teaching younger people to respect by sometimes beating them.

The question is this, are cultural differences cultural handicaps? It is a fact that at all stages of an individual's development, heredity and environment interact. For us as human beings, culture permeates all our environmental contacts. According to Anastasi, since all behaviour is affected by the cultural milieu in which the person is raised and

since psychological tests are but samples of behaviour, cultural influences will and should affect culture. It is therefore futile to try and devise a test that is free from cultural influences (Anastasi & Urbina, 1997).

In any case, no single test can be universally applicable or equally "fair" to all cultures. It is also unlikely that any test can be equally "fair" to more than one cultural group, especially if the cultures are quite dissimilar (Anastasi & Urbina, 1997). Since every test tends to favour persons from the culture within which it was developed, it is understandable why the British children did much better than the Ghanaian children.

Although it has been thought that non-language tests are more culturally fair than language tests, a growing body of evidence suggests that non-language test may be more culturally loaded than language tests (Anastasi & Urbina, 1997). This seems to be the case here as the schoolchildren did better on the verbal tests than the performance tests. Investigations with a wide variety of cultural groups in many different countries also found larger differences in performance and other nonverbal tests than verbal test (Irvine, 1969a, 1969b; Jensen, 1968; Ortner, 1963, 1972; Trimble, Lonner, & Boucher, 1983; Vernon, 1969). Evidence also indicates that figural tests may be more subject to training than verbal and numerical tests (Irvine, 1983).

Another reason for the poorer performance on the performance as opposed to the verbal subtests is that nonverbal, spatial-perceptual tests frequently require relatively abstract thinking processes and analytic cognitive styles characteristic of

middle-class western cultures (IW Berry, 1972; RA Cohen, 1969). Thus, persons raised in other cultural settings such as Ghana, may be less accustomed to such problem solving approaches. However, it appears that lack of exposure to items on the test and different social contexts account for the disparities in performance.

Other factors accounting for the lower performance of Ghanaian children may be emotional and motivational. In some instances, some of the children who had been told by their teachers to do well especially in one of the public schools were so nervous that they were even afraid to ask permission to go to the bathroom. The pressure to do well probably had a negative effect sometimes. Among the many relevant conditions that differ from culture to culture are the intrinsic interest of test content, rapport with the examiner, drive to do well on test, desire to excel others and past habits of solving problems individually or cooperatively. According to Steele, Spencer and Aronson (1995), the existence stereotypes, be they cultural or otherwise may directly affect an individual's test performance. The schoolchildren who having been told repeatedly how dumb they are will be less inclined to perform well on the test.

The issue of cultural background and intelligence, at the end of the day boils down to what intelligence is. In a world, which is becoming an increasingly small global village, the dominant cultures are apt to override the minority cultures and judge them by their standards. What is measured by IQ and achievement tests, is componential intelligence (Sternberg & Suben 1983). This refers to the many information-processing

skills that are used to solve problems such as planning, organizing, remembering facts and applying them to new situations. If these skills are needed to make it in our world now, then it is important to teach these skills to Ghanaian children. This should be especially stressed to the underprivileged children in the public and rural schools so they will not be overly disadvantaged and wrongly labelled as unintelligent or even retarded. Even beyond classroom work and academic achievements, the kind of intelligence needed is that which enables the child to adapt to his/her environment and maximises the use of whatever talents and resources available to him.

In Argentina, Sans (1984), found that the order in which the elements in the WISC subsets for children were introduced was wrong for Argentinean children who were of a different social and cultural background. Some words in the Information and Vocabulary subtests were too insensitive to the subjects' cultural differences while in the Comprehension subtest, some questions turned out to be too difficult because the required information was less frequent in that environment. The performance subtests were however all right for the kids. This finding contrast with what was found in Ghana where some performance subtests items especially on the Object Assembly and Picture Arrangement subtests were found to be more culturally irrelevant than items on the verbal subtests.

The Ghanaian children also did worse on the RCPM compared to 1982 Standardization sample based on 598 children from Dumfries United Kingdom. Whereas the general average score of the six and half year olds was above 75th percentile using

Anum's 1996 norms, the same score was only slightly above the 25th percentile using the Dumfries Standard scores. With the nine and half year olds, while their general average performance on Anum's norms was between the 75th and 90th percentile, it was slightly above the 25th on the Dumfries standard scores. On Anum's norms, the eleven and half year olds had a general average score above the 50th percentile while on the Dumfries norms they were just above the 10th percentile. These results are comparable to Anum's in that he also found such differences between the performance of the Ghanaian pupils and those reported in the test manual (Anum, 1996).

What accounts for the above differences? Although the RCPM is considered to be one of the most culture-fair tests available (Jensen, 1980) cultural factors nonetheless affects performance on the tests. It is likely that the British children have been exposed to figures resembling those used in the RCPM and as such know how to manipulate such figures. Although Anum argued that the differences he found between his Ghanaian sample and the British sample is because the capacity to reason by analogy as measured by matrix reasoning is delayed (Anum, 1996), the problem is more likely to be that the tool used does not adequately measure reasoning by analogy in the Ghanaian sample used for this study.

At the end of the day, IQ scores by themselves are abstract things. They become relevant because of the interpretation we give them and the uses we put them to. By far, the most important consideration in multicultural testing is the interpretation of test scores (Anastasi & Urbina, 1997). If a test taker from a different cultural setting than the

one in which the test was designed obtains a low score on a test, it is imperative to investigate why he/she did so. From the ongoing discussion, it can be seen that although the schoolchildren tested did poorer on most of the subtests, it is not because they are less intelligent than their British counterparts. Rather cultural factors such as unfamiliarity with some items, foreign social contexts and interaction, different cultural and subcultural values and lack of certain skills such as pictorial reading among others are likely to have influenced their performance.

5.2.2 School Differences on the WISC-IIITM

The results showed that while all the four schools were different from each other on many of the subtests, the private schools differed significantly ($p < .001$) from the public schools on all the subtests of the WISC-IIITM and the RCPM. This confirmed the hypothesis that type of school attended will significantly influence performance on the WISC-IIITM.

The significant difference ($p < .001$) between the private schools and the public schools is likely to be a true reflection of difference in performance between the two groups. This shows that even within the same cultural setting, the type of school attended affects performance on the test. Even within the same group, there are significant differences on a number of subtests of the WISC-IIITM and RCPM. The performance of children in the private schools was significantly much better than those in the public schools.

Several factors account for this difference between the private and public schools. One important factor is the medium of instruction. In the public schools, the official medium of instruction for the lower classes is the local language. As has recently been announced by the Minister of Education, Prof Christopher Ameyaw-Ekumfi, this has adversely affected the performance of children in these schools. Worse still, most of the children in this category are not introduced to the English language at home and are thus introduced to the English language much later, thus affecting their understanding and usage of the English language. Since all the instructions on the test are in English, it is no surprise that the performance of the children in the public schools was lower than those in the private schools. Worse still, whereas in years gone by English used to be taught as a second language right from primary one while (still teaching the children in the local language) so that by the time the child reached primary four and became exposed to being taught in English, she had a fair command of the language, this practice has stopped. Most of the teachers coming out of the training colleges in Ghana do not even know how to teach English as a second language.

On the other hand, most if not all of the children coming from the private schools in this study are used to speaking English and as such have a fair command of the language. To many of these children, English is a first rather than a second language. It is most likely that if the children in the public schools are taught English as a second language intensively right from primary one, they will develop a better command of the

language and the results will be a snowball effect, affecting their performance in other subjects as well as other school related activities.

The fact that children from poor socio-economic backgrounds do not do as well in school and on IQ tests as children from middle class families is well established and as such the finding that children from private schools who tend to come from upper middle class families do better than those from public schools who come from less wealthy families is not surprising. The traditional explanations that such children live in crowded conditions, have poorer health care, are not exposed to middle-class experiences such as books, have lower career aspirations and do not know how to succeed in school (Biehler & Snowman, 1982) have been challenged.

White asserts that although socio-economic class (SES) and achievement or intelligence quotients are related, the strength of the relationship should not be generalized to the individual student and efforts should be concentrated on how home factors affect academic achievement. If this assertion holds, then many poor families can promote academic achievement in their children by parents reading to their children, helping them with their homework, taking them to the library and expanding their vocabulary. Since these home variables are more predictive of academic and intellectual achievement, then they should be the unit of analysis (White, 1982).

Since these factors can be changed more readily than socio-economic status by concentrating on home environments, attention will then be turned away from any particular group to particular parent-child relationships, home variables and child rearing

strategies. This is important because concentrating on SES may mask the truly important variables that predict academic achievement and intellectual functioning level. We all know children from poor families who have achieved great things because their parents emphasized things they could change rather than things they could not change. In addition, some parents who earn less still send their children to some of the top school because they value education highly.

Although the type of school attended is important and related to performance on the measures used in this study, there are some schools, which although classified as Grade III schools are doing as well or even better than some Grades I and III schools. As the results show, on the Arithmetic, Block Design, Symbol Search, Digit Span and Mazes subtests, St Paul's Lutheran and SLEP, a private and public school respectively, did not differ significantly. What accounts for this may be school related variables. It might be that certain schools and teachers are more successful than others. It is likely that teachers in SLEP spend more time and effort on direct instructions in the basics and monitor the progress of their pupils while at the same time providing remedial work when necessary as compared to the other public school, Sempe No. 5. This was evident during the testing period. Other factors that might explain this are family and home variables. Although some parents might not be able to send their children to some of the top private schools, they nevertheless value education. As such, they may spend time supervising their children's homework, showing interest in their education and encouraging them to do their best. In fact, it was found that the parents of the children

in SLEP had agreed to pay a small amount per month so that the teachers there may be motivated to do their best for their wards.

It is important to remember that tests are designed to show what an individual can do at a given point in time. They cannot tell us why he/she performed as he/she did. It may be that the person might have had a bad day or may have been very anxious. Several authors have investigated test anxiety in both children and college students and their conclusion shows that both school achievement and intelligence test scores have significant negative correlations with test anxiety (Gaudry & Spielberger, 1974; Hagtvet & Johnsen, 1992; I. G Sarason, 1980; Spielberger, 1972). In order to understand why the person performed as he/she did then, other factors such as the test taker's background, motivations and other pertinent issues should be looked at.

Another thing tests cannot tell us is how able a culturally or educationally disadvantaged child might have been if she had been raised in a more favourable environment. Moreover, Anastasi argued that since tests cannot compensate for cultural deprivation by eliminating its effects from their scores, they should rather reveal such effects so that appropriate remedial steps can be taken (Anastasi & Urbina, 1997).

Looking at Table 13A, the significant differences between the Ghanaian schoolchildren occurred on the Block Design, a difference of 4.6 (using scaled scores) between the children from private and public schools. In decreasing order of differences following similar lines, the others are Vocabulary (4), Similarities (3.4), Information (3.4), Comprehension (3.3), Object Assembly (2.9), Picture Completion (2.8) Arithmetic,

(2.7), Picture Arrangement (2.6) Digit Span (2.6), Mazes (2.5), Coding (2.3), Symbol Search (2.1). The least differences among the children were on the Coding and Symbol Search subtests. The scores of these two subtests, both of which measure visual-motor speed together give the Processing Speed Index (PSI). The significance is probably that in terms of speeded tasks, Ghanaian children do not differ as much as they do on other subtests. The differences between the Ghanaian and British children have been discussed in the previous section.

To conceal such socio-cultural disadvantages by rejecting tests or by trying hard to devise tests that are insensitive to such effects can only retard progress toward a genuine solution of social problems. Once again, the need to look at the individual child in totality vis a vis her socio-cultural background and other abilities not revealed by standard tests should be carefully noted. When this is done, together with a more comprehensive assessment of the child's strengths and weaknesses, a more holistic picture of the child will emerge and the appropriate help and encouragement can be given.

5.2.3 Sex Differences

The data in Table 3 shows that, apart from the Mazes subtest ($F = 6.7$ $p < .01$), there are no significant difference between males and females on verbal and spatial tasks. Although some sex differences were expected, the results are not surprising as recent research shows that such differences may not be present. Forrester and Geffen

(1991) administered the Rey Auditory Verbal Learning Test to 10 boys and 10 girls in each of four age groups with the youngest being 7-8 years old and the oldest being 14-15 years old. Although age effects were present on several of the variables, they found no effect for sex.

Although the results of this present study and that by Forrester and Geffen did support the large literature on sex differences on certain tasks, Collaer and Hines (1995) report that sex differences can be quite small, and large samples may be necessary to detect a small effect. The significant differences $p < .01$ between males and females on Mazes subtest with males doing better than females confirms work done by some researchers such as Wilson and Vandenberg, 1974 and Burnett, 1986 as quoted in Anum (1996), who found that visual spatial relations and perceptual speed and visual memory are the areas of cognitive ability that has continued to show consistent sex differences. The fact that the Mazes subtest measures visual planning, ability to follow a visual pattern, visual-motor coordination and foresight and is influenced by solving mazes and as such is dependent on such visual spatial relations might explain the male-female differences. In addition, since performance on this subtest is also influenced by experience with solving mazes, the fact that boys run around a lot in nooks playing hide and seek and other such games that depend on getting out of a boxed area might have influenced their performance on the Mazes.

In Anum's work on the RCPM, WRAT and the Digit Span, although he found significant sex differences on the RCPM ($p < .005$), he did not find any significant

differences on the Digit Span. This compares with what the present study found on the Digit Span test. The difference in his findings on the RCPM compared to that of this study may also be due to the difference in sample size. Whereas he tested 734 children on the RCPM, this study tested only 200 children.

In Ghana, even though the '*send your girl child to school project*' as well as other projects like holding science workshops for girls during vacation have reaped some benefits, by and large a lot of girl children are still disadvantaged. This is especially true in the lower SES groups and especially in the rural areas. In such communities, whereas boys are encouraged to study after school and not play too much so they can become outstanding community members in future, girls do a lot of household chores after school and even when they squeeze some time to read, they are discouraged, often being asked where they will be going with all that education. Since research has shown that girls are not intrinsically poorer at schoolwork than boys, it is important to encourage them at all levels. It is therefore most likely that if rural children had been tested, there would have been significant differences on the measures between boys and girls.

The media, both print and electronic, are powerful ways of reaching people. If parents and educators as well are encouraged to help the girl children strive for all that they can be and not see their lot in life as ending in some man's kitchen, then the chances of them rising to be all that they are meant to be in life will be very high. This

effort in particular should be emphasized in rural areas since this is where there is the likelihood of a greater disparity between boys' and girls' performance in school.

5.2.4 Age / Class Differences

Although the age groups differ significantly from each other, there are discrepancies in the distribution of scores in Table 8 in that there are lower age groups having higher means on some subtests than higher age groups. The class distribution on the other hand, shows a more consistent picture with the older classes doing better than the younger classes.

The differences found in the age and even the class groupings are not consistent. However, since mental growth occurs in spurts rather than in a smooth fashion, the results are not far from expected. Several researchers have reported differences in performance across all ages on various intelligence tests (Kanel and Fisherman, 1991). Several explanations have been given for this but only two will be discussed. The first is that as children grow older, they perform better or think better while the second explanation is that they know better.

The first explanation of older children thinking better is typically Piagetian. Piaget argued that there are major qualitative changes in the children's understanding and learning about the world as they grow older. In his view, the older children do better because their thinking is of a different kind than the younger children and not simply

because they have more experience. Development cannot therefore be understood without allowing for these giant leaps in understanding.

The second explanation of knowing more on the other hand, is typical of information processing theory. These theorists are particularly interested in changes with age in problem-solving skills. In their opinion, the different responses of the younger and older children is explained in terms of the amount of experience they have in solving problems and the particular skills they have available to deal with a situation as well as the ease and flexibility with which they can apply those skills. Thus, the older children know more because of the gradual improvement in attention, memory and thinking that lead to greater skill in interpreting events and understanding, and a wider range of problem-solving strategies.

However, the results of this study show that age was not an important a discriminant as class. This brings up the issue of age versus schooling effect on intellectual development and performance on intelligence tests. The effect of formal education as opposed to chronological age on intelligence tests has suffered from inadequate empirical investigation. Most studies of this issue have relied on natural variation in exposure to school among school children of the same age, thus confounding differences in schooling with differences in other intelligence related variables (Cahan & Cohen 1989).

The findings of the quasi-experimental study by Cahan and Cohen (1989) estimating the independent affects of age and schooling in grades five and six on raw

scores obtained on a variety of general ability tests by school children in Jerusalem's Hebrew language state controlled elementary schools explains this. Their findings unambiguously point to schooling as the major factor underlying the increase in test scores as a function of age and to the larger effect schooling has on verbal than non-verbal tests. This is in line with what the present study in Ghana found.

Morrison, Smith, and Dow-Ehrensberger (1995) also assessed the impact of schooling with age held constant by comparing the ability of first graders and kindergartners to recall pictures of nine common objects. The first graders were on average, only a month older than the kindergartners, and at the start of the school year, the performances on the two groups were virtually identical. At the end of the school year however, the first graders almost doubled the number of pictures they could remember and they were seen to engage in active rehearsal. One year of schooling had clearly brought about a change. Similar results were obtained for such diverse skills as the ability to analyse the sound components of words, a cognitive skill that seems to be promoted by reading instruction, and to solve a variety of cognitive tasks that are often included in IQ tests.

The findings of the study on the effect of schooling as opposed to age on performance on cognitive tasks confirm earlier work done by several researchers in Africa. For instance, Sefa-Dedeh et al, (1997) concluded that generally picture perception improves with increasing exposure to education. Anum's (1996) findings also confirmed that schooling affected the scores on the RCPM.

Other findings support the influence of education on performance of African children on cognitive tasks (Serpell & Deregowski, 1980; Dawson, 1967; Duncan, Gourley & Hudson, 1973; Deregowski, 1974; McFie, 1961; and Serpell & Deregowski, 1974).

The findings on the effect of schooling as opposed to age on performance on cognitive tasks in African children definitely contribute to our understanding of the causal model underlying the development of academic or school related intelligence. The finding also gives hope to parents, teachers and school children alike in that if schooling has such a bearing on this type of intellectual development, then changing factors within certain schools, which make the performance of children in such schools poor, will enhance the academic or componential intellectual development of children in such schools.

5.2.5 Correlation of the WISC-III^{L-K} with RCPM

The RCPM performance of the children tested was much better than on the WISC-III^{L-K} subtests. Using the general average class means, the performance of the children was at the 75th percentile or greater except for the primary 5 children whose performance was >50th percentile using Anum's 1996 urban norms (Table 16). This corresponds to intellectual capability of average and above average performance.

This finding is similar to what Anum found as shown in Table 16 although his findings were lower by 25 points in some instances. The most likely reason for this difference is that Anum's larger sample of 735 schoolchildren as opposed to 200 in this study

included schoolchildren from the rural areas while this study used schoolchildren from only the urban areas. The lower performance of the children from the rural areas therefore lowered his averages.

The performance of the children on the RCPM supports the fact that the children tested are not intellectually inferior as one would think by the results obtained when their performance on WISC-III^{RM} was rated with the British norms (Tables 6 - 9). This finding as well as that of Anum, (1996) indicate that scores obtained from the RCPM are more reflective of a Ghanaian child's performance in school related work than scores obtained on the WISC-III^{RM}.

The correlation of the RCPM with the WISC III-^R subtests (Table11) was significant on majority of the subtests except the Coding subtest and the Symbol Search subtest. The highest correlation was with the Block Design subtest. This was expected as both the Block Design subtest and the RCPM seem to measure similar concepts such as non-verbal concept formation, ability to analyse a whole into parts and visual-spatial organization (Kaplan, 1993; Lezak, 1995).

Being a nonverbal measure designed to de-emphasize cultural and academic content, the RCPM is considered to be a more appropriate test and is recommended for use with individuals who may be at a disadvantage on tests that rely heavily on verbal and / or academic skills (Jensen, 1980; Llabre, 1985). As an untimed test, it is useful with individual's who do not respond quickly due to physical handicap (Llabre, 1985).

brain damage (Botwinick, 1978); or emotional / motivational difficulties as well as being preferred with individual's whose cultural groups do not necessarily value speed in work (Jensen, 1980).

This together with proof of its efficacy as a measure of intelligence and wide correlation to the widely used Wechsler tests (Burke, 1985) as supported by this present study makes it an instrument that can be used to estimate WISC-III-R FSIQ. Since a lot of work in terms of its use as a clinical tool in Ghana has been done (coupled with the availability of local norms), it is recommended that the RCPM be used as a general screening test in educational and clinical purposes and the more time consuming WISC-III-R used when an individual's strengths and weaknesses need to be assessed.

5.3 Relevance of WISC-III-R to all Populations

Although core intelligence tests like WISC-III-R have been criticised, their role in individual assessment of children cannot be underestimated. The instrument being standardised on a cross section of children in the UK including those of African descent and across all social strata makes it a more appropriate test. Nevertheless, as the results indicate, the type of school attended invariably affects performance on the test. Theoretically, although intelligence tests like the WISC-III-R are supposed to be ability tests, they hardly tap an individual's innate ability. Rather, most of the things they test

are education related. Those children exposed to a better educational system invariably do better than their counterparts because they have better educational opportunities. The findings of this study therefore buttress this point because it showed that children from similar backgrounds who go to different schools perform differently on tests with those going to the private schools in this case the better schools doing much better than their counterparts in the worse schools..

Although WISC-III[®] in its original form and using its UK norms showed some cultural differences that made the Ghanaian children score lower on the tests, with some modification and the new derived norms, it can be used with Ghanaian children. However, it is important to interpret the test results cautiously, taking into account the background and education of the child as well as all the other “confounding variables” that have been discussed earlier. In particular, in a setting such as ours where testing is not very popular, let alone sitting in front of a strange adult asking you to answer all sorts of questions, it is vital that the examiner establishes a good rapport with the child so the child can feel very relaxed. If all the emotional and motivational aspects of the test are taken care of, it is likely that the WISC-III[®] can become a great tool in the hands of those qualified to use it. The test is best used for assessing school related tasks. Although labelled as an intelligence test, it does not really assess innate abilities and so one needs to be careful how scores on the tests are interpreted.

5.4 Implication for Clinical Assessment of children in Ghana

The importance of this study cannot be overemphasised since it is the first of its kind in establishing Ghanaian norms for the WISC-III[®]. One of the main findings that came out of this study was the difference in performance of the two groups of children, those in the private as opposed to those in the public schools. Since the poorer performance of the children in the public schools is not an indication of an inferior intellectual capability, it will be better if norms for public schools were obtained. Thus, for the short term, different norms for children from the two school groups of private and public are needed for realistic and meaningful assessment of children in Ghana.

For the long term however, since one of the reasons underlying the changing of various school uniforms to one type was to let the children in various schools in Ghana be at the same level, instead of just having separate norms for private and public schools, the factors underlying the generally poorer performance of children in public schools as opposed to those in the private schools should be delineated and adequate measures put in place to rectify them. Something like a head start program for disadvantaged children most of whom are in the public schools will be a good start.

One of the factors that have been identified recently as contributing to the poor performance of children in the public schools on the Basic Education Certificate Examination (BECE) in Ghana is the use of Ghanaian languages for the first three years

of school. This is a highly debatable issue. The problem is more likely to be the type of tests and examinations the Ghanaian children are given rather than the language of instruction. Even though English is not the mother tongue, it is the only official language in Ghana as well as the only language that cuts across various ethnic groupings in the country. It is also the most widely used language worldwide. For Ghanaian children to be able to compete with their peers all over the world, a critical look needs to be taken at how they are taught.

Using local languages as a medium of instruction in the lower primary classes has been beneficial. On the contrary, even though both the public and private schools in Ghana, at least at the primary level use almost the same types of textbooks, the children in public schools have consistently performed poorer than the private schools because most of the children do not understand what they read. Since you need a basic understanding of English to be able to understand other subjects such as Mathematics and Geography, it is no wonder that children in the public schools do poorly in school related work.

The effects of using English as the medium of instruction right from the lower primary is amply demonstrated in the few public schools such as SLEP where right from primary one the children are not only taught in English but are encouraged to speak it as well. These schools are a cut above their peers and in this study, on a number of subjects; there was not much difference between SLEP and St Paul's Lutheran, one of

the top middle-class schools in Accra. In addition, other factors such as quality of teaching, school resources, school supervision and teacher motivation also contribute to the superior performance of the children in SLEP.

In addition, it is important that tests are developed locally to reflect the cultural environment we live in while still finding ways of making the foreign tests that have been tried and tested, more culturally relevant. Culture specific instruments are needed if we want to make testing relevant in Ghana.

6 CONCLUSION

6.1 Summary of findings

The study confirmed that an individual's performance on the WISC-III[®] is influenced by his/her cultural milieu with children from Ghana doing poorer than children from Britain. The children from private schools were different from children from public schools on all the WISC-III[®] subtests and the RCPM. There were also significant differences within the two school groups as well as some overlap between one of the private schools and one of the public schools (i.e. St Paul's and SLEP respectively). These findings support and add to the many in the literature, which indicate that differences exist in the performance of different cultural and socio-economic groups.

The results also indicated that males and females did not differ significantly from each other on almost all the subtests of the WISC-III[®] and RCPM except on the Mazes subtest. Although increasing age did not show a uniform improvement in scores, generally, children in the upper primary classes did better than children in the lower primary classes. Class was therefore a better reflection of cognitive development than chronological age. The performance of the WISC-III[®] correlated strongly with performance on the RCPM.

This study sought to answer the question "Is the WISC-III[®] applicable to Ghana?" The major finding of the study supported the hypothesis that an individual's performance on the WISC-III[®] is influenced by his/her cultural milieu and exposure to western culture. As indicated in the discussion, using the WISC-III[®] as it is with its norms

is not applicable to Ghana. Most of the school children tested will score in the retarded range if the UK norms are used for them when obviously they are not.

Most of the concern about multicultural testing or testing children of other cultures with a test designed primarily for one cultural group centres on the lowering of scores by cultural conditions that may have affected the development of aptitudes, interests, motivation, attitudes and other psychological characteristics of minority group members and most importantly, the unfamiliarity of the tasks.

Certainly, WISC-III[®] is not applicable to Ghana in its present state and with its British norms. In order for it to be applicable, a number of changes will need to be done. Some of the culturally loaded Verbal subtests such as the Comprehension and Similarities subtests need to be changed. We can replace Similarities subtest with a more culturally relevant like the Digit Span test and modify some of the questions and answers on Comprehension subtest to reflect the practical common sense and the social mores and rules in Ghana. With the culturally loaded Performance subtests such as the Object Assembly and the Picture Arrangement subtests, we can replace the Picture Arrangement subtest with the Mazes subtest and change the Caucasian looking girl and face to that of an African looking girl and face. With some of these basic changes and locally derived norms, the WISC-III[®] can be a better tool for assessing school related tasks in Ghana.

6.2 Educating the Disadvantaged

In concluding this study, one of the important issues to be tackled is how to improve the poor performance of Ghanaian children in the public school system not only on the WISC-III[®] but on the BECE as well. If these same children who had done poorly on the test were removed from their environment and put in better schools and given extra tuition to catch up, it is likely that their performance would improve as is indicated by the findings of the children in SLEP.

However, since it is unlikely that all these children can be moved to a different environment, their environment can be enriched. Possible ways of doing this are as follows:

- Teachers teaching in such deprived schools be they in the urban or rural centres should be given special incentives so they will be willing to teach in such places.
- Emphasis should be on teaching children English right from primary one and encouraging them to speak with their friends and teachers in English.
- Educational materials and audiovisual teaching aids should be made available to public schools. In addition, if the Ministry of Education and the Ghana Education Service cannot provide textbooks to the primary

schools free of charge, then they can be highly subsidised by these two institutions so that most parents can afford to get them for their wards.

- A type of head start program can be put in place as a remedial measure for children.
- Extra tuition should be given to the children so they can catch up with what they have lost.
- A massive and large scale public education campaign on the importance and value of education should be undertaken as a nationwide project.

6.3 Study Limitations

There are many problems and limitations in undertaking a project of this kind.

First of all, due to time and financial constraints, the sample size of 200 schoolchildren was not large enough for a study that had the goal of deriving local norms for the WISC-III[®]. In addition, the sample was not representative enough as all the subjects were drawn from only four schools in Accra. The norms can therefore be used for assessing children mainly in Accra. However, if one needs to assess children outside Accra, the interpretation of the scores will need to be done cautiously, taking cognisance of the fact that children in other parts of Ghana do not have the same experiences and exposures as those in Accra.

Secondly, school selection in the public schools was limited to schools with good testing environment. It is possible that such schools are better equipped and may produce better pupils compared to other schools in the same category.

Thirdly, only children who could communicate in English were used for the study as no translation of the test material into local languages was done. This in itself may have selected the fairly good students in the public schools, as they are the ones most likely to have a fair command of the English language.

Finally, the lack of a pilot study is also a limitation. If a pilot had been done to find out those items that were not understood, they could have been replaced or taken out and the performance of the children would have been more reflective of what they are capable of doing.

6.4 Implications for Future Research

Psychological testing is becoming increasingly more acceptable in Ghana with tests not only being used in the clinical and educational setting, but in other areas such as selection of personnel for various jobs and professions including those in the military. Tests are also used regularly in research by researchers in diverse fields.

The need to use a test standardised on a sample of the population from which those tested will come from cannot be overemphasised. One way of doing this is what this study did by adapting a foreign-based test for local use by developing local norms

for the test. However, a better way of testing in developing nations such as ours is for psychologists who are members of the indigenous culture to eventually develop and use tests appropriate for that culture.

In undertaking to do this, researchers will need to widen their concept of intelligence and go beyond developing just IQ tests to developing ability and aptitude tests that can tap a wide range of abilities and help individuals identify their strengths and those fields of endeavours where they can excel. If we are able to do this, the testing industry will move from one where people are classified and labelled without much help being given to them to one where people with their varying talents, gifts and abilities would be helped to identify what these areas are so they can work on them and become productive citizens in our nation.

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APPENDIX I

Table 14 Scaled score equivalents of raw scores: 6 years, 0 months – 6 years, 5 months

Verbal subtests

Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	-	-	0-2	0-4	0	0-3	1
2	-	-	3	-	-	4-6	2
3	-	-	4-5	5	1	7-9	3
4	-	-	6	6	-	10	4
5	-	-	7	7	2	11	5
6	-	0	-	8	3	-	6
7	4	1	8	9	4-5	12	7
8	-	2	-	10	6-8	13	8
9	5	3	9	11	9-10	-	9
10	6	4	10	12	11	14	10
11	-	5	11	13	12-13	15	11
12	-	6	12	14-15	14	-	12
13	8	7	-	16	15-16	16	13
14	9	8	13	17	17-19	17	14
15	10	9	-	18-19	20	-	15
16	11	10	-	20-24	-	-	16
17	12-13	11-13	14	25-26	-	-	17
18	14	14-15	15	27-29	-	-	18
19	15-30	16-33	16-30	30-60	21-36	18-30	19

Performance subtests

Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	0	0-10	-	0	0-2	0-2	0-1	1
2	1	11-14	-	1	-	3-4	2	2
3	2	15-19	-	2	3	5-7	3	3
4	3	20-24	-	-	-	8-9	3	4
5	-	25-26	-	-	-	10-11	-	5
6	4-5	27-28	-	3	4	12	4-5	6
7	6	29-31	0-1	4	5	13	6	7
8	7	32-34	-	5-8	6-8	14	7	8
9	8	35-36	2	9-12	9-11	15	8	9
10	9-11	37-40	3	13	12	-	9-10	10
11	12-13	41-42	4	14-17	13-14	16	11	11
12	14	43-44	5	18	15-16	17	12	12
13	15-16	45-48	6	19-21	17-18	18	13-14	13
14	17-18	49-50	7	22-24	19-20	19	15-17	14
15	19	51-52	8	25-31	21-28	-	18	15
16	-	53-55	9-23	32	29-30	20-27	19	16
17	20	56-58	24-25	33-35	31	28-29	20	17
18	21	59-60	26-27	36-39	32-33	30-31	21	18
19	22-30	61-65	28-64	40-69	34-44	32-45	22-28	19

Table 14: Scaled score equivalents of raw scores: 6 years, 6 months – 6 years, 11 months

<i>Verbal subtests</i>							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0	-	-	-	-	0-1	1
2	1	-	-	-	-	2-3	2
3	-	-	-	0-2	-	4-5	3
4	2	-	-	3-4	-	6-8	4
5	-	0	-	5	-	9	5
6	3	1	-	6	0-1	10	6
7	4	2	-	7-8	2	11	7
8	-	3	-	9	3-4	12	8
9	5	4	-	10-11	5-6	13	9
10	6	5	-	12	7	14	10
11	-	6	10-11	13-14	8	15	11
12	7	7	12	15	9-10	16	12
13	8	8	13	16-17	11-12	17	13
14	9-10	9	14	18	13-14	18	14
15	11	10-13	-	19	15	19	15
16	12-13	14	-	21-26	16-17	20	16
17	14	15	-	27-28	18-19	21	17
18	15	16	15	29	20	22-23	18
19	16-30	17-33	16-30	30-60	21	24-30	19

<i>Performance subtests</i>								
Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	-	0-8	-	0	0	0-1	-	1
2	-	9-14	-	1	-	2-3	-	2
3	-	15-17	-	2	-	4-8	-	3
4	-	-	-	-	-	9-10	-	4
5	0	18-25	-	-	-	-	0-1	5
6	1-2	26-24	-	-	-	-	2	6
7	3-4	25-26	1	-	3	11-13	3-5	7
8	5-6	27-30	2-3	4-5	4	14	6-7	8
9	7-8	31-33	4-5	6	5-6	15-16	8-9	9
10	9-11	34-37	6-7	7-10	7-8	17	10-11	10
11	11	38	8-10	11	-	18-19	12	11
12	12-13	39-42	11	12-14	11-11	20-21	13-14	12
13	14-15	43-46	12-14	15	12	22-23	15	13
14	16-17	47-50	15	16-17	13-14	24-26	16-18	14
15	18-19	51	16-17	18-31	15	27-28	19	15
16	20	52-58	18-23	32	16	29	20-21	16
17	21	59-60	24-25	33-35	17	-	22	17
18	22	61-63	26-27	36-39	18-20	30-31	-	18
19	23-30	64-65	28-64	40-69	22-44	32-45	23-28	19

Table 14 Scaled score equivalents of raw scores: 7 years, 0 months – 7 years, 5 months

Verbal subtests							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0	-	0	0	-	0-3	1
2	1	-	1	1	-	4	2
3	2	-	2	2	-	5	3
4	-	-	3	3	-	6-8	4
5	-	-	-	4	-	9	5
6	-	-	4	5	-	10	6
7	3	-	5-6	6-7	-	-	7
8	4	-	7	8	4	11	8
9	5	-	8	9	5	12	9
10	6	-	9	10-11	6	13	10
11	-	4	10-11	12	7-10	14	11
12	7	5	12	13	11	15	12
13	8	6	13	14-15	12	16	13
14	9	7	14-15	16-25	13-14	17	14
15	10	8	-	26	15-18	18	15
16	11-14	9-10	-	27-28	19	-	16
17	15	11-12	-	29	20	19	17
18	16-17	12-13	16-17	30-32	21	20	18
19	18-30	21-31	18-19	-	22-36	21-30	19

Performance subtests

Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	0	0-14	-	0	-	-	-	1
2	-	15-16	-	-	-	1	-	2
3	-	17-18	-	-	-	2-4	-	3
4	-	19-20	-	-	-	5	-	4
5	-	21-22	-	-	-	6	-	5
6	2-3	23-26	-	-	-	8-10	0-1	6
7	4-5	27-28	-	0-4	-	11	2	7
8	6-7	29-31	1	5	0-4	12-13	3	8
9	8	34-37	2-3	6-9	5-7	14	4	9
10	9-10	38-40	4	10	8-9	15-16	5	10
11	11-12	41-47	5	11	10-11	17	6	11
12	13	48-50	6	12	12	18	7-9	12
13	14	51-52	7	13	13	20-21	10-11	13
14	15-16	53-58	8	14-17	14	22-28	12-19	14
15	17-20	59-60	9-11	18-20	15-17	29-30	20	15
16	21	61-62	12-21	21-22	18-33	31	21	16
17	22	63	28-29	23	34	32-33	22	17
18	23	64	30-33	24-47	35-36	34-37	23	18
19	24-30	65	34-64	48-69	37-44	38-45	24-28	19

Table 14: Scaled score equivalents of raw scores: 7 years, 6 months – 7 years, 11 months

Verbal subtests							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0-1		0-3			0-4	1
2			4			5	2
3			5			6	3
4			6	2		7	4
5	2		7	3		8	5
6	3		8	4-6	1	9	6
7	4		9	7	2	10	7
8	5	3	10	8	3	11	8
9		4-5	11	10	4	12	9
10	6	6	12	11-12	5-7	13	10
11	7			13-14	8	14-15	11
12	8	8	13	15-16	9-10	16	12
13		9	14	17	11	17	13
14	9	10	15-16	18-25	12-14	18	14
15	10-14	11	17	26	14	19	15
16	15	12-16	18	27-28	15-20	20	16
17	16	17-18		29	21	21	17
18	17	19-20	19-20	30-32	22-24	22	18
19	18-30	21-33	21-30	33-60	25-36	23-30	19

Performance subtests

Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	-	0-18	0	0-2	-	0	-	1
2	-	19-21	-	-	-	1	-	2
3	-	22-24	-	-	-	2	-	3
4	-	25-26	-	-	-	3-4	-	4
5	0-1	-	-	-	0	5-8	0-1	5
6	2-3	27-30	-	-	1-2	9-10	2-3	6
7	4	31-33	1	3-6	3-4	11-12	4-5	7
8	5-6	34	2-3	7-9	5	13	6-7	8
9	7-8	35-37	4-6	10-12	6-7	14-16	8-9	9
10	9	38-39	7-8	13-16	8	17-18	10-11	10
11	10-11	40-43	9-10	17-19	9-10	19-20	12-13	11
12	12-13	44-45	11-13	20-21	11-12	21-23	14-15	12
13	14	46-47	14-16	22-25	13-15	24-25	16-18	13
14	15	48-49	17	26-30	16	26-28	19-20	14
15	16-18	50-51	18-20	31-34	17	29-31	21-22	15
16	19-20	52-62	21-22	35-40	18	32-33	23	16
17	21	63	23-31	41-42	19-22	34-35	-	17
18	24	64	32-33	43	23-36	36-37	24	18
19	25-30	65	34-64	44-69	37-44	38-45	25-28	19

Table 14: Scaled score equivalents of raw scores: 8 years, 0 months – 8 years, 5 months

<i>Verbal subtests</i>							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0-1	-	0-3	0	-	0-3	1
2	2	-	-	-	-	4	2
3	-	-	4	-	-	5	3
4	-	0	5	-	-	6-8	4
5	3	1	6	1-3	-	9	5
6	4	2	7-8	4-5	0	10	6
7	5	3	9	6-7	2-5	11	7
8	6	4	10	8-10	6	12	8
9	7	5	11	11-12	7-9	13-14	9
10	8	6	12	13-14	10	15	10
11	9	7-8	13	15-18	11-14	16	11
12	10	9	14-15	19	15	17	12
13	11	10	16	20-21	16-17	18	13
14	12	11-15	17	22-24	18-20	19	14
15	13	16	18	25-27	21	20	15
16	14	17-18	-	29-30	22	21	16
17	15-17	19-20	19	31	23	22	17
18	18-19	21-22	20	32-33	24-25	-	18
19	20-30	23-24	21-30	34-60	26-36	23-30	19

<i>Performance subtests</i>								
Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	-	0-10	-	0-2	-	0-2	0-4	1
2	0	-	-	3-4	-	-	5	2
3	2	11-13	-	-	-	-	-	3
4	3	-	-	-	-	-	-	4
5	4-5	-	-	-	-	-	-	5
6	6	14-17	0-1	-	-	3-4	-	6
7	7-8	18-19	2-4	-	5-6	5-7	6-7	7
8	9	20-23	5	5-9	7-8	8-9	8-9	8
9	10	24-28	6-7	10-13	9-10	10-11	10-11	9
10	11-12	29-30	8-9	14-16	11	12-16	12	10
11	13	31-33	10-12	17-19	12	17	13	11
12	14	35-38	13-14	20-26	13-14	18-19	14-15	12
13	15	39-41	15-17	27-40	15-16	20-22	16-18	13
14	16-17	42-44	18	41-43	17-18	23-24	19-20	14
15	18-22	45-49	19-29	44-45	19-20	25-27	21-22	15
16	23	50-53	30-31	46	21-35	28	23-24	16
17	24	54	32-33	47	36	-	25	17
18	25	-	34-37	48-50	37	-	-	18
19	26-30	55-119	38-64	51-69	38-44	29-45	26-28	19

Table 14: Scaled score equivalents of raw scores: 8 years, 6 months – 8 years, 11 months

<i>Verbal subtests</i>							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0-1		3	0	0	0-4	1
2	2		4			5	2
3	3		5			6	3
4	4		6	1-4		7	4
5	5		7	5		8-10	5
6	6		8	6-7	1-3	11	6
7	7	3-4	9	8-9	4-5	12	7
8	8	5	10-11	10-12	6-7	13-14	8
9	9	6	12	13-14	8-9	15	9
10	9	7-8	13	15-16	10-11	16-17	10
11	10	8	14	17-18	12-14	18	11
12	11	10-11	15	19-20	15	19-20	12
13	12	12	16	21-23	16-17	21	13
14	13	13-14	17-18	24-25	18-20	22	14
15	13	15	19	26-30	21-22	23	15
16	14	16-18		31	23	24-26	16
17	15	19-20		32	24	27	17
18	16-20	21-22	20	33	25		18
19	21-30	23-33	21-30	34	26-28	28-30	19

<i>Performance subtests</i>								
Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	0	0-11	0	0-4	0-3	0-3	0-5	1
2	1							2
3	2	12-14						3
4	3-4	15-16				4		4
5	5-6	17-19				5-6		5
6	7	20-23	2-4	5-6	4	7-8	6-7	6
7	8-9	24-25	5-6	7-10	5-6	9-10	8-10	7
8	10	26	7-9	11-13	7-10	11	11-12	8
9	11-12	27-29	10-11	14-17	11	12-14	13-14	9
10	13	30-31	12-13	18-20	12-14	15	15-18	10
11	14-15	32-33	14-16	21-24	15	16-17	19	11
12	16	34-37	17-18	25-29	16-19	18	20-22	12
13	17-18	38	19-20	30-32	20-23	19-20	23	13
14	19	39-41	21-24	33-35	24-25	21-24	24	14
15	20	42-45	25-26	36-38	26	25	25-27	15
16	21-23	46-49	27-35	39-50	27-30	26		16
17	24-25	50-52	36-37	51	31-33			17
18	26	53-54	38-39	52-53	34-38			18
19	27-30	55	40-64	54-69	39-44	27-45	28	19

Table 14: Scaled score equivalents of raw scores: 9 years, 0 months – 9 years, 5 months

<i>Verbal subtests</i>							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0-3	2	2-8	0-9	0-3	0-4	1
2	4		9	10		5	2
3	5		10			6	3
4	6		11			7-10	4
5			12			11	5
6	7	3	13	11			6
7		4			4-5	12	7
8		5		12	6	13	8
9		6	13	13	7		9
10	8	7	14	14	8-9	14	10
11				15	10-11		11
12		8	14		12-13	15	12
13	9	9		16	14-15	16	13
14		10		17		17	14
15	10-18	11-16	15-20	18-35	16-23	18	15
16	19	17-18	21	36-37	24-25	19	16
17	20	19-20	22	38	26	20	17
18	21	21-23	23	39	27-28	21	18
19	22-30	24-27	24-30	40-60	29-36	22-30	19

<i>Performance subtests</i>								
Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	0-6	0-14	0-7	0-5	0-4	0-4	0-6	1
2		15-16				5	7	2
3		17-18				6-7		3
4						8		4
5	7				5	9		5
6	8		5		6	10		6
7	9-10	19-21	4-5	6-9	7	11-12	8-9	7
8	11	22-24	6	10-11	8	13-14	10-11	8
9	12	25-27	7-8	12-13	9-10	15-16	12-13	9
10	13	27-26	9	14-15	11	17-18	14	10
11	14-16	28-30	10	16-18	12	19	15-16	11
12	17-21	31-34	11	19-21	13	20	17-20	12
13	22	35-38	12	22-24	14-32	21-23	21-23	13
14	23	39-42	13-14	26-28	33-34	24	24	14
15	24	43-49	15-36	29-53	35-36	25-26		15
16	25	50-52	37-38	54	37	27	25	16
17	26	53-54	39-40	55-56	38	28	26	17
18	27	55-61	41-44	57	39	29-30	27	18
19	28-30	62	45-64	58-69	10-44	31-45	28	19
		119						

Table 14: Scaled score equivalents of raw scores: 9 years, 6 months – 9 years, 11 months

Verbal subtests							Scaled Score
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	
1	0-4	3-7	0-4	0-5		0-4	1
2	5		10			5	2
3			11			6-7	3
4						8	4
5		5			9	9-10	5
6	6	4	12	6-9	3-5	11-12	6
7	7	5-6	13	10-11	6	13	7
8	8			12-14	7-9	14	8
9	9-10	8-9	14	15-16	10-11	15-16	9
10	11	10		17-20	12-13	17	10
11	12	11-12	15	21-23	14-15	18-19	11
12	13-14	13		24-26	16-17	20	12
13	15	14	16	27-28	18-19	21-22	13
14	16	15		29-32	20-23	24-25	14
15	17-18	16-17	17	33	24-25	26	15
16	19	18	18	34-38	26		16
17	20	19-20		39	27		17
18	21-22	21-26	19-24	40-43			18
19	23-30	27-33	25-30	44-60	28-36	27-30	19

Performance subtests								Scaled Score
Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	
1	4	0-15	0	0-8	0-5	0-4	0-1	1
2	5	16		9		5		2
3	6					6-7		3
4	7	17-18				8	2-4	4
5	8-9	19-21	1-3			9	5-7	5
6	10	22-23	4-5	10	6-8	10-11	8-9	6
7	11-12	24-26	6-7	11-15	9	12-13	10-11	7
8	13-14	27-29	8-10	16-17	10-11	14	12-14	8
9	15	30-31	11-13	18-24	13-15	15-16	15-16	9
10	16	32-33	14-17	25-26	16-18	17	17-19	10
11	17	35-37	18-20	27-29	19-23	18-19	20-22	11
12	18-19	38-41	21-22	30-31	24-25	20-21	23-25	12
13	20	42	23-27	32-36	26-28	22	26-27	13
14	21-23	43-44	28-29	37-40	29-31	23-24		14
15	24	50-51	30-31	41-42	32-33	25-26		15
16	25	52-54	32-38	43-49	34-37	27		16
17	26	55-58	39-40	50-57	38-40	28		17
18	27	59-61	41-44	58-61	41	29-30		18
19	28-30	62-119	45-64	62-69	42-44	31-45	28	19

Table 14 Scaled score equivalents of raw scores: 10 years, 0 months - 10 years, 5 months

Verbal subtests

Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0-2	0-2	0-9	0-7	0-3	0-4	1
2	3		10			5	2
3	4		11			6	3
4	5		12			7	4
5	6		13			8-12	5
6	7		14	8-9	4-5	13-14	6
7	8	3-4		10-11	6-7	15	7
8	9	5		12-13	8	16	8
9	10	6	15	14-15	9	17	9
10	11	7-8		16-17	10-12	18	10
11	12	9-10		18-21	13-14	19	11
12	13	11-12	16-18	22-23	15-16	20	12
13	14	13	19	24-25	17-25	21	13
14	15	14	20	26-37	26	22	14
15	16	15-24	21	38-39	27	23-24	15
16	17-21	25	22	40-41	28	25	16
17	22	26	23	42-43	29		17
18	23	27-28	24	44	30		18
19	24-30	29-33	25-30	45-60	31-36	26-30	19

Performance subtests

Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	0-6	0-10	0	0-5	0-2	0-4	0-3	1
2	-	11-15	-	6	3	5	4	2
3	-	16-18	-	7	4	6	5	3
4	-	19	-	8	5	7-8	6	4
5	-	20	1	9-11	-	9-10	7	5
6	7-8	21	2-5	12-15	6-7	11-12	8-9	6
7	9	22-25	6-7	16-20	8-9	13	10	7
8	10-11	26-30	8-10	21-23	10-12	14-15	11-12	8
9	12	31	11-13	24-25	13-15	16-17	13-14	9
10	13-14	32-35	14-16	26-27	16-19	18-19	15-18	10
11	15-16	36-39	17-19	28-30	20-22	20-22	19-20	11
12	17	40-42	20-21	31-34	23-25	23	21-22	12
13	18	43-45	22-36	35-37	26-29	24-25	23-24	13
14	19	46-48	37-38	54-56	30-37	26-27	25-27	14
15	20-22	49-51	39-40	57-58	38	28		15
16	23-26	52-58	41-42	59-60	39	29		16
17	27	59-61	43-44	61-62	40	30		17
18	28	62-67	45-47	63	41	31-32		18
19	29-30	68-119	48-54	64-69	42-44	33-45	28	19

Table 14: 10 years, 6 months – 10 years, 11 months: Scaled score equivalents of raw scores

<i>Verbal subtests</i>							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0-2	0-1	0-9	0-2	0-2	0-8	1
2	3		10			9	2
3	4		11	3		10	3
4	5		12	4-6	3-5	11	4
5	6	2	13	7-9	6	12	5
6	7	3-4		10-11	7-8	13-14	6
7	8	5-6	14	12-13	9-10	15	7
8	9			14-15	11	16	8
9	10-11	8-9	15	16-17	12-13	17	9
10	12	10-11		18-21	14-15	18	10
11	13	13	16	22-23	16-17	19	11
12	14	14		24-25	18	20	12
13	15-16	15-16	17	26-27	19-20	21	13
14	17-18	17-19		28-30	21-26	22	14
15	19	20-25	18	31-33	27	23	15
16	20	26		34-43	28	24	16
17	21	27	19	44	29		17
18	22	28		45-47	30		18
19	23-30	29-33	20-30	48-60	31-36	25-30	19

<i>Performance subtests</i>								
Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	0-5	0-9	0-1	0-8	0-5	0-5	0-7	1
2	6					6		2
3	7					7		3
4	8	10-13	2-3					4
5	9	14-16	4-5	9-10	6	8-9	8-9	5
6	10	17-21	6-7	11-13	7-9	10-11	10-12	6
7	11	24-25	8-10	14-17	10-11	12-14	13-14	7
8	12	26-29	11	18-21	12-15	15-17	15-18	8
9	13	30-34	12-13	22-25	16-17	18	19-21	9
10	14	35-38	14-15	26-30	18-19	19-20	22	10
11	15	39-42	16-18	31-33	20-22	21-22	23-25	11
12	16	43-49	19	34-37	23-26	23-25	26-27	12
13	17	50-51	20-21	38-41	27	26-27		13
14	18	52-55	22-23	42-45	28-30	28-30		14
15	19	56-60	24-40	46-51	31-39	31		15
16	20	61-68	41-42	52-61	40	32		16
17	21	69	43-44	62	41			17
18	22-28		45-47	63-64	42	33		18
19	29-30	70-119	48-64	65-69	43-44	34-45	28	19

Table 14: 11 years, 0 months - 11 years, 5 months: Scaled score equivalents of raw scores

<i>Verbal subtests</i>							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0-2	0-2	3-8	0-5	0-2	0-8	1
2	3		9	6	3	9	2
3	4		11	7	4-7	10	3
4	5		10	8	8	11	4
5	6		11	9	9-10	12	5
6	7		12	10	11	13	6
7	8	3	13	11-12	12-13	14	7
8	9-10	4-5	14	13-15	14-15	16	8
9	11	6-7		14-17	16-17	17	9
10	12	8-9	15	18-20	18	18	10
11	13-14	10-11		21	19-21	19	11
12	15	12-13	16	22-23	22	20	12
13	16	14-16		24-25	23-26	21	13
14	17	17-18	17	26-28	27	22	14
15	18-19	19-26		29-43	28	23-24	15
16	20-22	27	18-22	44-45	29	25	16
17	23	28	23-24	46-47	30	26	17
18	24	29	25	48	31		18
19	25-30	30-33	26-30	49-60	32-36	27-30	19

<i>Performance subtests</i>									
Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score	
1	0-5	0-9				1-5	0-2	1	
2	6	10-13				6	3	2	
3	7	14-18				7	4	3	
4	8	19-20				8	5	4	
5	9	21-22				10-12	6	5	
6	10	23-24	0-7		7	13-15	7	6	
7	11	25-26	3-6		8-10	16-17	8-11	7	
8	12	27-30	7-10		16-18	11-12	18	8	
9	13	31-32	11-12		20	13-14	19-20	13-14	9
10	14	33-37	13-17		21-26	15-16	21	15-18	10
11	15	38-39	18-20		27-37	17-19	22-23	19-21	11
12	16	40-45	21-29		33-37	20-22	24	22-24	12
13	17	46-51	24-25		38-40	22-24	24	25	13
14	18-24	52-55	26-38		41-44	25-28	25	26-27	14
15	25	56-61	39-40		45-60	29-39	26-29		15
16	26	62-64	41-42		61-62	40	30-32		16
17	27	65-67	43-45		63	41	33		17
18	28	68-71	46-49		64	42	34		18
19	29-30	72	50-64		65-69	13-44	35-45	28	19

Table 14: 11 years, 6 months – 11 years, 11 months: Scaled score equivalents of raw scores

<i>Verbal subtests</i>							
Scaled Score	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit Span	Scaled Score
1	0-3	0-1	0-9	0-5	0-2	0-8	1
2	4		10	6	3	9	2
3	5		11	7	4-7	10	3
4	6		12	8	8	11	4
5	7		13	9	9-10	12	5
6	8	1-4		10-13	11	13	6
7	9	5-6	14	14-15	12-13	14-15	7
8	10	7-8		16-18	14-15	16	8
9	11-12	9-10	15	19-21	16-17	17	9
10	13	11-12	16	22-12	18	18	10
11	14	13-14		24-26	19-21	19	11
12	15	15-17	17	27-29	22	20	12
13	16	18		30-32	23-26	21	13
14	17	19-20	18	33-42	27	22	14
15	18	21-22	19	43	28	23-24	15
16	19	23-27		44-45	29	25	16
17	20	28	20-24	46-47	30	26	17
18	21-24	29	25	48	31		18
19	25-30	30-33	26-30	49-50	32-36	27-30	19

<i>Performance subtests</i>								
Scaled Score	Picture Completion	Coding	Picture Arrangement	Block Design	Object Assembly	Symbol Search	Mazes	Scaled Score
1	0-5	0-10	0-3	1-3	0-5	0-8	0-4	1
2	6	11-15	4	4	6	9	5	2
3	7	16-20	5	5	7	10	6	3
4	8-9	21-23	6-7	6-9	8	11-12	7	4
5	10	24-26	8-10	10	9	13	8-9	5
6	11-12	27-29	11	11-14	10-12	14-16	10-11	6
7	13	30-34	12-13	15-20	13	17	12-14	7
8	14-15	35-36	14-15	21-25	14-15	18-19	15-17	8
9	16	37-40	16-17	26-27	16-17	20-21	18	9
10	17-18	41-44	18-21	28-31	18-21	22-24	19-22	10
11	19	45-47	22	32-35	22	25-26	23-24	11
12	20-21	48-51	23-24	36-38	23-24	27-28	25-27	12
13	22	52-56	25-26	39-45	25-26	29-31		13
14	23-24	57-60	27-30	46	27-29	32		14
15	25	61-64	31-45	47-60	30	33		15
16	26	65-66	46-47	61-62	31-40			16
17	27	67-71	48-49	63	41	34		17
18	28	72-75	50	64	42	35-36		18
19	29-30	76-119	51-64	65-69	43-44	37-45	28	19

Table 15. IQ equivalents of sums of scaled scores: Verbal Scale

Sum of S Score	Percentile		Sum of S Score	Percentile	
	IQ	Rank		IQ	Rank
5	44	0.5	51	102	55
6	45	1	52	103	56
7	46	1	53	104	58
8	48	2	54	105	60
9	49	2	55	107	61
10	50	2	56	107	63
11	51	3	57	109	66
12	53	3	58	110	68
13	54	4	59	112	73
14	55	4	60	113	75
15	56	4	61	114	77
16	58	5	62	115	79
17	59	5	63	116	80
18	60	6	64	118	82
19	61	6	65	119	84
20	63	7	66	120	86
21	64	7	67	122	87
22	66	8	68	123	88
23	66	8	69	124	89
24	68	8	70	125	90
25	69	9	71	126	90
26	70	9	72	128	91
27	72	10	73	128	91
28	73	10	74	130	92
29	73	11	75	131	92
30	75	11	76	133	93
31	76	12	77	134	93
32	78	14	78	135	93
33	79	16	79	136	93
34	80	18	80	138	93
35	82	21	81	138	93
36	83	23	82	140	94
37	84	25	83	141	94
38	86	27	84	143	95
39	87	28	85	144	95
40	88	30	86	145	96
41	89	32	87	146	96
42	90	34	88	148	97
43	92	37	89	149	97
44	93	39	90	150	97
45	94	42	91	151	98
46	96	45	92	153	98
47	97	47	93	154	99
48	98	50	94	155	99.5
49	99	52	95	156	99.7
50	100	53			

Table 15: IQ equivalents of sums of scaled scores: Performance Scale

Sum of S Score	Percentile		Sum of S Score	Percentile	
	IQ	Rank		IQ	Rank
5	39	0.5	51	102	55
6	40	1	52	103	58
7	41	1	53	104	59
8	43	2	54	106	63
9	44	2	55	107	66
10	45	2	56	108	67
11	47	3	57	110	70
12	48	3	58	112	75
13	50	4	59	113	77
14	51	4	60	114	79
15	52	4	61	116	81
16	54	5	62	117	82
17	55	5	63	118	82
18	56	6	64	120	84
19	58	6	65	121	85
20	59	7	66	122	86
21	60	7	67	124	88
22	62	8	68	125	88
23	63	8	69	126	89
24	65	8	70	128	90
25	66	9	71	129	90
26	67	9	72	130	91
27	69	10	73	132	91
28	70	10	74	132	92
29	72	11	75	134	92
30	73	11	76	135	93
31	74	12	77	137	93
32	75	14	78	139	93
33	77	16	79	140	93
34	79	18	80	141	93
35	80	21	81	142	93
36	81	23	82	144	94
37	83	25	83	145	94
38	84	27	84	146	95
39	86	28	85	148	95
40	87	30	86	149	96
41	88	32	87	150	96
42	90	34	88	152	97
43	91	37	89	153	97
44	92	39	90	155	97
45	94	42	91	156	98
46	95	45	92	157	98
47	96	47	93	159	99
48	98	49	94	160	99.5
49	99	50	95	161	99.7
50	100	52			

Table 15: IQ equivalents of sums of scaled scores: Full Scale

Sum of S Score	Percentile		Sum of S Score	Percentile	
	IQ	Rank		IQ	Rank
10	36	1	56	69	34
11	36	1	57	69	34
12	37	2	58	70	34
13	38	2	59	71	34
14	39	3	60	71	34
15	39	3	61	72	35
16	40	3	62	73	35
17	41	3	63	74	35
18	41	3	64	74	35
19	42	4	65	75	36
20	43	4	66	76	36
21	44	4	67	76	36
22	44	4	68	77	36
23	45	5	69	78	37
24	46	5	70	79	38
25	46	5	71	79	38
26	47	5	72	80	39
27	48	6	73	81	40
28	49	6	74	82	42
29	49	6	75	82	42
30	50	7	76	83	43
31	51	7	77	84	44
32	51	7	78	84	44
33	52	7	79	85	45
34	53	8	80	86	46
35	54	8	81	86	47
36	54	8	82	87	48
37	55	9	83	88	49
38	56	10	84	89	50
39	56	10	85	89	50
40	57	12	86	90	51
41	58	14	87	91	52
42	59	16	88	91	52
43	59	16	89	92	53
44	60	19	90	93	54
45	61	21	91	94	55
46	61	21	92	94	55
47	62	25	93	95	56
48	63	25	94	96	57
49	64	27	95	96	57
50	64	27	96	97	58
51	65	30	97	98	59
52	66	32	98	99	60
53	66	32	99	99	60
54	67	32	100	100	61
55	68	33	101	101	63

Table 15: IQ equivalents of sums of scaled scores: Full Scale

Sum of S Score	Percentile Rank		Sum of S Score	Percentile Rank	
	IQ	Rank		IQ	Rank
102	102	64	147	134	89
103	102	64	148	134	89
104	103	66	149	135	89
105	103	66	150	135	89
106	105	68	151	136	90
107	105	68	152	137	90
108	106	68	153	138	90
109	106	68	154	139	91
110	107	69	155	139	91
111	108	69	156	140	91
112	109	70	157	141	91
113	110	72	158	141	91
114	110	72	159	142	92
115	111	73	160	143	92
116	112	74	161	144	93
117	112	74	162	145	93
118	113	75	163	145	93
119	114	76	164	146	93
120	114	76	165	146	93
121	115	77	166	146	93
122	116	79	167	148	94
123	117	80	168	149	94
124	117	80	169	149	94
125	118	81	170	150	95
126	119	81	171	151	95
127	119	81	172	151	95
128	120	82	173	152	95
129	120	82	174	153	96
130	122	83	175	154	96
131	122	83	176	154	96
132	123	84	177	155	97
133	124	84	178	156	97
134	124	84	179	156	97
135	125	85	180	157	97
136	125	85	181	158	98
137	126	86	182	159	98
138	127	86	183	159	98
139	128	86	184	160	98
140	129	87	185	161	99
141	130	87	186	161	99
142	130	88	187	162	99
143	131	88	188	163	99.5
144	131	88	189	164	99.7
145	132	88	190	164	99.9
146	133	88			

Table 15: Index Score (IS) equivalents of sums of scaled scores: Verbal Comprehension Index

Sum of S Score	Percentile		Sum of S Score	Percentile	
	IS	Rank		IS	Rank
4	46	1	40	100	53
5	48	1	41	102	55
6	49	1	42	103	56
7	51	2	43	105	58
8	52	2	44	106	61
9	54	3	45	108	63
10	55	3	46	110	68
11	57	3	47	111	70
12	58	4	48	113	75
13	60	4	49	114	77
14	61	5	50	116	81
15	63	5	51	117	82
16	64	5	52	119	84
17	66	6	53	120	85
18	67	6	54	122	86
19	69	7	55	123	87
20	70	7	56	125	89
21	72	8	57	126	90
22	73	8	58	128	91
23	75	9	59	129	92
24	77	12	60	130	92
25	78	13	61	132	93
26	80	16	62	133	93
27	81	18	63	134	94
28	82	19	64	136	94
29	84	23	65	137	94
30	85	25	66	139	95
31	87	27	67	141	95
32	89	32	68	142	96
33	90	34	69	144	96
34	92	39	70	145	97
35	92	39	71	147	97
36	94	45	72	148	98
37	96	47	73	150	98
38	97	50	74	151	99
39	99	51	75	153	99.5
			76	154	99.9

Table 15: Index Score (IS) equivalents of sums of scaled scores: Perceptual Organisation Index

Sum of S Score	Percentile		Sum of S Score	Percentile	
	IS	Rank		IS	Rank
4	40	1	40	100	51
5	42	1	41	102	55
6	43	1	42	103	58
7	45	2	43	105	63
8	47	2	44	107	66
9	48	3	45	109	70
10	50	3	46	110	73
11	52	3	47	112	75
12	53	4	48	114	79
13	55	4	49	115	80
14	57	5	50	117	82
15	59	5	51	119	83
16	60	5	52	120	84
17	62	6	53	122	85
18	63	6	54	123	86
19	66	7	55	126	88
20	67	7	56	127	89
21	68	8	57	129	90
22	70	8	58	130	90
23	72	8	59	132	92
24	74	10	60	134	92
25	75	10	61	136	93
26	77	12	62	137	93
27	79	14	63	138	94
28	80	16	64	140	94
29	82	18	65	142	94
30	84	21	66	143	95
31	86	25	67	145	95
32	87	27	68	147	96
33	89	34	69	148	96
34	90	35	70	150	97
35	92	39	71	152	97
36	93	42	72	153	98
37	95	44	73	155	98
38	97	47	74	157	99
39	98	50	75	158	99.5
			76	160	99.9

Table 15: Index Score (IS) equivalents of sums of scaled scores: Freedom from Distractibility Index and Processing Speed Index

Sum of S Score	IS	Percentile Rank	Sum of S Score	IS	Percentile Rank
2	47	5	2	46	5
3	49	1	3	49	1
4	52	1	4	52	1
5	55	2	5	55	2
6	58	2	6	58	2
7	61	3	7	61	3
8	65	4	8	63	4
9	68	4	9	68	4
10	71	5	10	71	5
11	74	6	11	73	6
12	75	7	12	77	7
13	80	12	13	80	12
14	83	16	14	83	16
15	86	21	15	86	21
16	89	25	16	89	25
17	92	32	17	92	32
18	95	39	18	95	39
19	98	47	19	97	47
20	100	53	20	100	53
21	103	61	21	103	61
22	106	66	22	106	66
23	110	75	23	110	75
24	113	79	24	113	79
25	116	84	25	116	84
26	118	86	26	118	86
27	122	90	27	122	90
28	124	91	28	124	91
29	128	93	29	128	93
30	130	94	30	131	94
31	134	96	31	133	96
32	137	97	32	136	97
33	140	97	33	138	97
34	142	97	34	142	97
35	145	98	35	145	98
36	148	98	36	148	98
37	151	99	37	151	99
38	154	99.7	38	154	99.7

Directions for administration and scoring

1. Picture Completion

Introduction

Materials

Picture Completion items bound in the Stimulus Booklet
Stopwatch

Description of subtest

For each item in this subtest, the child is required to look at a picture and name or indicate by pointing the important part that is missing from the picture. The child must respond to each item within a 20-second time limit.

Start rules

- Ages 6-7 Sample item and then Item 1
- Ages 8-9 Sample item and then Item 5
- Ages 10-13 Sample item and then Item 7
- ✓Ages 14-16 Sample item and then Item 11

Allow corrections on the first two items administered for any age group. If a child aged 8-16 obtains perfect scores on both of the first two items administered give full credit for all preceding items.

Reversal rule

If the child aged 8-16 does not obtain a perfect score on either of the first two items administered, the earlier items are given in reverse sequence until the child obtains two consecutive perfect scores (counting the starting-point item). No corrections are allowed on these earlier items. If a child obtained a perfect score on the starting-point item (the first item administered), count it in the reverse sequence. When this criterion is met, give full credit for any preceding items that were not administered. Note that the child should be given both start items before reversing.

Discontinue rule

Discontinue after 5 consecutive failures.

Directions

- I Before presenting any items to the child, say:

I am going to show you some pictures. In each picture there is a part missing. Look at each picture carefully and tell me what is missing.

- I Place the Stimulus Booklet in front of the child, open it to the Sample item and say:

Now, look at this picture. What important part is missing?

Allow a maximum exposure time of 20 seconds.

If the child responds correctly, continue with starting-point item appropriate for the child's age by saying:

Now what is missing in this one?

This question may be shortened or eliminated when the child clearly understands the task.

- I If the meaning of the child's verbal response is ambiguous, say to the child:

Show me where you mean.

- I A maximum exposure time of 20 seconds is allowed for each picture.

- I If the child does not indicate the missing part on the Sample item within 20 seconds, say:

You see, the lead is missing (point).

If the child responds incorrectly or fails to respond within 20 seconds to Item 1 or Item 2, record a score of 0 points and say (for Item 1):

You see, the ear is missing (point)

or (for Item 2):

You see, the flap on the box is missing (point).

- I For all other items give no help. If the child does not indicate the missing part within 20 seconds, either by naming it or by pointing, record 0 points for that item and present the next item. If the child responds incorrectly, proceed to the next item even if the full 20 seconds have not elapsed.
- I The following cautions should be given, if necessary, but each caution may be given only once during the course of the subtest.

If the child merely names the object pictured, rather than the missing part, say:

Yes, but what's *missing*?

If the child mentions a part that is off the card, for example the legs of the man in Item 6 or the body of the woman in Item 14, note the response and say:

A part is missing *in* the picture. What is it that is missing?

If the child mentions an inessential missing part, for example "The thing to hold the paint bucket" in Item 13 (Stepladder), note the response and say:

Yes, but what is the *most important* part that is missing?

Scoring and recording

Record 1 point for each correct response and for each unadministered item preceding the child's starting point. An item is failed if a child responds incorrectly or does not respond within 20 seconds.

Most children give a verbal response for the missing part. Sometimes, however, a child will merely point. If the child points to the right place, give credit for a correct response; however, if the child points to the right place but spoils it by making a verbal response that is clearly incorrect, the item is failed. For example, on Item 16 (Bath) the child might point to the bath and say, "The water is missing." Also, for Item 17 (Light bulb) make sure the child points clearly to where the filament should be and not to the base of the bulb.

Some children may not know or recall the exact name of a missing part and they may use a synonym for it or describe it in their own words. Such a response is scored as correct. For example, on Item 10 (Chest of drawers), a child who says, "A thing you use to open or pull on" is given credit. The item instructions include in parentheses children's actual responses to some items. These responses are equally acceptable and should be given full credit.

You should be reasonably certain that a child's verbal response is correct before giving credit for an item. As indicated above, whenever there is any doubt, say:

Show me where you mean.

This is particularly important when the child uses an inexact or made-up word for the missing part, such as "Scratchers" instead of "Whiskers" for Item 3 (Cat). It is also crucial for items such as Item 27 (Telephone) where a child's verbal response is frequently incomplete. Thus a child who says "The wire" for Item 27 must be asked to point to the missing part to determine whether the child is referring to the correct wire; the item is failed if the child points incorrectly.

Item instructions

Item	Missing part
1 Fox	Ear
2 Box	Flap
3 Cat	Whiskers
4 Hand	Fingernail (on the fifth finger), nail, nail polish
5 Elephant	Leg (foot)
6 Man	Watch strap
7 Door	Hinge
8 Mirror	Reflection of doll (If the child says "The doll", say: Show me where you mean.)
9 Clock	Number 11, or 1 next to where the 11 should be
10 Chest of drawers	Knob
11 Belt	Holes (hole)
12 Leaf	Veins
13 Stepladder	Step (rung)
14 Woman's face	Eyelashes, eye make-up
15 Dice	6th dot on top side of right die (If the child says "The dot", say: Show me where you mean.)
16 Bath	Plug hole
17 Light bulb	Filament (wires)
18 Whistle	Slot (hole)
19 Piano	Black keys
20 Scissors	Screw (bolt)
21 Male profile	Eyebrow
22 Thermometer	Mercury (alcohol) in the bulb (If the child says "The mercury", "The alcohol" or "The red stuff", say: Show me where you mean.)

2. Information

Introduction

Materials

Questions for the Information subtest are included in this Manual.

Description of subtest

In the Information subtest, the child is asked a series of general information questions and is required to respond verbally.

Start rules

Ages 6–7	Item 1
Ages 8–10	Item 5
Ages 11–13	Item 8
Ages 14–16	Item 11

If a child aged 8–16 obtains perfect scores on the first two items administered, give full credit for all earlier items.

Reversal rule

If the child aged 8–16 does not obtain a perfect score on either of the first two items administered, the earlier items are given in reverse sequence until he/she obtains two consecutive perfect scores (counting the starting-point item).

When this criterion is reached, give full credit for any earlier items that did not have to be administered. Then proceed with the subtest until the discontinue criterion is met.

Discontinue rule

Discontinue after 5 consecutive failures.

Directions

I Say to the child:

I am going to ask you some questions, and I would like you to tell me the answers.

Read each question exactly as stated. If the response is not clear, it is permissible to say:

Explain what you mean or Tell me more about it.

Do not, however, ask leading questions or spell any words.

Item	Missing part
23 Trellis	A section (piece) of the lattice work
24 Orange	Segment line (vein) (If the child says "seeds", say: Tell me another part that is missing. Allow an additional 20 seconds.)
25 Goldfish	Gills
26 Supermarket	Labels on tins
27 Telephone	Wire (cord) connecting the receiver to the base of the telephone (If the child says "The wire" or "The cord", say: Show me where you mean.)
28 Umbrella	Spokes
29 House	Shadow of the tree (If the child says "The shadow", say: Show me where you mean.)
30 Tennis shoe	Eyelet

- 1 If the child fails Item 1, point to your nose again and say:

This is called a nose.

Encourage the child to verbalise the correct response. Then proceed to Item 2, but do not give any further help, except as indicated above.

Scoring and recording

Score 1 point for each correct response and 0 points for an incorrect response. If a child spontaneously gives an answer to an earlier item later during the subtest, allow this as an acceptable response.

Acceptable answers are noted below to the right of the question. Where several possible answers are listed (separated by three dots), the child need give only one—or one of the same calibre as the samples—to receive credit.

Maximum score: 30 points

Item instructions

Test question	Acceptable responses
1 What do you call this? (Examiner points to his/her nose.)	Nose
2 How many ears do you have?	Two (If the response suggests that the child heard, "How many years do you have?" repeat the question, emphasising the word 'ears'.)
3 How many legs does a dog have?	Four
4 What is the day that comes after Thursday?	Friday (If the child answers "Yesterday", "Today" or "Tomorrow," say: "What day is that?")
5 Name two kinds of coins.	Two coins of any currency (5p, 10p, 100 lire, 5 francs, dime etc.)

Administration and scoring

Test question	Acceptable responses
6 What month comes next after March?	April
7 How many days are there in a week?	Seven (If the child answers "Five", say: How many counting the weekend?)
8 What must you do to make water boil?	Heat it... Fill the kettle and switch it on...Put it on the cooker...Put a fire under it...Put it in the micro-wave...Turn the cooker on... (or any such response indicating that the water must be heated).
9 What are the four seasons of the year?	Summer, autumn, winter, spring (The child is not required to give them in this order. If the child names only three, ask for the fourth.)
10 How many hours are there in a day?	Twenty-four
11 How many things make a dozen?	Twelve
12 What does the stomach do?	Digests food... Prepares food for digestion...Turns food to juices (fluid, liquid)...Dissolves food...Processes food...Mixes food...Stores (holds) food...
13 Which month has one extra day every four years?	February
14 Who was Christopher Columbus?	An explorer... One of the people who discovered America...A sailor who discovered America... The man sent by King Ferdinand and Queen Isabella of Spain to establish a spice trade route...
15 Name three oceans.	The child must name three of the following oceans: Atlantic, Pacific, Indian, Arctic and Antarctic.
16 How is oxygen returned to the air?	Plants... Leaves...Photosynthesis... Trees... Flowers...

Administration and scoring

Test question	Acceptable responses
26 What is a barometer?	It indicates (measures) atmospheric pressure... It tells the amount of air pressure... It predicts changes in the weather... Tells weather forecasts... Tells if it's going to rain... A pressure gauge...
27 What causes iron to rust?	Oxygen... Combining with oxygen... Oxidation... A chemical reaction... Mixing with moist air... Moisture in the air... Moisture on the iron... (If the child answers "Air" or "Water", say: Yes, but what is it in the air [water] that causes iron to rust?)
28 How far is it from London to Edinburgh? (Republic of Ireland: How far is it from Dublin to Cork?) <i>Answer: 1000 miles</i>	Any answer from 350 to 450 miles or 560 to 720 kilometres (Dublin to Cork: any answer from 130 to 190 miles or 200 to 300 kilometres) If the child gives a response such as "A few hours by train", say: How far is it in miles or kilometres?)
29 Who was Charles Darwin? <i>Teacher's note: ...</i>	He developed the theory of evolution... He started the thing about evolution... Studied evolution... Thought up the theory (wrote a book) that man came from monkeys... Wrote <i>Origin of Species</i> ... (For credit, the child must associate Darwin with evolution. If the child says "A scientist", "A biologist" or "A writer", say: What was he most famous for?)
30 What does aluminium come from?	Bauxite (If child answers "Ore", say: What kind of ore? The child must mention bauxite to obtain score.)

3. Coding

Introduction

Materials

- Coding level A and Coding level B included in the Record Form
- Two pencils without erasers
- Stopwatch
- Coding scoring key

Description of subtest

For this subtest the child copies simple symbols that are paired with simple geometric shapes (Coding A) or with numbers (Coding B). Using a key, the child draws each symbol in its corresponding shape (Coding A) or under its corresponding number (Coding B). The child's score is determined by the number of symbols correctly drawn within the 120-second time limit.

Start rules

All items are attempted using the appropriate level of the test for each child. Administer Coding level A to children aged 6–7 years and Coding level B to children aged 8 years or older.

Time limit

120 seconds

Recording and scoring

Record 1 point for each correctly drawn symbol. Do not include the responses to the Sample items in the child's score.

Use the acetate key to check responses and count the total number correct. A response is scored as correct even if the symbol is drawn imperfectly but is clearly identifiable as the keyed symbol. For example, on Coding A if the child has drawn two approximately parallel lines in the circle, do not penalise the response even if those lines intersect, are not exactly horizontal or are not of equal length.

Also give credit if the child, after realising he or she has made a mistake, spontaneously draws the correct symbol next to or on top of the incorrect figure.

Scores for Coding A

Accurate recording of the completion time on the Record Form is essential. Use the acetate key to check responses and count the total number correct. Record 1 point for each correctly drawn symbol.

Administration and scoring

Time bonuses are allocated for Form A of this subtest whenever all items are completed correctly within the 120 seconds time limit.

Coding A: Bonus points and total scores for perfect performance

Completion time in seconds	Bonus points	Total subtest score
0 – 85	+6	65
86 – 95	+5	64
96 – 100	+4	63
101 – 105	+3	62
106 – 110	+2	61
111 – 115	+1	60
116 – 120	+0	59

Maximum score, Coding A: 65 points

Scores for Coding B

Use the acetate key to check responses and count the total number correct. Record 1 point for each correctly drawn symbol.

There are no bonus points for Coding B. The total score is the number of correctly drawn symbols.

Maximum score, Coding B: 119 points

Coding A directions (Ages 6–7)

Place the Coding Response Sheet A before the child. A smooth drawing surface **must** be provided. If the table has a rough surface, the Response Sheet should be placed over a piece of cardboard. Have two pencils on hand in case one is broken during the test.

Hand the child a pencil without an eraser. Pointing to the key above the test items, say:

Look here and you will see a star, a ball, a triangle and these other things. See, the star has a line up and down like this (point); the ball has two lines across (point), the triangle has one line across like this (point), the cross has a little circle in the centre (point) and the box has two straight lines up and down (point).

Pointing to the Sample items and test items, say:

Now look down here (point) where you see the balls, the stars, the boxes, and other things all mixed up but without any marks in them. I want you to fill in the things here with the same marks they have at the top.

Pointing to the first Sample item, say:

This is the way to do it. Here is a ball. Let's look up at the top and find the ball (point). You see, it has two lines going this way (point). So you put the two lines in this ball like this (draw the two lines in the ball on the first Sample item, using a pencil).

Pointing to the second Sample item, say:

The star has one line going up and down, so you put the same mark in here (draw the line in the star).

Now you do the others until you get to this line. (Point to the line that separates the last Sample item from the first test item.)

Allow the child to work alone on the remaining Sample items. Praise the child's success on each Sample item by saying Yes or Right

If the child makes a mistake, point it out immediately. Using a Sample item the child has made a mistake on or is having difficulty with, explain and demonstrate again, using such words as:

You see, this is a triangle and it has a straight line in it, so you put the straight line in here (point), or This is a cross, and since it has a little circle in it you put the little circle in the cross here (point).

Do not begin the actual test until the child clearly understands the task.

Administration and scoring

During the Sample exercise, you may notice that a left-handed child blocks or partially blocks the key as he or she fills in the symbols. If this occurs, place an extra Coding A worksheet to the right of the child's worksheet so that the extra key is aligned with the one that the child's hand is blocking. Have the child complete the Sample items by looking at the separate key so that the child will be accustomed to it when the actual test begins.

When the Sample exercise has been completed and the child understands what to do, say:

When I tell you to start, you do the rest of them.

Pointing to the first test item, say:

Begin here and fill in as many things as you can, one after the other, without skipping any. Keep going until I tell you to stop. Work as quickly as you can without making mistakes. When you finish this line (sweep across the first row with your finger), go on to this one (point to the first item in row 2).

Say:

Go ahead.

Begin timing. If the child omits an item or starts to do only one type (e.g. only the stars), say:

Do them in order. Don't skip any.

Point to the first item the child omitted and say:

Do this one next.

Give no further assistance except to remind the child to continue until told to stop (if necessary). If the child finishes before the time limit has expired, record the time on the Record Form.

At the end of 120 seconds, say:

Stop.

Coding B directions (Ages 8–16)

Place the Response Sheet B before the child. A smooth drawing surface must be provided. If the table has a rough surface, the Response Sheet should be placed over a piece of cardboard.

Hand the child a pencil without an eraser. Then point to the key above the test items and say:

Look at these divided boxes. You see, each box has a number in the top part (sweep your finger along the numbers) and a special mark in the bottom part (sweep your finger along the marks). Each number has its own mark. (Point to the number 1 and its mark, then to the number 2 and its mark.)

Pointing to the Sample items, say:

Now look down here where the boxes have numbers in the top part but the squares on the bottom are empty. You are to put in the empty squares (point to the first several Sample spaces) the marks that should go there, like this.

Point to the first Sample item and say:

Here is a two.

Point to the symbol below the 2 in the key and say:

The two has this mark, so I put it in this square, like this. (Draw in the symbol using a pencil.)

Point to the second Sample item and say:

Here is a one.

Point to the symbol below the 1 in the key and say:

The 1 has this mark, so I put it in this square. (Draw in the symbol.)

Pointing to the third Sample item, say:

This is the number four.

Point to the symbol below the 4 in the key and say:

The four has this mark, so I put it in this square. (Draw in the symbol.)

After demonstrating the first three Sample items, say:

Now you fill in the rest of these boxes up to this heavy line. (Point to the line.)

Administration and Scoring

For each Sample item done correctly, offer praise such as Yes or Right, and finally say:

Now you know how to do them.

If the child makes an error on a Sample item, point it out immediately and show the child again how to use the key. Continue to help the child if necessary until the seven Sample items have been filled in correctly. Do not proceed with the test until the child clearly understands the task.

During the Sample exercise, you may notice that a left-handed child blocks or partially blocks the key as he or she fills in the marks. If this occurs, place an extra Coding B worksheet to the right of the child's worksheet so that the extra key is aligned with the one that the child's hand is blocking. Have the child complete the Sample items by looking at the separate key so the child will be accustomed to it when the actual test begins.

When the Sample exercise has been completed successfully, say:

When I tell you to start, you do the rest of them.

Point to the first test item and say:

Begin here and fill in as many squares as you can, one after the other, without skipping any. Keep going until I tell you to stop. Work as quickly as you can without making mistakes. When you finish this line (sweep across the first row with your finger), go on to this one (point to the first item in row 2).

Say:

Go ahead.

Begin timing. If the child omits an item or starts to do only one type (e.g. only the 3s) say:

Do them in order. Don't skip any.

Point to the first item the child omitted and say:

Do this one next.

Give no further assistance except to remind the child to continue until told to stop (if necessary).

At the end of 120 seconds, say:

Stop.

4. Similarities

Introduction

Materials

Stimulus words for Similarities are included in this Manual and on the Record Form.

Description of subtest

In this subtest the child is asked how two stimulus words are similar. The words represent objects or concepts and are presented orally to the child. The child must respond verbally.

Start rules

All ages Item 1

Discontinue rule

Discontinue after 4 consecutive failures.

Directions

I Say to the child:

Now I am going to say two words and ask you how they are alike. For example, if I ask, "How are red and blue alike?" you would say, "They are both colours."

I Now proceed to Item 1 and say:

In what way are a piano and a guitar alike? How are they the same?

If the child says that they are not alike, fails to respond, or gives a wrong answer, say:

They are both musical instruments and you can play them.

I Then proceed to Item 2 and say:

Now tell me, in what way are a candle and a lamp alike?

If the child fails, say:

They both give light.

I Then go on to Item 3 but give no help on this item or on Item 4.

I Items 1-5 are scored 1 or 0, whereas the remaining items in the test are scored 2, 1 or 0. To provide the child with the proper set for responding to the multi-point items, the following help may be given. If the child gives a 1-point

answer to Item 6, give an example of a 2-point response. For example, if the child answers Item 6—Apple-Banana with “You eat them both”, say:

That’s right, you do eat them both. Also, they both are fruits.

This kind of help may be given only on Item 6.

- 1 Say the items slowly. If the child’s response is unclear or ambiguous, or appears on the list of sample responses followed by a (Q), say:

Explain what you mean or Tell me more about it.

Scoring and recording

Items 1–5 are scored 1 or 0; Items 6–19 are scored 2, 1 or 0. Listed below each item are sample responses for each point level. See Chapter 3, pp. 46–50, for an explanation of the features of the sample-response format. The sample responses are illustrative, not exhaustive. For Items 6–19, use the following general criteria in addition to the sample responses to determine the number of points a child’s response merits.

2-point response

This expresses any general classification that is primarily pertinent for both members of the pair. The response should describe a universal property of both objects or concepts or a category common to both (e.g. “A *cat* and *mouse* are both animals”, “An *apple* and a *banana* are fruits”).

1-point response

This expresses any specific property or function that is common to both objects or concepts and constitutes a relevant similarity (e.g. “A *cat* and a *mouse* have four legs”). Also give 1 point for less pertinent but correct general classifications (e.g. “An *apple* and a *banana* are foods”).

0-point response

This expresses a specific property of either member of the pair that is not pertinent to both members (e.g. “An *apple* is round and a *banana* is long”); generalisations that are incorrect (e.g. “An *apple* and a *banana* are vegetables”) or not pertinent (e.g. “An *apple* and a *banana* both have juice”); differences between the members of the pair; or clearly wrong answers.

The degree of abstraction of the child’s response is an important determinant in scoring Items 6–19. That is why pertinent general categorisations are given 2 points, whereas the naming of one or more common properties or functions of the members of a pair (a more concrete problem-solving approach) merits only 1 point. Thus, stating that an *elbow* and a *knee* (Item 8) are ‘both joints’ (their general category) earns a higher score than saying, ‘both help you move’ (a main function of each). Similarly, the response that *anger* and *joy* (Item 9) are ‘feelings’

or 'emotions' is less concrete (hence worth a higher score) than describing them as 'ways you feel'.

Of course, even a relatively concrete approach to solving the problem ("A *telephone* and a *radio* both have plugs") requires the child to abstract something similar about the members of the pair. Some children are unable to do this and may respond to each member separately rather than to the pair as a whole ("Your *elbow's* in your arm, and your *knee's* in your leg"). Although such a response is a true statement, it is scored 0 because it does not give a similarity.

Maximum score: 33 points

One-point items and sample responses

1 In what way are a PIANO and a GUITAR alike? How are they the same?

1 point

- Both instruments; musical instruments
- Make music
- Play them both
- Both can play tunes (songs, notes)
- Both have strings
- Use fingers to play them
- Require tuning

0 points

- Play or make sounds (noise) (Q)
- Sing with them (Q)
- Sound (play) alike
- You can hear (listen to) them (Q)
- Both made of wood
- In a band

2 In what way are a CANDLE and a LAMP alike?

1 point

- Both provide (produce, give) light
- Illuminate; make things brighter; glow; shine
- Burn if you touch them
- Give heat
- Use them at night (when it's dark)
- Both make shadows

0 points:

- Straight; round
- Both have fire (flames)
- Electric
- Let you see (Q)
- Turn (go, cut) on or off

3 In what way are a SHIRT and a SHOE alike?

1 point:

- Both are clothes (dress, articles of clothing)
- You wear (get dressed with) them
- Cover (put them on) your body
- Keep you warm; provide cover (protection) for your body
- Both part of an athletic (football, sports) kit

0 points:

- Both tie (fasten, zip, button, have holes)
- Both cost money
- You put your arms in a shirt and your foot in a shoe

4 In what way are a WHEEL and a BALL alike?

1 point:

- Both are round (same shape, circles)
- Both roll (rotate, turn, spin)
- Go round (in a circle)

0 points:

- Toys; can play with them
- Both bounce
- Both move (Q)
- Both have air (rubber)
- You can ride them

5 In what way are MILK and WATER alike?

1 point:

- Both are liquids (fluids)
- You drink both; something you drink
- Quench thirst
- Nutritious; good for you

0 points:

- You could spill them
- Both are wet
- Both things you pour
- Both are food
- Substances (Q)
- Both in a jug

Two-point items and sample responses

6 In what way are an APPLE and a BANANA alike?

2 points: *A response indicating that both are fruits.*

1 point:

- Both are foods (sweet)
- Both are eatable (edible)
- You eat them
- Can use both to make pies and cakes
- Both have peel (skin, a cover, seeds)
- Both grow on trees
- Both nutritious (give energy, have calories, have vitamins)
- The good part is inside

0 points

- Both are round (long, small, yellow)
- Same kind of skin
- They're soft
- Both have juice
- Taste the same
- Good for you (Q)

7 In what way are a CAT and a MOUSE alike?

points: *A response indicating that they are animals, mammals, creatures, living things.*

- Both are alive
- Both are vertebrates
- Both are warm-blooded
- They're different kinds of animals

1 point:

- Both have tails (whiskers, fur, hair, nails, eyes, four legs)
- Both walk (move, run, make sounds)
- Both eat food (sleep, scratch)
- Both can see in the dark
- Both are pets

0 points:

- Both eat the same food (eat cheese, steal food)
- They chase each other
- They don't like each other
- Both have the same colour fur
- Both live in the house

8 In what way are an ELBOW and a KNEE alike?

2 points: *A response indicating that they are both joints or both like hinges, or are both the middle part of a limb.*

- They're joints (hinged, where your bones join up, jointed)
- Both like a hinge; work like a hinge
- Both places where you bend a limb
- Both are middle of a limb
- Holds both parts of your arm or leg together
- Like a ball and socket
- Both pivot

1 point:

- Both parts of body (anatomy)
- Both are bones (bones that connect, bones that hold together other bones)
- Both have sockets (Q)
- Both bend (help you move)
- Make you have a reflex
- They work up and down (Q)

0 points

- They connect (Q)
- Both move (break) (Q)
- They are curved (round, covered with skin, hard)
- They have a little knot (rough skin, muscle, the same colour)

9 In what way are ANGER and JOY alike?

2 points: *A response classifying both as feelings, emotions, emotional reactions or moods.*

- Both express feelings (emotions)
- Both types of feelings (emotions, moods)
- Mental states
- Reactions (Q)—emotional
- Signs of how you feel
- The way you feel (Q)—how you react, your emotions

1 point:

- Responses; reactions; attitudes; expressions (Q)
- Both inside us
- Both are the way you feel (Q)
- You can express (show) both
- Looks on your face

0 points:

- Opposites
- Sometimes you're cross and sometimes you're happy
- Signs; actions
- Part of you (your image)
- Things you do
- Making faces (Q)

10 In what way are a TELEPHONE and a RADIO alike?

2 points: *A response classifying both as means of communication.*

- Communication
- Both ways of communicating
- Communication devices (instruments)

2 points:

- You can listen to (talk on, speak through) both
- You can hear things (sounds, people) on both
- Have speakers (plugs, wires, antennae, buttons)
- Both use electricity
- Both are sources of information (news)
- Both are ways of sending (receiving) messages
- Both are man-made

0 points:

- Both make noise (sound, music)
- Hear; hearing (Q)
- Both are machines (appliances)
- Play them
- Both have numbers
- Turn on and off

11 In what way are a PAINTING and a STATUE alike?

2 points: *A response indicating that both are works, types, pieces, forms, kinds or representations of art.*

- Both are made (created, done) by artists
- Both are artistic expressions
- Both art
- Both creative works

1 point:

- People make them
- Represent something (people, places, things)
- Symbols (Q)
- Artistic; creative (Q)
- Found in a museum
- Express ideas (emotions)

0 points:

- Have designs (shapes, colours, figures)
- Both objects (sculptures, decorations)
- Both images (feelings, expressions) (Q)
- Both make (show, paint) pictures
- You paint (make, build, draw, look at) them
- Both capture things at a certain moment

12 In what way are a FAMILY and a TRIBE alike?

2 points: *A response indicating that both are related groups of people.*

- Both have common ancestry (relatives, kin, blood)
- Groups of people who live (band, stay, belong) together
- Groups of united people
- Both have their own culture; groups within a culture; organisations of culture
- Social groups

1 point:

- Both have members (generations)
- Both groups of people (Q)
- Relations (Q)
- Both have their own customs (Q)
- Both take care of (depend on, help, are committed to) each other
- Live close together

0 points:

- People; groups (Q)
- Both together (Q)
- Both families; ethnic groups
- Ancestors; households

13 In what way are ICE and STEAM alike?

2 points: *A response indicating that both are a form or state of water.*

- Both are physical changes in water
- Both water in a different form (state)

1 point:

- Both are water (water by-products) (Q)
- Both are made of (come from) water
- At certain points they were water (Q)
- Part of the water cycle
- Both can become a liquid
- Both have chemicals in them
- Both states of matter

0 points:

- Both wet (hot and cold, frozen, melted)
- Both give off smoke (fog, mist)
- Both can make each other (Q)
- Both liquids (gases)
- Condensation; evaporation

14 In what way are TEMPERATURE and LENGTH alike?

2 points: *A response indicating that both are kinds of measures or measurement.*

- Units of measurement; both have to do with measurement
- Both are measured in numbers
- Different types of measures
- Both are ways of measuring something
- Systems (types) of measurement

1 point:

- Both measure something
- Both have amount (give exact amount; have numbers to tell amount)
- Both are scales (can be shown on a scale)
- Both are quantities (have something to do with size)
- So much in each

0 points: *Any reference to fever or illness*

- Tell how much something is (Q)
- Measured in degrees
- Both rise (stretch, extend, expand)
- Both are long (give distance)
- Both give numbers

15 In what way are a MOUNTAIN and a LAKE alike?

2 points: *A response calling them both topographical, geographical or natural features of the earth or the environment.*

- Both parts of nature (the environment)
- Features of the environment
- Physical characteristics of the earth
- Made by nature (Mother Nature, God)
- Part of the terrain (earth's surface)
- Land forms; formations

1 point

- Both nature (Q)
- Both can be used as landmarks; both on a map
- Both natural resources
- Both for recreation (holidays, camping)
- Both formed by weather
- Both part of the earth

0 points

- Places to have fun (play) (Q)
- Places to go (climb, swim) (Q)
- Can be big (beautiful, high)
- Things to look at (Q)
- Both have water (dirt, rocks, animals)
- Both outside (in the country, out in woods)

16 In what way are RUBBER and PAPER alike?

2 points: *A response indicating that they are both made or manufactured from natural resources or trees.*

- Both come from (are made from, are by-products of) trees
- Both are made from natural resources

1 point:

- Both are materials (Q)
- Both are man-made (manufactured) (Q)
- Both are used to make things

0 points:

- Both are flexible (bendable, rough, smooth, flat)
- Can use them (Q)
- School (office) supplies
- Textiles (substances)
- Both recyclable (burn)

(If the child's answer refers to rubber as an eraser, say: Not a rubber but rubber and repeat the question.)

17 In what way are FIRST and LAST alike?

points: A response calling them extremes, extremes of position or positions in a series.

- Both are extremes; extreme placements (positions)
- Both are end points; both on (at) opposite ends; each one is at the end of a line; end points in a numerical sequence
- Both are part of a chronological sequence
- Positions (places) in a series

point:

- Both are places(Q) —in a race or competition
- Both ends(Q)
- Both in some kind of position(Q)
- Positions; places on a line
- In a sequence
- Designated points; points in time
- Rank; standings
- Both orders (ways of putting things in order)
- Both on a scale (part of a number scale)
- Placements

points:

- Places; points(Q)
- Beginning and end; front and back
- Numerical order(Q)
- Have to do with time(Q)
- Like a line or queue(Q)
- In a race, you can come in first or last
- Both numbers

18 In what way are the numbers nine (9) and twenty-five (25) alike?

? points: A response stating that they are both perfect squares or have odd-number square roots.

- Both are squares (perfect squares)
- Square root is odd
- Square root is a whole number
- Numbers to a second power

1 point:

- Both are odd (uneven) numbers(Q)
- Not divisible by 2(Q)
- Both have a square root

0 points: *Reference to a mathematical function, for example, together they are 34 c both can be divided.*

- Both are numbers
- Both are prime numbers (opposite numbers, positive numbers)
- Used for counting

(If a child gives a 1-point response to Item 18 that should be queried, ask How else are the numbers nine and twenty-five alike?)

19 In what way are SALT and WATER alike?

2 points: *A response indicating that both are necessary for life or are chemical compounds.*

- People use them to live; things we need in our bodies
- Basic things for our bodies
- Both chemical compounds

1 point:

- Compounds (Q)
- Both have chemicals in them (Q)
- Natural substances
- Both made of minerals
- Both mixtures of different elements (Q)
- Ingredients
- Used to cook with
- Both edible (Q)
- Body perspires them
- Both found in the ocean (sea)
- Put them both in food

0 points:

- Both substances (resources, have elements) (Q)
- Minerals, chemicals
- Organic compounds
- Salt dissolves in water
- Eat and drink them

Directions

1 For each item, arrange the picture cards in the specified mixed-up order in front of the child. The dot patterns on the back of the cards indicate the order for laying out the cards, from the child's left to right. Ask the child to arrange the pictures so that they make a logical story. The numbers, also printed on the back, provide the code for scoring.

1 Each card can be identified by the information on its back.

The number in the top left-hand corner indicates the order in which the child should arrange the cards.

The dot pattern in the top right-hand corner indicates the sequence for laying out the cards in front of the child.

The number in the centre is the subtest item number

1 Record the order in which the child arranges the cards in the column 'Order' on the Record Form for each item attempted (and for each trial of Items 1 and 2). Also, record the exact time the child takes to complete each item (or each trial). If the child exceeds the time limit, note this on the Record Form, stop the child, and proceed to the next item. The time limits are shown on the Record Form. Failure on an item can be due either to incorrect order or to failure to complete an item within the allotted time. Timing for each item begins when the last word of the directions is given. Accurate recording of timing information is essential for items 3–14 because bonus points are awarded for quick, correct answers.

1 Occasionally a child will place the cards from his or her right to left, thus beginning the story at the right instead of at the usual left. If this occurs, ask the child:

Where does your story begin?

If the sequence is correct according to the starting point indicated, give credit for the response.

Scoring and recording

Items 1–2

Record 2 points for passing on the first trial and 1 point for passing on the second trial. For either Item 1 or Item 2, if the child correctly arranges the cards on Trial 1, do not administer Trial 2.

Item	Time limit in seconds	Score for correct response	
		Trial 1	Trial 2
1	45	2	1
2	45	2	1

Items 3–14

Record 2 points for correct arrangement of the cards within the time limit. For Item 12 there are two arrangements either of which receives full credit. For Item 14, there is an alternative arrangement that is given partial credit (1 point) and no bonus points. For Items 3–14, you should stop timing when the child is obviously finished, even if the child neglects to tell you. Failure on an item can be due to either incorrect order or failure to complete the item within the allotted time.

Item	Correct response	Time limit in seconds	Points
3	1234	45	2
4	1234	45	2
5	12345	45	2
6	1234	45	2
7	12345	45	2
8	12345	45	2
9	12345	45	2
10	1234	45	2
11	12345	45	2
12	123456	60	2
	(456123)	60	2
13	1234	60	2
14	123456	60	2
	(654321 = 1 point)	60	1

Bonus points

Item	Completion time in seconds			
	1–5	6–10	11–15	16–45
3	1–5	6–10	11–15	16–45
4-11	1–10	11–15	16–20	21–45
12	1–10	11–15	16–25	26–60
13	1–10	11–15	16–25	26–60
14	1–20	21–25	26–30	31–60
Score	5	4	3	2

Maximum score: 64 points

Item instructions

Sample Item (i)

Place the three cards in order of dot patterns (one-dot to the child's left, two-dots in the middle and three-dots to the child's right) in front of the child and say:

These pictures tell a story about a woman getting something to drink. The pictures are in the wrong order now. Watch how I put them in the right order so they tell a story that makes sense.

After putting the cards in the correct order, point to each card in turn and say:

First, the woman is getting money out of her purse. Then she is putting money into the machine to buy the drink. Finally, she is drinking

Allow the child to look at the correct sequence for about 10 seconds. Then put the cards away and proceed with Item 1.

Item 1 (Trial 1)

Place the three cards (in order of dot patterns) in front of the child. Say:

These pictures tell a story about a girl playing. The pictures are in the wrong order now. See if you can put them in the right order so they tell a story that makes sense.

Start timing and allow 45 seconds. If the child arranges the cards in the correct order within the time limit, proceed to Item 2.

If the child does not arrange the cards in the correct order, administer Trial 2 of Item 1.

Item 1 (Trial 2)

Put the cards in their original mixed-up order. Say:

Watch how I do it.

Arrange the cards correctly in front of the child. Then point to each card in turn and say:

First, the girl is climbing the slide. Next, she is at the top of the slide. Finally, she is sliding down the slide.

Allow the child to look at the correct sequence for about 10 seconds and then put the cards in their original mixed-up order. Say:

Now I want you to try it again. Put the pictures in the right order so they tell a story that makes sense.

Start timing again and allow 45 seconds. If the child does not arrange the cards correctly on the second try, proceed to Item 2.

Item 2 (Trial 1)

Lay out the cards in order of dot patterns and say (while laying out the cards):

These pictures tell a story about a picnic. The pictures are in the wrong order now. Put them in the right order so the story makes sense.

Start timing and allow 45 seconds. If the child arranges the cards in the correct order within the time limit, proceed to Item 3.

If the child does not arrange the cards correctly, administer Trial 2 of Item 2.

Item 2 (Trial 2)

Say:

That's not quite right.

Put the cards in their original mixed-up order. Then take the second card out of the array and place it below the other two cards, at the child's left. Point to it and say:

This picture belongs first in the story; it shows a man and a woman walking with a dog following them. Now use these pictures (point to the two remaining cards) to finish the story. Put them in the right order, after the picture of a man and a woman walking with a dog following them, to tell the story.

Use these same words even if the child originally placed the second card in the correct position. Start timing again. After 45 seconds proceed to Item 3 even if the child does not arrange the cards correctly on the second try.

Item 3

Before laying out the cards for Item 3, say:

Here I have some more pictures that I want you to arrange. Each time, I will give them to you in a mixed-up order.

While laying out the cards, say:

I want you to arrange these pictures in the right order so they tell a story that makes sense. Work as quickly as you can. Tell me when you have finished.

Start timing and allow 45 seconds for Item 3.

If a child aged 9–16 does not arrange the cards in the correct order within the time limit, administer Items 1 and 2 in the normal sequence before proceeding to subsequent items. If a child aged 9–16 fails the first trial of either Item 1 or 2, provide the help indicated with those items.

On this item and all others that follow, stop timing when the child has obviously finished, even if he or she neglects to tell you.

Items 4–14

Follow a similar procedure for the remaining items. While laying out the cards for each item, say:

Now arrange these pictures in their right order so they tell a story that makes sense. Try to work as quickly as you can. Tell me when you have finished.

(These instructions may be shortened when the child clearly understands what to do.) Then start timing. Allow 45 seconds for Items 4–11 and 60 seconds for Items 12–14, as indicated above.

6. Arithmetic

Introduction

Materials

- Arithmetic problems included in this Manual
- Pictures bound in the Stimulus Booklet for Items 1–5
- Stimulus Cards for Items 19–24
- Blank card
- Stopwatch

Description of subtest

In this subtest the child is asked to solve mentally a series of arithmetic word problems.

- For Items 1–5, the examiner presents the pictures to the child and reads aloud the problems related to them.
- For Items 6–18, the child solves problems that the examiner reads aloud.
- For Items 19–24, the child is presented with a card on which the problem is printed. The child reads the problem aloud (unless he or she has a reading difficulty).
- The child is required to solve all problems mentally without use of paper or pencil.

Start rules

Age 6	Item 1
Ages 7–8	Item 6
Ages 9–12	Item 12
Ages 13–16	Item 14

If a child aged 7–16 obtains perfect scores on the first two items administered, give full credit for all earlier items.

Reversal rule

If the child aged 7–16 does not obtain a perfect score on either of the first two items administered, the preceding items are given in reverse sequence until two consecutive perfect scores are obtained (counting the starting-point item). When this criterion is reached, give full credit for any earlier items that were not administered. Then proceed with the subtest until the discontinue criterion is met.

Discontinue rule

Discontinue after three consecutive failures.

Bonus points

For Items 19–24 (the last six items), one bonus point is given if the item is successfully completed in 10 seconds or less.

Time limit

Items 1–17	30 seconds
Item 18	45 seconds
Items 19–24	75 seconds

Directions

- Items 1–18 are read to the child and Items 19–24 are printed on the Stimulus Cards for the child to read aloud. If a child has a visual problem or difficulty reading, you may read Items 19–24 aloud to the child.
- There is a time limit for each item. Begin timing immediately after the item has been read. Accurate recording of completion times is essential because the child may receive bonus points on Items 19–24 for quick, correct responses.
- An item may be repeated once if the child requests it, or if it is apparent that the child failed to understand. However, the timing always begins at the end of the first reading of the problem.
- The child may not use pencil and paper for any problem, but do not discourage the child from using a finger to 'write' on the table.
- If the child spontaneously changes a response, score the second response, provided it is given within the time limit. If the child does not clearly indicate which of the two responses is the final choice, say:

You said ... and Which one do you mean?

Score the child's final choice.

Scoring and recording

Record 1 point for each correct response and 0 points for an incorrect answer. Give credit if the child spontaneously corrects an incorrect response within the time limit. For Items 19–24, record an additional bonus point for each problem correctly solved in 1–10 seconds.

If the numerical quantity of a response is correct but the child does not state units (e.g. pounds), give credit.

Maximum score: 30 points

Item instructions

For Items 1–5, use the Stimulus Booklet

For Items 3–4, also use the blank card.

Item	Time limit (in seconds)	Correct response
1 Place the Stimulus Booklet in front of the child, open the Booklet to Item 1 and say: Count these birds with your finger. Count them out loud so I can hear you.	30	Counting correctly from 1 to 3

If the child counts the birds correctly from 1 to 3, proceed to Item 2. If the child counts incorrectly (even if he or she ends with 3), say:
Watch me and listen carefully.

Then count the 3 birds aloud from the child's left to right at the rate of about 1 per second before proceeding to Item 2.

Note that the same page is used for Items 2, 3 and 4

2 With page 2–4 in front of the child, say: Count these trees with your finger. Count them out loud so I can hear you.	30	Counting correctly from 1 to 12
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If the child counts the trees correctly from 1 to 12, proceed to Item 3. If the child counts incorrectly (even if he or she ends with 12), say:
Watch me and listen carefully.

Count the 12 trees aloud from the child's left to right at the rate of about one per second.

Proceed to Item 3.

Item	Time limit (in seconds)	Correct response
<p>3 With page 2–4 in front of the child, hand the blank card to the child and say: Take this card and cover up all of the trees except 4. Leave 4 trees showing.</p> <p>If the child does not understand the meaning of ‘cover up’, explain the concept (without using the cards for demonstration) and then repeat Item 3.</p>	30	Leaving 4 trees showing
<p>4 Make sure the child has the blank card. With page 2–4 in front of the child, say: Now cover up all of the trees except 9. Leave 9 trees showing.</p>	30	Leaving 9 trees showing
<p>5 Turn to page 5. Pointing to the ice cream cones, say: How many ice creams will be left if each child (point to the group of children) eats one?</p>	30	2
<p>Read Items 6–18 aloud to the child.</p>		
<p>6 If I cut an apple in half, how many pieces will I have?</p>	30	2
<p>7 John had 4 pence and his mother gave him 2 more. How many pence did he have altogether?</p>	30	6
<p>8 Joseph has 5 cakes. He gives 1 to Sam and 1 to Alice. How many does he have left?</p>	30	3
<p>9 Barbara had 5 books. She lost 1. How many books did she have left?</p>	30	4
<p>10 How many are 2 pencils and 3 more pencils?</p>	30	5

Item	Time limit (in seconds)	Correct response
11 If you have 10 pieces of chocolate and eat 3, how many pieces do you have left?	30	7
12 If you have 3 rulers in each hand, how many rulers do you have altogether?	30	6
13 Jim had 8 crayons and he bought 6 more. How many crayons did he have altogether?	30	14
14 A girl had 12 newspapers and sold 5. How many newspapers did she have left?	30	7
15 At £8 each, how much will 3 T-shirts cost?	30	£24
16 A shop had 25 cartons of milk and sold 14 of them. How many cartons were left?	30	11
17 Phil earned £36; he was paid £4 an hour. How many hours did he work?	30	9
18 If you buy 2 dozen pencils at 45 pence a dozen, how much change should you get back from £1?	45	10 pence

Items 19–24 are presented to the child from the Stimulus Cards. Select the Card for Item 19, place it in front of the child, and say:

Read this problem aloud. After you have read it, work it out in your head. Tell me your answer when you have finished.

For each of Items 20–24, say:

Now read this aloud and tell me your answer.

Begin timing as soon as the child has finished reading the problem aloud. If it becomes apparent that the child cannot read the problems, then you should read them to the child.

Item	Time limit (in seconds)	Correct response
19 Mary has twice as much money as Carol. Mary has £17. How much money does Carol have?	75	£8.50
20 If 3 boxes of biscuits cost £5, what is the cost of 24 boxes of biscuits?	75	£40
21 Becky bought a second-hand bicycle for £28. She paid two-thirds of what the bicycle cost new. How much did it cost new?	75	£42
22 Dave had 9 blue pens, 6 red pens, and 5 black pens in his desk. He picked out 1 pen without looking. What was his chance of picking out a red pen?	75	3 in 10 6 in 20 or 30%
23 Sarah's parents went on a car journey. They drove for 3 hours, stopped to eat lunch for 1 hour, and drove for another 2 hours. They drove a total of 225 miles. What was their average speed while driving?	75	45 m.p.h.
24 Six people can wash 40 cars in 4 days. How many people would be needed to wash all 40 cars in half a day?	75	48

7. Block Design

Introduction

Materials

- Nine blocks (cubes) each with two red sides, two white sides and two red-and-white sides
- Items 1–2 printed in this Manual
- Items 3–12 on cards bound in the Stimulus Booklet
- Stopwatch

Description of subtest

In this subtest, the child is shown a two-colour design and is asked to replicate it manually using the blocks. There are two-block, four-block and nine-block designs.

Start rules

- Ages 6–7 Item 1
- Ages 8–16 Item 3

If a child aged 8–16 passes the first trial of Item 3, give full credit for all earlier items and proceed to Item 4.

Reversal rule

If a child aged 8–16 fails the first trial of Item 3, administer the second trial. Then, regardless of whether the child passes or fails the second trial, administer Items 1 and 2 before proceeding with Item 4.

Discontinue rule

Discontinue after 2 consecutive failures. Items 1–3 are considered failed only if the child fails both trials.

Additional note

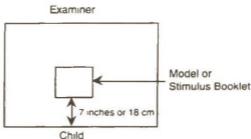
Items 1, 2 and 3 are two-trial items for all children. The second trial is administered only if the first trial is failed.

Time limits

- Item 1 30 seconds
- Items 2–5 45 seconds
- Items 6–9 75 seconds
- Items 10–12 120 seconds

Directions

- 1 The child works directly from block models that you construct for Items 1–2, and from printed cards for Items 3–12.
- 1 In setting up models and presenting designs, make sure that the designs are properly oriented. For designs shown in the Stimulus Booklet, present each design so that the numbered edge of the Booklet is toward the child.



- 1 When constructing the models for Items 1–2, observe the orientation indicated on pages 153 and 154 of this Manual. To prevent the child from looking at the side of the block design instead of the top, construct the model so that the child is required to look down on it.
- 1 Place the model or Stimulus Booklet a little to the left of the child's midline if the child is right-handed and a little to the right of the midline if the child is left-handed.
- 1 In laying out the blocks for the child to use, make sure that a variety of surfaces face up. For two-block and four-block designs, ensure that only one block has the red-and-white side facing up; for nine-block designs, only two blocks should have the red-and-white side facing up.
- 1 The time limit for each item is provided below and on the Record Form. Timing for each attempt begins when the last word of the directions is given. Record the exact time the child takes to complete each design, if it is within the time limit. Note on the Record Form if the child exceeds the time limit. Accurate recording of completion times is essential, especially for Items 4–12, because bonus points are awarded for quick, correct completion.
- 1 On the first trial of Items 1–3, if the time limit expires before the child finishes the design, stop him or her and permit a second trial. On Items 4–12, if the child

is still working when the time limit expires and is nearing completion of the design, you may not wish to stop him or her, in the interest of maintaining good rapport and motivation. The design, however, is still considered failed.

- | Failure on an item can be due to either a faulty design (i.e. one that does not precisely match the model) or failure to complete the design in the allotted time.
- | Rotation of a design by 30 degrees or more is considered a failure (see examples in the Recording and scoring section below). The first time the child rotates a design, score the response as a failure but show the child the correct design. Rotating the blocks to their correct positions, say:

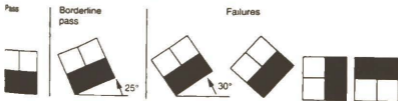
But you see, the blocks go this way

However, this correction may be given only once during the test. If the first rotation occurs on the first trial of Item 1, 2 or 3, correct it and ask the child to make the design again. If the first rotation occurs on the second trial of Item 1, 2 or 3, or on a subsequent design, show the correct arrangement but proceed to the next design.

- | Note that the Item 3 instructions for children starting with Item 1 differ from the Item 3 instructions for children starting with Item 3.

Recording and scoring

A trial or item can be failed because of faulty construction (a design that does not match the model or picture), rotation of 30 degrees or more, or the child's exceeding the time limit. Examples of rotation are shown below.



Items 1-3

Successful construction of a design within the time limit on Trial 1 earns 2 points. Successful construction of a design within the time limit on Trial 2 earns 1 point. On these items, if the child successfully constructs the design within the time limit on Trial 1, do not administer Trial 2. If the child fails to construct the design on both trials, record 0 points.

Time limits

Item (for Trials 1 and 2)	Time limit (in seconds)	Score for correct response	
		Trial 1	Trial 2
1 (2 blocks)	30	2	1
2 (4 blocks)	45	2	1
3 (4 blocks)	45	2	1

Record the exact time the child takes to complete each design. Note on the Record Form if the child exceeds the time limit.

Items 4–12

Score 4 points for successful completion of a design within the time limit. No credit is given for partially correct or incomplete performance.

Item	Time limit (in seconds)
4 (4 blocks)	45
5 (4 blocks)	45
6 (4 blocks)	75
7 (4 blocks)	75
8 (4 blocks)	75
9 (4 blocks)	75
10 (9 blocks)	120
11 (9 blocks)	120
12 (9 blocks)	120

Bonus points

Depending on the completion time, the child can earn 1–3 bonus points per item. The table below shows the total number of points per item for four ranges completion time.

Item	Completion time (in seconds)			
	1–5	6–10	11–15	16–45
4	1–5	6–10	11–15	16–45
5	1–10	11–15	16–20	21–45
6–8	1–10	11–15	16–20	21–75
9	1–10	11–15	16–25	26–75
10	1–25	26–30	31–40	41–120
11–12	1–30	31–35	36–55	56–120
Score	7	6	5	4

Maximum score: 69 points

Item instructions (Ages 6–7)

Item 1 (Trial 1)



Place two blocks in front of the child and say:

See these blocks? They are both alike. On some sides they are all red; on some sides, all white; and on some sides, half red and half white.

Turn the blocks to show the different sides. Say:

I am going to put them together to make something with them.
Watch me.

Assemble Item 1 in front of the child approximately 7 inches (18 cm) from the child's edge of the table. Then give the child two other blocks and say:

Now you put yours together just like mine.

Start timing and allow 30 seconds. If the child attempts to match the sides of the examiner's model, instruct the child to match only the top side.

If the child successfully completes the design within the time limit, proceed to Item 2. If the child fails the item, administer Trial 2 of Item 1.

Item 1 (Trial 2)

Say:

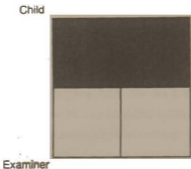
Watch me again.

Demonstrate a second time using the child's blocks. Then scramble the blocks but leave the examiner's model intact, and say:

Now you try it again and be sure to make it just like mine.

Start timing again, and allow 30 seconds. Proceed to Item 2 even if the child fails the second trial.

Item 2 (Trial 1)



Scramble the four blocks from the model and the child's design of Item 1 and say:

Now I am going to use four blocks to make something. Watch me.

Assemble Item 2 in front of the child. Then give the child four other blocks and say:

Now you put yours together just like mine.

Start timing and allow 45 seconds.

If the child successfully completes the design within the time limit, proceed to Item 3. If the child fails the item, administer Trial 2 of Item 2.

Item 2 (Trial 2)

Say:

Watch me again.

Demonstrate a second time using the child's blocks. Then scramble the blocks, leaving the examiner's model intact, and say:

Now you try it again and be sure to make it just like mine.

Start timing again and allow 45 seconds. Proceed to Item 3 even if the child fails a second time unless the discontinue criteria have been met.

Item 3 (Trial 1)

Scramble the child's blocks and remove the blocks that served as a model. Place the Stimulus Booklet in front of the child and open it to Item 3 of Block Design. Say:

This time we are going to put the blocks together to make them look like this picture (point to the card with Item 3). Watch me first.

Construct the design slowly, using the child's blocks, and when finished say:

You see, the tops of these blocks look the same as this picture.

Scramble the blocks used in the demonstration and say:

Now you look at the picture and make one just like it with these blocks. Go ahead.

Start timing and allow 45 seconds.

If the child correctly constructs the design within the time limit, proceed to Item 4. If the child fails to complete the design, administer Trial 2 of Item 3.

Item 3 (Trial 2)

Scramble the blocks and say:

Watch me again.

Make the design again; then scramble the blocks and say:

Now begin. See if you can do it this time.

Again, allow 45 seconds. Skip over the alternative instructions for Item 3 below, and proceed with the directions for Items 4–12 (unless the criterion for discontinuing has been met).

Item instructions (Ages 8–16)

Note that the instructions for Item 3 for children who start with this item differ from the Item 3 instructions above.

Item 3 (Trial 1)

Place four blocks in front of the child and say:

See these blocks? They are all alike. On some sides they are all red; on some sides, all white; and on some sides, half red and half white.

Turn the blocks to show the different sides. Place the Stimulus Booklet in front of the child, open it to Item 3 and say:

They can be put together to make a design like the one you see on the card. Watch me.

Construct the design slowly. Then scramble the blocks, give them to the child and say:

Now you make one like the one on the card. Go ahead.

Start timing and allow 45 seconds.

If the child passes the first trial of Item 3, give full credit for Items 1–2 (2 points for each) and proceed to Item 4.

If the child fails on the first trial, administer Trial 2 of Item 3.

Item 3 (Trial 2)

Scramble the blocks and say:

Watch me again.

Make the design again, using the child's blocks; then scramble the blocks and say:

Go ahead. See if you can do it this time.

Start timing again and allow 45 seconds.

If the child passes only the second trial of Item 3, or if both trials are failed, administer Items 1–2. Use the directions given above for the younger children, with one exception: for Item 1, start with the second paragraph (“Assemble Item 1–”). After administering Item 2, proceed directly to Item 4 (unless the criterion for discontinuing has been met).

Items 4–9

Scramble the child's four blocks. With the Stimulus Booklet in front of the child, open it to Item 4 and say:

Now make one like this. Try to work as quickly as you can. Tell me when you have finished.

Start timing and allow the specified number of seconds. When the child has finished the design or at the end of the time limit, scramble the blocks. No second trials are given on Items 4–9.

Present the remaining designs in the same way and with the same instructions. (These instructions may be shortened when the child clearly understands what to do.)

Allow 45 seconds each for Items 4–5 and 75 seconds each for Items 6–9.

Items 10–12

When Item 10 is reached, take the other five blocks out and say:

Now make one like this, using nine blocks.

Start timing and allow 120 seconds. Do not correct Items 10–12 or give second trials.

8. Vocabulary

Introduction

Materials

All words for the Vocabulary subtest are included in this Manual and on the Record Form.

Description of subtest

In this subtest the examiner reads a word to the child, and the child is required to give a verbal definition.

Start rules

Ages 6–8	Item 1
Ages 9–10	Item 3
Ages 11–13	Item 5
Ages 14–16	Item 7 ...

If a child aged 9–16 obtains perfect (2-point) scores on both of the first two items administered, give full credit for all preceding items.

Reversal rule

If a child aged 9–16 does not obtain a perfect (2-point) score on either of the first two items administered, administer the preceding items in reverse sequence until two consecutive perfect scores are obtained. If the child obtained a perfect score on the starting-point item (the first item administered), count it in the reverse sequence. When this criterion is met, give full credit for any preceding items that were not administered. Then proceed with the subtest until the discontinue criterion is met.

Discontinue rule

Discontinue after 4 consecutive failures.

Directions

I Say:

I am going to say some words. Listen carefully and tell me what each word means.

Proceed with the words in the order listed (starting at the appropriate place for older children), reading aloud each question. With a child who clearly understands the instructions, the formal question may be omitted after the third item; simply pronounce the word. Make certain that you are using the local pronunciation of each word or the pronunciation you believe to be familiar to the child.

If the young child gives less than a 2-point response to Item 1, say:

Well, a clock is something that tells the time.

Do not give any further help, except as indicated below.

If a child is not given credit for merely pointing to an object (e.g. clock). If this occurs, say:

Tell me in words what a...is.

If a child mistakenly hears a different word and thus responds incorrectly (e.g. *defines leaf* instead of *leave* or *eminent* instead of *imminent*), say:

Listen carefully. What does...mean?

Do not, however, spell the word for the child.

If it is difficult for the examiner to decide whether the child does or does not know the meaning of a word, say:

Explain what you mean or Tell me more about it

or some similar neutral inquiry. However, no other form of questioning may be used. This same inquiry is permitted when the child's response is unclear or too vague to be readily scored, or when the examiner judges that a marginal 0- or 1-point response indicates that a superior response could thus be evoked. (In the case of a clear-cut 0-point response or a clear-cut 1-point response, no such inquiry should be made.)

All word meanings recognised by standard dictionaries are acceptable (and are scored according to the quality of the definition). Regionalisms and slang not found in dictionaries are to be scored 0. If such a response is given, or if there is any doubt about the acceptability of a response, ask the child for another meaning.

Scoring and recording

Each word is scored 2, 1 or 0. (Consult the general scoring principles and the sample answers that are provided below.)

In general, any recognised meaning of the word is acceptable, disregarding elegance of expression. However, poverty of content is penalised to some extent; if the child indicates only a vague knowledge of what the word means, full credit is not earned.

- | If the young child gives less than a 2-point response to Item 1, say:

Well, a clock is something that tells the time

Do not give any further help, except as indicated below.

- | A child is not given credit for merely pointing to an object (e.g. clock). If this occurs, say:

Tell me in words what a...is.

- | If a child mistakenly hears a different word and thus responds incorrectly (e.g. defines *leaf* instead of *leave* or *eminent* instead of *imminent*), say:

Listen carefully. What does...mean?

Do not, however, spell the word for the child.

- | If it is difficult for the examiner to decide whether the child does or does not know the meaning of a word, say:

Explain what you mean or Tell me more about it

or some similar neutral inquiry. However, no other form of questioning may be used. This same inquiry is permitted when the child's response is unclear or too vague to be readily scored, or when the examiner judges that a marginal 0- or 1-point response indicates that a superior response could thus be evoked. (In the case of a clear-cut 0-point response or a clear-cut 1-point response, no such inquiry should be made.)

- | All word meanings recognised by standard dictionaries are acceptable (and are scored according to the quality of the definition). Regionalisms and slang not found in dictionaries are to be scored 0. If such a response is given, or if there is any doubt about the acceptability of a response, ask the child for another meaning.

Scoring and recording

Each word is scored 2, 1 or 0. (Consult the general scoring principles and the sample answers that are provided below.)

In general, any recognised meaning of the word is acceptable, disregarding elegance of expression. However, poverty of content is penalised to some extent; if the child indicates only a vague knowledge of what the word means, full credit is not earned.

General scoring principles

2-point responses

This response indicates good understanding of the word in one of the following ways:

- | A good synonym ("A *hat* is a cap", "Leave means to depart", "Brave means courageous").
- | A major use ("An *umbrella* keeps the rain off you", A *bicycle* is something used to get around).
- | One or more definitive or primary features of an object ("A *clock* has hands that move around on a dial").
- | A general classification to which the word belongs ("A *donkey* is an animal", "A *thief* is a criminal").
- | A correct figurative use of the word ("Procrastination is the *thief* of time").
- | Several less definitive but correct descriptive features that cumulatively indicate understanding of the word ("A *bicycle* has wheels and pedals" or "A *bicycle* has pedals and you ride on it").
- | For verbs, a definitive example of action or a causal relationship ("The birds *migrate* when they fly south for the winter").

1-point responses

In general, a response that is not incorrect but shows poverty of content in the following ways:

- | A vague or less pertinent synonym ("A *clock* is a watch", "A *donkey* is something like a horse", "A *fable* is like a proverb").
- | A minor use, not elaborated ("A *hat* is something you wear to parties").
- | An attribute that is correct but not definitive or not a distinguishing feature ("A *clock* has hands", "A *hat* has a brim").
- | An example using the word itself, not elaborated ("Absorb wetness").
- | A concrete instance of the word, not elaborated ("Brave means you fight a bear", "Migrate means you leave").
- | A correct definition of a related form of the word (defining 'rival' instead of 'rivalry', 'amend' instead of 'amendment').

2 What is an UMBRELLA

2 points

- Something that keeps you dry when it rains
- To protect you from the rain (sun)
- Hold it over your head so you won't get wet (hot)
- Keeps rain (sun) off

2 points

- Keeps you dry (Q)
- Carry it when it rains (Q)
- For rain (Q)
- Hold it (put it) over your head (Q)
- Big round thing (Q)—you can fold it up
- Helps you if it starts raining (Q)
- Put it up in the rain
- You hold it up (child gives appropriate demonstration of holding an umbrella)

0 points

- Plastic
- Go for a walk in the rain (Q)
- It holds rain (Q)
- Hold it; carry it (Q)
- Big round thing (Q)

What is a HAT?

2 points

- A cap (head cover)
- Wear it on your head
- Wear it to keep rain off (the sun out of your eyes)
- Put it on, like if it's too sunny (cold)

1 point

- You wear it (Q)
- Something you wear to parties (Q)
- It could help you from rain (Q)
- A hat has a brim
- You put it on so you look better (Q)
- Put it on and take it off (child gives appropriate demonstration)

0 points

- For cowboys (Q)
- Cowboy hat (Q)
- Makes you look nice (Q)
- A white (black) hat

2 What is an UMBRELLA?

2 points:

- Something that keeps you dry when it rains
- To protect you from the rain (sun)
- Hold it over your head so you won't get wet (hot)
- Keeps rain (sun) off

1 point:

- Keeps you dry (Q)
- Carry it when it rains (Q)
- For rain (Q)
- Hold it (put it) over your head (Q)
- Big round thing (Q)—you can fold it up
- Helps you if it starts raining (Q)
- Put it up in the rain
- You hold it up (child gives appropriate demonstration of holding an umbrella)

1 point:

- Plastic
- Go for a walk in the rain (Q)
- It holds rain (Q)
- Hold it; carry it (Q)
- Big round thing (Q)

What is a HAT?

1 point:

- A cap (head cover)
- Wear it on your head
- Wear it to keep rain off (the sun out of your eyes)
- Put it on, like if it's too sunny (cold)

1 point:

- You wear it (Q)
- Something you wear to parties (Q)
- It could help you from rain (Q)
- A hat has a brim
- You put it on so you look better (Q)
- Put it on and take it off (child gives appropriate demonstration)

1 point:

- For cowboys (Q)
- Cowboy hat (Q)
- Makes you look nice (Q)
- A white (black) hat

4 What is a THIEF?

2 points

- A burglar (robber, crook, criminal, outlaw)
- Someone who steals (robs banks, takes something from someone else)
- Breaks into your house and takes things

1 point

- A crime person (Q)
- A person who does illegal things (Q)
- Takes things (Q)
- Someone who breaks in (Q)

0 points

- A bad man (Q)
- They go to jail (Q)
- Someone the police try to catch (Q)
- Someone who wears a mask over his face (Q)
- Someone who goes where they don't belong

5 What is a COW?

2 points

- An animal; a mammal
- A farm animal
- A female bull
- It gives milk to you and meat (cheese)

1 point

- A meat source (Q)
- Like a bull but much smaller (Q)
- You could milk it (Q)
- Something that goes 'moo' (Q)

0 points

- A calf (Q)
- Eats grass; has horns; has four legs (Q)
- Cattle (Q)
- It walks
- It lives on a farm (in a field, in a barn) (Q)

Administration and scoring

6 What is a BICYCLE?

2 points:

- A vehicle; something to use to get around
- Get on it and ride to your friends' (the shop)
- Thing you ride, better than walking, it helps you save time
- It's got two wheels, one in front of you and one behind you

(Any two 1-point responses, such as "It's got wheels and handlebars" or "It has pedals and you ride on it" earns 2 points.)

1 point:

- A bike (Q)
- Like a moped (Q)
- It's like a car for kids (Q)
- You ride it (Q)
- Travel on it (Q)
- Has wheels (pedals, handlebars) (Q)
- (Child demonstrates riding or pedalling)

0 points:

- Has a basket (seat)
- It can go fast
- You fall off it
- Do tricks on it (Q)
- Ten speed (Q)
- My Daddy is going to get one for me to play with (Q)

7 What is a DONKEY?

2 points:

- An animal; a mammal
- Related to horses and mules
- A beast of burden
- Like a horse except smaller (slower)
- Sort of like a horse, carries things on its back
- A stubborn person
- You pin it (Q)—when you have a party you pin the tail on

1 point:

- Something like a horse (Q)
- Something you ride on (Q)
- Means of transport (Q)
- Goes slow, put heavy stuff on it
- Has a tail and long ears
- Makes a noise like 'hee-haw' (Q)
- A mule

0 points:

- A cross between horse and cow (mule)
- A pet (Q)
- Baby mule
- Type of horse (Q)
- It runs (bucks)
- You pin it (Q)
- Lives on a farm (Q)

5 What is the ALPHABET?

2 points:

- All the letters
- 26 letters (also credit 24–28)
- The letters of a language
- Names of the letters
- The consonants and vowels
- You use it to make words
- ABCs (Q) —helps you learn to write words
- Signs (symbols) that stand for different sounds
- Letters in a certain order, you can make words with them

1 point:

- (Child recites or sings all or part of the alphabet)
- The letters; ABCs (Q)
- You write (spell) with it
- Letters in a certain order
- Organisation of letters; whole group of letters
- They sound different (Q)
- You have to know the alphabet to read (write) (Q)

0 points:

- So you can learn your ABCs (Q)
- You learn at school (Q)
- Helps you learn, helps you read (Q)
- Something that's in your name (Q)
- All capitals (Q)
- Alphabet soup (Q)

Administration and scoring

9 What does ANCIENT mean?

2 points:

- Old; very old; really old
- Archaic; antiquated
- From a long time ago
- Opposite of modern
- Something very historical (from the past)
- An ancient ancestor lived in the time of the Stone Age

1 point:

- Historical (Q)
- Long time ago (Q)
- Out of date (Q)
- Antique (Q)
- Prehistoric (Q)
- Something made a long time ago
- Been here for about 100 years

points:

- History (Q)
- Valuable (Q)
- Sacred
- Like from Egyptians; ancient writings (Q)

10 What does LEAVE mean?

2 points:

- To depart (exit, abandon, vacate)
- To go away (go out, get away from)
- The opposite of stay there
- Not staying—going
- Absent from something, like a job or military duty
- To forget to bring away an object
- Put an object somewhere and walk away from it

1 point:

- To go (flee) (Q)
- To move; walk out
- To be gone (Q)
- Go somewhere else
- To dismiss
- You leave something somewhere
- Leave the house (Q)
- Military leave (Q)

0 points:

- People going home (Q)
- To lose
- To say good-bye

(If the child defines 'leaf' instead of 'leave', ask for another definition of 'leave'. Score 0 points for definitions of 'leaf'.)

1 What does BRAVE mean?

2 points

- Courageous; fearless; bold; having guts
- Not afraid; not scared
- An Indian warrior
- Willing to risk your life
- Someone with a lot of courage
- If you do something and you're scared of it, but you do it anyway
- When you do something to save someone in danger
- You'll stand up for something you believe in

1 point

- Daring; heroic
- An Indian (Q)
- To risk
- To stand up to (Q)
- You save people
- You're a hero
- Like having a splinter taken out of my finger and I'm brave
- You walk in a dark cave

0 points:

- Strong; good
- Have a fight
- You'll do anything somebody asks you to
- Very brave, people are very brave (Q)
- When you get shot (Q)
- A brave man

Administration and scoring

12 What is an ISLAND?

2 points:

- Land surrounded by water
- A piece of land in the middle of the sea (ocean)
- A place on the ocean made of earth and trees
- A little ground, has palm trees, is in the sea
- Land in the ocean (Q)—made from a volcano

1 point:

- Body of land (Q)
- Small land protected with water (Q)
- A place in the middle of the ocean (sea) (Q)
- Like Jersey (Q)
- Land in the ocean (Q)

0 points:

- Land (Q)
- A beach; an ocean
- A place by a river (in a pond) (Q)
- It's in the water
- Take a boat to an island (Q)
- Something that is deserted (Q)
- Place where you go if boat crashes (Q)

13 What does ABSORB mean?

2 points:

- To soak up (take in, sink in)
- To occupy full attention (interest, time)
- To bring in moisture
- To take in information
- When you use a paper towel, it absorbs water like a sponge
- A sponge absorbs water

1 point:

- Consume
- Bring in (Q)
- To collect (gather) (Q)
- Something that picks up something
- To absorb wetness (Q)
- Dry up
- If you look at something you haven't seen before and get to know all about it (Q)

0 points:

- To mix
- When water is evaporated (Q)
- To soak (Q)
- Concentrate on it
- Fill up
- To expel

H What does NONSENSE mean?

2 points:

- Foolishness; silliness
- Silly stuff
- Something that is stupid and could never happen
- Something that makes no sense (is foolish, isn't reasonable, is a silly waste of time)
- Doesn't have any meaning
- It's not sensible (logical, serious, realistic)

1 point

- Silly; foolish; dumb; crazy; ridiculous; stupid; rubbish (Q)
- Acting silly (foolish, stupid)
- Fooling (playing, messing) around
- Not really true; it's a lie
- Hard to believe
- Somebody trying to be funny
- Like not having any sense
- They tell you it's a talking dog, that's nonsense

0 point

- Fooled
- Being bad
- When we do something wrong
- You get your mother mad
- Something that doesn't need to be done (Q)
- Don't believe it (Q)

Administration and scoring

15 What does PRECISE mean?

2 points

- Accurate; exact
- Exactly to the point; exactly right
- Exact measurement (amount)
- Sharply defined
- Clearly expressed
- Right on the dot

1 point:

- Right; right answer; perfect; correct
- Specific; distinct
- Very detailed (Q)
- Exactly (Q)

0 points:

- Almost accurate
- Efficient
- Sure of something
- Prompt

(Score 0 for definitions of 'concise' but repeat question.)

16 What does TRANSPARENT mean?

2 points:

- Clear; see-through
- Not opaque
- Easily understood; obvious
- Allows light through

1 point:

- Visible (Q)
- To look through (Q)
- Transparent window (Q)

0 points:

- Invisible (Q)
- To remove
- Able to pass through
- You can see it (Q)
- Like a mirror

17 What does BOAST mean?

2 points

- To brag; show off
- To exaggerate (Q)—about yourself
- Praise yourself a lot
- To say you're better than other people

1 point

- To talk about (praise) yourself (Q)
- When you talk about something you're proud of (Q)
- Always talking and stretching the truth (Q)
- To exaggerate (Q)
- To gloat

2 points

- To encourage
- To boss
- Conceited (Q)
- A boastful person (Q)
- Lie about

18 What does MIGRATE mean?

2 points

- Relocate
- Move from one place to another
- To go south for the winter
- When you move back and forth between places
- Birds migrate south for the winter
- Leaving your country (Q)—like when you settle in a new place

1 point

- To move (Q)
- Fly south (Q)
- To go (travel) to another place (Q)
- Go somewhere due to weather (Q)
- When people come to Britain from other places (Q)
- Immigrate (Q)
- When animals hunt for food in a new place (Q)
- Leaving your country (Q)

0 points

- To leave, sneak out
- Some animals are migratory (Q)
- Like a migrant worker (Q)
- To visit another country
- Birds do it (Q)

Administration and scoring

19 What is a FABLE?

2 points:

- Story; myth; tale; legend
- A fairy (folk, tall) tale
- A story that teaches you a lesson
- A make-believe story
- A story that is not true and has a moral (meaning)
- A story Aesop made up

1 point:

- To tell a fib (lie)
- Proverb
- Book (Q)
- A lesson (Q)
- Fiction; not real (Q)
- *The Fox and the Grapes* (or title of another fable)
- You read a fable

0 points

- A saying (slogan)
- A film
- It's like a Mother Goose rhyme (Q)
- Like a knight fighting a dragon (Q)

20 What does STRENUOUS mean?

2 points:

- Gruelling; straining
- Physically demanding
- Requiring great effort (energy, exertion)
- Need a lot of power to do it
- Something that's too hard (difficult, tiring) to do

1 point:

- A strain
- Draining; tiring
- Stressful
- Hard; difficult (Q)
- A lot of pressure (Q)
- Exercise is strenuous

0 points:

- Strong; tough (Q)
- Tedious
- Painful for your muscles
- Overpowering

1 What does MIMIC mean?

2 points

- Imitate; mock; impersonate
- To repeat what somebody does
- To copy

1 point:

- Pretend (Q)
- To tease; make fun of (Q)
- To be (act) like someone (Q)
- Repeat (Q)
- To mime

(Score 1 point for definitions of 'mime'.)

0 points

- To fuss
- Telling something that is false

2 What does RIVALRY mean?

2 points:

- Competition
- On-going contest
- People compete with each other
- Trying to be better than somebody else
- When two people try to top (out-do) one another
- Like between two schools (Q)—who want to be the best

1 point:

- When you challenge (fight) someone
- A duel (Q)
- A fight
- To compete (Q)
- Squabbling between brothers and sisters (Q)
- Two people going against each other (Q)
- Fighting, like between families
- Opponents that are fond of each other

(Score 1 point for definitions of 'rival'.)

0 points:

- Gallantry
- Enemy (Q)
- Arguing with someone (Q)
- Like between two schools (Q)
- Like having a rival (Q)

23 What does SECLUDE mean?

2 points:

- To isolate (hide)
- Be away (apart, cut off) from everything
- To be put alone
- By yourself, hid away from everyone
- Shut off, put aside by itself
- To block off from the rest
- To draw away from, take away
- To be sort of private, to be away where not many people are likely to be

1 point

- Lonely
- Alone (Q)
- A quiet spot
- Far away
- Take away (Q)
- Out of the way (Q)
- To make lonely (Q)
- Not near lots of people (Q)
- To separate

0 points:

- Not to include
- Trapped
- To keep out
- To be confined (Q)
- Leave them out (Q)

24 What does UNANIMOUS mean?

2 points:

- Unopposed
- All in favour of; all for it
- Everyone decides the same way; all sharing all the same views
- Agreed by everyone
- Everybody wants it
- Chosen without question

1 point

- To agree on something
- Everybody(Q)
- No objections(Q)
- The whole group with one idea(Q)
- A unanimous vote(Q)

0 points

- Whole(Q)
- Clearly decided(Q)
- A winner
- A majority
- Almost everyone agrees(Q)

25 What is an AMENDMENT?

2 points

- A correction
- A revision
- An improvement
- An addition to the law
- A change made in a bill (law)
- An addition to a law to make it better (more fair)
- Something that's added on after the thing's finished

1 point

- A bill, states laws and rights we have
- Update a law
- Adding something extra on
- An addition
- To revise (change, adjust)

(Score 1 point for definitions of 'amend' or 'amending'.)

0 points:

- The laws; a new law(Q)
- A rule
- It makes something legal or illegal(Q)
- Like a promise
- Make amends for something(Q)

Administration and scoring

26 What does COMPEL mean?

2 points

- To force
- To make someone do something
- To drive someone on
- Act upon someone to make them decide
- It's as if writing is a force for me, I feel compelled to write

1 point

- To urge (encourage, motivate, prompt, persuade) (Q)
- To blackmail (Q)
- To push to do something (Q)
- When you make something happen (Q)
- An urge that makes you want to do something
- In the army when they give you an order (Q)
- You're drawn to it
- Felt a need to do something

(Score 1 point for definitions of 'compulsion'.)

0 points

- Threaten
- Obligation
- Stop from doing something
- Let nothing stand in your way
- Wanting to do something (Q)

27 What does IMMINENT mean?

2 points

- Impending; hovering
- Close at hand
- Will happen any minute; getting closer in time
- Something bad is about to happen

(To earn 2 points, the child must indicate something occurring very soon.)

1 point

- Likely; probable
- Immediate (Q)
- Inevitable; unavoidable (Q)
- Immediately
- Definite
- Pressing (Q)
- To be very close (Q)
- It's going to happen (Q)

0 points:

- Might happen
- Very close, personal
- Ever present
- Close (Q)—a close friend
- Like a position of supremacy
- Can replace 'your excellency'
- Famous

(If the child defines 'eminent' instead of 'imminent', ask for another definition of 'imminent'. Score 0 for definitions of 'eminent'.)

28 What does AFFLICTION mean?

2 points:

- A handicap (sickness, injury, defect, disease)
- Pain; suffering
- A burden you must bear
- Something that causes pain
- Some kind of disorder
- There's something wrong with you, like you lost an arm
- When someone has been hurt within

0 points:

- Misfortune (Q)
- A wound (cut) (Q)
- A broken arm (Q)
- Like a paralysis (Q)
- To get hurt (Q)
- Something that's wrong with someone (Q)
- Something bad is wrong

0 points:

- A problem
- Something you don't like
- Did something to upset someone
- Have something that is bothering you (Q)
- Something wrong with the mind (Q)
- To hurt someone; to cause pain (suffering)

(Score 0 for definitions of 'inflict' or 'inflation'.)

Administration and scoring

29 What does DILATORY mean?

2 points:

- Slow
- A sluggish person
- Causing delay
- Holding things up

1 point:

- Can't make up your mind (Q)
- You can't get started (Q)

0 points:

- Diligent
- Hard-working
- Lazy (Q)
- Has to do with eyes, dilating eyes

30 What does ABERRATION mean?

2 points:

- A deviation (change, shift) from normal path; a departure from the typical
- Abnormal alteration
- A lapse in mental state

1 point:

- Change
- Something different (unusual)
- Abnormal (Q)
- Character flaw
- A departure (deviation) (Q)

0 points:

- Foolish
- Strange; weird (Q)

9. Object Assembly

Introduction

Materials

- Six Object Assembly items (including a Sample), each in a separate box
- Object Assembly Layout Shield showing layout of pieces
- Stopwatch

Description of subtest

In this subtest the child is presented with several puzzle pieces that, when put together, make the shape of a common object. While being timed, the child is required to put the pieces together manually to form the object.

Start rule

- All ages . Sample Item and then Item 1

Discontinue rule

Do not discontinue. Administer all items.

Directions

- Use the Object Assembly Layout Shield as a guide for correct presentation of each puzzle and as a shield behind which the puzzle pieces are arranged. The diagrams below illustrate both the presentation arrangement and the correct arrangement with each point of juncture marked with an X.
- The time limit for each item is shown in the Scoring and Recording Section below and on the Record Form. Timing for each item begins when the last word of the directions is given. Record the exact time the child takes to complete each item; if the time limit is exceeded, note this on the Record Form.
- Accurate recording of timing information is essential because bonus points are awarded for quick, correct assembly.
- If the child is still working when the time limit expires and is nearing completion of the puzzle, you may not wish to stop him or her in the interest of maintaining good rapport and motivation. In that case, note the arrangement of pieces at the end of time limit. This is important since scores are given for partial arrangements.
- For a less-than-perfect arrangement of an item, note on the Record Form the number of correctly joined cuts.

Provide help only on Item 1, as indicated.

If the child turns a piece over, turn it right side up again unobtrusively.

Scoring and recording

The score for all items is determined by the number of cuts correctly joined and the completion time. It is important to be completely familiar with the scoring system so that you can score a response as soon as the child finishes an item.

To score an item, enter on the Record Form, in the column indicated, the number of correctly joined 'cuts'. (In the diagrams in this Manual, each cut is marked with an X on the object in its assembled form; thus, there is an X at each place where there is a joining of two adjacent pieces.) Also, record the time the child takes to complete the arrangement in the appropriate column on the Record Form.

For incomplete arrangements, note on the Record Form the number of cuts which the child joins correctly. This information provides the basis for scoring each item.

A cut is considered to be correctly joined even if the segment thus formed is not added to the rest of the object. For example, with Item 5 (Face), the child may put several pairs of pieces together correctly (the chin and mouth, the two hair pieces etc.) but not combine them to make the whole face, as in the example below. Give credit for each correctly joined cut regardless of the overall appearance of the assembled puzzle. In this example, the child receives credit for three correct junctures.



The Record Form presents scores associated with various completion times within the maximum allowed for each item. These bonus point arrangements are also presented on the next page of this Manual.

Scoring of Object Assembly

For each item, count the number of correctly joined 'cuts' and multiply by the factor indicated in the final column in the table below. The sample item (Apple) is not scored.

Item	Time limit (in seconds)	Number of cuts	Multiply by
1 Girl	120	6	1
2 Car	150	9	$\frac{1}{2}$ *
3 Horse	150	5	1
4 Ball	180	7	1
5 Face	180	13	$\frac{1}{2}$ *

* Round half scores upwards.

Bonus points

Where an item is completed within the time limit, bonus points are awarded. The table below shows scores associated with correct completion within specific time bands. The figures in the body of the table represent time intervals in seconds up to the maximum allowed for each item.

Item	Completion time (in seconds)				
1			1-15	16-25	26-120
2			1-20	21-25	26-35
3			1-15	16-20	21-30
4	1-25	26-35	36-60	61-180	31-150
5	1-40	41-55	56-80	81-180	
Score	10	9	8	7	6

Maximum score: 44 points

Item instructions

Sample Item (Apple)

Arrange the pieces behind the Object Assembly Layout Shield, according to the layout shown below (and on the shield). Then expose the array and say:

If these pieces are put together the right way, they will make an apple. Watch how I do it.

Put the pieces together, as shown below.

Allow the child to look at the completed figure for about 10 seconds. Then put the pieces away and proceed to Item 1.

CHILD



EXAMINER

Item 1 (Girl)

Arrange the pieces behind the shield, according to the diagram. As you are arranging the pieces, say to the child:

Now I am going to ask you to put some puzzles together.

Then expose the array and say:

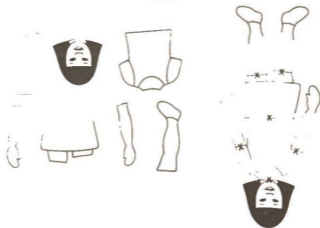
If you put these pieces together the right way, they will make a girl. Go ahead and put them together. Tell me when you have finished.

Start timing, and allow 120 seconds. If the child's assembly is not perfect, show the correct arrangement and say:

See, it goes like this.

Then proceed to Item 2, but give no further help on this or subsequent items.

CHILD



Number of cuts = 6

EXAMINER

For this and all other Object Assembly items, stop timing when the child has obviously finished, even if the child does not verbally indicate this.

Administration and scoring

Item 2 (Car)

Arrange the pieces behind the shield, according to the diagram. Then expose the array and say:

If you put these pieces together, they will make a car. Put them together as quickly as you can.

Start timing and allow 150 seconds.

CHILD



Number of cuts = 9

EXAMINER

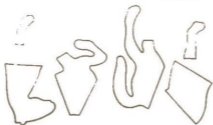
Item 3 (Horse)

Arrange the pieces behind the shield, according to the diagram. Then expose the array and say:

Put this one together as quickly as you can.

Start timing and allow 150 seconds. (Note that the name of the object is not given.)

CHILD



Number of cuts = 6

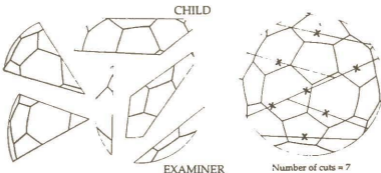
EXAMINER

Item 4 (Ball)

Arrange the pieces behind the shield, according to the diagram. Then expose the array and say:

Put this one together as quickly as you can.

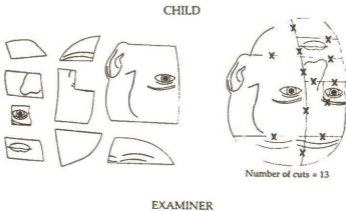
Start timing, and allow 180 seconds. (The name of the object is not given.)

**Item 5 (Face)**

Arrange the pieces behind the shield, according to the diagram. Then expose the array and say:

Put this one together as quickly as you can.

Start timing, and allow 180 seconds. (The name of the object is not given.)



10. Comprehension

Introduction

Materials

All questions for the Comprehension subtest are included in this Manual.

Description of subtest

In this subtest the child is asked to respond verbally to a series of questions that deal with solutions to everyday problems or understanding of social rules and concepts.

Start rules

All ages Item 1

Discontinue rule

Discontinue after 3 consecutive failures.

Directions

1 Read each question slowly to the child. Some children may find it difficult to remember the entire question. It is therefore always permissible to repeat the question but do not alter or abbreviate it. It is good practice to repeat the question if no response is obtained after 10 or 15 seconds but no further urging should be given, except as indicated below.

1 If a child is hesitant, encourage the child with such remarks as Yes or Go ahead. If the response is unclear or ambiguous, you may say:

Explain what you mean or Tell me more about it.

1 If the child does not give a 2-point response to Item 1, say:

Well, one thing you could do is put a plaster on it.

This help may be given only for Item 1.

1 On items for which the child must give two correct responses to receive full credit (e.g. Items 4 and 8) the child should be asked to give a second response if he or she gives one correct response but does not give another one spontaneously. Say:

Tell me another thing to do if you see thick smoke coming from the window of your neighbour's house

(or a similar restatement appropriate to the question). If the child's spontaneous response is clearly incorrect, do not ask for a second response.

- 1 The examiner may request a second response only once during the administration of each relevant item; that is, if the second response elicited from the child is either incorrect or an elaboration of the first response, the examiner may not ask for an additional response.

Scoring and recording

Each item is scored 2, 1 or 0. Scoring criteria and sample responses are included below.

Maximum score: 36 points

General scoring criteria

The score of 2, 1 or 0 will depend on the degree of understanding expressed and the quality of the response. In some cases the scoring will be fairly obvious; in others it may be difficult. The examiner should match the child's response against the general criteria and the sample answers given below for each question. Children will undoubtedly give unusual responses that are not covered below; no attempt has been made to include all possible replies. In these instances, use your own judgement. Most of the 0-point examples given typify marginal responses; those that contain evidence of some understanding may be queried in the neutral manner described above.

When scoring the items that require two correct responses for full credit (those items indicated by a dagger (†) preceding the item number) the examiner should be particularly careful. To receive 2 points, the child must express at least two of the general ideas that are indicated. If two answers are given, both of which express the same idea (e.g. if for Item 14, the child says that the advantage of newspapers over television news is that "Newspapers are more detailed" and "Newspapers tell more facts"), credit only 1 point.

Items, general criteria and sample responses

1. What is the thing to do when you cut your finger?

General: Perform a specific, direct or immediate action to take care of the wound.

2 points:

- Put a plaster or bandage on it
- Wrap (tape, tie, patch) it up
- Wash (clean, wipe, rinse) it off
- Wash it with soap and water
- Put on medicine (alcohol, peroxide, iodine, ointment, antiseptic)
- Put ice (pressure) on it
- Stop the bleeding
- Let it bleed (Q) —it cleans the cut

1 point:

- Tell my mother (father, teacher) about it
- Get help (Q)
- Go to the doctor (hospital)
- Get it stitched up
- Treat it; soak it (Q)
- Put stuff on it; get first aid kit (Q)
- Put under hot (cold) water (Q)

0 points:

- Hurt; scream; cry
- Let it bleed (Q)
- Go home (Q)
- Suck blood out

(If the child does not give a 2-point response, illustrate with a few 2-point answers as indicated under Directions before proceeding.)

2. What are you supposed to do if you find someone's wallet or purse in a shop?

General: Try to return it to the owner, either by looking for identification of the owner or by giving it to the shop owner, policeman etc.

2 points:

- Hand it in to the shop assistant (cashier, owner, security guard, lost and found)
- Give it to the police
- Try to find who it belongs to and return it
- Announce it on the loudspeaker
- Hand it to them if they dropped it
- Post it if there is an address; take it to their house

1 point:

- Look (check) for identification (name, address, phone) (Q)
- Look to see who it belongs to (Q)
- Try to return it (Q)
- Give it to my mum (dad) and she'll (he'll) find the owner
- Put it in the newspaper (onTV); call local radio
- Take it up to the counter

0 points:

- Keep (steal) it
- Nothing; leave it there
- Put it back
- Don't keep it (Q)
- Pick it up (Q)
- Give it to the postman
- Tell my mother (Q)



3. Why do cars have seat-belts?

General: *Recognition of safety precautions.*

2 points:

- To prevent injuries
- For safety
- To protect people in a crash
- Restrain us in an accident
- If you have an accident you won't fly out the window
- So if you stop quickly you won't bump your head

1 point

- To protect people (Q)
- It's safe (Q)
- To save people's lives
- So you won't get hurt (die) (Q)
- It's the law
- So you won't fly out the window
- It holds you back
- In case of an accident

0 points

- Lock yourself in (Q)
- Because you're supposed to wear them
- (Any reference to parents—e.g. mum and dad say so)

- † 4. What should you do if you see thick smoke coming from the window of your neighbour's house?

General: Have the fire brigade or police notified.

- Ring and say where the fire is
- Dial 999; report it
- Ask mum or dad to call the fire brigade (police station)
- Set off fire alarm; break window and ring bell

General Perform some action until the fire brigade arrives.

- Go and see what's the matter
- Tell your parents so they can check it out; ask an adult to help
- Call (ask, shout) for help
- Tell (warn) neighbours; wake them up; bang on door and tell them the house is on fire; try to get people out
- Check to see if there really is a fire
- Call ambulance (hospital)
- Stay away so you won't get hurt
- Get a fire extinguisher
- Get out of your house 'cause it could catch fire

2 points: A response indicating both of the general ideas given above.

1 point: A response indicating one of the general ideas given above.

0 points:

- Shout; shout fire (Q)
- Tell my mother (father) (Q)
- Call the operator (Q)
- Wait for firemen
- Stay away from it (Q)
- Go next door (Q)

5. What is the thing to do if you lose a ball that belongs to one of your friends?

General: Replace the loss.

2 points:

- Give him (her) one of mine
- Try to get it back
- Find it and give it back to your friend
- Replace it

† If the child's response reflects only one general idea, ask for a second response. Rephrase the test item appropriately, saying *Tell me another thing to do (reason why, advantage of ...)*

- Buy another one if I can't find it
- Pay him/her back; pay for a new one

1 point:

- Try and help find the ball (Q)
- Look everywhere for it (Q)
- Tell him, and let him decide (Q)
- Ask if they want me to buy them a new one
- Get them something else (Q)
- Tell my mum to buy another one
- Ask my parents to look for it
- Say you're sorry

0 points:

- Tell him to find it
- Tell your friend you lost it (Q)
- Tell mother I lost it
- Tell her the truth (Q)
- Give it back (Q)
- Nothing, I'll get in trouble

6. Why are names in the telephone book listed in alphabetical order?

General: Recognition that organisation will make use more efficient.

2 points:

- Find names easier (faster, better)
- You know where to look for names
- So that you don't have to search the whole book
- If there was no order, it would take you a long time

1 point:

- Can find the number by last name (Q)
- To find the names (Q)
- Most well-known order
- Know where to look for the number (Q)
- Less confusing (Q)
- More organised (Q)
- Easy access (reference) (Q)

0 points:

- So names will be in order (Q)
- Easier to read; easier looking (Q)
- So you can find someone (their address)
- So people can call people
- If you forgot the number, you could look it up (Q)

7. What is the thing to do if a boy (girl) much smaller than yourself starts to fight with you?

General: Take the initiative of not fighting with him (her). For 2 points, the response must indicate self-restraint; that is, the child accepts the responsibility of not fighting. In a 1-point response, the child places the burden of not fighting on someone else, including the smaller child.

2 points:

- Don't fight (beat her up, hurt him, hit back)
- Don't hit him, find out what's the matter
- Tell them you don't want to fight
- Try to talk her out of it; calm him down; talk to her sensibly
- Leave him alone
- Walk (run, turn, go) away
- Nothing (Q —I'd do nothing, not fight with her)

1 point:

- Tell him to stop (settle down, leave you alone)
- Tell him you don't want to hurt him (Q)
- Tell her not to fight (forget it, go away)
- Avoid the fight (Q)
- Ask the teacher (my father) to stop him

0 points:

- Punch (hit, fight, beat) her
- I'd just let him fight (Q)
- Hit her lightly; push him away; hold her down
- Tell him to leave me alone or else
- Don't do anything; nothing (Q)
- Tell the teacher (my father) (Q)
- Say "I'm telling"
- Call for help

- † 8. Tell me some reasons why you should turn off lights when no one is using them.

General: Recognition of conservation of energy resources.

- So that you don't waste (use up) electricity
- To save fuel (power, electricity, energy)
- You might need electricity in the future and then would not have any left

† If the child's response reflects only one general idea, ask for a second response. Rephrase the test item appropriately, saying Tell me another thing to do (reason why, advantage of ...)

General: Recognition of conservation of financial resources.

- To save money
- So that you don't run up the electric bill; otherwise the bill will be high
- It costs a lot of money to burn them
- Will use up (burn out) light bulbs

2 points: A response reflecting both of the general ideas.

1 point: A response reflecting one of the general ideas

0 points:

- So that you won't start a fire
- Safer
- Might blow a fuse
- Your parents get cross if you don't
- Use lights only when it's dark
- Don't need them on

9. Tell me some reasons why games have rules.

General: Recognition that some form of mutual understanding among players is necessary.

- So that everyone will understand the game
- So that everyone plays the same way; if you have no rules, people might play in different ways
- People might do things wrong in the game

General: Notion of fairness is present.

- So it's fair for everyone; all play fair
- No one will have an unfair advantage
- So that people don't cheat

General: Recognition that rules organise the activity of the game.

- So that you'll know how to play (how to begin and end)
- Game will be less confusing
- So that you know who wins
- If you disagree, you can look at the rules

2 points: A response reflecting two of the three general ideas.

1 point: A response reflecting one of the three general ideas,

† If the child's response reflects only one general idea, ask for a second response. Rephrase the **test item** appropriately, saying **Tell me another thing to do (reason why, advantage of ...)**

0 points:

- Something to go by (Q)
- Better competition
- So no one person will dominate the game (Q)
- You can play better; you can't make up the rules (Q)
- To keep it safe (Q)
- So that nobody gets hurt (Q)

10. Why is it important for the government to make sure that meat is inspected before it is sold?

General: To protect the consumer by ensuring that certain standards are met (to prevent disease or illness or to ensure meat quality).

2 points: The response must reflect an awareness of the importance of food inspectors to the public as a whole (i.e. that many people are protected by them or would be adversely affected if they did not exist).

- To make sure the meat isn't bad and can be sold to the public
- Can't let bad meat into the market
- Bad quality might endanger people's lives
- Prevent an epidemic; infectious diseases could be passed on
- To ensure the quality of the meat
- So that people don't get food poisoning
- So that people don't sell rotten meat to people
- To ensure that people get good meat

1 point: A correct specific statement that points out advantages of having food inspectors (or dangers of not having them), but that lacks implications for society. Correct but vague statements ("To be sure the meat's good") are also given 1 point.

- Meat could be bad (spoiled, rotten, sour, poisoned, not good)
- It could have diseases (germs, bugs, hair)
- In case drugs (razors) are in the meat
- Make sure nothing's wrong with it (the meat's good)
- Make sure it's edible (fresh, not old, not outdated)
- For safety (Q)
- So people won't die (get sick) (Q)

0 points:

- To inspect the meat (Q)
- Some of the people who work there may not know how to wrap meat (Q)
- It might be raw (have blood in it, have bones)
- So companies won't get sued
- So it will stay cold

11. Tell me some reasons why it is important for cars to have number plates.

General: Recognition that they are a means of identifying the owner of the vehicle.

- Proof of ownership
- So that they know who the car belongs to
- Catch (pick up) lawbreakers
- So police can find you
- In case of a crash (accident), they can tell who owns the car

General Recognition that they are a means of identifying the vehicle itself.

- Identify the car
- If there's an accident, you can take down the number of the car
- To show that it's registered
- To show it is yours
- Cars would get mixed up
- So that the police know which car to look for
- If stolen you can try to find the car by number plate
- For reporting an accident

General Recognition that they are a means of keeping statistical records.

- The way the government keeps a record of vehicles
- So that there's a record of the owners
- To keep tabs on how many people drive
- So that you know how many cars there are
- To tell how old the car is

2 points: A response reflecting two of the three general ideas.

1 point: A response reflecting one of the three general ideas.

0 points:

- Accidents (Q)
- So you can find it; so you can see the number (Q)
- For the police to see (Q)
- To show they know how to drive
- It's against the law to drive without a license (Q)
- So they won't get put in jail (a ticket)
- If somebody is going too fast (Q)
- In case it's stolen (Q)

Administration and scoring

12. Why do we put stamps on letters?

General: Recognition of paying for the posting of the letter. A 2-point response must indicate that stamps are like money. One point is given when the child shows awareness that the letter may not be delivered without a stamp, even though he or she does not (or cannot) explain the purpose of the stamps.

2 points:

- To pay for the postage (delivery of letters)
- To pay the postman; to support the postal system
- Stamps are a sign that you paid the post office money
- It's like a mailing fee (charge, cost)
- So that the person getting the letter won't have to pay for it
- Tax you have to pay to post something
- Can get to where it can go, pay for fuel for airmail

1 point:

- Because the postman doesn't take things that don't have a stamp
- So it can reach where you send it to
- So the man will pick it up
- If there is no stamp it will be returned (sent back to you)
- If not it won't be posted (delivered)
- Pay for shipping and handling (Q)

0 points:

- It's a form of tax (Q)
- So they can tell where the letter is going
- For posting (Q)
- To show what country or county it came from
- To know if it's first or second class (Q)
- For the postman to see it and stamp it

13. Why should a promise be kept?

General: Recognition that a promise is a basis of faith and mutual trust or has the status of an implied contract.

2 points: A response that is either a correct generalisation, usually in abstract terms, or a specific statement emphasising mutual or reciprocal advantage.

Generalisations:

- Agreement between two people is really a contract and should be honoured
- Our social system is based on faith in words and deeds
- Because if nobody keeps their promises, nobody can believe them

- People have to be able to trust each other
- A promise is your word of honour

Mutual advantage:

- They are trusting you and you want their trust
- To keep faith in yourself and so the other person can have faith in you
- If you're going to promise, then the person will trust you and if you value that person's friendship you'll keep it

1 point: A specific statement emphasising a particular advantage, usually to one person.

- So that people will trust you
- You gave your word and it would be a lie to break it
- People are depending on you
- If you don't the other person won't believe you any more
- So you won't hurt another person's feelings
- It shows you mean what you say
- So you won't lose friends

0 points: Usually a response emphasising vague necessity.

- It's moral (Q)
- Others know what kind of person you are (Q)
- The only way to keep friends (Q)
- It wouldn't be right not to keep a promise
- If you don't keep promises, you're not that good a friend
- It's your word (Q)
- You'd be lying
- It's not fair if you don't (Q)

14. Tell me some advantages of getting the news from a newspaper rather than from a television news programme.

General: Recognition of greater depth of coverage in a newspaper.

- Newspaper tells you more
- Newspaper goes into more detail; more elaborated
- Fit more words (facts) into it
- TV is brief

* If the child's response reflects only one general idea, ask for a second response. Rephrase the last item appropriately, saying *Tell me another thing to do (reason why, advantage of ...)*

Administration and scoring

General: Recognition of greater breadth of coverage in a newspaper.

- More articles (stories) in newspaper
- Wider variety of things in newspaper
- Get birth and death (marriage) announcements in newspaper
- Newspapers can have very local news—most TV news hasn't

General: Recognition of convenience of having printed material

- Can read (re-read) it at your leisure
- Newspaper has no time limit
- Don't have to wait, like for news programmes
- Can go at your own speed
- Take it wherever you go
- If you're deaf you can read it, instead of getting news with subtitles on television

2 points: A response reflecting two of the three general ideas.

1 point: A response reflecting one of the three general ideas.

0 points:

- Takes more time on TV
- Newspaper is cheaper than TV
- Newspaper is more accurate; you get the facts
- You'll get it earlier
- Use your mind more
- You can read it (Q)
- Might not have a TV
- Get other news in newspaper (Q)—comics
- Better coverage (Q)
- You can recycle it

15. Why is it good to hold elections by secret ballot?

General: Recognition that a person can vote as he or she chooses without fear of public pressure.

2 points: A response is worth 2 points only if the child (spontaneously or after querying) alludes to possible public pressure or attitude.

- So that people can't force (tell) you to vote their way
- So that people won't make you feel bad for voting the way you did
- So that you won't be led by how others vote
- Loser won't be prejudiced against people who didn't vote for him
- So there is less fighting over how one voted
- The minority will not be afraid to vote

1 point: A response reflecting only the idea that a secret ballot permits a person to vote as he or she wishes.

- People can vote as they choose
- So you can pick who you want to pick(Q)
- The way you vote is your own business(Q)
- So that people won't know (copy) your votes
- People who are elected won't know who didn't vote for them(Q)
- So that people won't argue (turn against you)(Q)
- So there is no pressure (penalty)(Q)

5 points:

- So that people can't cheat
- So that nobody could go in there and change it
- So no one can vote twice
- It's the right way(Q)
- Because voting should always be done in secret(Q)
- For people's safety(Q)
- So you won't break up a friendship(Q)

16. Tell me some reasons why paperback books are better than hard-cover books.

General: Recognition of convenience related to physical characteristics (lightweight, flexible).

- Lighter (easier) to carry around (weigh less)
- You can fold them back and read them better
- Flexible; bendable
- Easier to hold when reading
- Can carry one in your pocket

General: Recognition of expendability or lower cost.

- They cost less
- Hard covers cost more money
- Can write in them and not have to worry about it
- It doesn't matter if paperback books tear
- It doesn't cost as much to replace it

⁹ If the child's response reflects only one general idea, ask for a second response. Re-phrase the test item appropriately, saying Tell me another thing to do (reason why, advantage of ...)

General: Recognition of greater availability (i.e. for purchase).

- Hardbacks you can't replace as easily if damaged
- Easier to find
- Find them in more shops
- Can get them everywhere

General: Recognition of convenience of storing.

- They fit in places better; fit in small places
- Smaller; more compact
- Thinner (Q)—take up less space
- Gives you more room in your school bag

2 points: A response reflecting two of the four general ideas.

1 point: A response reflecting one of the four general ideas.

0 points:

- Easier to read (open, turn pages) (Q)
- They last longer
- Hardbacks can crack
- Not as expensive to repair
- Thinner (Q)
- Can put them anywhere (Q)

† 17. What are the advantages of having Members of Parliament?
(What are the advantages of having TDs?)*

General: Recognition that they are the lawmakers (i.e. make laws, levy taxes, vote on bills etc.).

- So they can make decisions on laws
- To make laws (pass bills)
- Make decisions for us
- Protect us from getting into wars
- Vote on issues
- Declare war

General: Recognition that they represent or act as spokespersons for the people.

- So that you'll have some voice in affairs
- If something is wrong in the city, you can write to them
- People voted for them so they could help in the community

† If the child's response reflects only one general idea, ask for a second response. Rephrase the test item appropriately, saying Tell me another thing to do (reason why, advantage of ...)

* Irish users may wish to alter terminology in the scoring criteria.

- Represent you in Parliament
- They'll speak for you

General: Recognition that they perform a checks-and-balances function.

- So that a lot of people make important decisions rather than one
- So that they can change the Prime Minister when he or she does something wrong
- So that the Prime Minister doesn't become a dictator
- The Backbenchers (MPs) can make sure the government doesn't become too powerful

General: Recognition that they represent all parts of the country

- Equal representation (represent all the people)
- So that each area has a chance
- To represent people in different areas

General: Recognition that the population is too large to meet as a body.

- So all the people don't have to vote every time there's a decision to be made
- There's just too many of us to meet as a group
- If everything had to be put up to a public referendum, nothing would get done

2 points: A response reflecting two of the five general ideas.

1 point: A response reflecting one of the five general ideas.

2 points:

- They will help the Prime Minister
- Keep the country in line
- Simplifies system (Q)
- Population is too big (Q)
- For laws (Q)
- They help
- Help make decisions; help run the country (Q)
- Make the country (city) a better place to live (Q)

18. Why is freedom of speech important in a democracy?

General: Recognition of the right to express opinions.

- Can disagree (agree) with the government
- It allows dissent
- You can criticise others without being arrested
- Can express differences
- So that all voices can be heard on an issue
- You can tell them what you are thinking (feeling)

General: Recognition of the right to participate in the political process.

- Can back or oppose candidates
- Lobby for or against issues
- Provides feedback to governmental representatives
- Provides a way to control power of the government
- So secrets won't be kept from the people

2 points: A response reflecting both of the general ideas.

1 point: A response reflecting one of the general ideas.

0 points:

- Self-expression
- You can do or say whatever you want
- So you know what the people are saying
- Without freedom of speech this would not be a democracy

† If the child's response reflects only one general idea, ask for a second response. Rephrase the test item appropriately, saying: Tell me another thing to do (reason why, advantage of ...)

11. Symbol Search

Introduction

Materials

- Symbol Search Response Booklet (containing both Level A and Level B)
- Two pencils without erasers
- Stopwatch

Description of subtest

In this subtest the child must visually scan two groups of shapes and indicate by marking a box whether any shapes are common to the groups.

Start rule

- Ages 6–7 Level A
- ✓ Ages 8–16 Level B

Discontinue rule

Discontinue after 120 seconds (2 minutes).

Recording and scoring

On the Record Form, indicate whether Level A or Level B was used by ticking the appropriate box. Record the time required by the child to complete the test (up to the maximum 120 seconds allowed).

Check all responses using the acetate key. Record the number of correct responses and the number of incorrect responses at the bottom of each page of the booklet in the spaces marked 'C' (Correct) and 'I' (Incorrect). Separately sum the subtotals of correct responses and subtotals of incorrect responses and transfer these totals to the Record Form. Subtract the total number of incorrect responses from the total number of correct responses. *The score for the subtest is the number of correct responses minus the number of incorrect responses. Items that the child did not attempt (either skipped or did not reach before time elapsed) are not included in these score calculations.*

Maximum score, Symbol Search A: 45 points

Maximum score, Symbol Search B: 45 points ✓



Directions for Level A (Ages 6–7)

Sample items

Place the Response Booklet, open at Level A, before the child. Point to the first sample item and say:

Look at these shapes (point, from the child's left to right, to all the shapes in Sample Item i).

Point to the target symbol in the left column and say:

This shape is in this group of shapes over here (point, from the child's left to right, to all the symbols in the search group).

Point again to the symbol in the left column and say:

See, this shape here is the same as this shape here (point to the matching symbol in the search group), so I will mark the 'YES' box like this.

Place a slash '/' in the 'YES' box. Then say:

Now look at these shapes (point, from the child's left to right, to all shapes in Sample Item ii). This shape (point to the target symbol in the left column) is not in this group over here (point, from the child's left to right, to all the symbols in the search group), so this time I will mark the 'NO' box like this.

Place a slash '/' in the 'NO' box. Then say:

You are to mark the 'YES' box if the shape here (point to the target symbol in the left column) is the same as any of these shapes here (point to the symbols in the search group) and mark the 'NO' box if the shape is not the same. Do you understand?

If the child appears confused or does not understand the instructions, explain further. Using only the Sample Items, again demonstrate the task to the child.

Practice items

Point to the two Practice items and say:

Now you do these here. Go ahead.

(Answers to these items are YES and NO, respectively.)

For each Practice item done correctly, offer praise such as Yes or Right, and say:

Now you know how to do them.

If the child makes an error on a Practice item, stop the child and explain the correct answer to the item. For example, if the child marks 'NO' when there is a match in a Practice item, say:

That's not quite right. Look here (point to the symbol in the left column). Here is the shape. Now look over here (point to the corresponding symbol in the search group). Here is the same shape. The shapes are the same, so you should mark the 'YES' box.

If the child incorrectly marks 'YES' in a Practice item, say:

That's not quite right. Look here (point to the symbol in the left column). Here is the shape, but when we look over here (point to the search group) none of the shapes is the same. The shapes are not the same, so you would mark the 'NO' box.

Do not proceed until the child clearly understands the task.

Test Items

When the Practice items have been successfully completed, open the booklet so that the two test pages are exposed to the child. Say:

When I tell you to start, you do these in the same way. Begin here (point to the first test item) and do as many as you can. When you finish the first page, go on to the second page and the following pages (turn the page briefly showing the child the third page of items). Keep working until I tell you to stop. Work as quickly as you can without making mistakes. Make sure you go in order without skipping any. Most people don't do all of them. There is a time limit, so just do as many as you can until I tell you to stop. Any questions?

Explain further if necessary. When the child is ready, say:

OK. Ready, go.

Begin timing. Remind the child to go in order if necessary.

Give no further assistance except to remind the child to continue until told to stop (if necessary). At the end of 120 seconds, say:

Stop.

Directions for Level B (Ages 8–16) ✓

Sample items

Place the Response Booklet before the child, opened to the Sample items for Level B. Point to the first Sample item and say:

Look at these shapes (point, from the child's left to right, to all the symbols in Sample Item *i*). One of these shapes (point, from the child's left to right, to the two target symbols in the left-hand column) is in this group of shapes over here (point, from the child's left to right, to all the symbols in the search group).

Point to the symbol in the target group that matches a symbol in the search group, and say:

See, this shape here is the same as this shape here (point to the matching symbol in the search group), so I will mark the 'YES' box like this (place a slash '/' in the 'YES' box).

Point, from the child's left to right, to all the symbols in Sample Item *ii* and say:

Now look at these shapes. Neither of these shapes (point, from the child's left to right, to the target symbols in the left-hand column) is in this group over here (point, from the child's left to right, to all the symbols in the search group), so this time I will mark the 'NO' box like this (place a slash '/' in the 'NO' box).

Point to the target symbols in the left-hand column and say:

You are to mark the 'YES' box if one of the shapes here is the same as any of these shapes here (point to the symbols in the search group) and mark the 'NO' box if none of the shapes is the same. Do you understand?

If the child appears confused or does not understand the instructions, explain further. Using only the Sample items, again demonstrate the task to the child.

Practice items

Point to the two Practice items and say:

Now you do these here. Go ahead.

(Answers to these items are YES and NO, respectively.)

For each Practice item done correctly, offer praise such as Yes or Right, and say:

Now you know how to do them.

If the child makes an error on a Practice item, stop the child and explain the correct answer to the item. For example, if the child marks 'NO' when there is a match in a Practice item, say:

That's not quite right. Look here (point to the target symbol in the group on the left). Here is the shape. Now look over here (point to the matching symbol in the search group). Here is the same shape. The shapes are the same so you should mark the 'YES' box.

If the child incorrectly marks 'YES' when there is not a match in a Practice item, say:

That's not quite right. Look here (point to the target symbols). Here are the shapes, but when we look over here (point to the search group), none of the shapes is the same. The shapes are not the same, so you would mark the 'NO' box.

Do not proceed until the child clearly understands the task.

Test Items

When the Practice items have been successfully completed, open the booklet so that the test pages are exposed to the child. Say:

When I tell you to start, you do these the same way. Begin here (point to the first test item) and do as many as you can. When you finish the first page, go on to the second page and the following pages (turn the page briefly showing the child the third page of items). Keep working until I tell you to stop. Work as quickly as you can without making mistakes. Make sure you go in order without skipping any. Most people don't do all of them. There is a time limit so just do as many as you can until I tell you to stop. Any questions?

Explain further if necessary. When the child is ready say:

OK. Ready, go.

Begin timing. Remind the child to go in order if necessary.

Give no further assistance except to remind the child to continue until told to stop (if necessary). At the end of 120 seconds, say:

Stop.

12. Digit Span

Introduction

Materials

All items for both Digits Forward and Digits Backward are included in this section of the Manual.

Description of subtest

In this subtest the examiner reads a series of number sequences to the child, at the rate of one per second, and the child is required to repeat each sequence in either the same order as spoken (Digits Forward) or the reverse order (Digits Backward). Each item consists of two trials with each trial consisting of the same number of digits.

Start rule

✓ All ages Item 1 on Digits Forward

Discontinue rule

Discontinue Digits Forward after failure on both Trial 1 and Trial 2 of any item, then proceed to Digits Backward. Discontinue Digits Backward after failure on both trials of any item.

Directions

- 1 The two parts of Digit Span—Digits Forward and Digits Backward—are administered separately. Administer Digits Backward even if the child obtains a score of 0 on Digits Forward.

Scoring and recording

Each item is scored 2, 1 or 0, as follows:

- 2 points if the child passes both trials
- 1 point if the child passes only one trial
- 0 points if the child fails on both trials

The scores for Digits Forward and Digits Backward are summed separately. For each item the score is the sum (2, 1 or 0 points) of the two trial scores. The total score for Digits Forward is the sum of the item scores; the total score for Digits Backward is the sum of the item scores. The total score for the Digit Span subtest is the sum of scores on Digits Forward and Digits Backward.

Maximum score, Digits Forward: 16 points
 Maximum score, Digits Backward: 14 points
 Maximum subtest score: 30 points

Directions for Digits Forward

Begin with Trial 1 of Item 1. Say:

I am going to say some numbers. Listen carefully, and when I have finished, you say them right after me.

Read the digits at the rate of one per second, dropping voice inflection slightly on the last digit in a series. After each sequence, pause to allow the child to respond.

Administer both trials of each item, even if the child passes Trial 1.

Item	Trial 1	Trial 2
1	2-9	4-6
2	3-8-6	6-1-2
3	3-4-1-7	6-1-5-8
4	8-4-2-3-9	5-2-1-8-6
5	3-8-9-1-7-4	7-9-6-4-8-3
6	5-1-7-4-2-3-8	9-8-5-2-1-6-3
7	1-6-4-5-9-7-6-3	2-9-7-6-3-1-5-4
8	5-3-8-7-1-2-4-6-9	4-2-6-9-1-7-8-3-5

Directions for Digits Backward

Sample item

Begin Digits Backward with the following Sample item. Say:

Now I am going to say some more numbers, but this time when I stop I want you to say them backwards. For example, if I say 8-2, what would you say?

Pause for the child to respond.

If the child responds correctly (2-8), say:

That's right.

Proceed to Item 1.

If the child fails the Sample, say:

No, you would say 2-8. I said 8-2, so to say it backwards you would say 2-8. Now try these numbers. Remember, you are to say them backwards: 5-6.

Whether the child succeeds or fails with the second example (5-6), proceed to Item 1. Give no help on the second example or on any of the items that follow.

Test items

As with Digits Forward, read the digits at a rate of one per second, dropping voice inflection slightly on the last digit in a series. After each sequence, pause to allow the child to respond.

Administer both trials of each item, even if the child passes Trial 1.

Item	Trial 1	Trial 2
1	2-5	6-3
2	5-7-4	2-5-9
3	7-2-9-6	8-4-9-3
4	4-1-3-5-7	9-7-8-5-2
5	1-6-5-2-9-8	3-6-7-1-9-4
6	8-5-9-2-3-4-2	4-5-7-9-2-8-1
7	6-9-1-6-3-2-5-8	3-1-7-9-5-4-8-2

13. Mazes

Introduction

Materials

- Mazes Response Booklet containing Mazes Level A and Mazes Level B
- Stopwatch
- Two pencils without erasers

Description of subtest

In this subtest the child must solve a series of mazes. In each maze the child is required to draw a line from the centre to the exit without entering any blocked passages or crossing through walls. The task is timed to determine how quickly the child can correctly complete the maze.

Start rules

- Ages 6–7 Sample Maze and then Maze 1
- ✓ Ages 8–16 Maze 4 (not the Sample Maze)

- | If a child aged 8–16 obtains a perfect score (2 points) on Maze 4, give full credit for Mazes 1–3.
- | If a child aged 8–16 obtains partial credit (1 point) on Maze 4, administer Mazes 1–3 in normal sequence before proceeding with the test.
- | If a child aged 8–16 obtains a score of 0 on Maze 4, first demonstrate the Sample Maze and then administer Mazes 1–3 in normal sequence before proceeding with the test.

Discontinue rule

Discontinue after 2 consecutive failures (excluding Maze 1).

Directions

- | A smooth drawing surface must be provided. If the table has a rough surface, the Response Booklet should be placed over a piece of cardboard. Have two pencils on hand in case one is broken during the test.
- | Always fold the Mazes Response Booklet so that only one page is exposed to the child's view.
- | Place each maze so that the figure in the centre box is the right way up for the child.

The child should not lift the pencil from the paper and should be reminded of this whenever necessary during the test. If he or she lifts the pencil, say:

Administration and scoring

Remember, keep your pencil point on the paper.

However, there is no penalty for lifting the pencil.

- 1 The time limit allowed for each maze is shown below and on the Record Form. Timing for each maze begins when the last word of the directions is given. Record the exact time the child takes to complete each maze. If the child exceeds the time limit, note this on the Record Form, stop the child, and proceed to the next item.
- 1 Because the score for each maze is also based on the number of errors, record the number of errors in the appropriate column on the Record Form. The possible scores according to the number of errors for each maze are provided in the scoring section on the Record Form.
- 1 The following cautions should be given, if necessary, but each caution may be given only once during the test. Timing does not stop when cautions are given.
 - 1 If the child crosses a line, say:
You're not allowed to go through a wall.
 - 2 If for any reason the child stops trying to solve a maze before the time limit is up (e.g. if the child enters a blind alley and stops, not realising he or she is permitted to reverse direction), say:
Don't stop. Keep going until you find your way out.
 - 3 If, after crossing a line or entering a blind alley, the child lifts the pencil and starts again from the centre box, say:
You're not allowed to start again. Keep going from here (point to the last place he or she had reached) and try to find the right way out.
 - 4 If the child begins outside the centre box, say:
You should start here (point to the boy or girl in the centre box).
 - 5 If the child does not clear the exit completely, say:
You must get right out.
 - 6 If the child begins at the exit, and starts to solve the maze by working toward the centre box, point to the boy or girl in the centre box and say:
You should start here.
- 1 Although all children are administered Maze 4, the Maze 4 instructions for children starting with Maze 1 differ from the instructions for children starting with Maze 4.

Scoring and recording

Note: A maze must be completed within the time limit to receive credit. Otherwise, it is automatically scored 0, regardless of the number of errors.

Each maze is scored on a multi-point basis.

- I Full credit is given if the child solves the maze within the time limit without making any errors.
- I Partial credit is given if the child solves the maze within the time limit but makes errors along the way (as long as he or she does not exceed the maximum number of errors allowed).
- I No credit is given if the child exceeds the maximum number of errors allowed or if he or she fails to reach the goal within the time limit. Error and failure types are discussed below.

For each maze, the time limit and the scoring system are shown in the table below. Detailed explanations of errors and of failures are provided following the table.

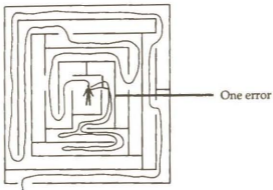
On the Record Form, record the number of errors and the time the child takes to complete each maze.

Maze	Time limit (in seconds)	Score					
1	30			2+ errors 0	1 error 1	0 errors 2	
2	30			2+ errors 0	1 error 1	0 errors 2	
3	30			2+ errors 0	1 error 1	0 errors 2	
4	30			2+ errors 0	1 error 1	0 errors 2	
5	45			2+ errors 0	1 error 1	0 errors 2	
6	60			2+ errors 0	1 error 1	0 errors 2	
7	120			3+ errors 0	2 errors 1	1 error 2	0 errors 3
8	120		4+ errors 0	3 errors 1	2 errors 2	1 error 3	0 errors 4
9	150		4+ errors 0	3 errors 1	2 errors 2	1 error 3	0 errors 4
10	150	5+ errors 0	4 errors 1	3 errors 2	2 errors 3	1 error 4	0 errors 5

Maximum score: 28 points

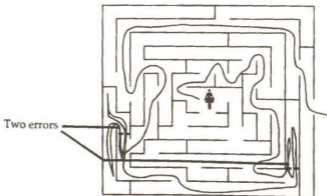
Any wandering within a blind alley or entrance into one of its branches is part of the same error and is not scored as a second error. See Example 2.

Example 2 Entering and wandering in a blind alley: one error



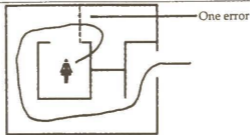
If a child's path leaves the blind alley, returns to the correct path and reenters the same blind alley, a second error is recorded. Two errors are the maximum recorded for any one blind alley, regardless of the number of times the child's path enters it. See example 3.

Example 3 Entering the same blind alley two or more times



Any path that does not properly leave the centre box—that is, cuts through a wall into a blind alley, passes the outside of the starting point, but does not omit any portion of the correct path—is scored as only one error. The error is made by the path's crossing the opening to the blind alley. See Example 4.

Example 4 Path does not leave centre box properly; one error



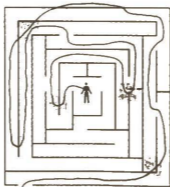
Overshoots

A child's response is not penalised for overshoots. Overshoots are slight deviations from the correct path, including cutting corners, tracing along the outside of a wall and cutting through walls. If an overshoot, however, results in a significant portion of the maze being omitted, the response is scored 0 (see Failures below).

Example 5 illustrates several kinds of overshoots. They usually occur at corners and at the ends of walls, but can also occur along a straight path. All of these kinds of overshoots are illustrated in Example 5. Occasionally a blind alley is actually slightly entered; this deviation, however, is considered only a slight overshoot and no error is recorded.

Example 5 Overshoots: no errors

Overshoots:
no error



Directions for Mazes Level A (Ages 6–7)

Sample Maze

The Sample Maze appears on the front of the Mazes Response Booklet. Place the Sample Maze in front of the child so that the figure in the centre box is the right way up for the child. Demonstrate the Sample Maze, as follows. Pointing to the girl figure in the centre box, say:

See this girl in the middle here? She wants to get out to the street, there (point). Let me show you how she could do it without getting stuck. Watch me.

Illustrate, starting from some point within the centre box. On reaching the opening to the blind alley, pause a moment (without lifting the pencil), point to the blind alley, and say:

No, not this way. You see, if she took this turn she would get stuck by the blocked road. She can't go through a wall (point). She must go this way to get out.

Finish the tracing. Be sure to trace a line that clearly extends beyond the maze exit. Proceed to Maze 1.

Maze 1

After completing the above demonstration, hand the child a pencil. Open the Mazes Response Booklet to Maze 1 and fold the pages back so that only one page is exposed to the child's view. Point to Maze 1 and say:

Now see if you can get out of this one yourself.

Pointing to the boy figure in the centre box, say:

Start here and draw the path you should take to get out without getting stuck. Don't lift your pencil from the paper until you have finished. Go ahead.

Start timing, and allow 30 seconds.

If the child completes Maze 1 within the time limit with no more than one error, proceed to Maze 2. If the child fails Maze 1 (obtains 0 points), demonstrate by drawing in the correct path before proceeding to Maze 2.

Maze 2

Place the opened Response Booklet in front of the child with the pages folded back so that only the page showing Maze 2 is exposed to the child's view. Point to Maze 2 and say:

Now try this one.

Pointing to the girl figure in the centre box, say:

Begin here and find your way out. Don't get stuck. Go ahead.

Start timing and allow 30 seconds.

If the child completes the maze within the time limit with no more than one error, proceed to Maze 3. If the child fails Maze 2 (obtains 0 points), demonstrate by drawing the correct path before proceeding to Maze 3.

Maze 3

Place the opened Response Booklet in front of the child with the pages folded back so that only the page showing Maze 3 is exposed to the child's view. Point to Maze 3 and say:

Now try to do this one.

Pointing to the boy figure in the centre box, say:

Begin here where the boy is and find your way out without getting stuck. Go ahead.

Start timing and allow 30 seconds.

Discontinue the test if the child fails Maze 3 and has also failed Mazes 1 and 2. If the child receives full or partial credit for Maze 3, continue to Maze 4.

Maze 4

Place the opened Response Booklet in front of the child with the pages folded back so that only the page showing Maze 4 is exposed to the child's view. Point to the girl figure in the centre box and say:

Now start here and find your way out. Go ahead.

Start timing and allow 30 seconds.

Skip over the alternative instructions for Maze 4 below, and proceed with the directions for Mazes 5–10 (unless the discontinue criterion has been met).

Directions for Mazes Level B (Ages 8–16)

Note that the instructions for Maze 4 for children who start with this item differ from the Maze 4 instructions above.

Maze 4

Open the Response Booklet to Maze 4 and fold back the pages so that only one page is exposed to the child's view. Place the booklet in front of the child so that the figure in the centre box is the right way up for the child. Point to Maze 4, saying:

This is a maze. You are to start here (point to the girl figure) and find your way out here (point to the exit) without crossing any lines. Try your best not to go into any blind alleys. Don't go into any roads that are blocked. Do you understand?

If the child has no questions, hand him or her a pencil and say:

All right. Start here (point to the girl figure) and find your way out. Do not lift your pencil until you have finished. Go ahead.

Start timing, and allow 30 seconds.

If the child obtains full credit on Maze 4 (completes the maze within the time limit with no errors), give full credit for Mazes 1, 2 and 3 (2 points for each) and proceed to Maze 5.

If the child obtains partial credit on Maze 4 (completes the maze within the time limit with only one error), administer Mazes 1, 2 and 3 as for the younger children. Then proceed directly to Maze 5, unless the criterion for discontinuing has been met.

If the child obtains a score of 0 on Maze 4, first demonstrate the Sample Maze and then administer Mazes 1–3 in the normal sequence. After administering Maze 3, proceed directly to Maze 5 (unless the criterion for discontinuing has been met).

Administration and scoring

Mazes 5–10

To present Maze 5, fold the pages back so that only one page is exposed to the child's view.

For each maze, point to the boy or girl figure in the centre box and say:

Now start here and find your way out. Go ahead.

(These instructions may be shortened when the child understands the task.)

Start timing, and allow the specified number of seconds for each maze.

Maze 5: 45 seconds

Mazes 7–8: 120 seconds each

Maze 6: 60 seconds

Mazes 9–10: 150 seconds each