Thesis By

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Ph.D. PSYCHOLOGY

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BY

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BEING A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, UNIVERSITY OF LAGOS, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY (Ph.D.) IN PSYCHOLOGY OF THE UNIVERSITY OF LAGOS, AKOKA, YABA, LAGOS, NIGERIA.

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# DECLARATION

I Esther Foluke Akinsola (Mrs) hereby sincerely declare that the thesis titled : The Standardization of Two Diagnostic Instruments and Their Use In Classifying Learning Disabilities In Nigerian School Children is the product of an original research carried out by me.

I do affirm that no part of this thesis has been presented anywhere else either for the award of a higher degree or for publication.

All works consulted in the process of writing this thesis have been duly acknowledged.

Esther Foluke Akinsola (Mrs.).
DECLARANT
Date 19-11-98

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SUPERVISOR
Date 19-11-98

SCHOOL OF POSTGRADUATE STUDIES
UNIVERSITY OF LAGOS

## CERTIFICATION

This is to certify that the thesis

SUBMITTED IN THE SCHOOL OF POSTGRADUATE STUDIES
UNIVERSITY OF LAGOS

for the award of the degree of

DOCTOR OF PHILOSOPHY (Ph.D)

*is a record of original research carried out by*

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# DEDICATION

This thesis is dedicated to:

THE OMNIPOTENT AND OMNIPRESENT GOD !

The Creator of Heaven and Earth !

The Giver of Life, Knowledge and Wisdom !

AND

My Consistent Guide and Guard.

My INESTIMABLE AND INDISPENSABLE CROWN AND JEWELS !

VICTOR OLUSEGUN !

AKINLOLU OLUMIDE, SOPEFOLU OLUWASEUN,

OLUWADAMILOLA OYINLOLA, AND OPEYEMI TEMITOPE.

THOSE NEGLECTED DISABLED CHILDREN AND YOUTHS

Who Yearn For Recognition And Assistance.

AND

ENDURANCE !

Without WHOM this thesis would not have been completed.

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**"ENI TI O BA DUPE ORE ANA YIO RI OMIRAN GBA"**

**"MEANING AN APPRECIATION OF ONE FAVOUR BEGETS ANOTHER"**

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## ABSTRACT

This research standardized two diagnostic instruments namely Raven's Coloured Progressive Matrices (CPM), used as an intelligence test, and Beery's Developmental test of visual-Motor integration (VMI), used as an achievement test. Nigerian Norms were established for the tests, and these norms were used to classify children who were having learning problems in school. Two studies were carried out, one to establish the norms and the other to classify learning disability.

In study one, 1375 normal children aged 6 to 11.5 years, divided into 12 groups, randomly selected from 2 private and 6 public primary schools in Lagos were tested on CPM and VMI tests. Validities of CPM and VMI tests were obtained by correlating the scores of some children from the normative sample in CPM and VMI tests, and with their scores in Draw a Man Test,(DAMT), and Bender Gestalt Test,(BGT). Reliabilities of the tests were also obtained by correlating the children's test retest scores, and their scores on odd and even items in both CPM and VMI tests. Results obtained indicated that:

(a) Children's scores in CPM and VMI tests increased with age, indicating developmental significance of the two tests.

(b) A positive and significant correlation was found between the children's:(i)CPM and VMI test-scores to indicate **concurrent validity;** (ii) CPM and DAMT test scores, and CPM and BGT test scores to indicate **construct validity of CPM;** (iii) VMI and BGT test scores, and VMI and DAMT test scores to indicate **predictive validity of VMI;** (iv)test and retest(after 2-weeks) scores in CPM and VMI tests to indicate **test retest reliability;** (v)scores on odd and even test items' of CPM and VMI tests to indicate **internal consistency** of the tests.

These results confirmed all the hypotheses tested in study one, and provided developmental norms for CPM and VMI tests.

In study two 170 children of which 85 were normally achieving, and 85 were identified by their teachers and school performance records as having learning difficulties were administered the CPM and VMI tests. Their results compared to the norms established in study one were used in classifying them. Three classes namely; **the learning disabled, the slow learners and normals** resulted from the classification.

(i) The learning disabled class obtained at least average t scores in CPM and significantly lower t scores in VMI.

(ii) The slow learners obtained below average t scores in both CPM and VMI tests.

These two classes emerged from the 85 children identified to be having learning problems in school.

(iii) The 85 normally achieving children obtained at least average t scores in both CPM and VMI tests.

The normal class scores in CPM and VMI tests were also correlated with their scholastic achievement scores denoted by the preceding year aggregate percentage scores, to indicate the scholastic predictability of CPM and VMI tests. The correlations obtained were low but significant.

The results above confirmed all the hypotheses tested and documented the existence of learning disabled and slow learners among Nigerian children. The implications of the results were discussed and recommendations were made.

# CHAPTER ONE

## GENERAL INTRODUCTION

### 1.1 PREAMBLE

This thesis deals with the standardization of two assessment instruments and their use in the diagnosis and classification of learning problems encountered by primary school children. Specifically the thesis is about the standardization of two diagnostic tools for use in identifying children who have problems with classroom learning and categorizing them according to some criteria. These criteria are related to the children's intellectual capacity and achievement levels. This is because learning problems usually become noticeable when the children begin formal classroom learning. As such the ideal way to establish criteria for classifying learning problems will be through the use of tests that assess intellectual capacity and achievement levels of children. The strength of such classification criteria will be tested against children's school performance records. It is hoped that this attempt at categorizing learning disabilities will bring into focus the following:

(a) The existence of learning disabled children in Nigeria.

(b) The diverse educational needs of Nigerian School children.

(c) The implications of addressing diversity of educational needs through differential instructional planning and implementation.

### 1.2 Special Education in Nigeria.

The national policy on Education recognizes that some groups of children and youth may not be able to cope with normal school learning due to different handicaps such as physical handicaps, blindness, partial sightedness, deafness, mental retardation, social maladjustment and learning disability. Therefore there is a provision in the policy to address the problems and needs of these groups by (i) making special Education arrangements for them in schools, clinics and learning centres. (ii) Making provisions for training teachers in special education and supportive staff who will assist the special education teachers to achieve the objectives of special education.

In response to these needs the government has ensured the inclusion of special education in the curriculum for would be trained teachers. Further more there are special educational institutions scattered across the country for handicapped children and youth. There are also vocational schools that provide further education for the handicapped population. In addition and most recently the Federal government has made provisions for the exceptionally gifted children by identifying them through the results of national common entrance examinations into Secondary schools and putting them together in a school designed for them.

A cursory look at the available facilities and educational opportunities for special children in Nigeria suggests that those groups in the handicapped population that are given attention are those whose problems are obvious and can be easily identified. Such groups include the deaf, the blind, the physically disabled, the severely mentally retarded and the exceptionally gifted. However there are two groups within the handicapped population who are not being given any attention as of now by the executors of the special education policy. These groups are the learning disabled and the slow learners. The learning disabled group consists of those children who are intellectually bright. They are usually of above average intelligence but they are achieving below their capacity in very few subjects due to psychological and other problems that can be identified and rectified. The other group, the slow learners are those children who are not severely retarded. They are rather of a little below average intelligence and they have a record of poor achievements in many subject areas. It is suspected that these two groups are present among the population of our primary school children. Due to the frustrations arising from the inability to cope with formal education, some of these children don't go beyond the primary school level, (especially the slow learners). For those who managed to go beyond primary school (the learning disabled) they mostly drop out before they get to the final year in the secondary school. Those who do not drop out end up with mass failures in their SSCE examinations. This assertion is strengthened by the available WAEC statistics of GCE/SSCE performance results (1981-1985; 1986 - 1990; 1991 -1995). According to these statistics on the average more than 55% of those who took the examination in the major subjects such as Mathematics, English, Chemistry, Physics, Biology, Commerce, Geography, History and agriculture failed with less than 20% of those who pass having grades between 1 and 6 (distinction to credit). This high rate of failure appears to be a major cause of the high incidence of "school drop outs". These drop outs are likely to be those handicapped children or individuals who belong to those two groups (e.g. the learning disabled and slow learners) who have not yet received any attention under the special education policy and programmes.

If the objectives of special education especially the first two stated above are anything to go by, these groups of children deserves recognition and attention so that they can develop their potential to the fullest. For these objectives to be realized it is crucial for the educational services to establish screening, identification, and classification procedures for these two groups of handicapped children. This precisely is the main thrust of this research. It is hoped that at the end of this study, these procedures would have been established and used to classify some members of the two groups (i.e. the learning disabled and slow learners).

**1.3 The Concept and Definitions of Learning Disability**

Learning disability (LD) as a concept emerged from a need to identify and serve a group of children who were failing in school but who did not fit the existing categories of exceptional children in special education. By its nature Learning disability can best be described as a heterogeneous and complex concept in special education (Wallace& McLoughlin,1988). It is heterogeneous in the sense that it is used to describe the handicap of a specific population with subtypes. Within the LD population, specific types can be identified. The learning disabled individuals are homogeneous as far as their disability in learning is concerned but they suffer from a variety of specific disorders such that no one individual will have problems in all areas of disorder. This is what makes the group heterogeneous.

The most widely used definition of learning disability is the one incorporated in the US Public Law Act (PL) 94 - 142 (The Education for All Handicapped Children Act of 1975), called the Federal definition, and reauthorised as (PL) 101-476 (The Individuals with Disabilities Education Act IDEA (1990)).It

Stated thus :

" Specific learning disability means a disorder in one or more of the basic psychological processes, involved in understanding or in using language spoken or written which may manifest itself in an imperfect ability to listen, speak, read, write, spell or to do mathematical calculations". "The term applies to such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia and developmental aphasia. The term does not apply to children who have learning problems which are primarily due to visual, hearing or motor handicaps, to mental retardation, emotional disturbance or environmental (cultural or economic) disadvantage, (Section 5(b) (4) of (PL) 94-142)".

" The ((PL)94-142) also includes a set of regulations that are frequently used to operationalize the learning disability definition. According to these regulations a student has a specific learning disability if he/she has been provided with learning experiences appropriate for his age and ability level, but his achievement lags behind those levels in one or more of the following areas, or there is a severe discrepancy between achievement and intellectual ability in one or more of these areas: 1) Oral expression, 2)Listening comprehension, 3) Written expression, 4) Basic reading skills, 5) Reading Comprehension, 6)Mathematical calculation, and 7) Mathematical reasoning".

The other part of the ((PL) 94-142) regulation for learning disabilities includes the exclusion component which states that, "the LD problem may not be due to other handicaps such as visual or hearing impairments, mental retardation, motor handicap, emotional disturbance or environmental, cultural or economic disadvantage".

Many professionals were using the Federal definition but there

was still a widespread dissatisfaction and disagreement, and many objections believed to delimit the field were raised.
These objections are that: 1).The use of the term children is restrictive because learning disability is a problem that extends from early childhood into adult life. 2).The inclusion of the phrase basic psychological processes has generated extensive and needless debate in the field. 3).Spelling should not be included in the LD definition because it is typically considered to be part of written expression. 4).The inclusion of many ill-defined terms (e.g. perceptual handicap, brain injury, minimal brain dysfunction) invites more controversy confusion and misinterpretation. 5).The wording of the exclusion clause lends itself to the misinterpretation that individuals with learning disabilities cannot be multi-handicapped or come from different cultural and linguistic backgrounds.

With these objections, the National Joint Committee on Learning Disability, (NJCLD), in 1981 proposed a modified definition of learning disability, which states thus:

"Learning disability is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening speaking, reading or mathematical abilities". These disorders according to (NJCLD), are intrinsic to the individual and presumed to be due to central nervous system dysfunction. They maintained that though a learning disability may occur concomitantly with other handicapping conditions such as sensory impairment, mental retardation, social and emotional disturbances, and psychogenic factors, it is not the direct result of these conditions, (Hammill Heigh, McNutt, & Larsen 1981).

However, the Association of Children and Adult with Learning

Disabilities board (ACLD) disapproved of this definition and adopted a different definition (Wallace and Mcloughlin 1988). Similarly, other countries around the world have also adopted other LD definitions. Nonetheless all these definitions are variations of the existing ones such as those of the national Advisory Committee on Handicapped Children (NACHC 1968), the Federal law definition (1975) and the (NJCLD) definition 1981. One thing about these definitions is that they share certain common dimensions, which include the following:
1).A discrepancy between the expected and the actual performance of an individual. 2).Behavioural manifestations of strengths and weaknesses in learning in academic and language areas. 3).A focus on primary explanation of the learning problems.

It is necessary to point out that though the discrepancy dimension is not explicitly included in all definitions but it is fairly well accepted and implied in practice, and there is a high degree of similarity in the descriptions of behavioural manifestations of learning disability.

Some characteristics are also agreed upon as necessary to a diagnosis of learning disability. These characteristics according to (Chalfant and King,1976; Mercer, King-Sears,& Mercer, 1990; Frankenberger,& Fronzaglio, 1991),include:
a).Difficulty in school learning, b).Uneven performance across a variety of tasks, c).Physiological correlates, d).Disruptions in basic psychological processes, e).Exclusion from any other previously established categories of disability.

To identify children as learning disabled it is important to establish that they have problems in one or more academic skill areas. If a child exhibit other symptoms associated with learning disability but does not have problems in school learning it will not be appropriate to label such a child learning disabled.

The criterion of uneven performance across tasks as indicator of learning disability, requires that there is a discrepancy within the child's own levels of performance. The LD child will have under achievement in some academic areas manifested in a discrepancy between assumed capacity and actual achievement, and superior skills in others. The child may be able to read excellently well and be unable to comprehend mathematical calculations or vice versa.

The inclusion of physiological correlates as a criterion for diagnosing learning disability, is based on the assumption that there is a disorder of basic processes which removes the possibility of labelling children as learning disabled on the basis of poor instructions and cultural differences. Some learning disabled children have clear signs of brain injury such as irregular patterns of brain waves, and for others, brain dysfunction is inferred from neurological examination (Reid & Hresko 1981 ). Such examination reveals subtle symptoms usually called "soft signs", and other symptoms such as awkwardness, distractibility, hyperactivity and lack of impulse control.

Disruptions in basic psychological processes as a criterion in diagnosing learning disability is presumed to cause the most difficulty (Reid and Hresko 1981).However there is no consensus as to what the basic psychological processes are, or how to identify them, or to what extent they are significant in causing the LD problem. Most professionals in this field consider disorders of perceptual-motor functions, attention, memory, language and emotionality as some of the basic psychological processes underlying learning disability, (Hammill,1974). Many attempts were made to remediate some of these disorders of psychological processes assumed to be prerequisites to academic learning, but most of the attempts failed to improve the academic performances of the children. This made it difficult to establish a clear evidence of causal relationship between these processes and children's ability to learn,(Reid & Hresko,1981).

Most definitions agree on the exclusion criterion, which states that learning disability should not include children with learning problems that are primarily the result of visual or hearing impairment or motor handicap, mental retardation, emotional disturbance, environmental, cultural or economic disadvantage. However many arguments were raised against this criterion from the point of view that it is often difficult to differentiate between children who are primarily emotionally disturbed, mildly retarded or culturally disadvantaged and the learning disabled children. The primary problems and learning disabilities frequently occur together such that it is extremely difficult to decide which problem is primary and which is secondary: Is it emotional or learning disability? Besides, the exclusion criterion tend to infer that learning disability cannot be multi-handicapped or come from different cultural and linguistic backgrounds, which in reality may not be so. As such most recent definitions of learning disability (LD) recognize the fact that learning disabilities can occur together with other handicapping conditions but are not the direct result of these conditions ( Wallace & McLoughlin 1988).

Some of the dimensions and characteristics shared by the LD definitions, mentioned on pages 7 & 8 above have been empirically evaluated. Taylor, Satz,& Friel, (1979), evaluated the traditional classification of dyslexia (a neurologically based inability to read). In their study, a group of poor readers were classified into two subgroups. One group met the standard criteria of dyslexia, and the other group did not due to below average IQ, (e.g.IQ < 90), low socio-economic status, emotional difficulties, or sensory/ motor deficiencies. The standard differentiating criteria for dyslexia relates to the intellectual status and the cause of the reading problem. For children to be labelled as dyslexics, they must have at least average IQ, have normal listening comprehension( their listening comprehension ability to be at or above grade level), but deficient in decoding ability( their ability to decode is below grade level). They also need to satisfy the exclusionary clause of not coming from low socio- economic level and not having emotional problems. Comprehension and decoding abilities are the two components in reading that are focused upon when assessing reading efficiency. Other poor readers (usually regarded as backward readers), and not dyslexics would have below average IQ and exhibit problems primarily in listening comprehension with or without adequate decoding skills. These criteria were established through the use of intelligence tests and reading comprehension tests that require listening comprehension and decoding skills (Aaron, Kuchta, & Grapenthin,1988). The results of Taylor et al.'s study showed that the dyslexic subgroup did not differ from other poor readers on progression or severity of reading disturbances, on frequency of letter reversal errors, on familial reading levels, on mathematical ability levels, or on neuro-psychological or personality functioning. Since the characteristics listed above are some of the major dimensions considered to be characteristic of the dyslexic child, the results of the study raise serious doubts about the clinical and research validity of such a classificatory system.

The implication of this result is that the tests administered to the two subgroups of poor readers failed to differentiate between them. Some reasons can be adduced for this. One is that the specific functions that could have differentiated them were not assessed by the tests used, especially since subtypes have been identified within the dyslexic group. To illustrate further, Manis, Szeszulski, holt, & graves,(1988), in their own study identified three major subgroups of dyslexics, namely: (a) those with a specific deficit in phonological processing of print,(the suspected group in Taylor et. al.'s study), they are in the majority-52%, (b) those with deficits in processing both the phonological and orthographic features of printed words,(24%), and those with phonological deficits in language,(8%). In addition Manis,et.al., reported that the remaining 16% of dyslexics in their study either had specific deficits in visual or orthographic processing of print in spelling or did not differ from the control group.

It is reasoned by the present researcher that if the other subgroups were represented in Taylor, et.al.'s study, may be it would have been possible to differentiate between the dyslexics and the backward readers. This is because Manis, et al. Reported that when all the subgroups of dyslexics were considered together they deviated significantly from normal readers of equivalent reading achievement, primarily on phonological skills, and that they were even superior to normal readers in visual processing of print. The present researcher believes that if a similar combination of dyslexics in Manis, et al's study was used in Taylor, et al's study there would have been a clear differentiation between the dyslexics and backward readers. On the other hand it could be that the only way to differentiate between the two groups is through the criteria used to divide them into two subgroups initially, and that the processes assessed by the tests given to the two groups after dividing them, are not directly related to the etiology of their disability. Besides most researchers that compared dyslexics to normal readers found significant differences between the two. It could also be that methodologically, the evaluation procedures as followed by Taylor,et al. Were faulty. However there seems to be nothing in the research report to suggest this line of argument. So rather than look for the failure to differentiate between dyslexics and non dyslexics in methodological flaws, the present researcher is more inclined towards a closer look at the definitions of learning disability with the aim of streamlining the characteristics used to define LD so as to lead to a neater, clearer and less diverse classificatory system.

In another study, an attempt was made to examine the nature and occurrence of discrepancies between ability and achievement scores of students demonstrating average overall performance on commonly used assessment devices,(Algozzine & Ysseldyke 1988). Ability and achievement scores in several domains on individual and group administered tests were compared. The subjects used were 83 primary three pupils, 48 primary five pupils and 50 SSS 3 students. These subjects were members of the standardization sample for the Woodcock-Johnson Psycho-Educational Battery. The battery consists of cognitive and achievement tests. The achievement test consists of tests in reading, mathematics, written language and knowledge. The cognitive tests test for long term retrieval, short term memory, processing comprehension, knowledge and fluid reasoning. The battery is for children from kindergarten through to 17 years. The subjects were administered the various assessment devices as part of the standardization process. The primary measure of ability was the Wechsler Intelligence Scale for children-Revised (WISC-R),and the achievement tests used include Peabody Individual Achievement test (PIAT), Wide Range Achievement test (WRAT), and IOWA Test of Basic Skills(ITBS). The findings of this study indicated that difference patterns in children's overall average performance scores were similar across class levels and achievement tests. Average discrepancies were found to be generally small. Since the subjects used in the study were normal subjects, the implication of the results is that the assessment devices used can document normal achievement and detect under-achievement.

Another study was carried out by Wilson(1985) in an attempt to justify the usefulness of the LD concept and the widely adopted definition of learning disability. The study reported by Wilson were in two parts. The subjects used in the first part of the study consisted of children referred for full psycho-educational assessment and diagnosis during the 1980-81 school year in IOWA. The referral sample had a total of 2,002 subjects and come from (Pre-primary), through (SSS2), with a mean value of late (primary four). Males out numbered females in the range of about ratio 3 to 1. The majority of the subjects were from public schools and were mostly Caucasians. The mean age was 10.5 years.

The subjects used in the second part of the study were chosen from a large sample of children already in IOWA learning disability classes called the "In-Programme Sample". The subjects were students in kindergarten (pre-primary), to grade 12(SSS3), with 77% of the sample being in (pre-primary), to(primary six). The mean grade level at placement was middle (primary four). The ratio of males to females was about 3 to 1 and majority of the subjects were also from the public schools and were mostly Caucasians, about 90% Caucasians. The mean Peabody Individual Achievement Test (PIAT) standard scores were generally near 100 for those diagnosed as non handicapped, and near 90 for those labelled as learning disabled. For the Woodcock Reading Mastery Test (WRMT), the values were near 95 and 85 respectively. The data collected were analysed in terms of meeting the four basic methods of quantifying academic discrepancy which are: (i)Deviation from grade level,(ii) Expectancy formula,(iii)IQ-standard score difference, and (iv) Regression equation.

The WISC-R, full scale IQ was used for ability measure. The achievement scores were from the Wide Range achievement test(WRAT), Peabody Individual Achievement test(PIAT), Woodcock reading test, and key math. The discrepancy criterion was expected to be met on only one subtlest. The use of IQ-standard score difference approach to quantify academic discrepancy was adopted in the IOWA study due ti its simplicity and the fact that it has been reported by others,(e.g. Algozzine & Ysseldyke,1983; Shepard & Smith 1981), to be a good index for comparing several learning disability populations, (Wilson 1985). In the approach adopted in the IOWA study, both the IQ and achievement scores were expressed on a common scale, one with a mean of 100 and a standard deviation of 15. With this the difference was assessed in such a way that a situation in which achievement is lower than IQ, indicated possible discrepant functioning. The question addressed in the IOWA study concerns the magnitude of the difference needed to indicate under achievement. This criterion according to Wilson must have statistical and educational significance. The educational significance criterion is reflected in the fixing of the critical difference that will indicate sufficient discrepancy between potential and achievement to warrant being labelled as learning disabled to be 10 points for the more reliable instruments and 15 points for the least reliable ones. This criterion value was 1.5 times the appropriate standard error of measurement. This was done to eliminate any difference occurring by chance, or due to measurement errors contained in both scores being used to determine sufficient discrepancy. From the statistical perspective, in the normal distribution, values larger than 1.5 standard deviation units from the mean in either direction occur about 7% of the time. Furthermore, under achievement is signified when achievement scores are lower than IQ scores. It then follows that in the IOWA study the probability of being incorrectly labelled as an underachiever was 7%, that is only 7% of the time would a child be labelled as discrepant when there was no real difference. These two educational and statistical criteria were believed to meet the lenient justifiable and defensible standards in the area of educational and statistical significance (Wilson 1985).

The results of the study indicated that 75% of the children in IOWA learning disability classes met the IQ-achievement standard score difference criterion in at least one of the academic areas measured. The percentage was 81 when a regression equation approach was employed to quantify academic discrepancy. A statistically significant difference between the learning disabled and not learning disabled groups was reported on all the variables addressed except full scale IQ. Children who were labelled as learning disabled clearly had lower achievement scores in all the three core academic areas studied, namely, reading, spelling, and arithmetic. The children labelled as learning disabled clearly had larger discrepancies between IQ and achievement, and were further below grade level than are those labelled as not learning disabled. The result further indicated that using the academic discrepancy criterion for children labelled as learning disabled, 80% met the discrepancy criterion and were classified, and 20% did not. For the children referred but not labelled, 34% met the discrepancy criterion and 66% did not. In addition, of all the children who had the required difference between IQ and achievement, 67% of them were labelled as learning disabled, and 33% were not labelled. The data suggested that learning disabled children had achievement scores that were considerably below grade level. The result that indicated that some non learning disabled children had academic discrepancy but were not labelled was explained on the premise that may be their achievement scores were not viewed as significantly deviant from grade level. To verify this factor further, Wilson(1985), employed an additional criterion called "a graduated deviation from grade level criterion". The standard of this criterion is described as follows: (a) for pre-primary and primary one levels, the difference between achievement and class level should be at least .5yr, for it to meet the criterion;(b)for primaries two and three, the required difference was .75yr, (c) for primaries four to six, the difference was 1yr, and (d) for Jss one and above the difference was 1.5yrs.

A joint criterion of meeting the previously defined academic discrepancy standard and now the graduated deviation from grade level standard in at least one of the achievement areas was applied to the research data. The results of this analysis indicated that out of the original number of children who had academic discrepancies but were not labelled as learning disabled, 60% of them met the class discrepancy criterion. That is 40% of them that had academic discrepancy were not significantly discrepant from class level as defined previously. Furthermore out of all the labelled learning disabled students with academic discrepancies, 92% of them met the class discrepancy criterion. These results according to (Wilson 1985),suggested that deviation from class level as well as academic discrepancy may be a critical factor in the diagnosis of learning disability. Using just academic discrepancy, 33% of the children who met the standard were not labelled as learning disabled, but when the class level criterion was added and a joint criterion used, the percentage decreased to 25. The above findings were interpreted by Wilson as consistent with the conclusions that the widely adopted definition of learning disability can be successfully and consistently used and applied by a large group of special education professionals. Wilson further stated that the various components of the currently accepted LD definition can provide the basis for discriminating a unique group of children and that the exceptions found in the study do not automatically invalidate previous conclusions.

### 1.3.1 Criticism of the LD Definitions

As discussed in 1.3. of this thesis, it is clear that there is a lack of consensus among professionals as to how to properly define LD, thereby giving rise to many definitions,( e.g. NACHC definition(1968),Federal definition (1975) (see page 5),and NJCLD (1981)(see page 6).This has led to difficulties in establishing a classification system for LD.

Some critical issues were raised about the LD definitions. One of such borders on the notion of specificity of a learning disability. The questions arising from this notion are whether learning disability is domain specific, and if there are subtypes. The reasoning behind the domain specific notion is that a child with a problem in one domain(e.g. reading), should be free of problems in other domains(e.g. arithmetic), otherwise if the child has problems across domains then it will be difficult to differentiate LD children from other categories of handicapped children,(Swanson,1988).In reality however this notion seems not tenable. What is tenable according to Siegel,(1988), is that though LD may be specific, it affects more than one domain. This is because for instance, a child who has reading problem would likely have problem with arithmetic if the underlying problem involves deficits in working memory, which is responsible for recognizing and labelling of abstract symbols.

The reasoning behind the subtyping notion is that LD children have different problems, and as such there are subgroups within the LD population. This is reflected in Siegel's findings which indicated that reading disabled children had difficulty with processing syntax while other LD children who are not reading disabled did not have this problem. This means that the former group is different from the latter group. Actually some subtyping studies have been carried out. In one of such studies Mckinney (1984) identified four subtypes of LD children comparing them to their average achieving classmates.

Members of (subtype I,33%) have average verbal skills but they are deficient in sequential and spatial skills. Behaviourally they show deficiencies in independence and task orientation. They are rated as being more considerate and less hostile than other subtypes. About 60% of this group are males and they are mildly impaired in reading and math.

Members of (subtype II,10%), were found to be the most severely impaired in achievement and had the lowest teacher ratings across all behavioural scales. They were seen as less considerate, more hostile, less competent academically, and less task oriented than members in other subtypes.

The (subtype III,47%) members were the largest and they were mostly males (93%). They were distinguished by above average conceptual skills, mild impairment in academic skills and low teacher ratings on task orientation. Members of the group are also seen as very extroverted.

The intellectual profile of the (subtype IV,10%), members were found to be similar to that of subtype I, but they are more impaired in achievement than either subtype I or subtype III. Notably no evidence of behavioural deficiency was found in this group (Wallace & Mcloughlin 1988).

In another subtyping study carried out in Florida as a longitudinal project, a hierarchical classification of learning disabled children without utilizing exclusionary criteria was developed,(Satz& Morris 1981; Fletcher& Satz 1985; Morris, Blashfied& Satz 1986). An initial classification of both learning impaired and normal children was developed, based on achievement levels. Those groups that showed impaired learning abilities were reclassified based on a set of neuro-psychological and cognitive tests. In the results, subtypes of children showing language, naming, visual-spatial, global, or no deficits were found. Extensive internal validation and reliability studies were performed to show the consistency of these subtypes(Morris et.al 1981). These groups were shown to differ on neurological soft signs, parental achievement levels and numerous other variables (Morris 1988). Due to the longitudinal nature of the Florida data base there was a unique opportunity to assess the developmental stability of subtypes (Morris et.al 1986).The subtypes in this study showed varying patterns of development between kindergarten, (pre-primary), and the fifth grade,(primary five). One subtype showed a rapid development of visual-spatial abilities from below to above average levels, but language abilities remained impaired. Another subtype showed a consistent rate of visual-spatial development while language skills developed at slower than average rates. These results raise questions about the use of cross-sectional samples for identifying valid subtypes of learning disabled children, and suggests that children may change their subtypes as they develop (Morris,1988).

From the above review on subtyping studies, it seems more reasonable to think of specificity of learning disabilities in terms of the subgroup notion. More importantly the identification of sub groups addresses the heterogeneity of the LD population. Therefore it has been suggested that more studies in this direction might eventually help to clarify the definition of learning disabilities (Wallace & Mcloughlin 1988).

Besides addressing the heterogeneity of the LD population, Swanson (1987a) identified some other advantages of sub-grouping towards the understanding of learning disabilities.These advantages are that: (a) Subgroups reduce a large amount of data about LD subjects to a manageable size, (b) Sub-grouping forces researchers to specify in a precise manner the important parameters of LD functioning. In line with the second advantage stated above some researchers were reported to have tried to group identified LD population on the basis of some parameters listed below: (a)Behavioural characteristics (e.g. Mckinney 1984, Speece, Mckinney & Appelbaum, 1985), (b)Memory performance, (e.g.

Torgesen & Houck, 1980), (c)Language ability (e.g. Ceci, Lea, & Ringstrom, 1980), (d)Achievement ability (e.g. Siegel & Linder, 1984), neuro-psychological profiles (e.g. Lyon & Watson 1981) and so on. (Swanson 1987b). It is reasoned that the success of sub-typing should reduce variability within a group and increase variability across groups. This will promote homogeneity within groups and heterogeneity across groups (Swanson 1987b).

As plausible and reasonable as the sub-typing notion may appear to be, there are some problems facing sub-typing studies. One of such problems has to do with acceptability. Sub-typing may not be readily accepted by fellow researchers if the definitional issues are not resolved and some theoretical frame work agreed upon,(Swanson 1987b). One problem with the definition has to do with the heterogeneity of the LD population. It is argued that the apparent heterogeneity of the LD population may not be real and only reflect definitions that are not specific (Keogh, Major-Kingsley, Omori-Gordon, & Reid 1982). If this is the case then subtyping studies must have been carried out on poorly specified LD samples in which the commonalities within the sample were not identified (Swanson 1987b). Theoretically it is argued that the majority of subtyping studies use psychometric measures or clinical instruments that do not reflect a theoretical framework of learning or cognition. As such tasks are assumed to be chosen arbitrarily or on the basis of what is used in the public schools. This gives rise to a post-hoc theory of task performance (Swanson 1987b, 1988). The main thrust of this argument is that if definitions are not specified and are non operational, if there is no theoretical integration in the choice of measures in subtyping studies,(Shepard & Smith 1983), and no agreed upon method for determining subtypes with the number of subgroups being determined arbitrarily (Mckinney 1984), then rather than clarify the definition of learning disabilities, subtyping studies might further fragment and obscure the field of learning disabilities (Swanson 1988).

### 1.3.2 Definition Adopted For The Present Research

For the purpose of this study, "Learning Disability is defined as a disorder in one or more of the basic psychological processes involved in understanding and using language, which is manifested in an imperfect ability to listen, speak, read, write, spell, or do mathematical calculations. This imperfect ability is reflected in the records of underachievement in classroom performance in few subjects. The learning disability status is confirmed by a significant discrepancy between assumed ability (as measured by CPM), and current achievement (as measured by VMI)".

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Characteristics of Learning Disability

The characteristics of children and students with special school learning problems are generally viewed in terms of the nature and type of problems encountered by them in the classroom. These problems are many and diverse. They include cognitive problems, reading problems, math problems and social behavioural problems. Some of them will now be discussed.

### 2.1.1 Cognitive Problems

Attentional deficit is one cognitive problem that is most frequently cited as characteristic of the learning disabled population (Reid & Hresko 1981, Wallace & Mcloughlin 1988 Lerner 1993). It has been documented that the learning disabled population exhibit attentional deficits, either short-term (Hallahan & Reeve 1980 Levine, 1987; 1988) or sustained (Kruspski 1980), when faced with tasks requiring voluntary attention. Teachers have also consistently rate the learning disabled students as less attentive than their non-handicapped peers, (Mckinney, McClure & Feagans,1982 Lerner & Lerner 1991 Conte 1991). Consistent research findings suggest that children and youth with a variety of learning problems share particular types of attention problems to some degree (Kruspski 1986), and these problems fall into three categories namely: coming to attention, decision making and maintaining attention (Keogh & Margolis 1976 Silver,1990,1992). Those who studied attention tend to view it as a multi-dimensional and complex process, and most of the researches on attention problems focused on selective and sustained attention (Douglas & Peters 1979, Kruspski (1980), Wallace & Mcloughlin 1988).

According to Hallahan, Kauffman, & Lloyd (1985) the concept of selective attention is closely related to the notion of coming to attention. Selective attention concerns a person's ability to respond to the relevant aspects of a task or situation and to ignore or refrain from responding to irrelevant aspects (Kirby & Grimley 1986). Most researchers in this area concluded that LD students have selective attention problems with both auditory and visual material (Hallahan & Reeve 1980 Frick & Lahey 1991; Lerner, & Lerner 1991). In addition some LD students also have difficulty in staying with a task over a period of time. This is sustained attention problem. Research findings in this area suggest that some learning disabled individuals can not concentrate because they are unable to organize what they are to do. Consequently they get distracted by irrelevant stimuli (Hallahan & Reeve 1980 Frick, & Lahey 1991). From various research findings and literature reviews, it seems that it can be safely concluded that many learning disabled children and youth have sustained attention to task problem (Douglas & Peters, 1979; Krupski, 1980; Krupski 1986 Conte, 1991; Lerner, & Lerner 1991). For selective attention however such conclusion seems not possible because of inconsistent evidences (Krupski 1986). What is evident is that learning disabled, individuals are generally inattentive, and distractible. High distractibility is task specific, meaning that if the learning disabled have selective attention problem which can be inferred from distractibility studies then such problem depends on the type of task involved and thus task specific. Selective attention problem can also be inferred from studies on incidental learning.

Das (1987), in his article reviewed a study involving selective attention. The study examined the relationship between attention and reading disability. The selective attention task was of two parts namely physical and name match. In physical matching the child had to cross out pairs of letters printed in upper case which were identical. In other words, two upper case A's, two upper case E's, or two upper case R's. The subject was not supposed to cross out non identical pairs. A physical match thus required visual coding in contrast to name match where name coding was required. The child here was asked to cancel pairs of letters which had the same name. Both time and errors were recorded and the scores consisting the number of correct responses made within a certain time. It was observed that the reading disabled children were as good as normal readers in physical match whereas they were significantly behind normal readers in name match. These children were those whose reading level was about two years below the normal controls who were of the same age. However when a group of reading disabled children who were three years or more backward in reading were observed, the picture changed. These severely reading disabled children were slow in both physical matching and name matching. The implication of this study was that the reading disabled children were not distracted, since the mildly disabled were as good in physical match as the normal readers, and name match was not exactly a measure of distraction. Name match was a measure of the type of coding that was required of the children. The implication is that whereas mildly disabled children were poorer in accessing the name of letters with which they were thoroughly familiar, the severely backward children had an additional difficulty which seems to be in the area of speed of encoding the letters themselves(Das 1984a,1984b).

In another study carried out by Carlson, Lahey and Neeper (1986), the cognitive functioning of children identified as attention deficit disorder with hyperactivity (ADD/H) was compared to that of children identified as attention deficit disorder without hyperactivity(ADD/WO). The two groups were compared to a group of normal children from the regular classroom. The three groups of children consisted of 20(ADD/H) children, 15(ADD/WO) children and 16 normal control children. Children from all the three groups were evaluated with a battery of cognitive tests which include intelligence tests such as WISC-R, academic performance tests(e.g. Beery's Developmental test of visual-Motor integration (VMI), Basic Achievement Skills Individual Screener(BASIS), language tests such as Clinical Evaluation of Language Functions(CELF), and attention tests such as Detroit Visual Attention Span for subjects, and Stroop Colour Distraction Test. The results of the study indicated that the ADD/H group obtained significantly lower Full-scale IQ scores than both the ADD/WO and control groups. Furthermore the ADD/H children obtained significantly lower verbal IQ scores than ADD/WO children. The two ADD groups performed more poorly than controls on spelling and reading achievement and the ADD/WO group performed more poorly on math achievement. The researchers concluded that the results validated the method of classifying the children as ADD in that the ADD groups differed from the controls on two of the four time measures of the stroop tasks and one of the two error measures of the prolonged visual matching task. Poor performance on attention tasks that are believed to require sustained visual attention is said to suggest that the two ADD groups of children were deficient in these attention areas relative to controls, hence the confirmation of the classification process. The results also indicated that the ADD/H children displayed educational and cognitive deficits and that the ADD/WO children also displayed similar deficits and their poor school achievement was attributed to a general deficit in reading ability. The IQ scores of the ADD/WO did not differ from those of the controls but the ADD/H children obtained significantly lower full scale and verbal IQ scores than both ADD/WO and control children. Since there wasn't much difference between the two ADD groups, it was concluded that it appears the differences between the two ADD subtypes may be more behavioural and emotional than cognitive(Carlson, Lahey& Neeper,1886).

Memory deficit is another cognitive problem commonly cited as characteristic of LD children. Reid & Hresko (1981) describe memory as the set of capacities that enable individuals to interact with incoming information in order to make sense of their environments. Hulse, Egeth & Deece (1980), described the memory process as: (a)the classification of information, (b)the ability to mentally store and keep information for future use, and (c)the ability to retrieve and recall the classified and stored information. Certain types of memory were identified as being crucial to various kinds of learning,(Wallace & Mcloughlin 1988). These are; (a)Short term memory, (b) Long term memory, (c) Rote memory, (d) Sequential memory.

Short term memory holds and retrieves information for a short period of time usually seconds or minutes (e.g. repeating digits or reproducing designs). Long term memory usually involves retention and retrieval several hours or days later (e.g. recalling words in reading). Rote memory is the process of remembering something that is not understood (e.g. memorizing words whose meaning are not known). Sequential memory is the ability to retrieve in a specified order the information being recalled (e.g. counting and reciting alphabets).

It has been reasoned that an individual who has difficulty with short term memory will certainly experience problems with most academic tasks and will equally have problem with many of the tasks of everyday living (Wallace & Kauffman 1986). Many researchers have carried out studies on the memory processes of learning disabled children. (Wallace & Mcloughlin 1988). The findings from these studies have consistently agreed on the following conclusions (Hallahan, Kauffman & Lloyd 1985):

(a) That in comparison to their non handicapped peers learning disabled children and youth exhibit difficulties on memory tasks.

(b) That the memory problems of the LD children can be attributed to a failure to use certain strategies that non-LD children freely uses, (c) That the strategies spontaneously used by non-LD children can be taught to LD children, and when taught to use such strategies, the LD children perform at par with their non-LD peers.

Some researchers found problems among learning disabled children with tasks on visual memory (Bryan 1972, Stanley & Hall 1973), and deficits on auditory memory tasks, (Aten & Davis 1968, Richie & Aten 1976, Van Atta 1973). In addition some evidence tends to suggest that the problems of the learning disabled may lie in being unable to transfer information from short to long term memory store (Marshall 1976), or inability to shift information back and forth between the memory stores (Spring 1976). Findings of some other studies tend to point to the inability of the learning disabled to organize material, and this organizational deficit is reasoned to be related to problems in memory (Bender

1976, Parker, Freston & Drew, 1975, Ring 1976, Torgesen 1977). (Reid & Hresko 1981), sees memory as a multifaceted skill that is dependent on many sub-skills. They believe that it is important for individuals working with the learning disabled to understand the memory process because to them it provides the backdrop against which memory problems can be understood.

### 2.1.2 Reading Problems

Many reading disabled pupils exhibit deficits in semantics syntax, and phonology (Sawyer, & Butler 1991). In addition they are unable to discriminate visually among various letters and words. Pupils with this problem may be confused by letters with similar configurations (e.g. h-n, i-j, v-w), or might be unable to distinguish between letters or words that look alike. Visual discrimination problems may also be observed among younger children who are unable to match various sizes, shapes or objects (Wallace & McLoughlin 1988).

One of the characteristics of pupils with auditory problems in reading is the inability to differentiate between phonemic sounds. Such pupils might be unable to identify the word that begins with an /S/ sound in a list of words read aloud. Similarly, they may be unable to differentiate auditorily between words such as beg and bag, pit and pet, pin and pen. One of the notable characteristics of pupils with auditory discrimination problems is the inability to tell whether two words read aloud are the same or different,(e.g. tank-sank, man-mat),(Wallace & McLoughlin 1988). It was noted that most auditory tests assess this particular ability (Wepman 1973).

It has also been noted that vocabulary and comprehension play an important role in reading, and when a reading disabled child shows low vocabulary and poor comprehension despite efforts from teachers to help the child acquire these, then problems with coding processes are suspected and examined. A study was carried out in this regard by Kirby & Das(1977), to probe the coding processes of children. In this study primary four children equivalent were divided into four groups on the coding processes. The four groups are: High simultaneous high successive group, low simultaneous low successive group, high simultaneous low successive group, low simultaneous high successive group. The four divisions were based on the children's performance on tasks that require predominantly simultaneous processing such as Raven's progressive matrices and Figure copying, and those that require successive processing, which were serial recall of words and digit span(mainly non-verbal part of simultaneous task and verbal part of successive task). The results of the study showed that those subjects who were high on both kinds of coding scored the highest on vocabulary as well as in comprehension and those who scored lower on the reading tasks were low in both of these processes and scored the lowest. The diagonal groups had scores between the two extreme groups. It was concluded that the study revealed the importance of both modes of information processing for reading skills and had important implications for remedial training (Kirby & Das 1977).

In another study the hypothesis that simultaneous processing is important at more advanced stages reading and that successive processing had no major role to play at proficient stages of reading was investigated (Cummins & Das 1978). The results of this study showed that among the children who are likely to experience difficulty in reading competence at the initial stages of reading acquisition, the salient coding process is successive, but among normal readers at more advanced level of reading skills, simultaneous processing is equally if not more important than successive in the reading process (Cummins & Das 1978). A study was also conducted to examine the relationship between planning and reading proficiency. The study was carried out by Ramey(1985) and reviewed by Das(1987). In the first phase of the research, school children at junior secondary level equivalent were given the coding and planning measures. The planning measures were visual search and trail making. In the visual search, a target such as the number 7 was embedded in a scatter of digits of 1 to 9 on a page. The individual has to find the target which occurs only once in the scatter. The trail making test consists of a page of numbers from 1 to 25. The subject's task is to join the numbers sequentially from 1 to 2 to 3 to 4. The numbers appear in a random scatter all over the page. The junior secondary school boys and girls were particularly tested for their standing on planning tasks, especially on visual search because it has proved to be the most important planning task in previous research, in that it had the highest loading on a factor of planning. The children were divided into 13 high performers and 7 low performers on visual search. They were given an extensive comprehension test which involved reading 9 different passages silently and trying to comprehend them. It was found that the top performers in visual search not only had higher comprehension but specifically showed characteristics such as ability to modify the hypothesis, making more inferential statements and questioning the responses that they had made from time to time. In contrast to the top performers, the bottom performers not only had lower comprehension scores but made fewer inferential statements tended to be impulsive, and become easily frustrated and they stopped with incorrect hunches (Ramey 1985). The interpretation of this result is that subjects who are proficient planners are also proficient readers. Those who scored high on planning tasks are better, who comprehended passages better and are more skillful in other cognitive areas than those who scored low on planning tasks. It also means that the planning tasks can be used to predict reading competency.

In the study of Morris, Blashfield & Satz (1986), a longitudinal cluster analysis was used in classification and validation studies of reading disabled children. This study also involved the Florida longitudinal projects(FLP) which started in 1970 and went on for 9 years. The FLP project was designed to address the incidence and prognosis of reading problems, to standardize and validate a kindergarten,(pre-primary), screening battery, to study the developmental processes related to reading disabilities and isolate potential subtypes of reading disabled children. In the study two samples from the FLP were combined to form the pool of subjects used for the cluster analysis. The first sample consisted of the original standardization sample of 497 white male kindergarten,(pre-primary), children. The second was a cross-validation group of 181 white male kindergarten(pre-primary), children tested one year later. The final sample for the clustering study was 200 subjects. The subjects were tested on eight measures that assess sensory-motor-perceptual and verbal- conceptual abilities. The measures are: (1) Peabody Picture Vocabulary test, (2) Verbal fluency, (3) Similarities, (4) Dichotic listening,(5) Recognition-Discrimination test, (6) Embedded figures test, (7) Berry-Buktenica developmental test of visual-motor integration,and (8) Auditory-visual-integration test From the results, five main types of children were identified.

They consisted of three types(A,B,& C) of poor readers and two types(D & E) of good readers. Type A children were said to show deficient verbal skills and increasing strength on visual perceptual motor skills with age. They showed poor academic achievement and teachers rated them as being more active and emotionally reactive than their peers. Type B children showed increasing deficits in performance as compared to their peers especially in verbal-conceptual skills as they became older. They and their parents had below average achievement scores but the families were average in socio-economic status and education.

The type-B subjects demonstrated more than average problems on neurological ratings and birth history ratings. Type-C children and their families were all below average on all tests and ratings. Type-D children were shown to be of above average, and they had average to above average performance on all tests, on all teacher ratings and for family, birth, and neurological data. Type-E children represented the most above average children in the sample. They were above average on all tests as were their parents. They were rated as having the least neurological and birth history problems. The cluster solution which classified the children into poor and good readers supports the use of longitudinal cluster analysis as a methodology for classifying reading disabled and non-reading disabled subjects into homogeneous groups without using exclusionary definitions or arbitrary reading level cut-off scores for subject selection. The sub-classification of the poor readers into three developmental subtypes supports the previous cross-sectional classification research that suggested multiple subtypes of reading disabled children. The classification methodology applied to the questions in this study provides an empirical approach for addressing the alternative hypotheses regarding reading disabled children.

Each of the subtypes showed different patterns across the eight verbal and visual-spatial tests used to form the classification. The results of this study tend to corroborate findings from previous research, that clustering methods provide a valid empirical methodology to operationalize subject selection and classification, thereby easing out the numerous limitations and problems associated with traditionally exclusionary definitions. The results also support findings from other researches which suggest the rejection of the "unitary syndrome" and the acceptance of multiple reading disabled subtypes, and the need to see these subtypes as viable options needed to be addressed. The results of this study supported the idea that a child may receive different subtype labels at different ages although the set of potential labels at any one age may be similar. Thus a child from cluster B would be classified as a visual-perceptual-motor deficit subtype at the pre-primary level but global deficit subtype in primary five. The developmental reading disabled subtypes identified in this study were different on a wide variety of ability and attributes from various domains although final achievement levels were similar. The earlier subtype research though consistent with the present results was based on cross-sectional data and can not describe the developmental paths of the children studied. Developmental subtypes are important for educational and research purposes, and different classification systems are needed for different research, educational, and clinical purposes. It was concluded that without such classification research, the limited understanding of the heterogeneity nature of the LD population will continue(Morris et.al 1986).

### 2.1.3 Mathematics Problems

Mathematics is generally recognized as an essential curriculum area in many schools and adequate performance in math is considered as fundamental to school success (Wallace & McLoughlin 1988). It has been indicated that a large number of identified LD students require remedial assistance in mathematics (McLeod & Armstrong 1982). Pupils with learning disabilities in math can be found at all age and grade levels. During the pre-school and early primary grade these pupils would have difficulty matching or sorting objects, counting and differentiating various sizes. During the elementary grade they often have problems with computational skills, measurement, decimals, fractions and percentages. At the secondary level their mathematical problems are the aftermath of the arithmetic deficit they experienced at the primary level. Thus many students have problems with mathematics at the secondary level because they have inadequate foundational skills. "(Wallace & McLoughlin 1988).

Pre-schoolers and primary school aged children with potential learning problems usually show some difficulty in understanding the concepts of one to one relationships. This ability is very crucial to the development of meaningful counting. Children with one to one correspondence problems will not understand for instance that four cars would fill four vacant parking spaces. Similarly they would not understand the basic principle underlying the game of musical chairs. These children are often frustrated by everyday classroom duties such as passing pencils, or papers to each other in a certain row The concept of number becomes confusing to the children with one to one corresponding difficulties because they can not attach numerical meaning to specific numbers. For example the numeral (5) may have no different numerical meaning from that of the numeral (3).Children with difficulty in this area often incorrectly count any group of objects and are confused when trying to assign a correct number to each object (Wallace & McLoughlin 1988). According to Reisman(1982) one to one correspondence is a necessary prerequisite skill for any work with numbers.

In a study carried out by Rourke,(1975, 1978, 1985), classification of learning disabled children was done through the analysis of patterns of reading, spelling and arithmetic abilities. Rourke(1985), identified three groups of children on the basis of Wild Range Achievement test(Jastak & Jastak 1977). The groups identified were:(a) those deficient(below the 20th percentile) in all three achievement areas; (b) those that showed deficits only in reading and spelling, and © those that showed deficits only in arithmetic. These studies showed that the three subgroups were different on external neuropsychological measures such that the global group was impaired on all external measures (especially verbal ones). The reading and spelling deficit group showed more impaired verbal than non-verbal skills. The arithmetic deficit group showed more impaired non-verbal than verbal skills(Rourke 1985). A review of the validity studies performed on these subgroups concluded that this grouping is one of the more promising classification alternatives even though it is partially founded on exclusionary criteria,(Fletcher 1985).

**2.1.4 Social-Behavioural Problems**

Some students who are unable to learn in school tend to become frustrated, anxious, depressed and angry about their lack of academic achievement. As such they tend to exhibit some mild social behavioural problems, (Wallace & McLoughlin,1988).

The development of social-behavioural skills and abilities is an important component of school success and is closely linked to the acquisition of various academic skills. Problems of social behaviour among learning disabled students have been recognized, studied, and identified, (Deshler & Schumaker, 1983). Some of these problems include distractibility, hyperactivity, poor self concept, anxiety, and poor interpersonal relationships.

Distractibility is one of the most frequently mentioned characteristics of learning disabled students (Strauss & Lehtinen,1947). Distractible LD students are unable to concentrate on any activity for more than a few minutes and are easily distracted by irrelevant and inappropriate stimuli (Kelly, & Aylward 1992). They find it difficult to focus attention on a specific task even when they are aware of the problem.

Distractibility as a social-behavioural characteristics is closely associated with attention. It has been found that LD children who exhibited attention deficits were also highly distractible when distractibility is defined as the inability to filter out extraneous stimuli and focus selectively on a task, (Tarver & Hallahan 1974 Lerner & Lerner 1991; Conte 1991).It has also been found that learning disabled pupils have problem giving sustained attention to all relevant aspects of academic tasks and social stimuli,(Hallahan, 1975; Ross 1976; Hallahan & Reeve 1980), spend less time on task and more time in non productive behaviour than do their peers, (McKinney, McClure, & Feagans, 1982 Shaywitz & Shaywitz 1991).It has equally been found that the activity level of these pupils is not always under their control, (Silver, 1990; Silver & Hagin 1990).

Lack of sensitivity to another person's feelings seems to be a frequently mentioned social-behavioural characteristic of Ld students. The insensitivity may be due to an inability to understand non verbal communication clues such as facial expressions, gestures or general moods (Silver, 1992; Bryan, 1991). As a result of this deficit the students experience difficulty in various inter-personal relationships, (Bryan, Pearl, Donahue, Bryan & Pflaum 1983; Bryan, 1986; Pearl, Donahue & Bryan, 1986). In addition pupils with social disabilities are often unable to assume personal or social responsibilities. Younger children may not understand why they should share toys or may be unable to participate in independent activities without constant support and direction. Older students with social skill deficit are often described as having little or no self control. They are viewed as rude and tactless because they continually do or say inappropriate things (Bryan, 1991; Vaughn, 1991; Silver, 1992). They are also characterized by the inability to predict the consequences of their own and others behaviour in many different situations, (Wallace & McLoughlin 1988; Lerner,1993).

Learning disabled students are frequently described as having very negative views of themselves , and their perceptions of self worth and self esteem are very low (Wallace & Kauffman 1986; Silver, 1992; Bryan, 1991; Vaughn 1991). Such pupils often lack self reliance and speak disparagingly of themselves. Due to repeated academic failure, they see themselves as "dumb", "stupid","worthless"and unable to accomplish anything worthwhile. Some pupils with poor self concept refuse to complete assignments for fear of further failure. They seem to have completely given up and are convinced of their inability to perform. Others exhibit undue concern over what other people feel due to lack of personal confidence,(Wallace & McLoughlin 1988 Lerner, 1993).

Research evidence indicates that self concept is directly related to achievement and that LD students have lower self concept than did their peers, (Black 1974).

### 2.1.5.Diversity & Universality of Learning Disability: Summary

In summary, the learning disabled population is heterogeneous and many characteristics are associated with learning disabilities. Each learning disabled person is unique and presents only some of the characteristics. The term encompasses a cluster of disorders and no individual displays all of them. While some have problems in mathematics, others excel in mathematics. For some, attention deficit and processing disorders are their problems, while others may not have these problems. In addition certain characteristics are more likely to be exhibited at certain age levels. To illustrate, young children likely to be more hyperactive than adolescents. Also deficits are manifested in different ways at different age levels. For instance an underlying language disorder may appear as a delayed speech problem in the preschool child , as a reading disorder in the primary school child, and as a writing disorder in the secondary school child, (Lerner, 1993).

Some of the characteristics commonly exhibited by the LD children include:- (a) Disorders of attention, Which include Hyperactivity, Distractibility, and short attention span. (b) Failure to develop and mobilize cognitive strategies for learning. This involves lack of organization, active learning set and metacognitive functions. (c) Poor motor abilities, which include poor fine and gross motor coordination, general awkwardness, clumsiness, and spatial problems. (d) Perceptual and information processing problems. These embrace difficulty in discrimination of auditory and visual stimuli, auditory and visual closure, and sequencing. (e) Oral language difficulties. These include problems in listening, speaking, vocabulary and linguistic competencies. (f) Reading difficulties. These include problems of decoding, basic reading skills, and reading comprehension. (g) Written language difficulties. These embrace problems in spelling, hand writing, and written composition. (h)Mathematics difficulties. These include difficulty in quantitative thinking, arithmetic, time, space, and calculation facts. (i) Inappropriate social behaviour. This embraces problems in social skill deficits, emotional problems and problems with establishing social relationships.

Learning disability is a universal problem that occurs in all cultures and countries all over the world. In all cultures there are children who experience severe difficulty in learning oral language, reading, writing, or doing mathematics despite the fact that they have normal intelligence. Clinical reviews of personal reports of children with learning disabilities, indicate marked similarities across cultures, (Lerner, 1993).

Linguistically Nigerian children are bilingual. They have native languages to which they are exposed from birth until school age. In school, they are exposed to the English language as a medium of expression. Many of the children are not proficient in the use of the two languages,(native, and English), and when this is combined with learning disabilities their problems become more complicated.

### 2.2 Theoretical Models of Learning Disability

#### 2.2.1 Multidisciplinary Approach to Learning Disability

Four disciplines have made major contributions to the study of learning disability. These are:- Education, Psychology, Language and Medicine. Other professions such as Social work, Occupational therapy, Guidance and Counselling have also contributed to the advancement of the learning disability's field. The mingling of the many professions has resulted in a multidisciplinary approach to the study of learning disabilities.

Due to the complex and heterogeneous nature of learning disability various researchers in the field have tried to explain the concept from many perspectives, and a single theory has been found insufficient to fully explain it.Indeed the current status of the learning disability field originated from the inputs of different disciplines. Different professionals have encountered learning disabled people of varying ages, they have applied concepts from their own perspectives, and developed terminologies within their own traditions to explain the etiology of learning disability.Such professionals include educators, psychologists,physicians and so on, (Wallace & McLoughlin, 1988).

Many concepts can be applied to the learning disabled population with the aim of establishing its parameters and describing it for identification purposes. The LD field actually operated under some theoretical models, each with its own assumptions about etiology, assessment, and intervention. These models were adopted in succession, with the hope that the succeeding one will explain the concept better than the preceding one. It is the failure to demonstrate skill generalization and maintenance, that served as the catalyst for the emergence of the succeeding model. These models are discussed below.

**2.2.2 The Medical Model.**

Within the medical model the problem of learning disability is assumed to be neurologically based (Strauss and Lehtinen 1947).

The emphasis during the period was on testing and treating neurological symptoms (Poplin 1988). The practice of describing and explaining a learning disability from a neurological approach was based on studies of electrical stimulation of the brain, brain injured children and adults, (Wallace and McLoughlin 1988). A battery of neurological tests together with classroom records and case histories were used then to diagnose learning disability. For instance if a student has trouble copying from a black board, the areas of the brain responsible for the functions involved are mentioned as possible sites of the problem. An example of such associations include the reticular formation of the midbrain and attention (Dykman, Ackerman, Clement & Peters 1971). Such associations appear to be hypothetical, but some research findings have suggested that the neurological status of the learning disabled persons is different from that of normal individuals, (Gaddes, 1985). The major distinction between the two populations is based on "soft" neurological signs (signs with uncertain or general diagnostic value). This concept of soft neurological signs was experimented upon by Kosc (1974). He proposed that learning problems in mathematics "called developmental dyscalculia" results from a genetic or congenital disorder of parts of the brain responsible for the maturation of mathematical abilities. He carried out a study by screening 374 children and giving them a variety of mathematical tasks involving addition, substraction, copying of complex figures and arithmetical reasoning. From the screening he identified 68 children who were having mathematical problems. These were then given neurological tests involving left-right and spatial orientation, finger agnosia and laterality. Of the 68 children he reported that 24 displayed the "neurological soft signs", characterized by difficulty in left-right orientation and so on. He further discovered that those subjects who performed most poorly on the screening tasks were more likely to display the neurological soft signs than those who did better. He then concluded that neurological deficiencies are at the basis of developmental dyscalculia.

The concept of minimal brain dysfunction is used to explain the idea that learning disabilities involving poor memory and poor association of various types of symbols may result from a non specific problem in the nervous system (Clements 1966). Characteristics such as impulsivity, inattention, hyperactivity, minimal tremors, motor awkwardness and poor coordination are assumed to result from minimal brain dysfunctions. For instance Dyslexia is assumed to be a neurologically based learning disability in reading. This assumption is supported by results from neuro-science studies involving postmortem anatomical studies of brain tissues of people with dyslexia. These results suggest that dyslexia results from an abnormality in brain structure and function, by showing that the brain structure of people with dyslexia is different from the normal pattern (Hynd 1992; Galaburda 1989;,1990; Geschwind 1982, 1986).

A further support for the neurological basis for dyslexia was documented in the study on dyslexic subtypes conducted by Manis, Szeszulski, Holt and Graves (1988). They tested 40 normal and 50 dyslexic children matched on reading level and IQ applying a developmental model. They used a comprehensive test battery that measured the level of development of visual, phonological and orthographic skills of the children. They found that the dyslexics deviated significantly from readers of equivalent reading achievement primarily in phonological skills and knowledge of word-specific spellings. The phonological processing problems are assumed to have a neurological basis.

Problems in the visual-motor aspects of following a line of print and reproducing letters accurately on paper are also assumed to result from minimal brain dysfunction. To further support the assumption of a neurological basis for learning disability, Cohn (1971), conducted case studies of some 31 children with severe learning problems. He proposed that mathematics learning disabilities represent special case of language dysfunction which itself results from "incoordination" of various complexities of neurological behaviour. Cohn obtained neurological data consisting of EEGs, measures of motor behaviour, and measures of orientation on the 31 subjects and compiled a neurological index for each subject from the data. He obtained samples of reading, writing, arithmetic and speech functioning from the children. He reported that (I) the combination of EEGs and the various "soft signs" yielded an estimate of neurological damage in the children; (ii) improvement overtime in the neurological index was directly related to improvement in the various language activities which included arithmetic and concluded that disturbances of neurological organization characterized the learning disabled children. Remedial strategies focused on aspects of the brain and nervous systems assumed to be involved, and medications were frequently used to treat children with these problems (Poplin 1988).

The major criticism against this model is its failure to differentiate the learning disabled (LD) from the non-LD, and the failure of motoric training to generalize to other areas of trainees lives (Poplin 1988; Wiederholt 1974).

In support of this criticism, Hiscock and Kinsbourne (1987) in their review reported that in most of the 19 studies on perceptual laterality in learning disabled children, using dichotic listening as visual tasks, and reviewed by Satz (1976), both the learning disabled and control groups showed the expected laterality implying that there was no difference between the two groups. They also reported that Aylward (1984), in her own study failed to find laterality differences among three dyslexic subtypes - dysphonetics, dyseidetics, and nonspecifics. She however found that the three dyslexic groups when combined tended to show a greater right-ear advantage in dichotic listening than did control subjects. The implication here is that the medical model has failed to consistently differentiate between the disabled and non disabled children. Despite this short coming,the medical model had been, and still is appealing to a segment of educators with medical orientation, and a smaller group of physicians interested in educational matters.



### 2.2.3 The Psychological Process model

Due to lack of evidence showing that neurological examinations can differentiate between pupils who are neurologically impaired and those who are not, coupled with the fact that neurological interventions do not generalize to alleviate school learning problems, emphasis shifted from medical to educational. A greater emphasis was then placed on the prerequisite skills necessary for school success. The term "brain damage" which is used to describe LD persons within the medical model became replaced with such terms as "minimal brain dysfunction", " perceptually handicapped", "psycho -linguistically handicapped", and later "learning disabled" (Kirk, 1962). At that time, learning disabilities were described in terms of inadequate and poorly coordinated transmission of information by the nervous system. Visual, auditory, and motor perceptions were seen as psychological concepts based on hypothetical models of neurological functioning. These concepts are demonstrated by such activities as recognition, discrimination, sequencing, recall and association of information. Thus the reading difficulty of an LD student may be attributed to confused orientation of b and d, and motor problems (e.g. coordination, directionality), considered as signs of poor or delayed development of essential underpinnings for later academic learning (Kephart 1971). This latter assumption connotes a developmental or maturational lag.

Maturational views of learning disabilities are built on the concepts of developmental psychology. The maturational theory proposes that there is a sequential progression in the maturation of cognitive skills, and a child's ability to learn will depend on his/her current maturational status. In addition the theory implies that attempts to speed up or bypass this developmental process may actually create problems.From the maturational theory's perspective the learning disabled children are experiencing maturational lags or developmental delays. Maturational lag is reflected in slowness in certain aspects of neurological development. According to this view point each person has a pre-set rate of growth for various human functions including cognitive abilities,(Bender, 1957). Discrepancies among the abilities indicate that they are maturing at different rates. The implication is that some abilities are lagging in their development, but these lags are temporary,(Lerner, 1993).

The maturational theorists believe that society creates many learning disabilities when students are pushed into performance of academic tasks before they are ready to do so. The implication here is that the demands of schooling in this case can cause failure by requiring students to perform beyond their readiness or capacity at a given stage of maturation. Readiness in this case refers to the state of maturational development needed for some desired skills to be learned. The readiness skills are picked by normal learners incidentally, but LD children require special attention from teachers to acquire these skills, (Lerner, 1993).It has been suggested that a maturational lag can intensify the learning disabilities of children and youth, (Kirk, 1967). It is argued that during the growing stages, a student normally tends to perform in functions that are comfortable, and to avoid those that are uncomfortable, and because certain processes have lagged in maturation and are not functioning adequately, the student avoids and withdraws from activities requiring those abilities. In the process the neglected functions fail to develop and the disability is intensified and exaggerated. The goal of teaching LD children should be to strengthen their thinking foundation upon which further learning can be grounded, and teachers who are sensitive to their pupils' needs can help them to achieve this goal, (Kirk,1967).

In support of the developmental lag hypothesis, Wong (1988) reported some groups of studies about learning disabled children. In one of such groups Tarver et al (1976, 1977), studied selective attention in LD subjects using central-incidental tasks. They found increasing efficiency in selective attention in older subjects but not in younger ones. In other studies carried out by Czudner & Rourke (1972),and Rourke & Czudner (1972), using reaction times as dependent measures, they found that younger LD subjects demonstrated slower reaction times and older ones did not. The implication is that some LD subjects do suffer from developmental lag and with time they do outgrow and overcome their problems. However some may not outgrow this lag if the lagging functions fail to develop. This seemed to be the case in the study carried out by Manis et al (1988) reported earlier,(pages 11&43). They found dyslexics to be significantly less accurate than normal readers of equivalent reading achievement with the greatest differences occurring in aspects of phonological processing. They then concluded that the results did not support the developmental lag hypothesis. Rather than say that the developmental lag hypothesis was not supported, the present researcher would beg to differ and say that the dyslexics in Manis et al's study did suffer from developmental lag which might have been neurological in nature,and it must have been neglected long enough for it not to have developed.So the phonological skills did not develop in these dyslexics.

From the developmental perspective therefore, many learning disabled children are described as behaviourally younger than their chronological ages in terms of motor, verbal, social and other activities indicating slow development. For example one of the participants in a study carried out by this researcher, Akinsola (1996), and published in Makanju (1996), was a boy of 14 years who could not read any word consisting of more than three letters. This boy is behaviourally younger than his chronological age verbally, indicative of neglected developmental lag in neurological system responsible for reading. This developmental perspective is based on established sequence and order of the neurological system's development. It is believed that children whose learning disabilities are developmentally based will outgrow their problems if given time, and in some cases appropriate and early intervention has been delayed under this mistaken belief (Wallace & McLoughlin, 1988).

The developmental nature of learning disabilities is frequently explained using piagetian concepts (Reid & Hresko, 1981). For instance the tendency of some learning disabled children to have problems with perceptual and symbolic tasks is seen as suggesting inappropriate movement through the stages of learning. Their poor internal organization of information and inadequate response to task completion are seen as due to poorly developed internal schemata of external information and the inability to modify such outlines when new information presents itself. These problems are indicative of developmental lag and decalage, concepts used by Piaget to explain poor performances of children in academic tasks.

Developmental lag mentioned earlier is reflected in slowness in certain aspects of neurological system resulting in some abilities lagging behind or not developing at all. Decalage on the other hand is the inability of the child to solve certain problems despite being able to solve similar problems that seem to require the same mental operations. Piaget in his theory of intellectual development maintained that the child's ability to think and learn changes with age through a series of preset developmental stages (1970).Discrepancies among abilities which would be reflected in children's poor performances in some academic tasks would be accounted by either immaturity, (e.g abilities maturing at different rates), or decalage, (the tasks though look similar are more complex and require higher cognitive functions) which are yet to emerge. When children fail to perform certain tasks, part of what is considered is whether the introduction of the task level was well timed and whether the children can learn through more concrete and manipulative means.

This developomental perspective has been used towards the understanding of the broken profile of strengths and weaknesses observed in LD children at early ages. It has equally helped parents and educators to learn to adjust their expectations in some areas of development especially learning thus prompting the delay in the introduction of academic instructions in some subject areas e.g. reading (Wallace & McLoughlin, 1988).

The psychological process model emphasizes disorders of the psychological processes needed for school learning.Psychological processes are underlying abilities in such areas as perception, motor, linguistic, and memory functions. Disorders in the psychological processes mean that the individual with these problems has an underlying deficit in certain developmental areas of learning. The psychological processing view urges educators to actively intervene by helping students to acquire the missing psychological processing skills, (Kirk, 1987). It is viewed that psychological processing dysfunctions are related to the student's inability to learn.This view provided the foundation for the field of learning disabilities, and provided teachers and professionals in the field with a new refreshing and hopeful way of viewing students who can not learn and planning teaching for them. It also offered parents a logical way to understand their children's inability to learn without blaming the child for not trying, or the teachers for not teaching. This model provided a fresh perspective for assessing and teaching students with learning disabilities, (Lerner, 1993).

Within this model, the diagnosis of learning disabilities was being obtained using psychological process tests. The psychological concepts were represented in standardized and informal tests included in many batteries that serve as the basis for both diagnosis and remedial activities aimed at improving performance in the areas of academic concern. Consequently remediation was attempted through training in auditory and visual skills, memory, discrimination, figure-ground, and other perceptual associations, with the hope that such training will bring about improvement in academic performance in problem areas (Poplin 1988).

However to the frustration of teachers, after implementing the various teaching plans, (e.g auditory, visual etc), students who were trained in the above mentioned skills were not making the expected progress in academic tasks performance. That is the skill acquisition training did not bring about better performance in the children's school work (no generalization). The psychological process tests used failed to differentiate between the learning disabled and the non learning disabled.(Poplin 1988). The psycholinguistic and perceptual process training used to remediate learning problems was not improving students ability to perform academic tasks.The goal of increased academic abilities was not realized, the treatment was not generalizing and the students were not integrating well into the regular classroom environment. This was the thrust of the criticisms levelled against this model,(Poplin 1988). This implies that the psychological process model failed to adequately explain the etiology of learning disability and provide effective remediation procedures. This failure gave birth to the behavioural model.

### 2.2.4 The Behavioural Model

The proponents of this model (e.g. Lovitt, 1974, 1975,Bateman, 1974), advocated that instead of dealing with hypothetical prerequisites, educators should teach directly the academic and social behaviours necessary to succeed in the school environment. This approach is called direct instruction. Direct instruction is defined as a comprehensive system that integrates curriculum design with teaching techniques to produce instructional programmes in language, reading, mathematics, spelling, written expression and science, (Tarver, 1992). Direct instruction concentrates on the academic skills that students need to learn and the structuring of the environment to ensure that students learn these skills, (Lovitt, 1991; Algozine, 1991; Reid, 1986). In support of the direct instruction approach, some qualities were listed as being characteristic of it. The qualities include: (i) being academically focused, which involves teaching academic skills directly; (ii) being teacher-directed and controlled; (iii) using carefully sequenced and structured materials; (iv) allowing the students to gain mastery of basic skills; (v) setting goals that are clear to students; (vi) allocating sufficient time for instruction; (vii) using continuous monitoring of student's performance, (e.g. curriculum based assessment);(viii) providing immediate feedback to students; (ix) allowing for teaching a skill until mastery is achieved, (Rosenshine, 1986; Rosenshine, & Stevens, 1986).

With direct instruction approach emerging, the process testing which was being used as a criterion for diagnosis of LD was being replaced by the significant discrepancy clause. It was required of the school personnel to document a significant discrepancy between academic achievement and potential for a student to be described as learning disabled,(Poplin 1988).Traditional intelligence and achievement tests were then used to demonstrate this criterion.In addition to the significant discrepancy criterion, the behavioural model requires that teachers analyse academic tasks in terms of the skills necessary for school success, skills that students would need to acquire if they do not possess them. This approach is called "Behaviour Analysis". The skills identified are then placed in an ordered and logical sequence, and students are tested to determine whether they possess them or not. If they do not possess them the teachers are then required to modify the students' behaviours on these skills, by helping them to acquire and master the skills by direct instruction, and by applying appropriate principles of reinforcement, (Lerner, 1993). Behaviour analysis thus provides the underlying theoretical support for direct instruction, Bijou, 1970; Gage, 1984). In behaviour analysis a complex terminal behaviour is analyzed into its component parts, (called enabling behaviours). The enabling behaviours not yet acquired are directly taught and integrated into the terminal objectives. This behaviour analysis approach does not consider unobservable underlying mental deficits within the pupil other than a lack of experience and practice with the task. The underlying assumption of this approach is that academic success or failure is a result of the connections between the sub-skills that are characteristic of a particular academic task. The emphasis here is on the analysis of the behaviours needed to learn the task.

In terms of diagnosis, criterion - referenced tests were developed to help teachers and those involved in diagnosis to quickly determine the specific academic behaviours that their students needed to acquire. In terms of intervention, programmed materials were developed to help students acquire the required skills, (e.g. skills in language, reading, and mathematics). An example of such programmes is the DISTAR programmes, (Engelmann & Bruner, 1973). The DISTAR programme is a highly structured decoding programme that contains drills and instructional reading.It emphasizes direct instruction, drill, and repetitions.

Behaviour management techniques which include the use of strategies such as reinforcement, shaping, extinction, contingency management, token reinforcements, behaviour monitoring, and modelling, were used to modify social behaviours that are self destructive or disturbing in school.

The behavioural model demonstrated effectiveness in the teaching of individual skills and this gave much hope for its success. The results of the study carried out by Dale & Cole (1988), supported this inference. In their study they compared Direct Instruction and Mediated Learning (two instructional methods from behavioural and cognitive models), using a randomized design. The subjects used consisted of 83 pupils under the special education programme, with 61 in preschool and 22 in kindergarten. The preschool children were divided into six classes, three for each instructional method and 12 pupils in each class. One of the three classes for each method consisted of 4 normally developing children and 8 handicapped children. The other classes contain only handicapped children. The preschool children attended training classes two hours per day, five days a week for 180 days. The kindergarten children attended classes for 5.5 hours per day, five days a week for 180 days. There was only one kindergarten class for each method with 14 pupils per class. The subjects were administered 8 different measures as pretest and post-test with a minimum of six months interval between pre and post test of each of the measures. The measures used include McCarthy scales of children's abilities, tests of language, reading and mathematics. The researchers reported gains for pupils in both programmes with differential effects for specific measures. It was reported that Direct instruction led to greater gains on the test of early language development, and basic concepts test. Mediated Learning led to greater gains on the McCarthy verbal and memory scales and mean length of utterance scale. These results indicated that both interventional approaches were effective.

The major criticism against this model is that the LD students were not making the kind of pervasive and lasting progress necessary for school success (Horn, O'Donnell & Vitulano 1983). There was still problem with generalization and maintenance of skills taught, and LD students were not integrating well into the regular classroom environment. The explanation for this is that children who were taught specific skills such as memory and comprehension skills acquired them and used them while freshly acquired. However they could not continue using the skills spontaneously without prompting, and maintaining high level of performance (no maintenance). Also they could not apply the skills acquired in one subject area to solve problems in another subject area (no generalization).

Due to the inability of the children to maintain a high level of performance, they could not fit well and integrate into the classroom environment, and since the integration of LD students into the regular classroom was the major goal during this period, the failure of the training programme to bring this about led to the adoption of yet another model, the cognitive model.

### 2.2.5 The Cognitive Model

From the cognitive perspective the concept of intelligence is central to the explanation of learning disabilities (Salvia & Ysseldyke 1991; Torgesen, 1991; Adelman & Taylor, 1991). In this regard, intelligence is seen as a composite of verbal and non verbal skills,(Sternberg, 1977), or technological and social skills, (Mundy-Castle, 1975; Agiobu-Kemmer, 1984), that predict academic success. Furthermore any of these component skills can be used to predict academic success. The implication is that the ability to acquire , recall and use information to solve daily problems and thrive in various situations can be revealed in a variety of ways and may not involve the use of verbal symbols, (Sternberg, 1986; Wallace & McLoughlin 1988; Lerner, 1993). From this viewpoint the learning disabled person is described as having at least average intelligence, although this ability to learn in academic settings is based on unevenly developed skills. It is thus possible for an LD person to be better with visual or visual-motor tasks than with verbal ones and vice versa. The student's comprehension of printed material may be below average, while mental computation problems may be acceptable.

One of the reasons why intelligence is central to the definitions of learning disability is that the academic underachievement of the learning disabled occurs in the absence of mental retardation. That is, the learning disabled child is not mentally retarded, rather she/he is at least average intellectually, but achieving below average in school work. Intelligence is a major consideration in the assessment of learning disability because the identification of the LD is based on a significant discrepancy between assumed ability and current school achievement. Another reason why intelligence is central to the definition of learning disability is that it is believed that some cluster of intellectual factors (e.g. memory) may be at the root of the disability and that the primary problem will be solved when the cluster is identified and remediated.

Beside intelligence, other theories of cognition are also used to explain learning disability. One of such theories focus on individual cognitive skills and emphasize what is brought into the learning situation in form of past experiences and what meaning is derived from these experiences (Reid & Hresko, 1981; Bateman, 1992). Learning is therefore seen as the constant assimilation of information into an existing structure and the modification of that structure to correspond with environmental factors. There are both a re presentational system by which an internal model of the world is created and modified through experiences and an executive control system by which a person uses and directs her own cognitive and thinking processes (Wallace & McLoughlin, 1988). This approach is called the information processing approach, (Lerner, 1993). The information processing model of learning traces the flow of information during the learning process from the initial reception of information to a processing function and then an action. In the human learning system there are inputs, (e.g. auditory stimuli), processing functions, (e.g. cognitive processes such as associations, thinking, memory and decision making), and outputs, (e.g. actions and behaviours). According to this model the human brain takes in information, (input), stores and locates it, (memory systems), organizes the information and facilitates operations and decisions, (central processing systems, executive functions), and generates responses to the information, (output), (Goetz, Hall, & Fetsco, 1989). The information processing model provides a useful way to conceptualize the processes and characteristics of human learning. The model depicts the component of input, output, and an executive control function, (Andre, & Phye, 1986). Central to the information processing model is the multi-store memory system, (Lerner, 1993). The multi-store memory system conceptualizes a flow of information among three types of memory namely: the sensory register, the short-term memory, (or working memory), and the long-term memory,(Atkinson,& Shiffrin,1968,Broadbent,1958).

The sensory register system serves as an input buffer which helps to interpret and maintain the information from the input receptor long enough for it to be perceived and analysed. Perception is important at this stage because it gives meaning to the stimuli. A person's perception depends on his/her past experiences and the ability to organize and attach meaning to the stimulus event. In terms of teaching, the information processing theory suggests that a copy of an experience is stored very briefly in the sensory register and if no attention is paid to it, it will be lost,(Lerner, 1993).This means that the student must be attending to the teaching in the class,and the lesson must be planned to initially spark the attention of the student.

The short-term memory is also a temporary storage system. Where as the individual is not consciously aware of information in the sensory register, he/she is very consciously aware of information in the short-term memory. The short-term memory is called the working memory. When the current information receives conscious attention it is acted upon. When a new information is encountered, it replaces the old one in the working memory. The old information either decays and fades off or is transferred to the long-term memory, (Goetz, Hall, & Fetsco, 1989).

In terms of teaching, information remains in the short-term memory for a short time. If the information is not acted upon, it will be lost.Strategies such as rehearsal can extend the duration that information stays in the short-term memory, by slowing down the forgetting process and facilitating the transfer of information to the long-term memory.

The long-term memory is the permanent memory storage. In order to learn and retain information for long periods of time, information must be transferred from short-term to long-term memory. It is believed that the information placed in the long-term memory remains there permanently, (Lerner, 1993). It has been shown through neurological research and clinical evidences that memories remain in the long term storage for a very long time (Klein 1987). The problem usually encountered by people concerning the long term memory is retrieval of information stored there. The way information is stored there helps with the process of retrieval. Through the teaching of learning strategies such as organizing schemes teachers can help students to improve on their retrieval of information from the long-term memory (Scruggs & Mastropieri 1991).

Apart from the three memory systems there is another component of the information processing model called the "Executive Control". This deals with the course and organization of one's mental activity. It refers to the control and regulation of one's own thinking. Executive control directs the flow of thinking, manages the cognitive processes during learning, and keeps track of what information is being processed. It involves the planning, evaluating, and regulation of the information processing routines. It determines which mental activities occur and which processing components receive system attention or one's concentration. The individual's motivation and goals are important factors in directing the patterns of priorities that receive attention,(Wong,1991; Mayer, 1988; Andre,& Phye,1986).

Memory deficits are frequently used to define the problems of the LD population. Learning disabled students may not recall different types of information well (e.g. visual or auditory data), or they may have more problems remembering information presented to them last week as opposed to those presented to them few hours ago. They also seem to have problems in applying their problem solving strategies (Wallace & McLoughlin, 1988). Maker(1981) suggests that LD students either do not apply known appropriate strategies or apply them poorly. Torgesen and Licht (1984) believe that LD students don't lack problem solving strategies entirely, but that they either use inefficient strategies or are inflexible in their approaches to problem solving. In support of this reasoning Eliason & Richman (1987) carried out a study using 30 learning disabled children and 30 non LD children. The two groups were matched on age and sex. The children were administered the continuous performance test (CPT), a response task used for measuring vigilance and impulsiveness. The researchers found that the LD group made significantly more omission errors and had a slower rate of responding. They concluded that the LD children have difficulty with allocation of processing resources or efficient application of strategies.

In another study, Ceci, Lea, & Ringstrom (1980), tested 32 normal and learning disabled children on coding processes in memory. The subjects were divided into four groups of 8 subjects per group. The groups consisted of the auditory impaired, visual impaired, those with both impairments, and the control. The subjects were presented with test items in visual and auditory modalities for free and cued recall. The researchers reported that (I) children with visual memory deficit recalled significantly fewer items from the visual task than either the control or auditory impaired group; (ii) the auditory impaired group recalled significantly fewer items from the auditory task than either the control or the visual impaired group; (iii) the semantic cue tended to lead to better recall than the colour and location cues on the visual task and to better recall than the acoustic and phonetic cues on the auditory task. The LD children showed abnormal pattern of cue effectiveness in the modalities where they had a memory deficit and this was in form of the loss of semantic advantage in the impaired modality. The researchers concluded that the LD children in the study exhibit deficits in the ability to access information in their disabled modality.

For intervention therefore, the cognitive approach recommends direct teaching of learning strategies to encourage active involvement in the learning process. It is advocated that learning disabled children must be taught that study skills, information gathering and problem solving techniques are all viable strategies to help them in academic areas (Jacobs, 1984). The students are taught ways to structure themselves cognitively in order to perform typical activities in school using such strategies as self questioning, rehearsal, and review (Torgesen, 1982). Self instructional programmes were developed (Meichenbaum, 1980) to provide students and teachers with guidelines such as focusing on relevant academic problems and building on existing student strategies (Wallace & McLoughlin, 1988).

From available research evidence the methods of intervention used in the cognitive approach were found to be effective. One of such evidences was documented in Wong and Jones'study (1982). In their study on metacomprehension, they taught 60 learning disabled students from grades 8 and 9,and 60 normally achieving grade 6 students a five step, self questioning training programme in which they learned to monitor their understanding of important textual units. The five steps taught were (a) what are you studying this passage for, (b) find the main ideas in the passage and underline them, (c) think of a question about the main idea you underlined, (d) learn the answers to your questions, and (e) always look back at your questions and answers to see how each successive question and answer provides you with more information. The researchers reported that training substantially increased the subjects' awareness of important units of text and their reading comprehension as well as their ability to formulate questions about target units.

However the cognitive strategy training programme does not still effectively address the problem of maintenance and generalization of strategies across tasks and situations. It was reported by Ryan, Short, & Weed (1986), in their review, that maintenance of training has been good, but generalization has been weak. This makes the model alone incapable of effectively remediating learning disability. This partial failure led to the adoption of the cognitive behaviour modification model.

### 2.2.6 Cognitive Behaviour Modification Model

The cognitive behaviour modification model combines cognitive psychology and behaviourism together. In this model behaviour management is combined with instructional training. The advocates of this model recommended that instead of teaching directly the contents of the academic and social skills behaviours drawn from the school curriculum, students should be taught the strategy behaviours necessary to perform the various academic tasks. It was hoped that by supplementing the behaviour management programme with self instructional training educators would obtain the much desired generalization and maintenance effects which have previously eluded them.

In support of the cognitive behaviour model Torgesen (1977a) proposed that many LD students may have performance problems and not ability problems and that a primary feature of LD students was their passive responses to the academic learning environment. Metacognition:- the ability to facilitate learning by taking control and directing one's own thinking processes, was also stressed in the cognitive behaviour model.Individuals exhibit metacognitive behaviour when they do something to help themselves learn and remember, such as rehearsing and repeating what has just been learned to help stabilize and strengthen their learning, (Lerner, 1993) These behaviours it is claimed indicate an awareness of one's own limitations and the ability to plan for one's own learning and problem solving, (Wong, 1991; Ellis, Deshler, Lenz, Schumaker, & Clark, 1991; Flavell, 1987).

It is reasoned that efficient learners must have efficient metacognitive skills, and that students with learning disabilities would tend to lack the ability to direct their own learning. When they learn the metacognitive strategies used by efficient learners they can then apply them in many situations, (Lerner, 1993). The metacognitive strategies needed for school learning include :- **Classification**, **and Checking**, (Kluwe, 1987).

**Classification** for instance is a strategy for determining the type, status or mode of a learning activity. Questions on classification may include: "Is this activity important to me?"

**Checking** involves steps taking during the process of problem solving to determine progress, success, and results. For example statements that would reflect checking include: "I remember most of the lesson" or "There is something I do not understand here".

Within this model classroom assessment often involves observations of the strategy behaviour that students use while performing an academic task. In essence the cognitive strategists are concerned about how the student learn while the behaviourists are interested in what the students learn (Reid & Hresko, 1981). It is asserted that efficient learners can count on a number of learning strategies to help them learn and remember. The learning disabled students in contrast lack these functional learning strategies. They do not know how to control and direct their thinking. They must first become aware of and acquire learning strategies to facilitate learning and remembering. They can then use these acquired strategies in many contexts (Lerner 1993). Research evidences have shown that students with learning disabilities do improve after receiving instructions in learning strategies (Pressley, 1991; Ellis et al, 1991; Wong, 1991; Palinscar, & Brown, 1989; Mayer, 1988). One of such evidences was reported by Graham & Freeman (1985),in their study. They examined the recall performance of 40 fourth grade LD students in response to strategy training and variations in study conditions. Following individual training in the use of a five-step study strategy which are :- (I) say the word; (ii) write and say the word; (iii)check the word; (iv) trace and say the word; (v) write the word from memory and check, students studied 15 spelling words for 30 minutes under one of the following three conditions, (a) directed-study, in which the instructor verbally directed the student's use of the study procedure; (b) teacher-monitored, in which the students were instructed to use the study procedure independently but were monitored and received assistance as necessary from the instructor; (c) student-controlled, in which students were told to use the study procedure to independently direct their behaviour. Those assigned to the free-study (group four) first played a spelling game with the instructor and then studied words in any manner they wanted. Two days later the subjects participated in the same study and test procedures using a new list of 15 words. It was reported that students taught the study strategy recalled correct spelling of more words than those in the free-study group, but the spelling performance of students in the three study conditions did not differ significantly. These results support the effectiveness of strategy training as intervention technique in the cognitive/strategy model, and the effectiveness of mediated learning as intervention technique in the cognitive model.

This study was replicated by Harris, Graham & freeman (1988), using the same number of LD subjects and methods. The researchers here reported that only subjects in the teacher-monitored group exhibited significantly greater usage of the taught strategy and had higher spelling scores than those in the free-study condition. The results in this second study provided only partial support for the effectiveness of strategy training and point to the possibility of this training not leading to the desired improvement in academic performance.

In addition to learning strategies, the styles of learning as they relate to the effectiveness of learning have been examined, (Lerner, 1993). A student's style of learning refers to the student's general behaviour, attitude, and temperament when presented with a learning task. The learning styles in an academic situation influence the effectiveness of learning. The learning style of the student may be incongruent with the style required to succeed in a traditional educational system. The analysis of the student's learning style can provide insight into the nature of the learning difficulties,(Carbo, & Hodges, 1988; Dunn, 1988; Carbo, Dunn, & Dunn, 1986).

One way of analysing styles of learning is to determine whether the student's learning behaviour is reflective or impulsive. In the reflective style the student proceeds with careful deliberation considering alternatives before choosing a response to a problem. In the impulsive style the student responds very quickly without considering possible alternatives. Research evidence suggests that LD students often respond in an impulsive style which is detrimental to school performance,(Walker,1985; Keogh,1977; Epstein, Hallahan,& Kauffman, 1975).Students with learning disabilities often speak without first considering their thoughts and race through written assignments without monitoring right and wrong answers. Impulsive students seem to come to decisions too quickly without sufficient time between the stimulus and the response, (Lerner, 1993). The impulsive behaviour of LD students may stem from a basic lack of alternative cognitive strategies,(Vaughn, 1991). These students may respond impulsively because they do not have other ways readily at hand for coping with the assignment. The solution tend to lie in helping the students to acquire a number of useful cognitive learning strategies, (Torgesen, 1982, 1991).

Another way to view students' styles of learning is to consider whether they are active or passive. It is advocated that efficient learning requires an active and dynamic involvement in the learning process; and that active learners efficiently use many cognitive strategies. They work at structuring the information, (organization), they ask themselves questions about the material, (self questioning), and compare new information to what they already know, (assimilation and accommodation). They are intensely involved and have a desire to learn or have motivation, (Brown, & Campione, 1986; Walker, 1985). The LD students on the other hand have learned to approach the learning task in a passive manner.They lack interest in learning because past learning experiences were often dismal exercises in failure and frustration. The LD students do not know how to go about the task of learning, and so they become passive and dependent learners. This style is called "learned helplessness", (Lerner,1993).

The social context in which learning occurs also significantly influences the learning processes. It is recognized that cognitive learning is more than an individualistic, student-centred activity.The social interactions between the teachers and students, and among students are seen as important ingredients in academic understanding and cognitive growth,(Torgesen,1982; Lerner,1993). Those who emphasize the social context of learning, (e.g.Vygotsky,1978), believe that social influences are crucial in the learning processes.Vygotsky sees learning as an interpersonal and social event that depends on at least two people, with one better informed than the other, and that human learning occurs as a transfer of responsibility, with the learning abilities passing along the interpersonal plane and requiring the instructor's analysis of the task relative to the student's current ability. Learning and cognitive development are enhanced when the student works cooperatively and collaboratively with adults or other students,(Lerner, 1993).

In support of this assertion, Bos,Anders,Filip,& Jaffe (1989), investigated the effectiveness of an interactive vocabulary instructional strategy called (Semantic-feature analysis), on the content area text comprehension of LD adolescents. The testing materials consisted of a prior knowledge assessment, practice, and experimental instructional materials, comprehension tests and an interest assessment. The instructional materials consisted of the semantic feature analysis condition (SFA), and dictionary method condition (DM). The subjects consisted of 50 LD students and were randomly assigned to experimental (SFA(, or contrast (DM) condition with 25 subjects in each condition. Subjects in the experimental condition completed a relationship chart as part of the SFA condition, and those in the contrast condition used the dictionary to write definitions and sentences as part of the contrast condition before they were given reading comprehension tasks. The subjects were taught under each condition using the guidelines developed for each condition. After teaching them, the subjects were given the comprehension test on the passage taught immediately following teaching and six months after initial teaching. The researchers reported that students in the SFA instructional condition had significantly greater "measured comprehension" immediately following, and six months after initial teaching. They concluded that semantic feature analysis as an instructional strategy is effective for teaching LD adolescents content area concepts and related vocabulary, and for facilitating reading comprehension. These results supported mediated learning, and the teaching of learning strategies as intervention techniques



### 2.2.7 The Holistic Constructivist Model

This model was proposed by Poplin (1988). According to this model, learning is seen in terms of construction of new knowledge through the process of transformation and self regulation. Constructivism involves integration of new knowledge with the old to arrive at a new meaning. The new meaning occurs as a result of transformation between new experience, previous and current learning experiences. This transformation is self regulatory. The integration of new meaning into the present knowledge is known as generalization and this is regulated by the learner who finds meaning in what he is learning (Poplin 1988). The integration aspect is part of the learning process. The learning of a new experience changes the person's whole knowledge in that the old and the new experiences constantly interact. In this context learning is self selected, motivated and constructed. It is the constructivist view that instructions are to be addressed in the context of the learner's own sentences and stories. Also errors are essential to learning. The constructivist do not seek "error free learning", rather they seek to create environments where "penalty - free errors" can emerge and be realised. The learning technique in this perspective encourage students to take an active role in the evaluation of self and others. The recognition of errors in this disposition is a critical part of the complex system of self regulation and self preservation in learning. One of the major tenets of constructivist view of learning is that to learn new information "learners must be actively involved in the learning process". They must actively construct meanings for themselves instead of merely passively accepting information delivered to them from outside. According to the constructivists teachers can not make students learn because learners must construct new meanings for themselves. Learners cannot passively construct new meanings, they can only passively respond to lectures, worksheets and passively apply their short term memory or new learning strategies. According to this view, the modification of students' behaviour to apply active cognitive or learning strategies does not work because the strategy and the content are externally imposed on the students and as such are not meaningful to them . And that the methods used to teach strategies are drawn from a passive and reductionistic learning theory. The argument here is that the purpose and meaning of the strategy must be constructed within the students for learning to be successful (Poplin 1988). A second reason given for failure to learn new information from the constructivist perspective is "insufficient previous experience with necessary and related information". This can be developmental or experiential according to this view . It is argued that most young children especially those labelled reading disabled do not have enough experience with language, especially written language .As such they can not generalize vowel rules to their reading of text .It was actually discovered that students who depend too much on phonics rules in textual reading are poorer readers .It seems such readers never realize that the purpose of reading is to understand written messages and not to sound out words (Poplin 1988). It was further argued that for second language learners, (Nigerian children and students fall into this category), the phonic rules are even more remote from their linguistic experiences and thus more incomprehensible . A third reason given for the inability of students to learn new information is "a lack of interest". The argument here is that to a large extent learning choices are made for children and students without considering whether they are interested in the subjects or not. And that it will be difficult to get people to learn something they are not interested in. It is reasoned that if students have very little interest in a topic, they are not likely to participate actively or voluntarily in learning the information unless one generate their interest in the topic, or force them to learn it by applying strong external reinforcements. The latter practice seems to happen in schools and yet much is not achieved (Poplin 1988).

A fourth reason given for failure of students to learn specific material or new information is " a mismatch of previous experience with new learning experiences". The argument of the constructivists here is that the meaning of a text is constructed by the reader and not simply by the text or curriculum guide author. As such this meaning is personal in nature and thus subject to the reader's experiences. And different experiences or different interpretations of the same behaviour can bring a mismatch mentioned above. For example it was found that a behaviour naturally defined by non Anglo children as cooperative learning ( where they are helping each other), (Philips 1983, Trueba, Guthrie & Au 1981, Gilligan 1982), was consistently defined in Anglo schools as "cheating" (Poplin 1988). This according to the constructivists is a fairly substantial mismatch of cultural definitions for the same behaviour. Another example of such mismatch is given here by the author of this thesis. In a research on the validation of Denver pre-screening developmental questionnaire among Lagos children (Akinsola 1995), it was found that interpretations given to words can be tied to the cultural environments of the interpreter. She found out that when children under age six were asked: "what would they do when feeling "cold""? While the American children would put on their sweaters or go inside the house as reported by Frankenburg et al, (1976), Nigerian children would tell their parents to take them to the doctor. In this example the American children are interpreting the word "cold " within the context of their weather, being surrounded by cold weather most of the time, whereas the Nigerian children are equating the same word to being sick since they are mostly and always surrounded by hot weather. And they must have learnt previously that whenever they are feeling cold they are likely to be sick because they are taken to see the doctor. This is another mismatch of cultural definitions of the same word that will elicit different cultural behaviours.

The thrust of the constructivists' approach is summarized thus:

1) New experiences are integrated into the whole such that the new pieces of knowledge, and the new meanings are much larger than the sum of their parts.
2) Two or more learning experiences transform one another and transform the structure of present knowledge. Thus learning is not merely additive but transformative.
3) The learner is always learning and self regulation process determines when,what and how things are learned.
4) Instruction is best derived from the student's interest and talent and not from deficits or curriculum materials.
5) The assessment of the student's development, interests and involvement is more important to teachers than the student's performance on reduction sub-skills and sub-processes.
6) Good teaching is interactive rather than unidirectional.
7) Real life activities form better educational experiences than synthetically contrived ones.
8) Errors are necessary and should not be penalized.
9) Goals of instruction should be more life related (e.g. literacy and cooperative learning), than school related (e.g. reading worksheets and textbooks).
10) Reflection, creation of questions and construction of personal interpretations are more critical than "correct", "accurate", and "right" answers to prepared questions.

11) Problems in learning are the result of interactions of personalities, interests, development, expectations and previous experiences.
12) Learning involves a process of going from the whole to part and then to the whole with accurate parts being secondary to the whole.
13) Form follows purpose (function) and meaning, and premature instruction in accurate forms will inhibit fluency.
14) Passion, trust, and interest are paramount, implying that subjectivity surrounds learning and cognitive processes are only one part of the picture.

This holistic / constructivist view reveals a different view of the classroom and of the interaction of teacher and student.

In reflecting on Poplin's model, Reid, (1988), maintained that the holistic model is only more comprehensive but not fundamentally different from Piaget's biological model of human intellectual development. She argued that the latter work of Piaget in which he regarded cognitive development as the extension of the biological organism into its environment with the process of assimilation and adaptation equally relevant to intellectual and psychological growth is compatible with the holistic view. In this perspective Piaget, (1952) views humans as living systems who are inherently active and growth oriented, and the child is a constructivist who acts on novel objects and events and thereby gain some understanding of their essential features. And that if children are to know something they must construct that knowledge themselves. This description of human functioning according to Reid is in line with the holistic perspective. She also reasons that the information processing theory which tends to be currently in vogue appears to be a more widely comprehensible vehicle for promoting the holistic perspective. The information processing theory is a model based on the assumption of an inherently active self regulating learner who constitutes a system with internal integrity, who lives in a social world and who has feelings and intellect. The theory is more appealing because it is more explanatory, has better ability to focus on higher levels of organisation and processing and the teachers understand the concepts of the theory. Furthermore, according to Reid some of the features in the holistic model are already being achieved in main stream education using the information processing approach, though she agreed that this approach is different from the holistic perspective. In addition the information processing approach has evolved some technique of strategy instruction which is not just another behavioural intervention but that it is personalized, contextualized, error dependent, socialized and interactive. This technique treats learning as the construction of meaning and the reading process as a whole. The major objective of this technique is the gradual transformation of the individual's effort. (Reid, 1988). This technique is called reciprocal teaching. In this method the teacher explains and models four activities namely self questioning, summarizing, predicting and evaluating. This is followed by the children taking turns at "playing teacher" and performing the same set of tasks with the teachers support. In this method, strategies are demonstrated within the context of the ideas to be learned stating when and where they are applicable. The rationale for the use of any specific strategy is made explicit so that the children can learn how and when to apply the strategy in their independent reading. Children other than the "teacher" answer the "teachers" questions, comment on the effectiveness of the summary, discuss the clues that enable them to make prediction and offer their own strategies and solutions for the clarification of difficult passages. In this method there is no drill and no attempt to reduce reading to a series of theoretical additive parts. This technique according to Reid (1988) meets the criteria set by Poplin (1988). However the technique fails to address the larger and more complex issues related to what to teach, to whom and under what circumstances. These are the socio-cultural and passion interest questions that reach beyond the fundamental reading, writing and arithmetic goals of schooling which are addressed by the holistic approach. This makes the holistic approach a better model,(Reid 1988).

**2.2.8. The Theoretical Position of this Research: Eclectic Model**

The theoretical model adopted in this research is **ECLECTICISM.** Eclecticism by definition in this case is a theoretical orientation that borrows freely concepts from a variety of other theories to give a broader and a more embracing perspective to the subject matter under consideration which in this case is learning disability. The theoretical model adopted in this study is eclectic in the sense that some relevant concepts from different theoretical orientations were employed as bases for explaining the etiology of learning disability and as underlying concepts that justify the use of the assessment instruments that were used in this research. For instance the developmental theory of Piaget was adopted in this research. This is because it was useful in explaining some of the problems encountered by LD children. In this category are such problems that can be traced to poor or slow development and inconsistent progression through the developmental stages of learning. Piaget used the concepts of developmental lag and decalage to describe such problems. According to Piaget cognitive growth occurs in a series of invariant and interdependent stages and that each child has a preset rate of growth for various cognitive functions. He further maintained that at each stage the child is capable of learning only certain cognitive tasks such that the quantity, quality, depth and breadth of learning that occur are a function of the stages during which the learning takes place. Discrepancies among abilities would indicate that the abilities are maturing at different rates such that some are lagging in their development

In addition Piaget used the concept of horizontal decalage to describe the inability of a child to solve certain problems despite being able to solve similar problems requiring the same mental operations. According to Piaget this happens because problems that appear similar may actually differ in complexity such that the more complex one would require higher operational ability or skill which would evolve at the next higher stage of cognitive attainment. This is why it is reasoned that most LD children do not display generalized deficits and it is possible to document a profile of strengths and weaknesses in their cognitive performance. The argument which is supported by this research is that most Ld individuals display specific deficits in some area of academic learning. So the deficits are seen as a profile of weaknesses arising from developmental lags and unevenly developed skills. And since cognitive abilities according to Piaget evolve gradually and sequentially, as the children mature and grow older their ways of thinking and their intellectual capability continually change and become more complex. It is therefore anticipated that in the standardization study there would be need to establish developmental norms. This makes it imperative to subscribe to a well established theory of intellectual development which in this case is Piaget's theory, and in particular his concepts of gradual and sequential development of cognitive abilities.

Another concept in Piaget's theory that is useful in explaining the inability of LD children to learn is **CONSTRUCTIVISM.** According to Piaget children are constructivists who actively explore their environment and construct their own knowledge of the world from moderately novel aspects of experience as interpreted by them. It is important to state here that Piaget's theory is not on childhood education, but his concepts have been borrowed and applied in the field of education. One of such people who borrowed and expanded on Piaget's concepts is Poplin. She proposed a constructivist theory to explain learning disability. According to this theory, learning is a construction of new knowledge through the process of transformation and self regulation. And that constructivism involve integration of new knowledge with the old to arrive at a new meaning. This integration is regulated by the learner. In this context learning is self selected, motivated, constructed and directed and this encourages the learner to take an active role in the learning process. The kind of instructional practices that obtain in our schools here are such that can make it impossible for the children to learn. This is because the practice is mass instruction that is unidirectional, the children are passive learners and the content of what they learn are externally imposed on them. So the children may not learn because they are not actively involved in the learning process. To complement Piaget's theory therefore, the constructivist theory of Poplin was also adopted in this research.

Besides the developmental and constructivist theories, the cognitive theoretical orientation is equally useful in explaining learning disability. Central to the identification of learning disability in this research is the concept of intelligence. The identification criterion of significant discrepancy between assumed ability and current achievement originated from the concept of intelligence. In addition it is believed that academic underachievement occurs in the absence of mental retardation in the learning disabled children. Since learning disability proposes a deficit between actual intellectual capacity and manifested intellectual profile of the child it would be necessary to adopt a theory of cognition that will allow one to talk about intelligence. In this case Spearman's two factor theory of intelligence was adopted. According to this theory intelligence consists of two factors namely, " g" or general ability and " s" or special abilities, that each special ability is specific to a particular test, and that these two factors affect children's performances on all cognitive tasks (Spearman, 1927). Spearman claimed that the more the overlap between the "g" and "s" factors the surer it is to predict the specific abilities from the general ability. The Raven's progressive matrices which was used in this research as a test of general intelligence has the Spearman's "g" factor as its underlying theoretical base. The test was designed to measure Spearman's "g" factor. Thus it was important to adopt this theory in this research.

Eye-hand coordination skill is crucial to academic achievement ( Kavale 1982). This is why tests that are based on such skills are used to predict achievement. The Visual-Motor Integration Test (VMI) that was used in this research measures eye-hand coordination. One of the theoretical principles underlying the development of this test is Werner's principles of development, and specifically the principles of **DIFFERENTIATION** and **HIERARCHIZATION.** According to Werner development proceeds from a more global, undifferentiated and simpler level to a more differentiated and complex level. He also claimed that there is hierarchization in intellectual competence as the child matures such that the emergence of one stage of competence is dependent on the preceding stage and the current stage is superior to the preceding one. The VMI test is arranged in increasing order of difficulty. This demands increasing mental competence for its mastery and is developmental in nature and fits into Werner's principles of development, hence the adoption of this theory in this research.

The concept of readiness in Education which is related to maturational level is equally applicable and useful in explaining the problems of some of the learning disabled children in Nigeria. The concept of readiness refers to the state of maturational development that is needed before some desired skill can be learned. The practice in our educational system is such that allows the society comprising of parents, teachers, school owners, and others in charge of educating children to push children into performing academic tasks for which they are not mentally ready. The demand of the school in such a case can require children to perform beyond their readiness or capacity at a given stage of maturation. An illustrative example is the situation in some schools where pupils in a class are taught curriculum meant for a higher class (e.g primary four pupils are taught primary five curriculum, primary five pupils are taught primary six curriculum and sit for common entrance examination in primary five instead of primary six).

Another example is the situation in which parents make false declaration of age for their children so as to secure admission into schools for them before the right or acceptable age.

In terms of practical implications the eclectic approach allows for a fuller explanation concerning the etiology of learning disability and throws more light on how to proceed to the rectification of the problem. The multidisciplinary approach provided by eclecticism improves the understanding ability of those who are dealing with the problems of the learning disabled population. It has made it possible to uncover some of the practices in the Nigerian Educational system that can actually cause and accelerate learning disability. It also allows for a socio-academic approach to understanding and solving the problem of the disabled population (see page 67,Vigotsky 1978 ). From the above discussions it is clear that adopting an eclectic approach to the study and understanding of learning disability in Nigerian children is appropriate.

## 2.3 Assessment Techniques for Learning Disability

### 2.3.1 Introduction

Educational assessment is defined as "the process of collecting data for the purposes of making educational decisions for and about children and students",(Ysseldyke 1977).Such decisions lead to diagnosis, identification, classification and formulation of appropriate remediation procedures (Smith and Niesworth 1969). This is the definition of assessment adopted for this research. Educational assessment focuses on many areas of learning in school as well as other factors affecting school achievement. It includes the process of putting test scores into perspective by relating them to the child tested rather than to the test used. It evaluates the total child as an organism interacting with his/her environment and examines the variables that may influence both the test scores and the interplay of the variables themselves (McLoughlin, & Lewis 1986). Educational and psychological assessment is seen as a variable process that depends on the questions asked, the child involved, the classroom context and some other social and developmental factors. It is a strategic problem solving process that used educational and psychological measurements within a theoretical framework, and testing is part of this assessment process.

Assessment process serves a variety of purposes (wallace & McLoughlin 1988, Lerner 1993). One is "SCREENING". Screening is used to detect pupils who may need a more comprehensive examination. It is used to identify students and children who may have learning disabilities. In the screening process, students are given a cursory test to determine those who need further evaluation. The goal of screening here is to use a set of fairly discriminating and reliable characteristics to find a pool of possible candidates for special programming. The procedure used at this point is brief, economical and non technical.

Another purpose of assessment process is "REFERRAL". This involves seeking additional assistance from other school personnel. After observation and evaluation of classroom performance the classroom teacher requests for further evaluation.This is done to make possible decision about whether a student qualifies or not for special education services.

A third purpose of screening process is "CLASSIFICATION" . This involves an in-depth assessment in order to define the student's level of performance in areas of concern. In this case students are assessed for purposes of classifying the type of disability they have and their eligibility for special educational services.The in-depth assessment is also used to determine strength and weaknesses and to identify mastered and unmastered skills. The result of such assessment is used as guides in planning remedial instruction. The challenge of this phase of the assessment process is the organization of a suitable assessment plan and the selection of procedures that will yield the necessary information,(Wallace & McLoughlin 1988).

A fourth purpose of assessment process is "INSTRUCTIONAL PLANNING". This involves planning an educational programme for an individual pupil. The assessment information is used to make decisions about placement, goals and objectives for instruction and make specific plans for teaching,(Lerner 1993).

Lastly, the assessment process allows for "MONITORING of PUPIL'S PROGRESS". This involves reviewing a student's achievement and progress on a regular basis to determine student's growth and programme efficacy,( Lerner 1993, Wallace & McLoughlin 1988). The implication is that assessment occurs in a formative and summative fashion which makes it possible to decide whether or not the programme should be continued,and in what form? (Wallace & McLoughlin 1988). The ultimate goal of assessment therefore is the remediation of perceptual, cognitive, linguistic, social and behaviour disorders as well as related disabilities,(Swanson & watson 1989). The attainment of this goal depends on developing adequate assessment procedures that will ensure the accurate use of test data.

### 2..3.2.Assessment Techniques

Assessment techniques are of two types, namely Informal and Formal. Both are used for Educational screening and guidance, (Miller,1986; Saba,1996), and identification and classification of LD pupils,(Salvia & Ysseldyke 1991; Lerner, 1993).

### 2.3.2.1 Informal Techniques

These techniques can accompany standardized procedures, and provide suitable devices for answering some assessment questions. The major advantage of informal assessment techniques is their relevance to instruction. Informal techniques provide information about the student's current levels of performance and aid in the selection of instructional goals and objectives. They also point to the need for instructional modifications, document student's progress,and suggest directions for further assessment. While norm referenced measures focus on student's ability to function in a structured testing situation, informal measures approximate typical classroom conditions,(McLoughlin, & Lewis, 1986).

There are many types of informal assessment techniques and it is important to conceptualize them in some ways. One dimension of conceptualizing them is whether informal strategies introduce a test task into the assessment situation, that is how obtrusive they are. With procedures such as observation, no test task is presented to the student. The student is simply observed within the natural environment of the classroom or whatever setting is of interest. Informal inventories and criterion referenced tests on the other hand are assessment procedures in which something is added to the environment. The tester presents the test tasks to the student and observe how the tasks are performed. Another dimension of conceptualizing informal assessment is whether measures are direct or indirect. Direct measures attempt to answer an assessment question about a particular student or classroom condition by assessing that characteristic or condition. For instance if the question concerns a student's ability to read a story book fluently, the student is asked to read the story book. Indirect measures rely upon some less direct source such as an informant. An indirect means of determining a student's ability to read a story book fluently would be to interview the student's language teacher.

Informal assessment technique is relevant to instruction, in that When it is designed by teachers to answer specific questions about their students, results are immediately applicable to the solution of instructional problems. The data assist in the identification of areas for further assessment, in the description of the student's current classroom performance, and in the planning or modification of instructional strategies.

Informal assessment measures have a number of limitations. The greatest limitation is the lack of information about their reliability and validity. In many cases the user of informal techniques does not know whether a particular informal procedure is technically adequate. If technical data are not available for a measure, the results of such a measure stand the risk of interpretation error. This is because the assessment results may not be accurate and the degree of accuracy is unknown.
Another limitation is that there are no guidelines for determining if a problem exists, and if it does, whether it is serious enough to warrant some kind of intervention. In most cases it is left to the user of the measure to set the criteria.

Yet another limitation is that though informal procedures are designed to describe behaviours exhibited by the students, tasks they can complete, mastered skills, and those that continue to require instruction, they make no attempt to match the students' present performance with the performance appropriate for their age, grade, and ability levels, (McLoughlin, & Lewis, 1986).

#### 2.3.2.2 Formal Techniques

Formal techniques make use of standardized tests to gather data that permit comparison of one student's level of performance with that of other students. Formal tests provide clear directions for administration, and yield numerous types of scores such as age, grade, percentile, stanine, and standard scores with which to communicate a student's level of performance. Standardized tests also permit the identification of certain strengths and weaknesses within the student's overall performance. These types of tests are essential in assessing learning disability by establishing comparative levels of underachievement and a degree of discrepancy between general ability and actual performance.

School achievement tests are often used to establish general levels of academic performance. These results are then compared to those from tests of intelligence and adaptive behaviour to determine the existence of a significant discrepancy between the expected and the actual achievement.

Individual standardized tests are preferable to group tests because of the reduced test taking demands on the student, and the increased ability of the tester to observe and judge performance. In addition individual tests in specific academic areas permit in-depth analysis of specific skill areas and their inter-relationships, (Wallace, & McLoughlin, 1988).

### 2.3.3. Tests and Test Evaluation

A test is "a set of tasks or questions intended to elicit particular types of behaviours under standardized conditions and to yield scores with which to describe the behaviour elicited

(APA,1974)". Some assumptions underlie testing.These are:1)a continuum of traits/functions exist and can be defined.

(2) groups or individuals can be given a series of tasks or questions which will lead to differential responses.

(3) the presentation of these tasks and responses occurs under controlled circumstances and,

(4) a quantitative characterization of a group or person's place on the continuum is appropriate,(Newland 1973).

Tests are the best known type of assessment measures. They are part of the school experience from the early grades to the university level. Nobody can pass through the educational system without taking one form of test or another, either weekly or terminally, or per semester or per session. The test could either be informal measures devised by teachers for classroom use or very structured instruments known as norm-referenced standardized tests. These formal tests are a regular feature of education whether they are achievement tests administered at intervals throughout the elementary and secondary school levels, aptitude tests which are used for secondary school, polytechnic and university admissions or individual tests which are used in special education.

In standardized testing, tests tasks are presented under standard conditions so that the student's performance can be contrasted to the performance of a norm group. The resulting data are comparative in that the student's level of functioning is described in relation to typical or average performance. This type of information is necessary in screening and determination of eligibility, where the goal is the selection of students whose performances are so divergent from that of others that special attention is needed. Results from such tests help professionals to plan instructions, by identifying curriculum areas where students fail to perform as well as their peers, and to document changes in performances relative to age and grade level expectations, (McLoughlin & Lewis 1986).

Before confidence can be placed in the results of tests their quality must be demonstrated. The techniques used to construct the tests must be sound. The tests must produce reliable data and must show validity. For a test results to be accurate and dependable, the practical and the technical qualities of the test must be ascertained. Ascertaining the practical quality of the test involves making sure that:

(a) The test fit the purpose of assessment, that is the test must provide the particular information needed for answering the assessment question. If for instance the goal of assessment is to answer questions about a student's standing in relation to his/her peers, then norm-referenced tests are appropriate.

(b) The test must be appropriate for the student, that is it must fit the student's needs and abilities. When using a norm-referenced test the student's characteristics must be consistent with those of the norm group on which the test was standardized. Achieving this in the present research necessitates the standardization of the tests concerned among a representative sample of Nigerian primary school children. The age or grade level of the student is equally an important consideration, since test norms are generally arranged by chronological age or according to grade in school. If this is not considered it will be impossible to convert the student's responses to norm-referenced test scores. In the present research the age factor was adequately considered. The researcher ensured adequate matching of age and grade levels.

The test must be appropriate for the user, by matching the user's skills. The testers must be trained in test administration and must know how to use in particular the test in question. In the present research the research assistants employed were trained on how to administer the tests concerned.

(d) The test must be technically adequate.The technical quality of a test is its adequacy as a measurement device. Some characteristics of tests that are considered in the evaluation of their technical quality includes (i) Reliability,(ii) Validity, and (iii) The norm group against which a student's performance is compared.

For norm-referenced tests, the standard is the performance of a norm group. For criterion- referenced tests the standard is a curricular goal. A norm group serves as the outside reference for norm-referenced tests.Factors that determine the appropriateness of test norms include the age/gender of subjects, method of sample selection and size and its representativeness.

The age/grade/gender of the norm group must match the characteristics of the student. For example it is wrong to give a test to a child beyond the age of the norms and then use the closest age group to estimate results. Also if the variable of interest is gender, a test normed only with males will be inappropriate for females.

Norm groups samples are meant to represent some population of interest. As such randomly selected samples that approximate the characteristics of a population, are preferable. Those selected due to accessibility to the researcher is not appropriate. Generally, larger samples produce more accurate results. And if the norm group is divided into age levels for which separate norms are provided,the size of each group also requires adequate consideration. In the present research each group has at least a hundred (100) children in the standardization sample.

Reliability is one of the methods used in validating a test. A reliable assessment instrument produces consistent results. Reliability as defined by Anastasi (1988) is: "the consistency of scores obtained by the same persons when re-examined with the same test on different occasions, or with different sets of equivalent items or under other variable examining conditions", (Anastasi,1988, P. 109).

"Reliability can also be defined as (i) the degree to which score variance results from the true score or (ii) the extent of the subject's performance that will remain constant with repeated administration", (Swanson, & Watson, 1989, P. 67). According to Swanson and Watson, although reliability can be defined as the consistency of a child's obtained scores on the same test or equivalent items tested on different occasions, reliability technically relates more to the ratio of true to obtained scores. They noted that scores vary from one administration to another and that repeating the measurement permits an estimate of the true score to be made and the error of measurement of a single score to be noted. A minimum level of reliability coefficient has been recommended for data that are used for assessment, (Salvia, & Ysseldyke, 1985). A coefficient of .80 is recommended for individual data that influence screening decisions, and .90 for individual data that influence Special Education Placement decisions, and .60 for group data that are used for administrative purposes. There are several types of reliability including test-retest, split half and inter- scorer reliability.

Test-retest reliability refers to the consistency of a measure from one administration to another.It is usually studied with some segment of the norm group. The measure is administered once during norming and then again to the same group of individuals after say a week or two after the first testing.

Equivalent forms reliability is of interest when there is more than one form of the same measure and the forms are designed to be used interchangeably. All the forms are administered to the same group of individuals, and the results are correlated.

Split half reliability has to do with a measure's internal consistency. It is studied with one form of a measure and one group. The measure is administered to one group of individuals and then divided into two halves, odd and even numbered items and the scores for the two halves are correlated.

Inter-scorer reliability concerns the consistency among persons who evaluate the performances of the individuals being assessed, and it is most important when scoring standards are subject to interpretation.

In the present research test-retest and split- half reliability studies were carried out on Ravens Coloured Progressive matrices, (CPM), and Beery's Visual-Motor-Integration, (VMI) tests to ascertain the degree of consistency of performance of the children in the tests. Inter-Scorer reliability study was carried out on (VMI) test to ascertain the consistency of scorers.

Validity is another method of evaluating a test. It refers to whether an assessment tool actually measures what it purports to measure. Validity is related to reliability. A measure can not be considered valid if it produces inconsistent results. Valid instruments are reliable instruments. If a test is demonstrated to have content, construct, congruent, concurrent, or predictive validity, it must have some degree of reliability. But a measure can be reliable and have little or no validity, because a measure can be valid for one purpose and not for another, and this will not remove its reliability. For example a test can be valid for screening for academic difficulties but not for differentiating between types of reading problems, (McLoughlin, & Lewis 1986). Validity therefore is concerned with the content of the measure and whether that content enables the measure to perform its intended function. Without validity a test is of little value, and validity is best conceptualized as having both a reasonable and an empirical base. The different types of validity include content, predictive, concurrent, and construct validities.

Content validity is defined as "the extent to which the instrument represents the content of interest",( Ary et al, 1979, P.197), or "the extent to which a measure covers a representative sample of the behaviour to be measured",( Anastasi, 1988, P.140). Usually content validity is built into a test from the construction stage through the choice of appropriate test items.

Predictive validity refers to a measure's ability to predict future performance. It is studied by administering the measure in question to a group of individuals and then sometimes in future administering the criterion measure to the same group. An example of this will be comparing and correlating the secondary school entry examination results with senior secondary school examination results of a group of students. This will indicate the predictive validity of the entry examination tests.

Concurrent validity is defined as the matching of test scores to measures of contemporary criterion performance. In other words it is concerned with a measure"s relationship to some current criterion. It is studied by administering both the measure in question and the criterion measure to the same group at the same time. For instance the concurrent validity of a new language ability test can be established by correlating its results with students' achievement grades/scores in language.

Construct validity refers to the degree to which an instrument measures the theoretical construct or trait it intends to measure. Since theoretical constructs are not directly observable, they are inferred from observed behaviours. The construct validity of a measure can be studied with correlational techniques. For example a correlation can be made between the present test score and scores from other tests that have similar theoretical framework.

### 2.3.4 Intelligence Testing

Currently there is no clear consensus about how to define intelligence despite the fact that much research has been done in this area,(Weinberg, 1989). The experts in this field are not in total disagreement, because most of them agree that intelligence reflects an ability to adapt, to think abstractly, and to solve problems effectively, (Sternberg, & Berg, 1986). However there is no singular definition of intelligence because different theorists make different assumptions about the origins, the structure,and the stability of attributes that are considered as indicators of "intelligent" behaviour, (Shaffer, 1993 P.320) The early psychometric view of intelligence defines it as a trait or a set of traits that characterize some people to a greater extent than others. The goal of the psychometrician is to identify these traits and measure them so that intellectual differences among individuals can be detected and described. Recently as part of critical reactions to the early psychometric definitions of intelligence, a triarchic theory of intelligence was proposed by Robert Sternberg, (1985, 1988). This theory emphasizes three aspects of intelligent behaviour. These are context, experience, and information processing skills. The contextual aspect is equated to "practical wisdom", the ability to tailor one's behaviour to the demands of the environment which varies from culture to culture. Unfortunately this aspect can not be assessed with the present traditional intelligence tests.

For the experiential aspect, responses to novelty are taken as indications of one's ability to generate new ideas or fresh insights. In addition performance on familiar tasks is expected to reflect automatization, that is increasing efficiency of information processing with practice. The implication is that, in order to properly assess a person's intellectual prowess from his/her responses to tests, one has to know how familiar the task is to the testee, and which aspect of intelligence: response to novelty or automatization is reflected in the responses.

The proposal from the information processing skills aspect is that, rather than estimate a person's intelligence only from the quality of the responses given, one should focus on the components of intelligent behaviour, that is the cognitive pro cesses that are involved in problem solving. The triarchic theory thus provides a rich view of the nature of intelligence and suggests that to know how intelligent people are, one needs to consider, (1) the context in which they are performing (e.g.their ages and socio-cultural environment),(2) their experiences with the task and whether their behaviour qualifies as responses to novelty or automatized processes, and (3) the information processing skills that reflect how each of them is approaching the tasks. However the traditional tests of intelligence that are currently being used are not based on this type of broad and sophisticated view of intellectual processes, (Shaffer, 1993).

For the purpose of the present research " Intelligence is defined as consisting those attributes of intelligent behaviour that can be measured by the coloured progressive matrices test, (CPM). The CPM measures the Spearman's "g" factor- the aspect of "g" that requires the eduction of relations among abstract items.

Tests according to Cronbach,(1970),may be classified in to broad classes, namely: (1)those that measure "maximum" performance and (2) those that measure "typical" performance. Tests that measure maximum performance are called "mental tests", intelligence tests and so on. There is a large group of tests that are referred to as "measures of general mental ability". These tests seek to measure those mental abilities that are valuable in almost any type of thinking, and they are often called "intelligence tests".

General abilities may be contrasted with specialized abilities that are of value only in a limited range of tasks. Tests of specialized abilities are called "measures of special abilities". Under the tests of special abilities are different aptitude and achievement tests. An aptitude test is the one intended to predict success in some occupation or training course. A test is referred to as an achievement test when it is used primarily to examine the person's success in past study and as an aptitude test when it is used to forecast his/her success in some future course or assignment, (Cronbach, 1970). Intelligence tests are designed and used for predicting academic success or failure in a school environment, (Abiola, 1966), and they have been shown to be excellent predictors,(Brown, & French, 1979; Swanson, & Watson, 1989; Salvia, & Ysseldyke, 1991).

Individual tests of intellectual functioning are part of the assessment battery for most students being considered for special education programmes. Information about general learning aptitude is needed for initial decisions for many disabilities as well as for the periodic re- evaluation of eligibility. Individual tests of intelligence are usually administered in educational settings by school psychologists specially trained in assessment techniques. Individual tests may be designed for a special age group such as preschool children or students between the ages of 5years and 18years, or may be appropriate for the entire age range from early childhood through adulthood. Unlike group tests, individual tests usually have only one version divided into sections by either subtests or age levels. Subtests contain items that attempt to assess the same skill or ability and test items are arranged in order of difficulty. When tests are broken into age levels, each age level usually contains a variety of tasks that assess different skills and abilities.

Most individual tests of intellectual performance assess both verbal and non- verbal reasoning. Verbal skills may be emphasized but non- verbal abilities are evaluated by means of figural or mathematical problem solving tasks. Academic skill demands are not emphasized in individual intelligence tests. Reading is not required and written responses are usually limited to drawing or writing numbers. Information is presented orally or with pictures or objects and students answer orally or with some type of motoric response,(McLoughlin, & Lewis, 1986).

There are many individual tests of intelligence currently in use in educational assessment in countries where norms have been established for them (e.g. Britain, USA, Canada,etc.). One of them is the WISC-R.

The WISC-R is an individual test most often used to assess general intellectual performance of school-aged children. It is one of a family of tests that spans all age levels. The Wechsler pre-school and primary scale of intelligence (WPPSI) (Wechsler 1967) is appropriate for children between the ages of 4 to 6 and a half years. The Wechsler Adult intelligence scale-Revised (WAIS-R) (Wechsler 1981) is for persons between the ages of 16 to 74 years. There is a wisc-R version for deaf children and research edition in Spanish language.

The WISC-R assesses general intellectual functioning by sampling performance on many different types of activities. In special education assessment the Wisc-R is often used to gain an overall estimate of the student's present global intellectual performance.This test provides information on strengths and weaknesses in specific areas. The wisc-R contains 12 subtests; 10 are required and 2 are supplementary.The required subtests are used to determine IQ scores. Sub tests are classified as either verbal or performance scale. Verbal scale subtests require students to listen to questions and answer orally. Performance subtests are visual-motor tasks. The student listens to oral directions,looks at stimulus materials and responds motorically.

In terms of technical quality the WISC-R was standardized in the U.S.A. in 32 states, on 2,200 individuals between the ages of 6 and a half years and 16 and a half years. Equal number of males and females were included at each age level. Average reliabilities of 0.94, 0.90, and 0.96 were reported for verbal, performance and Full scale IQs across all ages respectively. When correlated with Stanford Binet intelligence scale, concurrent validities of 0.71, 0.60, 0.73 were reported for verbal, performance and full scale IQs, (Anastasi,1988). The WISC-R has not been standardized in Nigeria, so there are no Nigerian norms.

Group intelligence tests are designed primarily for assessing a large number of people at the same time. They are sometimes used in regular education. Their results may be available for students referred for special education assessment. Group tests of intellectual performance are typically designed with several levels so that one test series can be used for grade 1 through 12. The content of group tests varies but most attempt to asses both verbal and quantitative reasoning skills. Some provide separate measures of verbal and nonverbal abilities and some contain several subtests each of which addresses a different cognitive skill (McLoughlin & Lewis 1986). Most produce total test scores similar to IQ scores that indicate overall cognitive functioning. In group intelligence tests, test items are typically in multiple choice format. Directions are presented orally by the tester and the student reads each question and responds in writing. Most tests including the group intelligence tests are timed. Group intelligence tests are most useful in screening programmes, and in terms of frequency group tests are used more often than individual tests in schools, industries and organizations,(Tyler & Walsh 1979). One example of group intelligence tests currently in use in places where they have been standardized, (e.g. US, Britain, Canada, etc), is the Cognitive abilities test (CAT).

The cognitive abilities test is an integrated test series designed to assess the development of cognitive abilities in children in grades ranging from kindergarten through the end of the secondary school year. The series consist of primary I, primary II and the CAT multilevel. The complete series yields comparative scores in cognitive development for the same individual at different times. The CAT yields three scores namely verbal, quantitative and non-verbal.

In terms of technical quality, reliability coefficients range from 0.76 to 0.94 for retesting at a six month interval. Construct validity with Sandford Binet ranges between 0.65 to 0.75. Concurrent validities with Iowa test of basic skills ranges between 0.70 to 0.80. Norms were established for Cat in 1978 and 1979 in IOWA , U.S.A. taking into consideration variables such as size of school district enrollment, geographic region and the socioeconomic status of the community in selecting the normative sample, (Swanson, & Watson,1989). CAT has not been standardized in Nigeria, as such there are no Nigerian norms for it.



**2.3.5.Cross Cultural Testing.**

Traditionally, in cross-cultural tests attempts are made to rule out one or more parameters along which cultures vary. One example of such parameters is language. If the cultural groups to be tested spoke different languages, tests were developed that required no language on the part of either the examiner or the testee. When educational backgrounds differed and illiteracy was high, reading was ruled out. Oral language was not eliminated from the tests because they were designed for people speaking a common language.

Speed was another parameter in which cultures differ. The tempo of daily life, the motivation to hurry and the value attached to rapid performance vary from one national culture to another, from one ethnic group to another, from rural to urban subcultures, ( Knapp 1960; Womer 1972). As such cross-cultural tests tried to eliminate the influence of speed by allowing long time limits and giving no premium for faster performance.

Another parameter along which cultures differ relates to test content. Many non-language and non-reading tests call for items of information that are specific to certain cultures. Such items may require the testee to understand the functions of the objects in these test items. People reared in certain cultures may lack experiential background to respond correctly to such items. It is to control this type of cultural problems that the classic "culture fair" tests were developed,(Anastasi 1988).

According to Swanson & Watson (1989), to be culture fair, a test should meet the following criteria:

a)Similar test predictions should be possible across cultures.

b) Language and reading should be kept at a minimum.

c) Pictures used in tests must be familiar to all cultures.

d) Subjects should not be penalized by timed items.

e) Tests items must be equally difficult across cultures.

f) Test items should equally motivate all cultures.

It was with the above criteria in mind that the culture-fair movement developed tests which they claimed to yield similar scores for any given population regardless of race or culture. Among the tests developed are, (a) the International Performance Scale (1929) and (b) the Raven's Progressive Matrices, (Raven, Court & Raven, 1977, 1986). These two tests the LIPS and RPM described below were adjudged to be the culture-fair tests currently in use.

**2.3.5.1 Leiter International Performance Scale (LIPS)**

The Leiter International Performance Scale (LIPS) was developed to test IQ differences between races. It was assumed that if language is removed as part of a test's format the test will serve as a culture-fair instrument. The (LIPS) is an individually administered performance scale. It was developed through several years of use with different ethnic groups. A distinctive feature of the Leiter scale is the almost complete elimination of instructions. Each test begins with a very easy task. The comprehension of the test is treated as part of the test. The Leiter scale was designed to cover a wide range of functions similar to those found in verbal scales. The tasks include: matching identical colours, forms, pictures, copying a block design, picture completion and so on. The test has no time limit and items are arranged into age levels from 2 to 18 years.The scale is scored in terms of MA and ratio IQ.

In terms of technical quality norms for the scale were established on a sample of 289 children of middle class status from the metropolitan Midwest, (Swanson & Watson 1989).

Split half reliabilities reported for the test range between .91 to .94. Validation against the Binet and WISC were reported as ranging between .56 and .92.



#### 2.3.5.2 Raven's Progressive Matrices (RPM)

The Raven's Progressive Matrices (RPM) is also very popular as a non-verbal and a culture fair test. It was designed primarily as a measure of Spearman's "g" factor (Raven 1983; Raven, Court and Raven 1985). By using the Spearman's theoretical analysis of g as a base, the test requires the eduction of relations among abstract items. The items consist of a set of matrices or arrangement of design elements into rows and columns from each of which a part has been removed. The task is to choose the missing insert from given alternatives. The easier items require accuracy of discrimination, the more difficult ones involve analogies, permutations, and alternation of patterns and other logical relations. The test is administered with no time limit and can be administered individually or in groups.

The Raven's Progressive Matrices is available in three forms that differ in difficulty level. These forms are:

(1) The standard progressive matrices (SAM 1983 edition). The 1983 edition of (SAM) was standardized on over three thousand British children aged 6 to 16 years.

(2) The coloured Progressive Matrices (CPM), is an easier form made for younger children and for special groups who cannot be adequately tested with the (SAM). The CPM is made up of three sets, A, AB, & B. Each set has twelve big figures each with a missing pattern. Below each figure, there are six alternatives to choose from to complete the missing pattern in the big figure. The CPM is easy to administer and score. To administer the CPM test, the child will be instructed to look carefully at each big figure and the alternatives provided below the figure and choose one of the alternatives that will complete the missing pattern in the big figure. To score the CPM, every correct choice of the missing pattern is scored one and every wrong choice is scored zero. So for each set there is a maximum score of twelve and a minimum score of zero. For the entire test the maximum score is thirty six and the minimum score is zero. Percentile norms are available for this test by half years from 5.5 to aeries. It was reported that the CPM correlated significantly with other IQ measures and the correlation is higher with performance sub-scales. For example correlations between CPM and full-scale WISC was given as

0.58, with WISC verbal sub-scale as 0.51, and with WISC performance sub-scale as 0.62. (Raven & Summers, 1986; Anastasi, 1988). The CPM is thus said to be a valid test of non-verbal intellectual ability.

(3) The Advanced Progressive Matrices, (APM 1962 edition). The Advanced progressive matrices was developed for above average adolescents and adults. Percentile norms for ages 11 1/2 to 14, 20 & above, 30 & above, and 40 & above are provided with the test. Test retest reliability in groups of older children and adults are available and ranges between .70 -.90. Correlations with both verbal and performance tests of intelligence range between .40-.75.

Another non-verbal test that is used as a culture fair test is the "Goodenough Draw a Man Test". In this test the test taker is simply instructed to make a picture of a man and make the very best picture he/she can. The test is designed to evaluate intelligence in children of five to fifteen years of age. The test can be used for such purposes as screening, as a rapid, non-threatening means of gaining an impression of a child's general ability level and of estimating mental ability of children for whom the usual verbal tests are inappropriate. There is no time limit for the test. To score the test there are 73 points to be scored for drawing a man. Every correctly drawn item is scored one point. So the maximum possible score is 73 and the minimum is zero. To bring the individual score to percentage, it is multiplied by 10/7. Part of the items that are scored include the head, neck, eyes, nose, ears, correctly drawn and positioned,(see Appendix vii), for short scoring guide. Test retest (of one week interval) reliability yielded 0.68 and split half reliability yielded 0.89. The Draw a man test was standardized in Nigeria by

Ebigbo,& Izuora,(1981).

#### 2.3.5.3 Relationship between CPM and Present Study

In the present research the coloured progressive matrices (CPM) is used as a test of general intelligence and as a group test. Since it is established that the CPM correlate significantly with other intellectual ability measures,(Raven & Summers, 1986; Anastasi, 1988), it is used here as a screening device to identify and classify those who are learning disabled,and those who are slow learners, and differentiate them from the normal children. This is achieved by first standardizing the CPM using a representative sample of Nigerian children and establishing age norms for them. Then those children who are reported by their teachers as having learning problems in the classroom and supported by their school records of poor performances in few subjects would be identified and given the CPM test. Their performances in this test would be compared to the average scores of their age groups in the normative sample. Those whose scores are at least average would be reported as learning disabled and those who score below the norm average would be reported as slow learners.

Similarly, the draw a man test is designed to evaluate intelligence,(Goodenough, 1926; Harris, 1963), and has been standardized and validated in Nigeria, (Ebigbo, & Izuora,1981). In the present study therefore, the CPM is validated against the Draw a Man test since both evaluate intelligence.

### 2.3.6 Issues in Intelligence Testing

A number of issues surround the assessment of intelligence. One of such issues concern the stability of the IQ score. There are two sides to this issue. One side believes that IQ scores are relatively stable over time. In support of this view an extensive body of research data which has been accumulated has shown that over the elementary high school and college period intelligence test performance is stable (Anastasi 1988; McCall, Appelbaum & Hogarty, 1973). As reported by Anastasi (1988), and Husen (1951), in a Swedish study, a correlation of .72 was found between the test scores of 613 third grade school boys and the scores obtained by the same persons 10 years later on their induction to military service. In a later Swedish study, Harnquist (1968) reported a correlation of .78 between tests administered at 13 and 18 years of age to over 4,500 young men. A follow up study was carried out on children originally tested between the ages of 2 and 5.5yrs as part of the 1937 Sandford-Binet standardization sample by Bradway, Thompson and Cravens (1958). They found that the initial IQ's correlated 0.65 with 10 years retests and .59 with 25 years retest and the correlation between the 10 year retest and the 25 year retest was .85 It was also found that the retest correlations are higher for shorter intervals between tests. when the time between tests are constant retest correlations tend to be higher the older the children.

Some explanations have been given for the IQ stability trend. One of such explanations relate to the cumulative nature of intellectual development. It is argued that the individuals intellectual skills and knowledge at each age include all his or her earlier skills and knowledge plus an increment of new acquisitions. And that even if the annual increments bear no relation to each other, a growing consistency of performance level would emerge because earlier acquisitions constitute an increasing proportion of total skills and knowledge as age increases. It then follows from this that prediction of IQ's from age 10 to 16 would be more accurate than 3 to 9 years. This is because scores at 10 years include over half of what is present at 16 while scores at 3 years include a smaller proportion of what is present at 9 years (Anastasi 1988).

The relationship between successive scores is described as the overlap hypothesis by Anderson, (1940), reported by Anastasi, (1988). According to this hypothesis since the growing individual does not lose what he or she already has, the constancy of the IQ is in large measure a matter of the part-whole or overlap relation, (Anderson 1940). Anderson computed a set of correlations between initial and terminal scores and this correlations agreed closely with empirical test retest correlations in intelligence test scores found in three published longitudinal studies. Thus the overlap hypothesis accounts for some of the increasing stability of the IQ in the developing individual. However there are other conditions. One of such conditions is the environmental stability characterizing the developmental years of most individuals. Children tend to remain in the same family, the same socio-economic level and the same cultural milieu as they grow up. They are not typically shifted at random from intellectually stimulating to intellectually retarding environment. As such whatever intellectual advantages or disadvantages they had at one stage in their development tend to persist in the interval between retests, (Anastasi 1988).

Another condition contributing to the general stability of the IQ concerns the role of prerequisite learning skills on subsequent learning. The individual retains prior learning and much of this prior learning provide tools for subsequent learning such that the more progress the child has made in the acquisition of intellectual skills and knowledge at any one point in time, the better able he/she is to profit from subsequent learning experiences. The concept of readiness in education and other compensatory educational programmes are based on the recognition of the importance of the prerequisite learning skills, (Anastasi, 1988; 1982; 1976; Siegel, 1973; Stanley, 1972; 1973). It has been observed that when the IQ test deals with high levels of intelligence, the IQ of the tested child is not only stable but highly predictive of later success, (Weiner & Stewart 1984).

The other side of the stability issue is the belief that IQ scores are not so stable over time. Those researchers who view IQ critically and conclude that it is unstable regard the IQ score as primarily representing performance on one particular test at one particular time. And since IQ tests are the major tools for assessing intelligence, many people define intelligence as "what an intelligence test measures". This definition indicates that the many intelligence tests that are being used today assess many different aspects of intellectual functioning.

Many researchers have pointed out that a person can score low on one test and high on another. The score will depend to a large extent on the skills being tested and the conditions under which the tests are taken, (Weiner & Stewart 1984). It has been argued that sharp rises or drops in IQ may occur as a result of major environmental changes in the child's life. Drastic changes in family structure or home conditions, severe or prolonged illness and therapeutic or remedial programmes are examples of the types of events that may alter the child's subsequent intellectual development. Children who remain in the same environment may even show large increases or decreases in IQ on retesting. These changes will only mean that the child is developing at a faster or a slower rate than that of the normative population on which the test was standardized.

Another condition associated with rising IQ's is described as accelerated attempt or the extent to which the parent deliberately trained the child in various mental and motor skills which were not yet essential. Research on the factors associated with increases and decreases in IQ throws light on the conditions determining intellectual development. It also suggests that prediction of subsequent intellectual status can be improved if measures of the individual's emotional and motivational characteristics and of his/her environment are combined with initial test scores. The findings from these researches point to the kind of intervention programmes that can effectively alter the course of intellectual development in the desired directions.

There seems to be sufficient and well conducted studies to support each side of the stability issue. It is true that the IQ is stable when one considers large groups of people and the average statistical correlations between testings. It is equally true that the test-retest correlations are less than 1.00, that is they show less than perfect reliability. This implies that for any particular person within the group, one may find changes from one testing to another.

Regardless of the evidences that support each side of the stability issue, the author of this research identifies with the position that IQ is relatively stable over time. This is borne out of the belief that intellectual development is largely a continuous process with some degree of overlap between the old and new structures brought about by a relatively stable environment over the span of development. In addition the concept of readiness in education is based on the recognition that subsequent learning is built upon prior learning and is dependent on the acquisition of prerequisite skills and knowledge needed for such learning. All these factors provide stability of IQ scores over time. The researcher wishes to state here that those factors which have been adduced to be responsible for instability in IQ scores can be filtered out or controlled to pave way for the documentation of more stable IQ scores over time. These factors include consistency in what intelligence tests measure

Another issue that surround the assessment of intelligence concerns heritability. One argumentative position is that intelligence is primarily an inherited characteristic. This follows the basic genetic arguments. The argument holds that parents pass intellectual abilities on to their children through genetic transmission just like the way other characteristics such as hair colour and height are transmitted. Heritability estimates are usually used to examine the relationship between intelligence test scores and heredity. A heritability index shows the proportional contribution of hereditary factors to the total variance of a particular trait in a given population under existing conditions. A number of points have been noted when interpreting heritability estimates. Firstly the basic data that are used to compute heritability indices are obtained from measures of familial resemblances in the trait being considered, (e.g. identical twins and fraternal twins, twins either reared together or separately). Secondly these empirical data on familial resemblances are subject to some distortions because of the unassessed contributions of environmental factors. For instance the environment of identical twins may be more similar than the environment of fraternal twins reared together and actually some research evidence has shown this to be, (Anastasi

1958, pp.287-288, Koch 1966). Besides twin pairs reared apart are not randomly assigned and as such, this type of study is far from being an ideal experiment. In addition the twin data regarding heritability may not be generalizable to the population at large because of the greater susceptibility of twins to prenatal trauma leading to severe mental retardation. The inclusion of such severely retarded cases in a sample may greatly increase the twin correlation in intelligence test scores, (Nichols & Broman, 1974). All these short comings will make the twin studies data a questionable and contaminated data, (Anastasi 1988).

There are other limitations regarding heritability indices. Firstly the concept of heritability is applicable to populations and not individuals. So in trying to establish the etiology of a child's mental retardation, the heritability index will not be useful, because regardless of the size of the heritability index in the population, the child's mental retardation could have resulted from causes other than heredity such as a defective gene, prenatal brain damage or experiential deprivation.

Secondly heritability indices refer to the population on which they were found at the time. Any change in either hereditary or environmental conditions would alter the heritability index. For example an increase in inbreeding would reduce the variance attributable to heredity and thus lower the heritability index. On the other hand, increasing environmental homogeneity would reduce variance attributable to environment and hence raise the heritability index, and a heritability index computed within one population is not applicable to an analysis of the differences in test performance between two populations.

Thirdly heritability does not indicate the degree of modifiability of a trait. Even if the heritability index of a trait in a given population is 100%, it does not mean that the contribution of environment to that trait is unimportant or zero. So regardless of the magnitude of heritability indices found for IQs in various populations, one empirical fact which has been established is that the IQ is not fixed and unchanging, and as such is amenable to modification by environmental interventions. Rises and drops in IQ may result from both fortuitous environmental changes occurring in a child's life and planned environmental interventions. Major changes in family structures, sharp rises or drops in family income or adoption into a foster home, all may produce conspicuous increases or decreases in IQ.

Another position is to argue that much of intelligence is acquired or learned. Research evidences have shown that the correlation between IQ scores or the inheritability index increases when two children share the same environment.And that foster parents and their children show correlations averaging .32. This correlation is related to environmental factors because they do not share the same genes.

Further more many recent studies and reviews have shown the effect of environmental manipulation on changes in IQ scores, (Albee, 1980: Fox 1981, Mercer 1979; Satler 1982; Scarr 1981). These evidences support the argument that intelligence is partly acquired. At this point one can argue for a complementary position and say that both genetic and environmental factors play important roles in determining intelligence. This is because it is an accepted fact that people can not be born as intellectual equals, and as such equal opportunity can not make them equal. Rather than make people equal, equal opportunity for all may actually allow differences among people to become greater if those of higher intellectual ability profit more from their educational opportunities than those of lower ability. At the same time it is important to stress that the relationship between measured intelligence and indicators of accomplishment such as school grades is only moderately high with correlations typically falling in the range of .40 to .60. This means that only a fraction of the variability in school grades can be accounted for by assessed intelligence. The remaining fraction can be attributed to hard work, persistence, attitude, and other factors. So the fact is that intelligence has an inherited component and an environmental component, and actually while this researcher supports the complementary position, she is emphatically stating that the environmental factors (Nurture), or indices are more crucial to optimal intellectual performance. This is the underlying premise on which the classification of learning disability is based. The premise is that under-achievement occurs in the absence of mental retardation. This implies that factors responsible for under-achievement of the learning disabled are embedded in the environmental circumstances surrounding their learning experiences. These circumstances can bring about developmental or slowness in development within the child which will consequently lead to uneven development of skills required for school success. On the other hand the circumstances may prevent the children from using their acquired skills to derive maximum benefits from the learning experiences.

The usefulness of intelligence test does not lie in detecting innate differences but in showing the present functioning of the person. Assessment devices especially tests can be used as tools to diagnose educational, vocational, and social skills and needs, and to test for their improvement,(Weiner & Stewart 1984).

### 2.3.7 Achievement Testing

Achievement tests are designed to measure the effects of a specific programme of instruction or training. They are usually contrasted with aptitude tests.The difference between them is said to be a difference in the degree of uniformity of relevant antecedent experience. In this regard achievement tests measure the effects of relatively standardized sets of experiences such as a course in psychology or computer programming.

Aptitude test performance on the other hand reflect the cumulative influence of a multiplicity of experiences in daily living. In other words aptitude tests measure the effect of learning under relatively uncontrolled and unknown conditions while achievement tests measure the effect of learning that occurred under partially known and controlled conditions..

Another difference between aptitude and achievement tests relate to their uses. Aptitude tests serve to predict subsequent performance. They are used to estimate the extent to which the individual will profit from a specified course of training or to forecast the quality of his/her achievement in a new situation.

Achievement tests on the other hand represent a terminal evaluation of the individual's status on the completion of training. The emphasis in achievement tests is on what the individual can do at the time. While aptitude tests are evaluated in terms of predictive validation procedures, achievement tests are evaluated in terms of content validation procedures, ( Anastasi 1988). However no strict distinction can be made between the aptitude and achievement tests. Some aptitude tests depend on fairly specific and uniform prior learning, some achievement tests cover broad and unstandardized educational experiences. An achievement test may be used as a predictor of future learning and thus serves the same purpose as an aptitude test. For instance achievement test on pre-medical courses can serve as predictors of performance in medical school. Also when individuals have had the same or closely similar course of study, achievement test based on such courses may provide efficient indices of future performance.

The identification of learning problems is also made with achievement tests. Teachers and parents may recognize that the child's performance is below grade placement, and the child is not achieving at his/her maximum performance level. Such a child needs to be tested with a norm referenced test to determine the nature of his/her problem and the most appropriate programme; and if it will involve special education placement or modifications of in-class programmes.This is necessary because before eligibility for special education is determined the relationship between school performance problems and a handicapping condition must be documented, (McLoughlin & Lewis 1986).

**2.3.7.1 Individual Tests of Academic Achievement**

Individual achievement tests are preferred for assessment of school performance in special education. They are designed for a wide span of grades usually from nursery school to end of secondary school level. Instead of having separate versions for different grade levels the tests are usually limited to one version that includes a wide range of items arranged in order of difficulty. Most individual achievement tests assess the basic skills of reading, mathematics and spelling. Content subjects such as science and social studies are not usually included. Since the tests are individually administered, students responses can be written or oral. This allows for the assessment of oral as well as silent reading and permits students with poor writing skills to bypass this difficulty when answering questions in other subject areas, (McLoughlin & Lewis 1986). An example of individual achievement test is described below.

**2.3.7.1.1. Wide Range Achievement Test (WRAT).**

This is a norm referenced test for the assessment of school performance. The purpose of the test is to measure the codes which are needed to learn the basic skills of reading spelling and arithmetic. So the WRAT contains reading, spelling and arithmetic subtests. Each sub-test has a pre-academic section that is administered to young children and to individuals who do not reach specified criteria on the academic portion of each subtest. The academic portion of the reading subtest requires the subject to read a list of words. On the spelling subtest the individual writes the words dictated by the examiner. The subject completes arithmetic calculations on the arithmetic subtest. The test samples limited aspects of areas of reading and arithmetic. Each subtest is divided into two levels. Level I is designed for children from five to eleven years and Level II is used with persons from twelve to seventy-four years of age. Portions of the test are timed but the entire test is usually completed in 20 to 30 minutes. Although some portions of WRAT can be administered in a group, individual administration is preferred.
Three types of scores namely: grade equivalent, percentiles and standard scores are provided with the test.

The WRAT was standardized on a stratified national sample of 5,600 persons from 17 states in the USA. Twenty-eight age groups from 5 to 74 years were included. The WRAT appears appropriate for a wide age span of individuals.

Split half reliability coefficients were provided with the early forms,(1978), and test-retest reliability coefficients provided with the revised edition (1984), and ranged from .79 to .97. In terms of validity the manual emphasizes the apparent content validity of the test, since the test purpose is the measurement of skills in the rote recall or code aspects of basic skills. One validity study examined the relationship between the 1984 edition and earlier editions, and correlations between different versions ranged between .91 to .99. Intercorrelations between WRAT subtests were high ranging between .83 to .93.

**2.3.7.2 Group Tests of Academic Achievement.**

Group academic achievement tests are typically administered in regular as opposed to special education. The results of the group tests help to evaluate the performance of individuals and classes and determine the effectiveness of school programmes. Several group tests of academic achievement are used in schools, and they usually contain several levels, so that one test series can be used from the earliest elementary grades through to the end of secondary school level. The subject areas assessed by group measures are the basic skills of reading, mathematics and language arts. Some tests also evaluate study skills and content area subjects such as science and social studies. Since group administration procedures do not allow for oral responses, assessment of reading is limited to silent reading skills, and the test items are multiple-choice for easy scoring.

Many types of scores are available for group measures, and they include grade equivalents, percentile ranks and stanines. Group tests have some uses in special education. They are useful in the special education's screening processes. They are useful in identifying students that need further assessment and they can provide information about the academic progress of handicapped students in regular classroom in relation to their non handicapped peers, ( McLoughlin & Lewis 1986). An example of a group achievement test is described below.

**2.3.7.2 1. Metropolitan Achievement Tests (MAT)**

This was reported to be a widely used achievement test battery,(Anastasi,1988). This test has undergone extensive changes in successive editions. A major feature of the latest edition (1985) is the inclusion of a survey battery and three diagnostic batteries for specialized purposes. The survey battery extends from kindergarten to grade 2 in eight overlapping batteries. All batteries are available in two parallel forms. There is a practice booklet containing typical items which can be administered a few days before the test proper. The survey battery comprises ten tests yielding scores in five content areas. The content areas are reading, mathematics, language, science and social studies. The reading section consists of three subtests namely vocabulary, word recognition skills and reading comprehension. The mathematics section consists of three subtests namely concepts, problem solving and computation. The language section consists of two subtests namely spelling and language. The remaining two content areas are science and social studies. At the elementary level, reference, alphabetizing and dictionary skills are in the language test. Graphs and statistics are in the problem solving test, inquiry skills and critical analysis are in both the science and social studies tests. At all levels the entire survey battery requires several testing sessions.
Several kinds of scores are provided including percentile ranks,

stanines and grade equivalents.

The test was standardized in 1985 in Texas, USA, with over 250,000 students. Test reliabilities were high for all levels, with a range of .90 to .96 for the five content areas.

Convergent validity which is a correlation between tests of similar content, was established between mathematics and recognition subtests of Peabody Individual Achievement Test (PIAT), and Metropolitan Achievement Test (MAT).

**2.3.8.Visual-Motor Perception and Academic Achievement**

Motor skills are required in many school related activities. In the classroom for example, handwriting is a very important mode of expression. The two major areas of concern to educators are gross motor development and fine motor development. Gross motor such as running, jumping and throwing involve large muscles of the body. The fine motor skills involve small muscles. Examples of school related fine motor tasks are cutting with scissors tracing and copying. Many of these skills involve both fine motor ability and visual perception. The combination of these skills is called eye-hand coordination. Many of the measures developed to assess motor skills are concerned with this ability, that is the motor skill of eye-hand coordination. This skill is emphasized because it is required in many educational activities the most notably of which is handwriting. Among the measures designed to evaluate eye-hand coordination are:

(a) Bender Visual-Motor Gestalt Test (Bender 1938) and its adaptation for young children (Koppitz, 1964).

(b) The Slosson Drawing & Coordination Test (Slosson 1967) and

(c) The Developmental Test of Visual-Motor Integration (Beery 1982).These tests require pupils to copy geometric designs to test for the development of eye-hand coordination.

Many studies have demonstrated a significant relationship between measures of visual perception and achievement in reading, arithmetic and spelling, (Kavale 1982; Keogh & Smith 1967; Koppitz 1964, 1975). Thus the evaluation of visual processing is an important part of the instructional procedure. It is noted that aspects of perception including visual perception are only one component of academic tasks, and other variables such as current parental relationships, family's socio-economic status and school variables contribute to the prediction of a child's performance in school ( Stevenson & Newman 1986).

The data obtained from the assessment of visual perception have two major uses. The first is in the achievement of the most efficacious match between the traits of the learner and the methods and materials used in teaching, (Ensminger 1970; Neville 1970). But most measures of visual processing use geometric shapes and so it is difficult to extrapolate directly from tests results to academic programmes. The second major use of assessment of visual perception is in differential diagnosis. When a child is not learning at an appropriate rate, a test of visual perception may be part of the battery administered to determine the area or areas of dysfunction. If a deficit is determined, additional testing may be necessary to obtain all the information necessary for the planning of an educational programme. Some of the standardized tests of visual-motor perception that measure eye-hand coordination are described below:



### 2.3.8.1. Bender Visual-Motor Gestalt Test (BGT)

Bender (1938) developed this test as a means of investigating the applicability of the concepts of Gestalt psychology to the studies of personality and brain injury. Bender stated that the quality of the reproduction of the designs varies according to the motivational level of the individual and his/her pathological states either functionally or organically induced.

Initially the test was primarily used as a clinical and research instrument with adults. The BGT consists of two parts. The first part is a continuation pattern test in which the testee is instructed to continue the pattern by linking the dots in the right half by pencil lines. There are ten of such continuation patterns, (see appendix vi). The second part is a design copying test in which the testee is instructed to copy exactly the same designs as the testee sees them. There are sixteen of such designs to copy.

To score the first part of the test, one point is scored for each correctly filled space between the vertical pairs of dots. Sometimes the pattern is started wrongly and reproduced there after correctly. In this case, the faulty entry is penalized and the correct continuation scored right. Each set of dots for each pattern yield a total possible score of 10, giving a maximum score of 100 for the ten patterns. So the maximum score for the first part of the test is 100 and the minimum score is zero.

To score the second part of the test, for Design set I: one point each is scored for the first four designs if correctly copied, and two points each for the last two designs, one point for the triangle and one point for the extension line if correctly copied. For Design set II: the first two designs are scored three points each for correct drawing and positioning of the designs, the next two designs are scored four points each for correct drawing and positioning, and the last design in the row is scored five points for correct copying and positioning of the designs. For Design set III: the first design is scored four points, the second is scored six points, the third is scored three points, the fourth design is scored three points, and the last design is scored four points for correct copying and positioning of the designs. The total maximum possible score for this part of the test is 47, and the minimum is zero. The total maximum possible score for the entire test is 147, and the minimum is zero. The individual score is brought to percentage by multiplying the score by 5/7. The test can be administered individually or in groups,(see appendix vii).

The test was standardized in 1964 and 1974 by Koppitz, and the normative study was reported by Swanson, & Watson,(1989). The norms for the two sets of data were remarkably similar except at five years of age in which the mean number of errors was higher in the 1974 norms. From ten years of age the standardized deviations were identical with the means, (Koppitz,1964;1975).

In terms of reliability, inter-scorer ranged between .79 and .89, and test-retest reported in nine studies ranged from .50 to .90 over periods of from one day to eight months,(Koppitz,1975).

In terms of validity the BGT has face validity as a measure of visual motor integration: In addition significant relationships were found between the BGT and the verbal, performance and full scale IQ scores on the WISC-R (Wright & Demers, 1982). Furthermore Koppitz (1964, 1975) also found statistically significant relationships between BGT scores and achievement in reading and arithmetic in grades one through three. Also moderate to high correlations were found between BGT and developmental visual-motor integration tests (VMI), (Aylward & Schmidt, 1986; Wright & DeMers, 1982). The BGT is found to be a valid test of visual-motor integration that can be scored reliably. It is however noted that the score only signals a difficulty, it does not indicate the step in the process at which the difficulty occurred, (Swanson & Watson 1989).

**2.3.8.2.Developmental Test Of Visual-Motor Integration (VMI).**

The VMI developed by Beery (1967, 1982), was the result of an effort to develop a test of geometric form reproduction that (1) included designs appropriate for young children (2) was well standardized(3) provided developmental information for individual designs and (4) was suitable for group administration. This test is a popular measure of eye-hand coordination. The test may be administered in groups or individually. The test is used with children from age two years and nine months to nineteen years and eight months, (2-9 to 19-8). The children are required to copy geometric figures such as a square, horizontal and vertical diamonds and a cube into spaces directly below the standard figures. The VMI contains 24 geometric forms which are placed three per page in order of increasing difficulty. Testing is terminated when the subject fails to produce satisfactorily three consecutive drawings.

To score the test, the first ten geometric forms are scored one point each if correctly drawn, the next five geometric forms are scored two points each if correctly drawn, the next six geometric forms are scored three points each, and the last three geometric forms are scored four points each if correctly copied. This makes the total maximum possible score to be 50, and the minimum score is zero,(see appendix v), for recording and scoring guide. The most recent norms provide age-equivalent scores, percentiles and standard scores with a mean of 10 and standard deviation of 3. Subjects in the standardization research (carried out in 1981) included 3090 males and females from urban, suburban and rural areas of Chicago in USA Norms were provided for ages 4 to 13+ years. In terms of reliability,inter-rater reliabilities ranged from .80 to .94. It was reported by McLoughlin,& Lewis (1986) that other studies cited in the 1982 manual supported test-retest and split half reliabilities. They also reported that the results of cited studies in the 1982 manual supported concurrent and predictive validities, and that correlations between VMI-R, VMI, and WISC-R ranged between .75 to .99, and correlation between VMI and VMI-R was .99. This demonstrated that VMI and VMI-R are equivalent.

**2.3.8.3.Visual-Motor Integration Test and Learning Disability**

One use of visual perception assessment is differential diagnosis. If a child is not learning at the appropriate rate, a test of visual perception is given to the child to determine if there is an achievement deficit. In the present research therefore, Beery's visual motor integration test would be used to detect achievement deficit in children who are having learning problems in school. This is achieved by first standardizing the test and establishing norms for Nigerian children. Then the test is given to those children whose performance records in school show poor achievement in few subject areas and which were corroborated by teachers' observations and reports. Children's performances in this test are then compared to the average scores of their age groups. Children with scores below their age group's average are reported as having achievement deficits.

### 2.3.9 Types of Assessment

#### 2.3.9.1 Traditional Assessment.

The traditional assessment type is typically used to evaluate students with learning disabilities. In this approach students are referred for an evaluation because they are experiencing academic problems. The students are then assessed using standardized tests, under proper conditions,and other informal measures to determine why they are having learning problems. The assessment results which represent reliable estimates of the students' ability and performance are then used to classify them and identify strengths and weaknesses in the development of specific skills (Swanson 1991).

The traditional approach also called the Attribute approach is based on the assumptions that (1) Individuals can be characterized by tributes that can be placed at some point on a continuum. (2)Children have different amounts or quantities of the same attribute (3)There is a true placement (score) on the continuum of attributes that can be approximated by test data. Underlying this assessment approach is a theory of child learning. According to this theory, behaviour is determined by traits, demonstrated through " diagnostic-prescriptive teaching", (Swanson &Watson1989).Assessment through this approach focuses on the identification of effective instructional strategies for children who differ on variables related to academic learning, (Ysseldyke & Salvia 1984; Deno 1986). For this to happen Newcomer (1977) suggested that there must be (1) the determination of the cause of the learning problem for purposes of classification (2) the gathering of diagnostic information about a child's style of learning and psychological processes and (3) the determination of academic content needs for instructional purposes. Such an assessment process uses standardized instruments to identify a child's strengths and weaknesses on sub-test items. This is followed by the extrapolation of the information to provide a plan for instruction (Swanson & Watson 1989). The diagnostic-prescriptive approach stresses the diagnosis of specific constructs or attributes such as form discrimination, auditory sequencing which are related to intellect and learning and the training in specific abilities, assumed to improve academic functioning. These diagnostic-prescriptive procedures are currently being used for the assessment of handicapping conditions such as learning disabilities and mental retardation in special education. It is reasoned that the procedures for the development of a diagnostic-prescriptive assessment procedure can be logically broken down for classroom implementation as follows: (1) Select a construct (e.g language, perception), (2) divide the construct into sequential measurable categories (3) administer a test(s) to evaluate performance(s) in these categories and (4) develop a programme to remediate the deficit (Swanson & watson 1989). This traditional approach utilizes more formal than informal techniques, and this was the thrust of the criticism against the approach. The approach was criticized on a number of counts. Firstly it was argued that the rigid adherence to formal testing imposes a limitation on what is measured and what is taught(Dudley-Marling,1988). He illustrated this by explaining that standardized tests of reading and writing are limited to discrete skill(e.g. oral retells,& comprehension questions), that can be objectively and reliably measured, as opposed to the readers' ability to integrate what they are reading with their background knowledge, which are ignored because they are difficult or impossible to quantify. He said that(i) many of the interesting and observable reading and writing behaviours are neither stable nor easily measured,(ii) too often test construction theory and not reading and writing theory is used to determine which behaviours are assessed, and that this test construction theory does not consider the many components of behaviour that are needed to be assessed.

It has equally been recognized that standardized assessment provides a highly effective and applied technique which holds the testing environment as constant as possible to promote comparison between individual and the group. This is considered to be its strength. It's weakness however lies in the fact that it does not promote intra-individual comparison which is achieved by varying the environment and observing the child's functioning under different environmental conditions,(Meyers, Pfeffer, & Erlbaun, 1985). So the traditional assessment approach appears to be incomplete. This view is shared by the author of this research. Meyers et al affirmed that the traditional assessment approach effectively answers the questions about selection, prediction, diagnosis, and classification, but fail to satisfactorily answer the questions about specific instructional interventions. This means that the intervention procedure advocated in this approach is ineffective. Part of the reasons advanced for this failure include(a)lack of congruence between classroom behaviour and behaviour in a testing situation, in that behaviour being situation specific may bring about conflicting judgements between teachers and testers,(b) lack of direct relationship between the ability skills being remediated and classroom tasks problematic to the children,(Deno,1986, Fuchs & Fuchs,1986).

Since the goal of the present research is the classification of learning disability, achievable by the traditional approach

it's adoption for this research is in place.
It has also been recognized that intelligence and cognitive functions which are the focus in traditional assessment are not static. These functions continue to develop through interaction with the environment, and for effective interventions, it is necessary to incorporate into the assessment process techniques that measure developmental process,(Meyers et al,1985). The present researcher is also sympathetic to this line of argument.

**2.3.9.2 Functional Assessment**

This type of assessment makes use of the task analysis approach. An important characteristic of this approach is that it considers attributes stated in observable terms. For instance within this perspective "attention" can be defined as amount of eye contact to a task (Swanson & Watson 1989). The approach uses task analytical process, in order to broaden the diagnostic-prescriptive approach and to generalize the child's ecosystem (Lentz & Shapiro 1986). Within this approach the classifications of behaviour are described functionally and not in terms of traits or underlying deficits (Swanson & Watson 1989). McReynolds(1971) described four aspects of the functional assessment approach to include:

(1)The identification and descriptions of behaviours and behaviour settings. This aspect focuses on applying reliable techniques, (e.g. describing visual perception in the environmental context in which it occurs).

(2) Assessment of incidence and generalization of behaviour. This focuses on obtaining answers to questions such as: Does the behaviour occur in other situations besides the regular or special classroom ? To what environmental

event(s) is the behaviour related?, etc.

(3) The assessment of behaviour determinants. This aspect focuses on behavioural classes such as the relationship between behaviour settings and their long term consequences (e.g. relationship between special education placement and later regular classroom functioning),etc.

(4) Assessment of behavioural consequences. Behaviour is assessed by how much it is controlled by consequences.

Task analysis is the most well known application of functional assessment, and this has been criticised. It was criticized for de-emphasizing the use of standardized tests, (Eaves, & McLoughlin, 1977). Task analysis assumes that because certain tests are structurally unsound within the classroom context, all standardized tests are useless to the development of educational objectives. According to Eaves and McLoughlin such an argument obscures the point of standardized testing, in that the value of testing is not the specification of objectives, rather its value is in deciding whether or not the objective needs to be specified at all. The task analysis approach ensures that the situation can be generalized to the classroom. However it was argued that special arrangements are needed to measure the variety of setting characteristics that may relate to task achievement. So although task analysis provides measures from which classroom learning outcomes can be determined, it does not provide for the assessment of the learning environment. So the functional approach too can be regarded as incomplete. The present researcher also agrees with this position.

#### 2.3.9.3 Ecological Assessment

This is another assessment approach. This approach incorporates behavioural and ability assessment measures, (Scott 1980). The focus is on socializing, or teaching the child to perform socially competent or adaptable behaviour. The actual assessment process involves several activities which include the following : (1) Identifying the child's micro ecology (components of various environmental contexts), (2) establishing a task inventory of each social setting within the child's micro ecology, (3) assessing the child's competency to perform each task, (4) assessing characteristics judged deviant within each social setting, (5) assessing the child in each social setting, (6) assessing tolerance of individuals interacting significantly within the child's ecosystem, and (7) analysing data on the child's competency, deviance and tolerance for differences. This approach specifically extends the role and objectives of assessment to include the identification of both the elements in the child's ecosystems and the demands from school programme in the school context, (Swanson, & Watson, 1989).

The ecological assessment approach was also criticized for de-emphasizing the use of standardized tests and focusing on the behavioural competency of the child and the social setting. From this angle ecological assessment is also regarded as incomplete.

#### 2.3.9.4 Curriculum Based Assessment

This approach to assessment is a widely accepted practice in special education. It is a behavioural approach to the assessment of LD students and can be used as an alternative or a complement to more traditional assessment procedures. It is a form of criterion-referenced assessment in which the criterion

being referenced is the school curriculum, (Neisworth & Bagnato 1988). Curriculum based assessment differ from traditional assessment in that the materials used to assess students are always drawn directly from the student's course of study. Testing procedures are designed to strengthen the connection between assessment and instruction by evaluating the student in terms of the curricular requirements of the student's own school or classroom. The materials for testing are those of the student's own curriculum. For example if a student is expected to spell some words in the classroom, the assessment measures the student's performance on those words,(Shinn & Hubbard 1992; Lloyd & Blandford 1991; Lovitt 1991; Deno 1987, 1985; Fuchs 1987).
Curriculum-based assessment requires that the teacher first determine the area of the curriculum that the student is expected to learn. The student is then assessed through frequent, systematic and repeated measures of that curriculum area. Performance results are graphed or charted so that the student's progress is clearly observable to both the teacher and the student.(Lerner 1993).Curriculum based assessment thus:

(1)provides an alternative to norm-referenced measures.
(2) is based on the curriculum in the local school
(3) links testing to instruction
(4) can be tied to individualized education programme goals.
(5) requires graphing of performance.

By using direct and repeated measures it displays performance changes over successive time periods e.g. days (Lerner 1993).

It has also been found that curriculum based assessment is useful for monitoring progress towards instructional goals in individualized education programme,(IEP) (Fuchs, 1987; Germann, & Tindal,1985). When an IEP is developed, the person implementing the programme establishes a basic measurement strategy to monitor student's growth and document both current and projected functioning in that material. After the long term goal is established, progress toward the goal can be monitored through curriculum-based instruction procedures, (Lerner, 1993).

Some criticisms were advanced against the curriculum based assessment approach. One of such criticisms has to do with the problem of linkage, between assessment and curriculum. The argument is that the instruments that are used whether they are norm referenced or criterion referenced did not have adequate content validity. Though this problem is partly solved when the test items are drawn from the content covered in the curriculum, it is further argued that curriculum based assessment can not be better than the curriculum it employs, and that when the assessment is based on a poor curriculum, the students' knowledge and skills in the domain will be very limited, even when there is excellent progress in the curriculum, (Neisworth, & Bagnato, 1986). So if the basis of the assessment is restricted, weak or poor, the outcome will be equally restricted, weak, or poor.

Another criticism against this approach concerns the problem of regular changing of the curriculum. The argument is that the curriculum on which the assessment is based changes regularly and frequently in relation to text book adoption. The implication is that to solve this problem the tests that are used for such assessment will have to be revised as often as the curriculum changes and this has not yet been explored. It was noted that though curriculum based measurement is an important aspect of the instructional programme for special children, its acceptance for use in diagnosis, classification and programme evaluation is still being validated. (Swanson, & Watson, 1989). Also the curriculum based assessment can not be regarded as complete since it fails to consider the assessment of the learning environment, and de-emphasized the use of standardized tests.

In summary therefore, the type of test selected should be determined by the purpose of the testing. Norm referenced tests are the instrument of choice when the task at hand is to diagnose, identify, and classify students and children with learning problems. When the need is to plan for instruction or to evaluate the effectiveness of an instructional programme, or to determine progress in a school curriculum, criterion referenced, or curriculum based tests are the most appropriate. In the present circumstance, the aim of the present research is to diagnose, identify, and classify some children who are experiencing learning difficulties in school. As such the ideal tests to be used are norm referenced tests. The norm referenced tests employed in this research are the Ravens' Coloured Progressive Matrices (CPM), and the Beery's Visual Motor Integration Test (VMI). Before the tests were used for diagnosis, identification, and classification of children with learning problems, they were first standardized, and norms for normal and representative sample of Nigerian children established.

# CHAPTER THREE

## STUDY I :STANDARDIZATION OF THE TESTING INSTRUMENTS

### 3.1 Introduction

Standardization in the context of the present research implies both the standardization of procedures and the establishment of norms. Standardization of procedure implies uniformity of procedure in the administration and scoring of a test. This aspect of standardization is necessary and important because if the scores obtained by different individuals are to be comparable, then testing conditions must be the same for all the test takers. In order to secure uniformity of testing conditions, the test constructor provides detailed directions for administering the test. The formulation of directions is a major part of the standardization process. Such standardization extends to the exact materials employed, time limits, oral instructions, preliminary demonstrations and every other detail of the testing situation. So when giving instructions or presenting test orally, consideration had to be given to the rate of speaking, tone of voice, inflection, pauses and facial expressions.

The second important step in the standardization of a test is the establishment of norms. Psychological tests do not have predetermined standards of passing or failing. Performance on each test is evaluated on the basis of empirical data. For many purposes an individual's test score is interpreted by comparing it with the scores obtained by others on the same test and a norm is the average performance. For instance, if normal 6 year old children complete ten (10) out of fifty (50) problems correctly on a particular arithmetic reasoning test, then the 6 year old norm on this test corresponds to a score of 10. This score is known as the raw score on the test. The score may be expressed as the number of correct items, number of errors, or some other objective measure appropriate to the content of the test. However, such a raw score is meaningless until evaluated in terms of suitable interpretive data (Anastasi 1988).

When standardizing a test, the test is administered to a large and representative sample of the type of persons for whom it is designed. The norms obtained indicate not only the average performance but also the relative frequency of varying degrees of deviation above and below the average,(Anastasi,1988). The norms may be expressed in the following specific ways that will allow for the designation of each individual's position in relation to the standardization sample.

### 3.1.1 Developmental Norms

One way in which meaning can be attached to test scores is to indicate how far along the normal developmental path an individual has progressed. Often those norms are used to describe highly specific functions, such as sensori-motor activities or concept formation. Such scales can indicate that a four year old child's current behaviour is like that of other four year old children in other areas.

Developmental norms are found almost exclusively in tests for young children and severely handicapped individuals. Such tests include the Bayley scales of Infant Development (Bayley, 1969) and Denver Developmental Screening test (Frankenburg & Dodd, 1967). These norms are useful in clinical case studies, and screening research, but they are not exact enough for detailed statistical treatment (Anastasi 1976, Swanson & Watson 1989).

### 3.1.2 Grade Equivalent Norms

One of the ways in which educational achievement test results are interpreted is in the form of grade equivalent scores. This practice is understandable because the tests are employed within a school setting. To describe a student's achievement as equivalent to primary six grade in spelling, primary five grade in reading, and primary four grade in arithmetic has the same appeal as the use of mental age in the traditional intelligence tests.

Grade norms are found by computing the mean raw score obtained by children in each grade. If for instance the average number of problems solved correctly on an arithmetic test by primary four grade pupils in the standardization sample is 25, then a raw score of 25 corresponds to a grade equivalent of 4.

Despite the popularity of grade norms, they have several shortcomings. According to Swanson & Watson (1989) grade level scores can not be taken as a standard of excellence, because the content of instruction varies from grade to grade, as such grade norms are appropriate only for common subjects taught throughout the grade levels covered by the test. Secondly the norms are generally taken from many schools, some with good programmes and some with poor programmes, as such performance that is based only on grade level could mean poor student effort and poor instruction. In addition grade equivalent scores are in most cases median scores that is 50% of the scores of the norm group are higher and 50% are lower. This does not represent standards of excellence. Besides, scoring three grades higher than their actual grade placement does not mean that the children have mastered the academic material at that higher grade level,(Anastasi, 1988; Swanson & Watson, 1989). Due to these many shortcomings, the use of grade equivalent scores is being discarded in favour of percentiles and standard scores.

### 3.1.3 Age Score Norms

This is also called mental age. The mental age became popular due to its use on the Binet-Simon Scales and their revisions,(Swanson & Watson,1989). In the standardization of this test, items answered correctly by a majority of persons in a given age group were assigned to that age group on the test. This process continued until there were sufficient items at each age level. If a child of six years passes majority of items appropriate for the eight year old, such a child is said to have a mental age of eight,(Swanson, & Watson,1989).

Mental age norms have also been used with tests that are not divided into year levels. In such a case the child's raw score is first determined, which may be the total number of correct items on the whole test or it may be based on time or number of errors or on some combination of such measures. The mean raw scores obtained by the children in each year group in the standardization sample constitute the age norms for such a test. The mean raw score of the 8-year old would represent the 8-year norm. If a child's raw score is equal to the mean of 8-year old raw score then the child's mental age on the test is 8 years. However all raw scores on such a test can be transformed in a similar way by reference to the age norms,(Anastasi, 1988).

Mental age scores are sometimes used in achievement tests, but since age and educational experience do not often go hand in hand, age scores can be sometimes misleading, and progress in school achievement may not depend upon chronological age, but upon exposure to the learning situation in the classroom. It is thus advised that age norms should not be used for achievement tests (Hagen, 1961, p.12). It is also noted that the mental age unit does not remain constant but shrinks with advancing years. For instance a child who is one year retarded at age 4 will be approximately 3 years retarded at age 12. One year of mental growth from ages 3 to 4 is equivalent to 3 years of growth from ages 9 to 12.It has been observed that intellectual development progresses more rapidly at the earlier ages and gradually decreases as the individual approaches his/her mature limit and the mental age unit shrinks correspondingly with age,(Anastasi). Despite the few shortcomings of the mental age norm, most currently available tests provide both the age and grade norms.



### 3.1.4 Percentile Norms

A percentile indicates the percentage of a norm group that falls at or below a particular raw score,(Swanson,& Watson,1989). For instance if a person received a raw score of 25 which is better than that received by 49% of the norm group, that person's percentile is 49. A percentile indicates the individual's relative position in the standardization sample. Percentiles can also be regarded as ranks in a group of hundred except that in ranking it is common to start counting at the top, with the best person in the group receiving a rank of one; but with percentiles one begins counting at the bottom so that the lower the percentile the poorer the individual's standing. The 50th.. percentile (P50) corresponds to the median. Percentiles above 50 represent above average performance and those below 50 indicates inferior performance. Like the median percentiles provide convenient landmarks for describing a distribution of scores and comparing it with other distributions. Percentiles are different from percentage scores. Percentage scores are raw scores expressed in terms of percentage of correct items. On the other hand percentiles are derived scores expressed in terms of percentage of persons. A raw score lower than any obtained in the standardization sample would have a percentile rank of zero (Po), while a score higher than any score in the standardization sample would have a percentile rank of 100 (P100), but they do not imply a zero raw score and a perfect raw score (Anastasi (1988 P.82).

There are several advantages for using percentiles. Firstly, they are easy to compute and are easily understood even by technically untrained persons. Secondly percentiles are universally applicable. They can be used equally well with adults and children and are suitable for any type of test whether it measures aptitudes or personality variables. They can also be used to compare performance across various subjects or topics. Thirdly, for percentile norms the reference point is usually closely related to the characteristics of the person taking the test. For example in a standardized achievement test the score of say a third grader, (primary three), is generally based on a comparison with other third graders not with second or fourth graders. So for each group with which the test is to be used a set of different percentile norms is required.

The major disadvantage of percentile norms is that it does not have equal units at all points on the scale. If the scores on the distribution approximate normal curve as is true of most test scores, percentile of 48 on reading and 53 on arithmetic represent very similar raw scores whereas the same five points difference at the 93rd and 98th percentiles represent large differences. The implication is that there is clustering of scores toward the middle of the distribution and they scatter more widely as the extremes are approached. Consequently any given percentage of cases near the centre covers a shorter distance on the baseline than does the same percentage near the ends of the distribution,(Anastasi, 1988). The discrepancy in the gaps between percentile ranks is a reflection of the extent to which the test performances of the norm groups deviates from the normal (curve) or distribution. So it is apparent that percentiles show each individual's relative position in the normative sample but not the amount of difference between scores, (Anastasi, 1988, Swanson & Watson 1989). One way out of this problem is to have a score profile chart by plotting percentile scores on arithmetic probability paper. The percentile scores can provide a correct visual picture of the differences between scores. Arithmetic probability paper is a cross-section paper in which the vertical lines are spaced in the same way as the percentile points in a normal distribution, or the horizontal lines are uniformly spaced or vice versa,(Anastasi, 1988). Such normal percentile charts can be used to plot the scores of different persons on the same test or the scores of the same person on different tests. In either case the actual inter-score difference is correctly represented (Anastasi 1988).



### 3.1.5 Standard Score Norms

Standard score norms describe in terms of standard deviation unit the distance between a particular score and the mean. Current tests are increasingly using standard scores which are the most satisfactory type of derived score from most point of view (Anastasi, 1988). Standard scores can be derived from linear or nonlinear transformation of the original raw score. When standard scores are found by a linear transformation they retain the exact numerical relations of the original raw scores, because they are computed by subtracting a constant from each raw score and then dividing the result by another constant. The relative magnitude of differences between standard scores derived by such a linear transformation corresponds exactly to that between the raw scores. All properties of the original distribution of raw scores are duplicated in the distribution of these standard scores without any distortion of results,(Anastasi, 1988).

Linearly derived standard scores are often designated as "standard scores" or "z scores". To compute a z score the difference between an individual's score and the mean of the normative group is divided by the standard deviation of the normative group. These z scores can sometimes be negative or involve decimals that can bring about many errors and confusion. This can be corrected by further linear transformations, which may result in normalized standard scores such as a T score. The additional transformations would eliminate the negative signs. The T score is a standard score transformed to fit the normal curve or distribution. It has a mean of 50 and a standard deviation of 10. A T score of 40 is equal to a z score of - 1. Another standard score commonly used in educational and psychological tests is the "stanine scale". The scale provides a single digit system of scores with a mean of 5 and a standard deviation (SD) of about 2. The name "stanine" (a contraction of "Standard nine") is based on the fact that the scores, run from 1 to 9. Raw scores can be converted to stanines by arranging the original scores in order of size and assigning stanines in line with the normal curve percentages, (Anastasi, 1988).

The standard scores discussed above have such characteristics that are desirable in test scores as indicated by Thorndike & Hagen (1969), which are that:

(i) their meaning is uniform from test to test and

(ii) their units are of uniform size.

Despite the recognition that normalized standard scores are the most satisfactory type of scores for the majority of purposes, there are still certain technical objections to normalizing all distributions routinely. It is therefore suggested that such transformation should be carried out only when the sample is large and representative and when there is reason to believe that the deviation from normality results from defects in the test and not from the characteristics of the sample or from other factors affecting the behaviour under consideration,(Anastasi, 1988). It was also noted that when the original distribution of raw scores approximates normality, the linearly derived standard scores and the normalized standard scores will be very similar, even though the methods of deriving the two types of scores are different.

It is more desirable to obtain a normal distribution of raw scores by properly adjusting the difficulty level of test items than normalizing a non-normal distribution. With an approximately normal distribution of raw scores the linearly derived standard scores will serve the same purpose as normalized standard scores.(Anastasi, 1988).

### 3.1.6 Validity

Validity as defined before(page 91), is the extent to which a test measures what it purports to measure.

Construct validity is the extent to which a test measures a theoretical construct or trait such as intelligence. One criterion employed in validating many intelligence tests is age differentiation. This is because abilities are expected to increase with age during childhood, and the concept of age scale of intelligence is based on the assumption that "intelligence" increases with age,(Anastasi, 1988). The CPM used in this study is a developmental test, and a non-verbal test of intelligence. If it is valid, performance scores on it should increase with age. So the documentation of local and developmental norms for CPM is one evidence of its construct validity.

Another evidence of its construct validity can be obtained by correlating test scores of children in CPM with test scores of the same children in other tests that have been established to measure similar construct. In the present case, the DAMT has been established as a developmental test, and an intelligence test for children. Similarly the BGT has been established as a developmental test for children, and as an aptitude test that can predict academic achievement in that its test scores have been shown to correlate moderately with test scores of established intelligence tests, and achievements in reading,(Wright & Demers, 1982;Koppitz,1975). DAMT and BGT thus qualify to validate CPM.

Predictive validity is defined as the extent to which a test can predict future performance. However both the predictive and the concurrent validities can be substituted for one another,(Anastasi, 1988). This is because one of the premises for differentiating between concurrent and predictive validity is based on time relations between the criterion measure and the test in question. When the criterion measure and the test being validated are given at the same time, the correlation between tests' scores is an evidence of their concurrent validity.

Another differentiating premise between concurrent and predictive validity is based on the objectives of testing. In the present study, the objective of using the BGT test is to use it to validate VMI as a predictor of academic achievement, because, the BGT test has been established as a good predictor of academic achievement, (Keogh, & Smith, 1967; Swanson, & Watson, 1989), and a high correlation between BGT and VMI test scores will validate VMI as a good predictor of academic achievement. Since all intelligence tests are predictors of educational achievement, (Swanson, & Watson, 1989), correlation between VMI and DAMT test scores should give another evidence of predictive validity of the VMI test.

For a measure to detect under-achievement it should be able to assess achievement. Since the VMI is not content based and can be proved to be a good predictor of academic achievement, it should assess achievement potential, such that those who score high in intelligence tests should also score high in VMI test as potential high achievers. In this case the VMI test would serve as an aptitude test , and a high correlation between CPM and VMI test scores would suggest that they are tapping related factors, to the extent of their correlation coefficient. This will give another evidence of VMI's construct validity. Such a correlation would also document the concurrent validity of the tests, and indicate the current achievement status of the children that took the tests, in which case VMI is serving as an achievement test.

### 3.1.7 Reliability

Reliability refers to the consistency of scores obtained by the same persons by different methods such as split half method, test-retest method, or other methods. Test reliability indicates the extent to which individual differences in test scores are attributable to true differences in the characteristic under study and the extent to which they are attributable to chance errors. Through the assessment of test reliability, it is possible to estimate what proportion of the total variance of test scores is error variance. High reliability coefficient indicates small error variance and low coefficient indicates high error variance

Split half reliability is based on the correlation of odd and even test item scores. It provides a measure of consistency with regards to content sampling. The coefficient obtained by this method is called coefficient of internal consistency.

Test retest reliability is obtained by correlating the scores obtained by the same persons on two administrations of the test. Test-retest reliability indicates the extent to which scores on tests can be generalized over different occasions, and the higher the reliability the less susceptible the scores are to the fluctuations in the condition of the test takers or the testing environment.

Inter-scorer reliability is obtained by correlating different scores of the same children in a test independently scored by two or more examiners. This is a way to check scorer variance. The higher the correlation between these independent scores the more objective the scoring by the examiners.



## 3.2 RESEARCH UPDATE ON THE PRESENT TESTING INSTRUMENTS

### 3.2.1 Initial Standardization of CPM in BRITAIN

During 1948 an experimental "board form" of the test consisting of sets A and B of the standard scale made up of twelve problems each and fifteen problems which had been found to be intermediary in difficulty between these two sets and labelled set Ab was given to 291 children aged 5 to 10 1/2 years living in the Burgh of Dumfries, Scotland. A detailed item analysis was made of the figure chosen by each child to complete each of the 39 problems using the method of moving averages. From the results of the item analysis, three problems in set Ab were removed for which the percentage of correct choices fluctuated without a consistent upward trend as the total score on the scale increased. The remaining twelve problems were rearranged in order of difficulty. Two designs which the item analysis showed to be ambiguous were simplified. Confusing alternatives were revised and their positions rearranged so as to provide uniform distribution of choices. The data for the resulting scale of 36 problems was finally re-worked, (Raven 1977). 58 children aged 6.5yr plus or minus 1yr and 61 children aged 9.5yrs plus or minus 1yr who had been given the original scale were subsequently retested with the revised scale of 36 problems. The results showed a test-retest correlation of 0.6 and 0.8 respectively.

The scores obtained by Dumfries children on sets A and B alone appeared to be slightly lower than those obtained when these tests were given in a similar form to Colchester children. A comparison between the sample of school children selected and the Dumfries school returns showed that it was an accurate cross-section of the school population. This result was explained on the premise that possibly brighter and also that young professional families tended to move away from the district.

It was also observed that the relatively low re-test reliability at the age of 6.5 years compared to the retest reliability of 0.8 at the age of 9.5 years was a reflection of the fact that the scale was sensitive to fluctuations in the output of intellectual activity in early childhood and that the fluctuation was not due to any defect in the scale itself. The revised scale of 36 problems formed the Coloured Progressive Matrices (CPM) meant for use with children up to 11 years.

**3.2.2 Final Standardization of CPM in BRITAIN**

From a total school population of 2700 children between the ages of 5 to 11.5yrs, a sample of 627 children were selected to participate in the standardization study. During September to October of 1949, 608 of 627 children were tested individually. 19 of the children had either moved out of the district or were suffering from a physical illness of long duration. Children suffering from mental disabilities were traced and tested. The sample tested represented approximately 25% of the total school population within the age range stated above. Each child was given individually the Book form (CPM) and the Crichton vocabulary Scale. Six weeks after the first test, one in every three children aged 9 years was given the same two tests again.

From the results it was noted that the CPM is most sensitive to functional fluctuations in the output of intellectual activity and the more improved the test the more this had become evident.

For the 608 children tested there was increase in the percentage of correct solutions to each problem as the total score on the scale increased from 10 to 36. That is as the total score for the subjects increased, the number of subjects getting each problem correct also increased. The graphs of the results showed a consistent high correlation between the percentage of passes on each of the 36 items and the total score on the scale as a whole, and that the problems introduced in set Ab together with those in set A and set B provide a more uniform distribution of items in order of difficulty at the 50% pass level.

### 3.2.3 Notes on Reporting Results on CPM

It has been suggested that the most satisfactory method of interpreting the significance of a person's total score is to consider it in terms of the percentage frequency with which a similar score is found to occur amongst people of his or her own age. This is said to have an advantage over other methods in that no a priori assumption is made that in childhood the development of intellectual capacity is necessarily uniform or distributed *symmetrically*. According to Raven, it is convenient to consider certain percentages of the population and to group people's scores accordingly. In this way it is possible to classify a person intellectual ability according to the score he obtains as,

i. Superior: if his/her score lies at or above the 95th percentile of his age group.
ii. Definitely above average: ii+; if his/her score is at or above 90th percentile and ii; if his/her score lies at or above the 75th percentile.
iii Intellectually average if his/her score lies between the 25th and 75th percentile: iii+; if his/her score is greater than the median or 50th. percentile and iii-; if his/her score is less than the median.
iv. Definitely below average in intellectual capacity if his/her score lies at or below the 25th percentile; (iv-) if his/her score lies at or below 10th percentile.
v. Intellectually defective if his score lies at or below the 5th percentile for his age group.

### 3.2.4 Establishment of Non-British Norms for CPM

The Coloured Progressive matrices has been standardized in

Germany, Queensland, Australia, Czechoslovakia and Netherlands. The norms for these countries were shown in the context of data collected in 1982 in Dumfries, Scotland. For the CPM the expected maximum score is 36 and the minimum is zero. The German norms, Australian norms, and the Scottish norms are very close and strikingly similar. For example comparing German and Scottish norms, the scores for 95th, 75th and 50th. percentiles for ages 6 years to 9 years are as follows: 95th percentile; 6 yrs,(UK: 24 GM; 25), 6.5yrs (UK: 26, GM: 27), 7yrs (UK: 28, GM: 29) 7.5yrs (UK: 31, GM: 31), 8yrs (UK: 32 GM: 33) 8.5yrs (UK: 33 GM 34), 9yrs (UK:34 GM: 34 75th percentile: 6yrs (UK: 19, GM: 20), 6.5yrs (UK: 20 GM :21), 7yrs (UK: 21 GM: 22), 7.5yrs (UK: 23 GM: 24), 8yrs (UK: 25 GM: 27), 8.5yrs (UK: 27, GM 30); 9 yrs, (UK: 29, Gm: 31); 50th. percentile: 6yrs (UK: 16 GM: 17), 6.5yrs (UK: 17 GM: 17) 7yrs (UK: 18 GM: 18) 7.5yrs (UK: 20, GM: 20),8yrs (UK: 22, GM: 23) 8.5yrs (UK: 24: GM: 25), 9yrs (UK: 26, GM 27).

The Czechoslovakian and Dutch norms are not so close to the Dumfries norms like the German and Australian norms. The divergence between Czechoslovakian and Scottish norms was explained on the premise that all the children are three months older than their Scottish counterparts: The divergence of the Dutch norms was explained on the premise that the Dutch sample did not include a considerable proportion of younger children who were not attending school, those who were attending special schools of one form or another and those who were either absent or considered to be not well adjusted to school.

The non British norms described above were compared to Dumfries norms because: (I).the original norms for the CPM was established in Dumfries, where the author of the test lived and worked.(ii).the author (J.C. Raven) judged that norms obtained

from a carefully drawn sample of a small town which had a demographically balanced population is of more value than norms based on a poorer samples of a larger population.
It was because the author's judgement was vindicated that the 1982 standardization study was carried out in Dumfries England. It has been found that the Borders Region of Scotland of which Dumfries is one has a demographic composition approximating that of the UK and it did yield norms for the standard progressive Matrices which closely approximated those for the UK as a whole.

The CPM has also been standardized in some school Districts in the United States. For example it was reported that the norms established in Ontario-Mont. Clair and San Bernardino in California corresponded closely to the 1982 Dumfries data except for the higher percentiles at the younger ages.

The results of the norming studies carried out in Juneau in Alaska and in Montgomery Country in Maryland showed that the CPM scores for children in these areas were above the 1982 British norms, but norms for Montgomery in Maryland were continuous with those of Juneau in Alaska,(RPM research supplement, No.3)

### 3.2.5 Ethnic Norms for CPM

Attempts were made to establish norms for white and coloured children in American School Districts. In one of such studies 1534 children from two schools in New York were studied by (Cant well 1967) and reported in the manual for Raven's Progressive Matrices research Supplement No.3. One of the schools studied was in a stable white neighbourhood and the other in an unstable predominantly black neighbourhood. The norms for the school in the stable white neighbourhood was reported to be higher than those from the second school that was in the predominantly black neighbourhood. The white norms were reported to approach those for children of equivalent ages in the 1982 Dumfries standardization study while the norms for the black children are reported to consistently lag well behind the 1982 Dumfries norms.

The entire population of Mexican-American children in the public schools of Douglas Arizona were tested. It was reported that the norms for these children lagged behind the British norms. It was however noted that the children came from a relatively low income community.

Another normative study was carried out in the EL Paso in Texas in the public schools in 1972. It was reported that the norms for Anglo Children in this area were consistently close to those from Dumfries (British norms) while the Spanish surname children's norms consistently lagged behind the British norms.

Similarly in another study carried out in Riverside California in 1974 by Jensen, and reported in Raven's research supplement No.3, it was reported that the white norms were similar to those of 1982 Dumfries norms although they lagged behind at the younger ages, but the Black and Mexican American norms consistently lagged behind the white and British norms.

From the above review on ethnic norms for CPM, it is noticeable that poorer performances were recorded for the non-white subjects that participated in the study. Some explanations can be advanced to account for the differences in performance. The explanation given by those who carried out the study was that after item analysis, it was found that for few items certain distractors were more for some ethnic groups than for others. Building on this explanation, we need to remember that the progressive matrices including the CPM was developed initially within the British environment, and for the British population.

It was standardized on samples drawn from the British population. The non-white children and their environment were not considered when the test was being developed, neither were they represented in the standardization sample when the test was standardized. As such it is possible that some of the items in the test might not reflect the experiential background of the non-white children which is different from those of the U.S. white children. The experiential background of the U.S.white children is likely to be more similar to that of the British children, hence the similarity and closeness in their performances in the CPM test. Probably if the non-white children were represented in the sample of subjects used in developing the test or in the initial standardization study, the distractor elements found by Jensen(1974), would have been discovered and filtered out, and that might have made the test more appropriate for use for the non-white children, and make their performances to be at par with the white children's performances.

Another explanation for the differences in performance between the white and non-white children can be traced to test related factors. Such factors include previous experience in test taking, motivation to perform well in the test, rapport with the examiner and the emotional status of the subjects at the time of testing. If the non-white children are not as exposed to test taking as the white children or the non-white children lack motivation towards test taking or they were emotionally unstable at the time of taking the test, their performances on the test would be adversely affected. These and other factors which may not be readily feasible, but which are not related to the behaviour or ability being tested might have contributed to the poorer performances of the non-white children in the ethnic studies.

Another factor that might account for the differences in performance of the white and non-white children in the ethnic studies is socio-economic status. For example, Hoffman (1983), in his study using, standard progressive matrices (SPM), as the test, Anglo and Hispanic children as subjects, and multiple regression analysis on his results, found out that ethnicity (in terms of exposure and experience, and not ability accounted for 7% of the variance in performance, and socio-economic status accounted for 7% of the remaining variance. Since the CPM was fashioned out of SPM, these factors would have similar effects on CPM, and they might have been partly responsible for the differences in performance between white and non-white children in the ethnic studies.

Given the influence that the British Colonisation have had on Nigeria and is still having to some extent, one would expect the experiential background of the Nigerian children to be somewhat similar to that of the British children and therefore expect that the performances of Nigerian children in CPM be similar or close to the performances of the children in the British sample. The author of this research is optimistic that this would be so and would compare performances of the two samples.

### 3.2.6. Evaluation Studies on CPM

#### 3.2.6.1. Reliability

In one longitudinal study, the CPM was given by staff psychologists as s routine test three times in a year, at intervals of three months to children admitted to the Crichton Royal Department of child Psychiatry for emotional disturbances, and a control group of normal children of the same age range between 1952 and 1954. The normal school children were drawn from the same region as that served by the hospital. They were matched for age. The results of this study showed that over time the CPM provided consistent and reliable measures of the development of intellectual activity with age, while at the same time differentiated between the mental functions of children of the same age. The group of emotionally disturbed children had a lower mean score than the group of normal school children, (e.g. 24.9, 20.5; 27.2, 21.9; 28.9, 23.4), for 1st, 2nd, & 3rd testing. This result validated the CPM test.

In another reliability study, the CPM sets were tested for internal consistency, by correlating performances in sets, (A,Ab),(Ab,B),&(A,B). The correlations were high and they ranged between 0.64, & 0.83 for normal school children and 0.68, & 0.84 for the emotionally disturbed children. The test-retest reliability was also determined and was high, ranging between 0.86, & 0.90 for normal school children, and 0.85, & 0.92 for the emotionally disturbed children. These correlations for internal consistency, and test-retest reliability according to Raven et al.(1977), were sufficiently high for the CPM to be regarded as a reliable test that can predict mental development.

**3.2.6.2 Validity**

Additional validation for the CPM test was provided through the standardization and validation studies carried out by Judy Evans in Omaha, Nebraska, and reported in the research supplement No. 3, and edited by Ravens and Summers, (1986). In Judy Evans' study using 300 students aged 7 to 10 years chosen from standardization sample, the CPM was validated against the California achievement test, (CAT). The CPM was validated against both the full scale and the sub-scales of CAT. The correlations between CPM and the full scale was 0.54; and between Cpm and the sub-scales ranged from 0.30 to 0.54.

Another validation study was carried out by Glen Brosier in Richmond, Georgia and reported in the research supplement No.3. In this study the CPM was validated against the full scale and sub-scales of WISC., using 91 subjects. The correlation between CPM and full scale WISC was 0.58; between CPM and WISC verbal sub-scale was 0.51; and between CPM and WISC performance sub-scale was 0.62. The correlation between CPM and the sub-tests in the entire WISC scale was reported to range from 0.23 to 0.58.

So from the review of the CPM norming and evaluation studies across ethnic groups, it can be confidently concluded that the CPM measures the same behaviour within and across ethnic groups. In summary, from the above review of literature on norming, reliability and validity studies, it can be concluded that the CPM adequately measures the non-verbal aspect of general intelligence, and it is a very reliable and valid measure of intellectual ability. This justifies its use in the present research as a non-verbal intelligence test.

### 3.3 Standardization of Visual-Motor Integration Test (VMI)

After experimentation with many geometric forms and test formats and hundreds of children, a sequence of 24 forms each having a developmental age and distinct developmental characteristics was established (Beery 1989). The test was initially known as the Developmental Form Sequence. Test norms were first derived in 1964 by Beery from a normal sample of 1,030 children in urban, suburban and rural Illinois in USA. After further study the first edition of the VMI was published by Beery in 1967. Norms were then developed by others for children of Chinese, Greek, and other nationalities. These norms were found to be almost identical to United States' norms. In 1981 the 1967 Us norms were cross validated by Beery with samples of 2060 children from various ethnic and income groups in California. The 1981 samples were found to be virtually identical with, and thereby were added to the original 1964 samples and were published by Beery as the 1982 norms. In 1988 additional cross-validations were made using 2,734 children from several eastern, northern and southern states. The 1988 results were reported to be not significantly different from earlier samples. The 1989 VMI norms were thus based upon all the three US norming samples which is a total of 5824 children between the ages of 2 years, 6 months and 19 years and from all major sections of the US. It was reported by Beery that the analysis of the norming samples indicated that the 1989 VMI norms were reasonably representative of the U.S. population as reported in the 1980 census. In addition research evidence was reported to have indicated that sex, income level, ethnicity and residence were not significant factors in VMI performance.

The research update reported below were obtained from the instruction and administration manual of VMI,(1989) version, published by Beery. In many cases the individual researchers were not mentioned. The researches are mentioned in this work because they are relevant.

Concerning reliability the VMI was found to be highly reliable. Reliability coefficients for two or more scorers ranged from .58 to .99 with a median of.93.When the same children took the VMI twice, for normal samples test-retest reliabilities ranged from .63 over a 7-month period to .92 over a two-week period with a median of.81. A test-retest correlation of .59 was obtained for institutionalized and disturbed children over a two week period. In the 1988 norming studies using improved scoring and odd-even splits, one-year age span internal consistency correlation ranged from .76 to .91 with a median of .85.

Concerning validity the VMI was designed to measure changes in eye-hand coordination as children grow older. In this regard the VMI has been shown to correlate very highly with chronological age. The correlation was found to be .89. In relation to sex, statistically significant differences were not found between female and male performances in the 1981 VMI norming studies. This finding was reported to have agreed with most other studies on VMI and sex differences.

In relation to intelligence, correlations of the VMI with mental age on the Primary Mental Abilities test were reported by Beery. These correlations were: .59 for the primary one, .37 for primary four and .38 for JSS I level. Correlations with performance scale IQs were reported to be 0.40 for both low and middle income groups of first graders. VMI correlations with WISC-R IQ were reported to be .49 for verbal, .56 for performance and .56 for the full scale. The VMI was also reported to correlate with Slosson IQs with a correlation coefficient o .50. Correlations between the Stanford-Binet-Suzuki and VMI among Japanese children of ages 11 to 15 were reported to have ranged from .38 to .45,(Beery, 1989). All these correlations document evidence of construct validity of the VMI.

Concerning place of residence, which in this case is the state of Illinois in USA, no significant score differences were reported between rural, urban, and suburban Illinois children in the 1964 VMI norming studies. Similarly no significant differences were found between rural and urban Head start American white children's VMI scores. The Head start is a preschool Education project implemented in all the states of USA in 1964. However, a statistically significant difference in favour of rural and urban American white children's scores over those from mixed,(e.g. American black, Caucasian etc.)rural-urban populations was reported. The 1964 norming studies were carried out in the State of Illinois,(Beery, 1989).

In terms of ethnic groups, and according to Beery, at early ages, Chinese children were reported to have performed somewhat better than US children but the norms were reported to be very similar from ages 9 through 16. Greek and Norwegian children were reported to have performed slightly less well than the US children. No significant VMI score differences were reported between Native American and non-Native American kindergarten children. Beery,(1989),reported statistically significant differences in performance on VMI, between US Black and Caucasian children, with the black children performing better than the Caucasian children, and cautioned that statistical significance may be very different from practical significance, especially when large samples are involved. He maintained that it is possible for very small score differences to become statistically significant when large groups are studied. He illustrated this with Nye, (1977)'s report of a statistically significant difference between the VMI scores of 3,766 Black and Caucasian children in Head start programmes, in which only about 1% of the variance among the scores was attributed to ethnicity.

In the same way in the 1981 VMI norming studies with a sample of 2060 children, Beery reported statistically significant differences among children of Black, Caucasian, Hispanic and other ethnic groups, but that almost all of the score variance was attributable to chronological age with less than 1% of the variance due to ethnicity.

In terms of socio-economic status, Beery reported that the 1981 VMI norming study showed a statistically significant difference between the scores of children whose families had annual incomes below and above the poverty level, but that only about 3% of the variance in VMI scores was attributable to income level. Some studies were said to have recorded statistically significant differences on the VMI among various socio-economic groups. It is also said that those studies in which significant differences were reported confirmed the VMI to be a good predictor of low socio economic groups' achievement.

Concerning academic achievement, the correlations between the VMI and readiness tests reported averaged about .50. The correlations between VMI and reading and other achievement tests were reported by Beery to be higher for the primary grades than for the upper grades with a tendency for the VMI to correlate more highly with arithmetic than with reading. It was pointed out that not all studies indicated relationships but that even at the graduate school level, correlations of.37 with arithmetic and .25 with penmanship were still reported, Beery,(1989).

Inter-culturally, VMI correlations were reported by Beery to range from .51 to .73 for reading and mathematics among primaries five and six Taiwanese children. Also VMI correlations ranged from .42 to .55 for reading and from.65 to .67 for mathematics among Japanese children aged 11 to 15 years.

From factor analytic studies it was noted that visual motor integration was the underlying key factor for hand-writing performance. To support this, for various age groups, the average correlation between the VMI and handwriting was reported by Beery to be .42 and higher than correlations between handwriting and any of the several other measures including general intelligence, finger dexterity and visual perception.

In terms of identification of people with school related problems, Lyon, Stewart, & Freedman,(1982), found the VMI to be effective for identifying subtypes of learning disabled readers.

In terms of predictive validity, some researchers (e.g. Bray, 1974, Busch, 1974, Dibacco, 1975), have reported the VMI to be a valuable predictor when used in combination with other measures. Comparison of a battery of pre-kindergarten tests scores with the same children's achievement at the end of kindergarten and at the end of primary one was reported to have indicated that the VMI in combination with a test of auditory-vocal association best predicted achievement. The VMI was said to be sensitive in identifying high risk boys in kindergarten who subsequently had reading difficulty. (Salvia & Ysseldyke 1985), Reynolds, & Gutkin, (1980), reported that the VMI and the Test for Auditory comprehension of Language both significantly predicted SRA Reading, Language Arts and Mathematics scores between entering kindergarten and the end of first grade.

Similarly, Fletcher and Satz (1982) reported that the inclusion of the VMI with three other brief tests correctly predicted 85% of kindergarten children who were problem readers seven years later. When the children were classified by reading achievement in primary six as severe problem, mild problem, average or superior, it was found that their kindergarten VMI scores corresponded to these classifications.

However it was noted that predictive correlations appear to decline as children move up the grade levels presumably because many children learn to compensate for visual-motor weaknesses by using other skills, (Klein, 1978, Tucker, 1976).

In essence from the above review of literature on VMI, it is evident that the VMI can be used to predict academic achievement and detect underachievement. It can also be used to differentiate between the subtypes of learning disabled individuals. The VMI test is found to be a very reliable and valid measure of eye-hand coordination which is an important factor in academic success. This justifies its use in the present research as a predictor of academic achievement and a detector of academic underachievement.

### 3.4 Establishment of Western Norms for Bender-Visual Motor-Gestalt Test (BGT)

An extensive standardization of the Bender-Gestalt Test was carried out by Koppitz using children. Norms were provided on 1104 pre-primary to primary four children. The Test was prepared as a non-verbal developmental scale for ages 5 to 10 years. The sample used in 1974 in the norming study was a more representative sample than the one used in 1964 by the same author, (Koppitz, 1964, 1975). The 1964 norm group included only 2% non whites while the 1974 norm group included 8.5% black 1% oriental and 4.5% Mexican, American and Puerto Rican. The groups were said to reflect a socioeconomic cross section. The norms for the two sets of data were said to be remarkably similar except at 5 years of age. For this age group the mean number of errors was said to be higher in the 1974 norms. From ten years of age upward, the standard deviation was said to be identical with the means.

### 3.4.1 Reliability

Koppitz (1975) reported studies involving thirty inter-scorer correlations. Twenty five of these were at .89 or higher. The lowest correlation reported was .79. He also reported test-retest reliability coefficients in nine studies as ranging from .50 to .90 over periods of from one day to eight months.

### 3.4.2 Validity

Between the ages of 5 and 10yrs, the performance scores on the test were said to show consistent improvement with age and moderate to high correlations with standard intelligence tests Specifically, correlations ranging between .48 & .79 were found between BGT scores and Sandford Binet or WISC IQ, (Anastasi 1988). The BGT was reported to have face validity as a measure of visual motor integration,(Swanson, & Watson 1989).

Wright and Demers (1982) reported significant relationships between the BGT and the verbal, performance, and Full scale IQ scores on the WISC-R. It was also reported that Koppitz (1964, 1975) found similar and statistically significant relationships between BGT scores and achievement in reading and arithmetic in primaries one to three. That is as BGT scores increase, achievement scores in reading and arithmetic also increase but that the total BGT score correlated more with arithmetic scores than with reading scores. Becker(1970)in his study reported that kindergarten students who perform well on the BGT tended to do better on a word discrimination test than those with poor BGT performance. This means that there is a high correlation between performances in BGT and word discrimination test.

Smith and Keogh (1962) in their study found significant relationships between BGT scores obtained in pre-primary and primary one reading achievement. A follow up of this study by

Keogh (1965) using the same group of children but at primary three level revealed lower and non significant relationships between the BGT scores and reading and spelling achievement. It was however found that at primary six level the relationships between the pre-primary BGT scores and the achievement scores in reading, spelling and arithmetic were significantly stronger than the relationship between those achievement scores and BGT scores obtained at either primary three or one,(Keogh & Smith,1967). The implication of this is that though the results are inconsistent, the results have established that there is a positive relationship between performances in BGT and achievement in reading and that this relationship is stronger for older children. In addition children who perform well in BGT are likely going to do well in school and obtain high achievement scores whereas those who score poorly on BGT may or may not do well in school.This is consistent with Keogh, and Smith's finding that good BGT performance was a consistently good predictor of educational achievement but poor performance was not, in which case a pupil with a high BGT score would often do well in school, but one with a low score might do poorly, averagely, or very well in school,(Swanson & Watson 1989; Keogh,& Smith,1967)).

A study on the relationship between BGT and ethno-cultural variables was carried out by Zuelzer and Stedman (1976). The variables examined included ethnic groups, (e.g.Hispanic, black and white pupils)used as subjects,socio-economic status, and sex. Significant effects were reported for ethnicity, sex, and socio-economic status in a primary one level sample but this effect was said to have disappeared when IQ was added as a covariate.

Many studies were said to have reported moderate to high correlations between BGT and Beery's developmental visual motor-

Integration Test-Revised (VMI-R),(Aylward & Schmidt,1986; Wright & DeMers,1982; Breen, Carlson & Lehman 1985; Siewert' & Breen (1983)). In these studies significant differences in the mean levels of performance in these tests (BGT and VMI-R) were found. It was recognized that though the two tests share some common variance, they are not equivalent (Swanson & Watson 1989). Schneider and Spivack (1979) in their own study found that specific BGT designs differentiated between a group of primary and secondary reading disabled students.

Thus the BGT has been found to be a valid test of visual-motor integration that can be scored reliably. It was noted that BGT score only signals a difficulty, that is it indicates that an achievement problem exists but does not indicate the type or the location of the problem.

### 3.5 Establishment of African Norms for (BGT)

The Bender Gestalt test (BGT) has been standardized in Africa and African norms documented. It was standardized in Ghana by Mundy Castle (1962). In his standardization study the BGT was administered to 210 children. Nigerian children have also responded to the test. Akinsola,(1976) in her own study used 120 children in Lagos, and Abioye,(1985) used 120 children in two states (Lagos and Kwara states). The children used in Akinsola,(1976)'s study were of ages 7, 11, & 15yrs respectively. Those used in Mundy-Castle's and Abioye's studies were in the same age range of 5 to 10yrs respectively. Results of these studies indicated that the performances of the children followed similar developmental sequence, that is performances increased with age, and this established the test as a valid developmental perceptual test, suitable for use in Nigeria. This justifies its use in the present research.

### 3.6 Establishment of Western Norms for Goodenough-Harris Drawing Test: "DRAW A MAN"(DAMT).

"Draw a Man test" was designed to evaluate Intelligence in children (5 to 15 years of age). This test is a non-verbal test in which the test taker is instructed to make a picture of a man and make the very best picture he/she can. The Draw a Man test was first standardized in 1926 and was then referred to as Goodenough Draw -a-man-Test". The test was in use in this original form without change from 1926 till 1963. In 1963 the test was extended and revised. The extension and revision was published in 1963 and titled "Goodenough-Harris Drawing Test. In the revised version the examinees are asked to draw the pictures of a man, a woman and themselves. The self scale was developed as a projective test of personality although available findings from this application are said to be not promising. The emphasis in this test is placed on the child's accuracy of observation and on the development of conceptual thinking rather than on artistic skill. Credits are usually given for the inclusion of individual body parts, clothing details, proportion, perspectives, and similar features.

The test can be used for such purposes as screening, as a rapid, non-threatening means of gaining an impression of a child's general ability level and of estimating the mental ability of children for whom the usual verbal tests of ability are inappropriate. There is no time limit for the test but most young children rarely take more than ten to fifteen minutes to finish the test. In addition the test can be administered either as a group test or as an individual test.(Swanson & Watson 1989).

Norms for both the man and woman scales were established on samples of 300 children at each age level from five to fifteen years. They were selected in such a way as to be representative of the population of the United States with regards to fathers occupation and geographic region. The normative data were presented in standard scores with a mean of 100 and a standard deviation of 15. Also percentile equivalents for the standard scores were presented (Anastasi 1988; Swanson & Watson, 1989).

The Draw a Man Test has also been standardized in India (1935), in China (1939), (e.g. See Goodenough and Harris 1950), in Germany (Ziler 1975) and in Turkey (Ucman 1972). In all these studies, mean scores have consistently and significantly increased with the children's age and socio-economic levels.

### 3.6.1 Reliability

The reliability of this test has been repeatedly investigated. In one study of the earlier form administered to 386 third and fourth grade school children, the test retest correlation after a one week interval was, .68 and split half reliability was .89 (McCarthy 1944). Inter-scorer reliability for this version ranged between .90 and .94 (repeated scoring by the same person).

With the revised scale, inter scorer reliability coefficients of around .90s were also reported. For test-retest, reliability, coefficients ranging from .94 for a one day interval between testing to .65 for a three year interval between testing were reported. Most of the retest coefficients were said to be in the range of .60s and .70s (Swanson and Watson 1989).

### 3.6.2 Validity

The Construct validity of the test was provided by correlations with other Intelligence tests and these correlations vary widely. Correlations with the Stanford- Binet were reported to range from .43 to .74. Correlations with other tests were reported to be about the same range and magnitude. In some studies a correlation of .43 with the WISC , and correlations of between .51 and .72 with the California Test of Mental Maturity were reported.(Swanson & Watson 1989 p. 130).

In a study with 100 primary four children, correlations were found between the Draw a-Man Test and a number of tests of known factorial composition (Ansbacher 1952). The correlations from this study indicated that within the ages covered, the Draw a Man test correlates highest with tests of reasoning, spatial aptitude and perceptual accuracy. For kindergarten children, the Draw a Man Test was found to correlate higher with numerical aptitude and lower with perceptual speed and accuracy than it did for primary four children (Harris, 1963),reported by (Anastasi 1988).

This type of findings according to Anastasi (1988) suggests that the test may measure different functions at different ages.

The original Draw a Man Test was widely administered in Clinics as a supplement to the Stanford-Binet and other verbal scales. It has also been employed in a large number of studies using different cultural and ethnic groups including several American, and Indian samples (Anastasi 1988)

Cultural differences in experiential background were revealed in well designed comparative studies, one involving a comparative investigation of Mexican and American children, (Laosa, Swartz, Diaz - Guerrero 1974), and the other involving the analysis of comparative data obtained from 40 widely different cultural groups from 6-year old children. In these studies mean group scores appeared to be most closely related to the amount of experience with representational art within each culture.

### 3.7 Establishment of Nigerian Norms for (DAMT).

The Draw a Man test has been standardized and evaluated in Nigeria by a few researchers. The test was standardized and validated among Eastern Nigerian children using the Ziler's method (Ebigbo & Izuora,1981). It was evaluated using some other Nigerian children by Bakare, (1972) and Jegede (1979). Similarly in these studies mean scores increased consistently and significantly with age and socio economic levels.

From the above review of literature, therefore the Draw a Man Test has been found to be useful in assessing the intellectual maturity level of children between the ages of 5 and 11 yrs. Research evidences have shown that it is a valid and reliable test of intelligence for children both within and outside Nigeria. These evidences thus justify its use in the present research among Nigerian children.

### 3.8 Rationale for Choosing Non-Verbal Intelligence and Achievement Tests (CPM & VMI) for the present study

Mental development proceeds from global to restricted, from general to specific, from non-verbal to verbal, and from sensori-motor to operational,(Werner,1967,1973). The logic of the restricted or the specific or the verbal or the operational aspect of mental development is better understood by looking at the global or the general or the non-verbal or the sensori-motor level of development. If there is any problem with the specific for example, such a problem can be detected from the assessment of the general level. In addition there are educational theories and evidences that support a sensory motor basis for the development of intelligence and achievement, (Birch,& Lefford,1963; Bruner,1964; Hunt,1961; Piaget,1952; Vereecken,1961). According to these theories higher levels of thinking and behaviour require integration among sensory inputs and motor action and that integration is very important in this case. This is because it is possible for a child to have well developed visual and motor skills and yet be unable to integrate the two. The two tests that are of concern in this research namely the CPM and the VMI require sensory- motor integration and perceptual discrimination, which are the building blocks of verbal intelligence,(Olson,1970; Bruner,1975; Greenfield,& Smith,1976).

In addition both tests are universally accepted as culture fair tests, as stated before,(see chapter 2), whose contents can be objectively and similarly interpreted across cultures, (Makanju,1985; Saba,1987).Verbal tests on the other hand are more culturally bound and susceptible to subjective and different interpretations across cultures, (Akinsola,1986,1993,1995).

Besides, Nigerian children are bilingual and it has been shown that most of the children at the primary and secondary levels are not equally proficient in English language, the **weaker one** which is the medium of instruction in schools, and the mother_tongue which is the **stronger one .** As such there is interference of the stronger language with the weaker one during comprehension activities,(Awoniyi,1983; Opoku,1985; Odusina,1987; Akinsola, 1993; Saba,1996).The level of interference would depend on the level of mastery of the two languages and this may differ from one child to another.As such, results from verbal tests may not reflect the actual intellectual capacity of the child, may not be comparable across children and not generalizable as well.

Apart from this the present research is focusing on the capacity of the child to adapt appropriately to the demand of school. A verbal test can not but elicit from the child the content of school work, but a non-verbal test would by pass the content of school work and assess the above stated capacity of the child. In addition it has been affirmed that the CPM alone provides a valid means of assessing a child's present capacity for clear thinking and accurate intellectual work, (Raven, Court & Raven, 1977, 1986). Also the VMI test alone provides a valid means of assessing a person's achievement level, (Beery 1989).

Finally since intelligence is conceivable as a composite of verbal and non-verbal skills as stated earlier, (see chapter 2), and either can be used as an index of intelligence, this further explains why CPM is used in this research to assess the intellectual capacity of the children tested. Similarly the fact that the integration of sensory motor skill can be taken as an index of achievement explains further why the VMI is used here to assess the achievement levels of the children tested.

**The Use of VMI as an Achievement Test**

Achievement tests are designed to measure the effects of a specific programme of training in which case it measures the effects of relatively standardized sets of experiences, (e.g.a course in maths), (Anastasi, 1988).

In another perspective, achievement tests are contrasted with aptitude tests. Aptitude tests measure the effects of learning under relatively uncontrolled and unknown conditions, while achievement tests measure the effects of learning that occurred under partially known and controlled conditions. Sometimes the reverse may be the case in that some achievement tests may cover broad and unstandardized educational experiences or underlying functions that facilitate educational achievement. Such achievement tests can serve the same purpose as an aptitude tests ,and be used to predict future learning. From this illustration an aptitude test can be an achievement test, and an achievement test can be an aptitude test. When such tests are used as achievement tests they can assess the current achievement status of the testee, in that high scores in such tests would indicate mastery of the underlying functions that facilitate educational achievement, and current status as high achievers. The VMI falls into this category of achievement tests. It can serve both as an aptitude test and an achievement test. The VMI though not content based it can be used to predict achievement, and assess mastery of the underlying facilitators of educational achievement, and establish current status as high achievers.In the present research the VMI is serving a dual purpose as an aptitude and as an achievement test. The establishment of local norms for VMI will prove it to be an aptitude test and consequently a predictor. If the test scores of normal children in VMI increase as their scores in CPM increase, and there is high correlation between these scores it will indicate that the VMI is establishing the current achievement status of these children as high achievers, and the test is serving as an achievement test.

**Research Objectives for Study I:**

1. To standardize Coloured progressive matrices (CPM:Test1), and Visual Motor Integration test(VMI:Test2),and establish local norms for Nigerian children, and thereby determine the construct validities of the two tests in one way.
2. To determine in another way the construct validity of CPM

by correlating children's performance scores in CPM with their performance scores in Draw a Man test(DAMT),and Bender Gestalt test(BGT),both tests having been used in Nigeria and have been shown to measure related traits, (Akinsola,1976; Abioye,1985;Ebigbo,&Izuora,1981).

3. To determine the predictive validity of VMI by correlating children's performance scores in VMI with their performance scores in Bender Gestalt test(BGT), and Draw a man test,(DAMT),which have been shown to be good predictors of academic achievement ,(Keogh ,& Smith, 1967; Swanson, & Watson, 1989).
4. To determine the concurrent validity of CPM and VMI tests by correlating test scores of children in the two tests.
5. To determine the reliability of CPM and VMI tests by correlating test and retest scores, odd and even numbered items' scores of some children in these tests.

**Hypotheses**

Based on the above objectives, the hypotheses below are tested.

1. Children's scores in coloured progressive matrices test (CPM), will increase with age indicating developmental progression of intellectual ability.
2. Children's scores in visual-motor-integration test,(VMI), will increase with age indicating developmental progression of achievement potential.
3. There will be a positive and significant correlation between the CPM and the VMI test scores of normal children, in study one indicating concurrent validity, that is they are valid predictors, tapping from the same repertoire of behaviours.

4. There will be a positive and significant correlation between performances in CPM and BGT tests indicating construct validity, (that is both tests are tapping related developmental factors).
5. There will be a positive and significant correlation between performances in CPM and DAMT tests indicating construct validity,(that is both tests are valid measures of non-verbal intelligence).
6. There will be a positive and significant correlation between performances in VMI and BGT tests indicating predictive validity,(that is they are both valid predictors of academic achievement.
7. There will be a positive and significant correlation between performances in VMI and DAMT tests indicating predictive validity,(that is they are both valid predictors of academic achievement.
8. There will be a high and significant correlation between (first & second testing) performance scores of children in CPM test, indicating its level of reliability.
9. There will be a positive and significant correlation between (first & second testing) performance scores of children in VMI test indicating its level of reliability.
10. There will be a positive and significant correlation between (odd & even numbered items), performance scores of children in CPM test indicating the magnitude of internal consistency of CPM test scores.
11. There will be positive and significant correlation between (odd & even numbered items) performance scores of children in VMI test indicating the extent of internal consistency of its test scores.

## Method

**Participants.**

One thousand, three hundred and seventy five children,(1375), consisting of 578 males and 797 females participated in this study. The ages of the children ranged between 6 and 11.5yrs with half year interval between groups. The number of children per age group ranged between 100 and 130. There were twelve groups of children in the study. The children were randomly selected from two private and six public primary schools in Yaba and Mushin areas of Lagos. The children were selected according to age and class in all the schools sampled. For example the 6 & 61/2yr olds were selected from primary one classes across all the schools sampled, 7 & 71/2yrs from primary two; 8 & 81/2yrs from primary three; 9 & 91/2yrs from primary four; 10 & 101/2yrs from primary five; and 11 & 111/2yrs from primary six, across all the schools sampled. Six public and two private primary schools were randomly selected from Yaba and Mushin/Ikeja areas of Lagos for the study. At the class level the children of each age group were randomly selected through picking (yes/no) ballot papers after they have been separated from those who do not qualify by age in their classes, and those who qualify are many. This is to ensure that all the classes in the schools chosen were represented in the sample and the experiential level within the age group is uniform. In some cases there was no need for balloting either because those who qualify are very few (one or two), or none in the class qualify. Example of the age range used in the study are given as follows: 5yr.9mths to 6yr.3mths = 6yrs; 6yr.4mths to 6yr.8mths =61/2yrs; 6.9mths to 7.3mths =7yrs; 7.4mths to 7.8mths

=71/2yrs; and so on until 111/2yrs. The ages were calculated from the date of birth to the day of testing and 15 days and above is taken as one month. This procedure, (being the general procedure adopted in developmental research), was adopted earlier in an international cross-cultural infant communication research jointly carried out by Mundy-Castle in Nigeria and Trevarthen in Scotland in 1977 on mother-infant communication in which the present author was one of the key researchers.

The majority of the children in the study are from the public schools and from the biographical data collected from them, most of them are from such parental backgrounds where their fathers are either carpenters or brick layers, road side mechanics and so on; and their mothers are either petty traders, or seamstresses, hairdressers, and so on. From these data, it was assumed that most of the children are from the low socio-economic background. This makes the sample to be representative of the Nigerian urban/general population because the majority of Nigerian population are from the low socio economic level. The sample of children used in this study consisted of children of Yoruba, Igbo, Edo and Delta parents who are resident in Lagos. The children were tested on the Raven's Coloured Progressive Matrices (CPM) and Beery's Visual Motor Integration tests (VMI).



**Instruments**

The following tests were used as measuring instruments:

**a.Coloured Progressive Matrices (CPM).**

The CPM is one of the three forms of Raven's Progressive Matrices, first published in 1947 by Raven. The test consists of three sets, A,Ab and B. Each set contains twelve problems that are arranged in increasing order of difficulty, and this makes a total of 36 problems for the entire test. The test is designed to be used before the person's ability to reason by analogy has developed. The test is used to assess the chief cognitive processes, especially the perceptual reasoning processes of which children under 12 years of age are capable of (Raven, Court, & Raven 1977). Since significant relations have been empirically established between CPM and other IQ measures, (Raven, & Summers,1986; Anastasi, 1988), it is reasoned that the CPM is a valuable screening device of Intellectual ability.

Success in set A depends on the ability to complete continuous patterns. Success in set Ab depends on the ability to see discrete figures as partially related wholes and to choose a figure which completes the missing part. Set B contains sufficient problems involving analogies to show whether or not a person is capable of abstract thinking. A correct choice of the missing part for each of the 36 problems is scored one point (1), and a wrong choice is scored zero (0).This makes the maximum score for this test to be 36. In this research, the test is used as an intelligence test.

**b.Developmental Test of Visual-Motor Integration (VMI).**

The VMI test, developed and first published in 1967, by K.E. Beery, consists of a sequence of 24 geometric forms. It is used to predict academic achievement and detect under achievement. When the geometric forms are correctly copied the first ten forms are scored one point each; the next five forms are scored two points each; the next six forms are scored three points each; and the last three forms are scored four points each. This makes the total maximum possible score in this test to be 50.

**c.Bender- Visual Motor Gestalt Test (BGT).**

This test was developed by Bender and first published in 1938. The test is used as a non-verbal developmental scale for children of ages 5 to 10. The BGT is made up of two parts, the pattern continuation part, and the design copying part. The continuation pattern test consists of ten patterns that are to be completed. The testee is usually instructed to continue the patterns by linking the dots in the right half by pencil lines,(see appendix vi). Each set of dots yield a total possible score of 10 and the total maximum possible score for the continuation test is 100. The second part of the test is a design copying test that consists of 16 designs. To take the test, the testee is instructed to copy exactly the same designs as the testee sees them. The 16 designs are arranged in three sets. The first set consists of six designs which attracts a total score of eight (8),the second set consists of five designs which attracts a total score of 19; and the third set consists of five designs which attracts a total score of 20, (see appendix vii). The designs attract different scores depending on their complexity, but the maximum possible score for the design copying test is 47, and the total for the entire test is 147. The test is brought to percentage by multiplying individual score by 5/7. The scoring procedures for the design copying test has been described earlier, (see pages 141/142). The BVMGT test is said to measure visual-motor-integration, and between ages 5 and 10yrs, children's scores on the test have been shown to improve consistently with age and correlates moderately with their scores on standard intelligence tests,(e.g.WISC).Clinically the test is used for detecting brain damage (Anastasi 1988). The test was standardized in Ghana and Nigeria and has been shown to measure developmental trends in visual perception, and intellectual activity (Mundy-Castle 1962; Akinsola,1976; Abioye 1985).

**d.Goodenough Draw a Man Test(DAMT).**

This test was first originated by Goodenough in 1926. It was revised and extended by Harris in 1963. The test has been standardized and validated in Nigeria (Ebigbo & Izuora 1981) and is used to measure intellectual maturity. The original test was used in the present research.

**e.Many pencils that were used for answering the tests and for drawing where necessary.**

### Procedure

The two test were administered as group tests of a about 25 children per group. For the CPM, each of the children was given a test booklet, containing the three sets,(A,Ab,B); an answer sheet, and an HB pencil. At the beginning of the testing session, the children were asked to open the booklet to the first page along with the examiner. The examiner then asked them to each point to the big figure on this page and tell if they notice anything about this figure. When they responded with the information that part of the figure is missing, the examiner then asked them to point to the space where something is missing. The examiner then asked the children to look below the big figure and find the small six alternatives that can fit into the empty space in the big figure. The examiner then informed the children that only one of the six alternatives will perfectly fit the space to complete the big figure and they are to look very well and point to this alternative in the test booklet. The examiner went round to see the children's choices and those who made wrong choices were corrected and the examiner explained to the children why the correct choice was correct. After making sure that all the children were pointing to the correct choice, they were asked to record the number against this correct alternative in their answer sheet. After the recording the children were asked to turn to the next page (page two), on the test booklet and this procedure was repeated, and continued up to page five, after which the children were left alone to complete the rest in the set. This procedure was followed for the three sets. This guided responses to the first five problems of each set was recommended in the instruction manual as the maximum guidance allowed to ensure that the children understood what they were supposed to do, (Raven, Court & Raven 1977). No further guidance was allowed, and actually for most of the children in this study only the guided responses for the first five problems in the first set, (set A), was necessary, and was mainly for ages 6, & 61/2yrs. For most of them after the guided response to the first problem of set A, they knew what to do and went ahead to do it. The children were given sufficient time to complete the test. As mentioned earlier, (page ), for the CPM test , each correct response attracts a score of one point and a wrong response a score of zero. The maximum possible score for a set is 12, and for the entire test of three sets is 36.

For the visual-motor-Integration test (VMI), which was given to the children immediately after they finished the CPM test, each of the children was given a test booklet, containing the 24 geometric forms, two answer sheets containing four pages with six boxes on a page, and an HB pencil. The boxes on the answer sheets were numbered from one to twenty four. These numbers corresponded with the numbers of the geometric forms. There are 24 geometric forms numbered form one to 24 in increasing order of complexity. To start the test, the children were asked to open the test booklet to the first page from the back. This page contain the simplest of the geometric forms. They were then asked to copy what they see on this page on the first page of their answer sheets, such that what is in box one in the test booklet is copied in box one in their answer sheets, and that when they finish copying what is on the first page, they are to turn to the next page and copy what is in the boxes there on the corresponding boxes on their answer sheets. The children were asked to continue copying until they have copied all the 24 geometric forms on their answer sheets. The children were informed that they were not allowed to erase. They were informed that they should just copy, they were not expected to be artistic and that if they make mistakes instead of erasing they should ignore the errors and attempt another copying underneath the ones with errors. There was no time limit. The children were allowed to do the test at their own pace. They were informed that they should not skip any form, but that they were to copy from one to 24 in the systematic order in which the forms were numbered. They were also informed that when they get to the point that they can no longer copy the forms they are to stop. The order in which the forms were numbered was strictly observed and the use of eraser was prevented. These demands were recommended in the instruction manual and were adhered to in order to strengthen the validity of the test and the reliability of the test scores. As stated before, (see page ), the first ten designs attract a score of one point each with a total score of ten points; the next five designs attract a score of two points each with a total score of ten points; the next six designs attract a score of three points each with a total score of 18 points; and the last three designs attract a score of four points each with a total score of 12 points. This makes the total maximum possible score to be 50.

**Data Analysis**

For data analyses, pupils' test scores were used to establish age trends, validities and reliabilities of the tests using the SPSS Computer programme.

To establish norms for the tests, these statistics were used.

A. The age groups and overall mean scores and standard deviations were calculated to establish Age score norms.

B. The Polynomial Trend Analysis which is an extension of (ANOVA) was used to test for linear trends among the age groups and verify hypotheses 1 and 2.

C. The Scheffe test was used for post hoc multiple comparison analysis to determine which of the Means are significantly different from one another.

D. Percentile ranks were calculated to give percentile norms.

E. z scores were calculated to establish standard score norms.

F. Pearson product moment correlation statistic was used to correlate some of the children's scores in CPM and VMI and the result was used to verify hypothesis 3. This result was also used to assess concurrent validity.

G. Pearson product moment correlation statistic was also used to correlate some of the children's scores in CPM with their scores in DAMT and BGT and the results were used to assess the construct validity of CPM.

H. Pearson product moment correlation statistic was used to correlate some of the children's scores in VMI with their scores in BGT and DAMT and the results were used to assess the predictive validity of VMI.

I. Pearson product moment statistic was used to correlate test retest scores of children in CPM and VMI tests to assess their test-retest reliabilities.

J. Pearson product moment statistic was used to correlate odd and even numbered items' scores of CPM and VMI tests to assess their split half reliabilities.

To determine the construct validity of CPM test, 110 children randomly selected from the normative sample, and equated on sex and selected across the age groups in the sample were administered the DAMT test. Another 110 children selected as above were administered the BGT test, and their scores in these tests were correlated with their scores in CPM using the Pearson product moment statistic. The results of these correlations were used to assess the construct validity of CPM as a valid developmental, aptitude, and non-verbal intelligence test, in addition to the establishment of local norms for it.

To determine the predictive validity of VMI test, another set of 110 children equated on sex were randomly selected across the age groups in the normative sample, and were administered the BGT test. Another set of 110 children randomly chosen as above were administered the DAMT test. The children's scores in these tests were correlated with their scores in VMI test using the Pearson product moment statistic. The results from these correlations were used to assess the predictive validity of VMI test. The establishment of local and developmental norms for VMI test also provide evidence for its construct validity as an aptitude test and consequently as a predictor of achievement.

To document the concurrent validity of CPM and VMI tests, another set of 110 children equated on sex, were randomly selected across age groups in the normative sample, and their scores in CPM and VMI were correlated using Pearson product moment statistic.

To obtain split half reliability coefficients for CPM and VMI tests, a set of 125 children for CPM and 110 for VMI were randomly selected from the normative sample, and their scores in CPM and VMI were each split into odd and even item scores, and the odd and even scores for each test were correlated using Pearson product moment statistic. These reliability coefficients were corrected for length by using the Spearman Brown formula.

To obtain test retest reliability coefficients for CPM and VMI tests, another set of 110 children were randomly selected from the normative sample and re-tested on the tests two weeks after the first testing, and the two sets of scores were correlated using the Pearson product moment statistic.

To obtain inter-scorer reliability coefficients for VMI test, 55 children were randomly selected from the normative sample and their VMI drawings were scored independently by three of the four research assistants employed and trained by the researcher. The scores awarded by them were correlated using Pearson product moment statistic.

## RESULTS

### Validation

Pearson product moment statistic was used to inter-correlate some of the children's scores in the four tests used in study one. The matrix of the correlation coefficients is presented in table one below:

**Table 1**

**Matrix of correlation coefficients among the Tests used in study I**

| | CPM | VMI | DAMT | BVMGT | Validity type |
|---|---|---|---|---|---|
| CPM | - | - | 0.91** | 0.91** | construct |
| VMI | 0.85** | - | | | concurrent |
| DAMT | | 0.89** | - | - | Predictive |
| BVMGT | | 0.82** | - | - | predictive |

**** Significant, P<.001, df(2,108), Critical r df(2,100)= 0.32.**

**Source: Shavelson,1988.**



The significant correlations between the CPM test scores, DAMt, and BGT test scores in table one indicate that the CPM test has high construct validity. This is because the DAMT and BGT have been established as measures of intellectual development in children,(Akinsola,1976; Abioye,1985; Ebigbo & Izuora 1981). This means that the CPM is a valid test of intellectual ability and measures the "**Intelligence**" Construct.

The significant correlations between the VMI, DAMT, and BGT test scores also in table one, indicate that the VMI test has high predictive validity, because both the DAMT and BGT have been shown to be valid tests of intelligence, and the BGT test scores have been shown to correlate highly with reading achievement, (Koppitz, 1964; 1975). This means that the VMI test is a valid predictor of achievement potential. The significant correlation between CPM and VMI test scores in table one indicates that the two tests have high concurrent validity. This means that the CPM and VMI are tapping related factors within the same behavioural repertoire. At the same time the VMI is establishing the current achievement status of the testee by identifying the testee as a high achiever and thus serves as an achievement test. The results in table 1 support and confirm hypotheses 3,4,5,6,and 7, in study 1, and establish the CPM test as a valid intelligence test, and the VMI as a valid achievement and a predictor test.

**Reliability**

the Pearson product moment statistic was used to correlate the test retest, and the odd and even scores of some of the children in CPM and VMI tests. The Spearman Brown formula was used to correct for splitting in the split half correlations. In addition, the scores of some children's VMI test given by three examiners were correlated. The results are presented in tables 2 and 3 below:

**Table 2**

**Summary table for Reliability Coefficients for CPM and VMI tests**

| Reliability type | CPM N=125 | VMI N=110 |
|---|---|---|
| odd - even | 0.94** | 0.88** |
| correction for splitting | 0.96** | 0.94** |
| Test - retest | 0.95** | 0.93** |

** Significant, P<.001, df(2, 108) critical r df(2,100)= 0.32

**Table 3**

**Inter-scorer Reliability table**

| | |
|---|---|
| 1 vs 2 | 0.94** |
| 1 vs 3 | 0.91** |
| 2 vs 3 | 0.93** |

The significant correlations between the CPM and VMI test retest scores, odd and even scores recorded in table two show that both tests are highly reliable. When corrected for splitting by doubling the length of the tests using Spearman Brown's formula, the reliability coefficients of CPM and VMI tests increased from 0.94 to 0.96; and from 0.88 to 0.94 respectively. Similarly the significant and high correlations between the VMI test scores awarded by three examiners recorded in table three indicate that the examiners were objective and consistent in scoring the tests.



## NORMS

**(A) Age Score Norms**

Since the tests used in this research are not divided according to age levels, the mean scores for each of the age groups tested were calculated to establish the age score norms. The mean scores were also used to establish the developmental trend of the subjects performance. The results are presented in table four below:-

**Table 4**

**Mean Scores For The Subjects In CPM And VMI Tests**

| Age In Years | No of Subjects | CPM Mean Scores | Standard Deviation | VMI Mean Scores | Standard Deviation |
|---|---|---|---|---|---|
| 6.0 | 100 | 17.27 | 0.74 | 20.33 | 2.07 |
| 6.5 | 100 | 19.20 | 1.60 | 23.11 | 4.43 |
| 7.0 | 105 | 20.16 | 2.53 | 26.11 | 5.37 |
| 7.5 | 110 | 21.08 | 2.66 | 28.56 | 4.89 |
| 8.0 | 110 | 22.33 | 2.54 | 31.18 | 4.39 |
| 8.5 | 110 | 23.23 | 2.41 | 33.32 | 4.17 |
| 9.0 | 120 | 24.33 | 3.45 | 35.09 | 5.74 |
| 9.5 | 120 | 26.19 | 3.29 | 37.02 | 5.68 |
| 10.0 | 130 | 28.25 | 4.80 | 39.25 | 6.94 |
| 10.5 | 120 | 29.23 | 5.22 | 41.18 | 6.96 |
| 11.0 | 130 | 30.29 | 4.48 | 43.29 | 5.56 |
| 11.5 | 120 | 32.02 | 3.45 | 45.48 | 4.42 |
| TOTAL | 1375 | 24.81 | 5.65 | 34.26 | 9.24 |

The results in table 4 indicate that the children's scores in CPM test increased with age. The mean scores increased progressively from 17.27 for the 6yr old, to 32.02 for the 11.5yr old. Similarly the children's scores in VMI test increased with age as shown in table 4. The mean scores increased progressively from 20.33 for the 6yr old, to 45.48 for the 11.5yr old.

Further analysis was carried out using the children's performance scores by carrying out Polynomial Trend Analysis, to find out the magnitude of variation in performance scores that is due to the linear age trend or age factor. The results are presented in table 5 below:

## B.Polynomial Trend Analysis

**Table 5**

**Summary Table For Linear Trends for CPM and VMI tests.**

| **CPM TEST** | | | | | |
|---|---|---|---|---|---|
| Source | Sums of Sq. | df | Mean Sq. | Fc | P |
| Between groups | 27863.09 | 11 | 2533.01 | **215.77** | P<.001 |
| weighted linear Term. | **27638.22** | 1 | 27638.22 | **2354.27** | P<.001 |
| within groups | 16001.12 | 1363 | 11.74 | - | - |
| Total | 43864.21 | 1374 | - | - | - |
| **VMI TEST** | | | | | |
| Between groups | 79206.45 | 11 | 7200.59 | **258.18** | P<.001 |
| weighted linear Term. | **78822.86** | 1 | 78822.86 | **2628.18** | P<.001 |
| within groups | 38014.41 | 1363 | 27.89 | - | - |
| Total | 117220.86 | 1374 | - | - | - |

**CPM,lin.var.=99.2%,P<.001; VMI,lin.var.=99.5%,P<.001.**

The summaries of the analyses of linear trends carried out on the children's scores in CPM and VMI tests are presented in table 5. From table 5 the magnitude of the omnibus F indicate that the mean scores across ages are significantly different, from one another,(for CPM, F = 215.77, df = 11, 1363, p<.001, for VMI,F= 258.18, df=11, 1363 p<.001, Ft= 3.27, df = 8, 120 p<.001).

Also from the table , the magnitude of the variations in the children's performance scores that are due to age linear trend is significant. Results in table 5 indicated that, the variation due to linear trend for CPM is 27628.22 units, and the total variation in test scores is 27863.09. Thus 27638.22 units, or 99.2% of the variation in CPM performance scores is due to age trend and may be predicted from a linear regression equation. The F statistic for CPM linear trend is 2354.27, $p<.001$. The implication of this result is that performance in CPM test significantly increased with age linearly. Similarly the magnitude of variations in VMI test scores due to age linear trend is 78822.86 and is significant. The total variation in test scores is 79206.45. This means that 78822.86 units or 99.5% of the variation in VMI test scores is due to age trend and may be predicted from a linear regression equation. The F statistic for the linear trend is 2826.18, $p<.001$. Similarly the implication of this result is that performance in VMI test significantly increased with age linearly. With the results in table 5 above the first and second hypotheses which stated that children's performance scores in CPM and VMI tests will increase with age are hereby supported and confirmed.

In order to determine which of the pairs of mean scores are significantly different from one another, a post hoc multiple comparison analysis using scheffe's test was carried out on both the CPM and VMI mean scores. The results are presented in tables 6 and 7 below:-

Table 6

Summary table for Scheffe'test for multiple comparison of the groups mean scores for CPM test

| Ages in/Yrs | Mean scores | Groups | 6.0<br>1 | 6.5<br>2 | 7.0<br>3 | 7.5<br>4 | 8.0<br>5 | 8.5<br>6 | 9.0<br>7 | 9.5<br>8 | 10.0<br>9 | 10.5<br>10 | 11.0<br>11 | 11.5<br>12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6.0 | 17.27 | 1 | - | | | | | | | | | | | |
| 6.5 | 19.20 | 2 | | - | | | | | | | | | | |
| 7.0 | 20.16 | 3 | * | | - | | | | | | | | | |
| 7.5 | 21.08 | 4 | * | | | - | | | | | | | | |
| 8.0 | 22.33 | 5 | * | * | * | | - | | | | | | | |
| 8.5 | 24.33 | 6 | * | * | * | * | | - | | | | | | |
| 9.0 | 26.19 | 7 | * | * | * | * | | | - | | | | | |
| 9.5 | 28.25 | 8 | * | * | * | * | * | * | | - | | | | |
| 10.0 | 29.23 | 9 | * | * | * | * | * | * | * | * | - | | | |
| 10.5 | 30.29 | 10 | * | * | * | * | * | * | * | * | | - | | |
| 11.0 | 32.02 | 11 | * | * | * | * | * | * | * | * | * | | - | |
| 11.5 | 32.02 | 12 | * | * | * | * | * | * | * | * | * | * | | - |

Note: (*) denotes pairs of groups significantly different at $p<.05$. Age in years.

$Fc(11,1363)=215.77$; $Ft(8,120)=3.27$; $Fs=35.97$, $P<.05$.

**Table 7**

**Summary table for Scheffe'test for multiple comparison of the groups mean scores for VMI test**

| Ages | Mean | | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | 9.5 | 10.0 | 10.5 | 11.0 | 11.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in/Yrs | scores | Groups | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 6 | 20.33 | 1 | | | | | | | | | | | | |
| 6.5 | 23.11. | 2 | | | | | | | | | | | | |
| 7 | 26.11 | 3 | * | | | | | | | | | | | |
| 7.5 | 28.56 | 4 | * | * | | | | | | | | | | |
| 8 | 31.18 | 5 | * | * | * | | | | | | | | | |
| 8.5 | 33.32 | 6 | * | * | * | * | | | | | | | | |
| 9 | 35.09 | 7 | * | * | * | * | * | | | | | | | |
| 9.5 | 37.02 | 8 | * | * | * | * | * | * | | | | | | |
| 10 | 39.25 | 9 | * | * | * | * | * | * | * | | | | | |
| 10.5 | 41.18 | 10 | * | * | * | * | * | * | * | * | | | | |
| 11 | 43.29 | 11 | * | * | * | * | * | * | * | * | * | | | |
| 11.5 | 45.48 | 12 | * | * | * | * | * | * | * | * | * | * | | |

Note: (*) denotes pairs of groups significantly different at $p<.05$.

$Fc(11,1363) = 258.18$; $Ft(8,120)= 3.27$; $Fs = 35.97$, $P<.05$.

The results in table 6 indicated the pairs of mean scores that are statistically and significantly different from one another for the coloured progressive matrices test (CPM). The pairs of mean scores which are not significantly different from each other include, those of 6 & 61/2yrs; 61/2 & 7yrs; 61/2 & 71/2yrs: 7 & 71/2yrs; 71/2 & 8yrs: 8 & 81/2yrs; 8 & 9yrs; 81/2 & 9yrs; 9 & 91/2yrs; 10 &101/2yrs; 101/2 & 11yrs; 11 & 111/2yrs. All the other pairs are significantly different from one another.

Similarly the results presented in table 7 indicated the pairs of mean scores that are significantly different from one another for the visual motor integration test (VMI). The pairs of mean scores that are not significantly different from one another include, those of 6 & 61/2yrs; 61/2 & 7yrs; 7 & 71/2yrs; 8 & 81/2yrs; 9 & 91/2yrs; 10 & 101/2yrs; 11 & 111/2. All the other pairs are significantly different from one another. From the results in tables 6 &7, it can be confidently said that the performances of the children in the two tests, (CPM & VMI), truly follow a developmental pattern.

In order to determine the strength of association between the independent variable,(children's ages),and the dependent variable,(test scores of the children),the statistic "OMEGA-SQUARED",(Shavelson,1988), denoted by ($W^2$), was calculated for both tests, and the results are: ($W^2$)CPM = 0.63, ($W^2$)VMI = 0.67. These results imply that, 63% and 67% of the variances in the children's scores in CPM and VMI tests can be accounted for by the age variable. Similarly for the VMI, 67% of the variances in the children's scores can be accounted for by the age variable. The calculation of the Omega-Squared,($W^2$) is presented in Appendix (vii).

**Table 8.**

**SUMMARY TABLE FOR PERCENTILE NORMS FOR COLOURED PROGRESSIVE MATRICES (CPM)**

| AGE IN YEARS | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 | 10.5 | 11 | 11.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERCENTILE POINTS \| | 5.09 to 6.03 | 6.04 to 6.08 | 6.09 to 7.03 | 7.04 to 7.08 | 7.09 to 8.03 | 8.04 to 8.08 | 8.09 to 9.03 | 9.04 to 9.09 | 9.09 to 10.03 | 10.04 to 10.08 | 10.09 to 11.03 | 11.04 to 11.08 |
| 95 | 18 | 23 | 25 | 26 | 28 | 28 | 34 | 34 | 36 | 36 | 36 | 36 |
| 90 | 18 | 21 | 24 | 25 | 25 | 27 | 28 | 32 | 35 | 35 | 36 | 36 |
| 75 | 18 | 20 | 21 | 22 | 23 | 24 | 25 | 29 | 33 | 34 | 34 | 35 |
| 50 | 17 | 19 | 20 | 21 | 21 | 22 | 23 | 24 | 27 | 31 | 31 | 32 |
| 25 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 24 | 27 | 27 | 28 |
| 10 | 16 | 18 | 18 | 18 | 20 | 21 | 21 | 21 | 22 | 23 | 23 | 24 |
| 5 | 16 | 16 | 18 | 18 | 20 | 20 | 21 | 21 | 21 | 22 | 22 | 23 |
| No of subjects-> | 100 | 100 | 105 | 110 | 110 | 110 | 120 | 120 | 130 | 120 | 130 | 120 |



**Table 9**

**SUMMARY TABLE FOR PERCENTILE NORMS FOR VISUAL-MOTOR INTEGRATION TEST(VMI)**

| AGE IN YEARS | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 | 105 | 11 | 11.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERCENTILE POINTS \| | 5.09 to 6.03 | 6.04 to 6.08 | 6.09 to 7.03 | 7.04 to 7.08 | 7.09 to 8.03 | 8.04 to 8.08 | 8.09 to 9.03 | 9.04 to 9.09 | 9.09 to 10.03 | 10.04 to 10.08 | 10.09 to 11.03 | 11.04 to 11.08 |
| 95 | 24 | 31 | 35 | 37 | 40 | 43 | 49 | 49 | 49 | 50 | 50 | 50 |
| 90 | 23 | 29 | 33 | 35 | 38 | 40 | 44 | 45 | 49 | 50 | 50 | 50 |
| 75 | 22 | 26 | 30 | 30 | 34 | 35 | 38 | 43 | 47 | 48 | 48 | 50 |
| 50 | 20 | 23 | 27 | 28 | 30 | 32 | 33 | 34 | 37 | 43 | 44 | 46 |
| 25 | 19 | 19 | 21 | 26 | 28 | 30 | 30 | 33 | 33 | 34 | 40 | 41 |
| 10 | 18 | 18 | 19 | 22 | 27 | 30 | 30 | 31 | 32 | 32 | 40 | 41 |
| 5 | 16 | 16 | 19 | 21 | 27 | 30 | 30 | 31 | 31 | 31 | 33 | 40 |
| No of subjects-> | 100 | 100 | 105 | 110 | 110 | 110 | 120 | 120 | 130 | 120 | 130 | 120 |

Table 10.
**CPM NORMS FOR NIGERIAN CHILDREN IN THE CONTEXT OF 1982 DUMFRIES (UK ) DATA.**

| AGE IN YEARS | 6 | | 6.5 | | 7 | | 7.5 | | 8 | | 8.5 | | 9 | | 9.5 | | 10 | | 11 | | 11 | | 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5.09- 6.03 | | 6.04- 6.08 | | 6.09- 7.03 | | 7.04- 7.08 | | 7.09- 8.03 | | 8.04 - 8.08 | | 8.0 9 - 9:03 | | 9:04 - 9:08 | | 9:09 - 10.03 | | 10:04 - 10.08 | | 10:09 - 11:03 | | 11:04 - 11:08 | |
| PERCENTILE POINTS | UK | NIG | UK | NIG | UK | NIG | UK | NIG | UK | NIG | UK | NIG | UK | NIG | UK | NIG | UK | NIG | UK | NIG | UK | NIG | UK | NIG |
| 95 | 24 | 18 | 26 | 23 | 28 | 25 | 31 | 26 | 32 | 28 | 33 | 28 | 34 | 34 | 35 | 34 | 35 | 36 | 35 | 36 | 35 | 36 | 35 | 36 |
| 90 | 21 | 18 | 23 | 21 | 25 | 24 | 28 | 25 | 30 | 25 | 32 | 27 | 33 | 28 | 33 | 32 | 33 | 35 | 34 | 35 | 35 | 36 | 35 | 36 |
| 75 | 19 | 18 | 20 | 20 | 21 | 21 | 23 | 22 | 25 | 23 | 27 | 24 | 29 | 25 | 31 | 29 | 32 | 33 | 33 | 34 | 33 | 34 | 34 | 35 |
| 50 | 16 | 17 | 17 | 19 | 18 | 20 | 20 | 21 | 22 | 21 | 24 | 22 | 26 | 23 | 28 | 24 | 30 | 27 | 31 | 31 | 31 | 31 | 32 | 32 |
| 25 | 13 | 17 | 14 | 18 | 16 | 19 | 17 | 20 | 18 | 21 | 20 | 22 | 22 | 23 | 24 | 24 | 25 | 24 | 26 | 27 | 28 | 27 | 30 | 28 |
| 10 | 11 | 16 | 12 | 18 | 13 | 18 | 14 | 18 | 15 | 20 | 16 | 21 | 17 | 21 | 19 | 21 | 21 | 22 | 22 | 23 | 23 | 23 | 25 | 24 |
| 5 | 9 | 16 | 11 | 16 | 12 | 18 | 13 | 18 | 14 | 20 | 14 | 20 | 15 | 21 | 16 | 21 | 17 | 21 | 18 | 22 | 20 | 22 | 22 | 23 |
| No of subjects-> | 23 | 100 | 42 | 100 | 54 | 105 | 55 | 110 | 44 | 110 | 48 | 110 | 52 | 120 | 37 | 120 | 53 | 130 | 49 | 120 | 51 | 130 | 55 | 120 |

**Table 11.**
**VMI NORMS FOR NIGERIAN CHILDREN IN THE CONTEXT OF 1989 U. S. NORMS.**

| AGE IN YEARS | 6 | | 6.5 | | 7 | | 7.5 | | 8 | | 8.5 | | 9 | | 9.5 | | 10 | | 10.5 | | 11 | | 11.5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5.09- | 6.03 | 6.04- | 6.08 | 6.09- | 7.03 | 7.04- | 7.08 | 7.09- | 8.03 | 8.04- | 8.08 | 8.09- | 9:03 | 9:04 - 9:08 | | 9:09 - 10.03 | | 10:04- 10.08 | | | 10:09- 11:03 | | 11:04- 11:08 |
| PERCENTILE POINTS | US | NIG | US | NIG | US | NIG | US | NIG | US | NIG | US | NIG | US | NIG | US | NIG | US | NIG | US | NIG | US | NIG | US | NIG |
| 95 | 22 | 24 | 26 | 31 | 30 | 35 | 34 | 37 | 36 | 40 | 38 | 43 | 40 | 49 | 42 | 49 | 43 | 49 | 44 | 50 | 45 | 50 | 47 | 50 |
| 90 | 19 | 23 | 22 | 29 | 26 | 33 | 30 | 35 | 32 | 38 | 25 | 40 | 37 | 44 | 38 | 45 | 40 | 49 | 42 | 50 | 44 | 50 | 45 | 50 |
| 75 | 15 | 22 | 17 | 26 | 21 | 30 | 24 | 30 | 26 | 34 | 29 | 35 | 30 | 38 | 33 | 43 | 35 | 47 | 36 | 48 | 38 | 48 | 40 | 50 |
| 50 | 11 | 20 | 13 | 23 | 16 | 27 | 18 | 28 | 19 | 30 | 22 | 32 | 24 | 33 | 26 | 34 | 28 | 37 | 29 | 43 | 32 | 44 | 33 | 46 |
| 25 | 9 | 19 | 10 | 19 | 12 | 21 | 13 | 26 | 15 | 28 | 16 | 30 | 17 | 30 | 18 | 33 | 20 | 33 | 22 | 34 | 24 | 40 | 25 | 41 |
| 10 | 7 | 18 | 8 | 18 | 9 | 19 | 10 | 22 | 11 | 27 | 12 | 30 | 13 | 30 | 13 | 31 | 15 | 32 | 15 | 32 | 17 | 40 | 18 | 41 |
| 5 | 6 | 16 | 7 | 16 | 8 | 19 | 9 | 21 | 9 | 27 | 10 | 30 | 10 | 30 | 11 | 31 | 12 | 31 | 13 | 31 | 14 | 33 | 15 | 40 |
| No of subjects-> | | 100 | | 100 | | 105 | | 110 | | 110 | | 110 | | 120 | | 120 | | 130 | | 120 | | 130 | | 120 |

### C. Percentile Norms

The raw scores of the children in the two tests, (CPM & VMI), and for each age group were converted to percentiles to establish the percentile norms for each age group. The results are presented in Tables 8 to 11. The results presented in tables 8 & 9, showed that the percentile scores of the children increase as age increases for both the CPM and the VMI tests. The progression in the percentile scores imply a developmental trend in the performances of the children in the two tests. The median of the distribution of scores in the two tests which corresponds to the 50th percentile also increases with increase in age. This further confirms the developmental trend in the children's performances in the two tests. Since the tests being used in this study have been standardized elsewhere besides Nigeria, an attempt was made to compare the percentile norms for Nigerian children to the percentile norms established in other places.

The Nigerian norms for the CPM test were compared to the Dumfries norms for the same test in UK. **The percentile norms for the UK children were obtained from the CPM manual Research supplement No.3.** The results are presented in table 10.

Although the Nigerian norms compare favourably with the UK norms, an observable trend is that towards the upper end of the percentile scale the UK norms are higher than the Nigerian norms, while the reverse is the case towards the lower end of the scale. However there are a number of cases in which the percentile scores are the same for both Nigerian and UK children. For example at the 75th percentile, the percentile scores for ages 6.5yrs and 7yrs are the same for both samples. Similarly at the 50th percentile, the percentile scores for ages 10.5yrs, 11yrs, and 11.5yrs are the same. Also at the 10th percentile, the percentile scores for age 11yrs are the same for both the British and the Nigerian samples. For those percentile scores that are not equal, most of them are close with a difference of plus or minus one in most cases. Therefore one can confidently say that the percentile norms for both samples compare favourably well.

The VMI was standardized in the USA, and as such the Nigerian percentile norms were compared to the US percentile norms. **The US percentile norms were obtained from the administration and scoring manual of the VMI.** The results are presented in table 11.

The observable trend from this table is that the differences in percentile scores are bigger for the younger children than for the older children. It also appears that the gap between the scores closes up towards the upper end of the percentile scale and widens towards the lower end of the scale. However the general trend is that the Nigerian norms are higher than the US norms in all the percentile points listed in the table.

**D.Standard Score Norms**

The standard score norms were established by converting the children's raw scores to z scores. The Z scores were then converted to T scores, by multiplying each Z score by 10 and adding 50 to the product. The T scores were divided into ranges and the proportions of children falling within the ranges calculated. The results are presented in tables 12 and 13. The results in table 12 showed that the proportion of children in the standard score ranges in CPM test spread out well with the highest proportions clustering around the mean range. Some age groups recorded ties in their modal score ranges,(e.g.ages 6.5yrs, 8yrs, 8.5yrs, 9.5yrs, and 10yrs). The modal score for these groups fell within the (40-45) standard score range. For age 10.5yrs, though older, their modal score fell within a lower standard score range (35-40). For ages 6yrs and 11yrs, their modal score fell within the (55-60) and (60-65) standard score range respectively, which are higher than those mentioned before. The 11.5yr old recorded two modal scores that fell within the (35-40), and (55-60) standard score ranges. For this group there is a low and a high modal score. This implies that the sample of children consists of those just below and just above average in equal proportions. The general implication is that the majority of the children in the sample are in the (mean line) range which truly reflects the intellectual status of the majority of Nigerian children's population. The results also indicate that the norms established in this study are not spuriously high and can neither over nor under identify and classify children with learning disabilities if adopted for LD screening.

The results in table 13 indicated that the proportions of children in the standard score ranges in VMI test spread out across the age groups. Just as in the CPM test, there is a modal score clustering around the standard score mean range. Also some age groups in the VMI test recorded some ties in their modal score ranges,(e.g. ages 7.0yrs, 8.0yrs, 8.5yrs, 9.0yrs, 9.5yrs, and 10.0yrs), have the same modal score range. Their modal scores fell within the (40-45) standard score range. While the 11.5yr old has two modal scores in CPM test,it is the 6.0yr old that has two modal scores in VMI test, with one falling within the (40-45) standard score range, and the other falling within the (45-50) standard score range. The implication of these results is that the majority of the children in the standardization sample are in the average range intellectually. This finding makes the established norms for the two tests to be readily applicable and acceptable for screening of Nigerian children with learning problems. The proportion of children that fell within each of the standard score range specified are presented in the last columns of tables 12 and 13. The proportions in these columns represent proportions of all the subjects that participated in the standardization study, and looking at them, it can be seen that the modal score for all the subjects for both the CPM and VMI tests fell within the (40-45) standard score range. This further strengthens the inference that the majority of the children in the standardization sample are of average intelligence. This makes the established norms to be truly representative of the performances of Nigerian children in these tests, and makes the norms adequate for screening Nigerian children with learning problems for identification and classification purposes.

To further highlight the performances of the children in the tests the proportions of children within the score ranges were plotted as histograms and presented in figures 1 to 9.Looking at the figures the modal proportions for the age groups can be easily identified.

**Table 12.**
**STANDARD SCORES AND PROPORTIONS OF CHILDREN WITHIN EACH RANGE IN CPM TEST.**

| T SCORE | N = 100 | N = 100 | N = 105 | N = 110 | N = 110 | N = 110 | N = 120 | N = 120 | N = 130 | N = 120 | N = 130 | N = 120 | N = 1375 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE | 6.0 YRS | 6.5 YRS | 7.0 YRS | 7.5 YRS | 8.0 YRS | 8.5 YRS | 9.0 YRS | 9.5 YRS | 10.0 | 10.5 | 11.0 | 11.5 | TOTAL |
| 15 - 20 | 0.01 | | | | | | | | | | | | 0.0007 |
| 20 - 25 | | | | | | | | | | | | | |
| 25 - 30 | | | | | | | | | | | | | |
| 30 - 35 | 0.14 | | 0.05 | | | | | | | 0.06 | 0.12 | | 0.03 |
| 35 - 40 | | | 0.04 | 0.14 | | | | | 0.22 | 0.26 | 0.14 | 0.24 | 0.09 |
| 40 - 45 | 0.42 | 0.45 | 0.21 | 0.07 | 0.52 | 0.69 | 0.24 | 0.62 | 0.26 | 0.06 | 0.05 | 0.18 | 0.28 |
| 45 - 50 | | 0.25 | 0.31 | 0.52 | 0.16 | 0.04 | 0.49 | 0.08 | 0.09 | 0.08 | 0.14 | 0.04 | 0.21 |
| 50 - 55 | | 0.13 | 0.16 | 0.10 | 0.11 | 0.09 | 0.07 | 0.02 | 0.05 | 0.20 | 0.16 | 0.07 | 0.10 |
| 55 - 60 | 0.43 | | 0.07 | 0.06 | 0.07 | 0.03 | 0.02 | 0.12 | 0.15 | 0.15 | 0.19 | 0.24 | 0.13 |
| 60 - 65 | | 0.10 | 0.11 | 0.04 | 0.01 | 0.04 | 0.10 | 0.08 | 0.16 | 0.20 | 0.22 | 0.23 | 0.12 |
| 65 - 70 | | 0.02 | 0.01 | 0.03 | | 0.07 | | 0.03 | 0.06 | | | | 0.02 |
| 70 - 75 | | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.05 | | | | | 0.01 |
| 75 - 80 | | | 0.01 | 0.02 | 0.03 | 0.01 | 0.04 | 0.03 | | | | | 0.01 |
| 80 - 85 | | | 0.02 | | 0.01 | 0.01 | 0.01 | | | | | | 0.004 |
| 85 - 90 | | 0.03 | | 0.01 | | 0.01 | | | | | | | 0.004 |
| 90 - 95 | | | | | | | | | | | | | |
| 95 - 100 | | | | 0.01 | 0.01 | 0.01 | | | | | | | |

Table 13.
STANDARD SCORES AND PROPORTIONS OF CHILDREN WITHIN EACH RANGE IN VMI TEST.

| T SCORE | N = 100 | N = 100 | N = 105 | N = 110 | N = 110 | N = 110 | N = 120 | N = 120 | N = 130 | N = 120 | N = 130 | N = 120 | N = 1375 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGES | 6.00 | 6.50 | 7.00 | 7.50 | 8.00 | 8.50 | 9.00 | 9.50 | 10.00 | 10.50 | 11.00 | 11.50 | TOTAL |
| 15 - 20 | | | | | | | | | | | | | |
| 20 - 25 | 0.01 | | | | | | | | | | | | 0.0007 |
| 25 - 30 | 0.04 | | | | | | | | | | | | 0.003 |
| 30 - 35 | 0.03 | 0.07 | | 0.05 | | | | | 0.04 | 0.05 | 0.10 | | 0.03 |
| 35 - 40 | 0.09 | 0.05 | 0.18 | 0.09 | | | | 0.01 | 0.09 | 0.17 | 0.12 | 0.28 | 0.09 |
| 40 - 45 | 0.19 | 0.18 | 0.22 | 0.10 | 0.34 | 0.49 | 0.38 | 0.48 | 0.29 | 0.15 | 0.07 | 0.14 | 0.25 |
| 45 - 50 | 0.19 | 0.19 | 0.05 | 0.28 | 0.27 | 0.17 | 0.24 | 0.14 | 0.10 | 0.05 | 0.17 | 0.06 | 0.16 |
| 50 - 55 | 0.12 | 0.22 | 0.21 | 0.25 | 0.14 | 0.11 | 0.12 | 0.05 | 0.10 | 0.15 | 0.15 | 0.06 | 0.14 |
| 55 - 60 | 0.16 | 0.11 | 0.17 | 0.11 | 0.09 | 0.05 | 0.08 | 0.08 | 0.08 | 0.14 | 0.15 | 0.47 | 0.14 |
| 60 - 65 | 0.12 | 0.09 | 0.10 | 0.05 | 0.06 | 0.06 | 0.09 | 0.16 | 0.26 | 0.29 | 0.25 | | 0.13 |
| 65 - 70 | 0.05 | 0.05 | 0.04 | 0.06 | 0.03 | 0.06 | 0.03 | 0.04 | 0.04 | | | | 0.03 |
| 70 - 75 | | 0.03 | 0.03 | | 0.06 | 0.02 | 0.06 | 0.05 | | | | | 0.02 |
| 75 - 80 | | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | | | | | | 0.01 |
| 80 - 85 | | | | 0.01 | 0.02 | 0.01 | | | | | | | 0.0030 |
| 85 - 90 | | 0.03 | | 0.01 | | 0.01 | | | | | | | 0.0015 |
| 90 - 95 | | | | | | | | | | | | | |
| 95 - | | | | | | | | | | | | | |

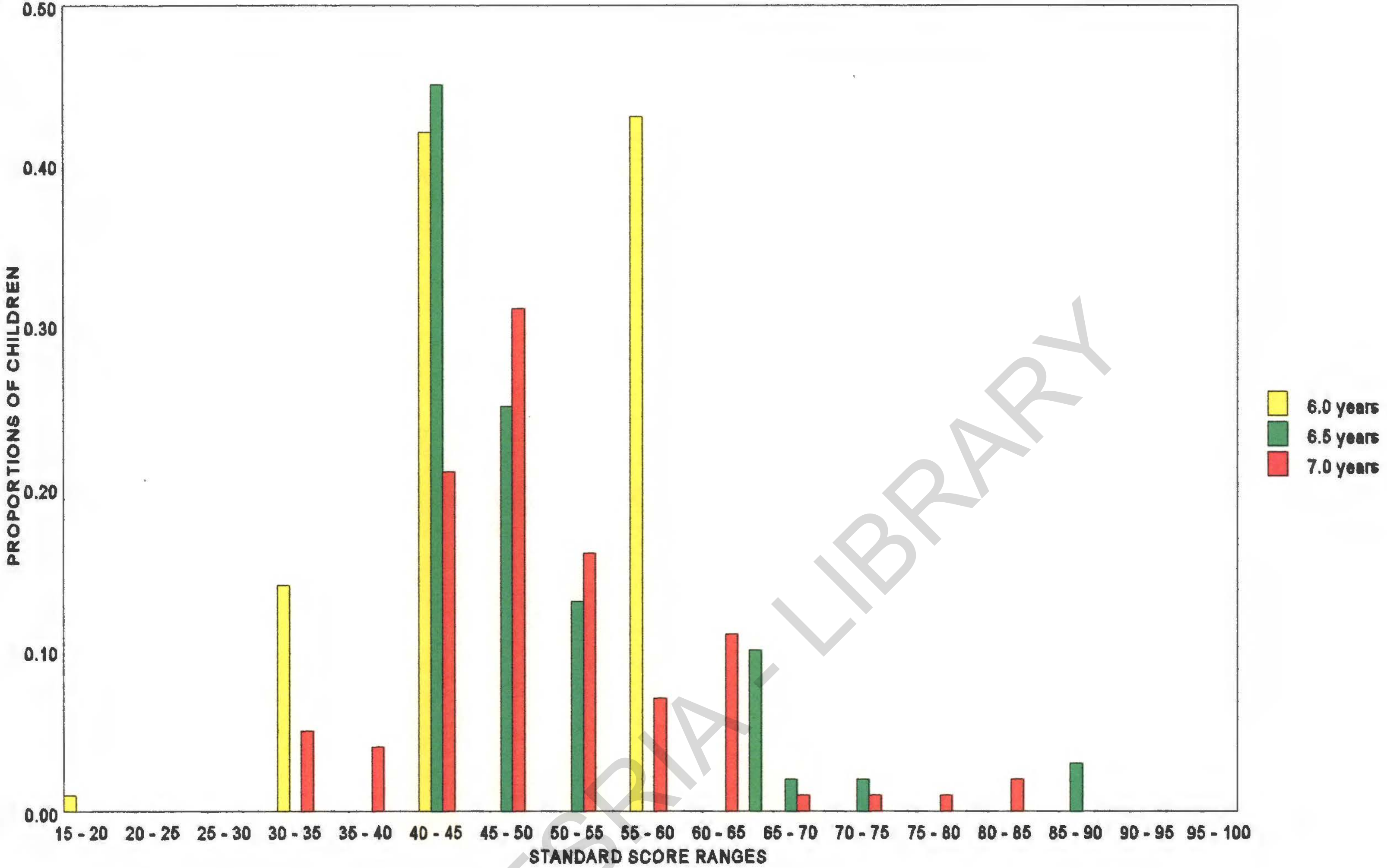


**FIG 1:** PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN THE CPM TEST FOR AGES 6 YEARS TO 7 YEARS

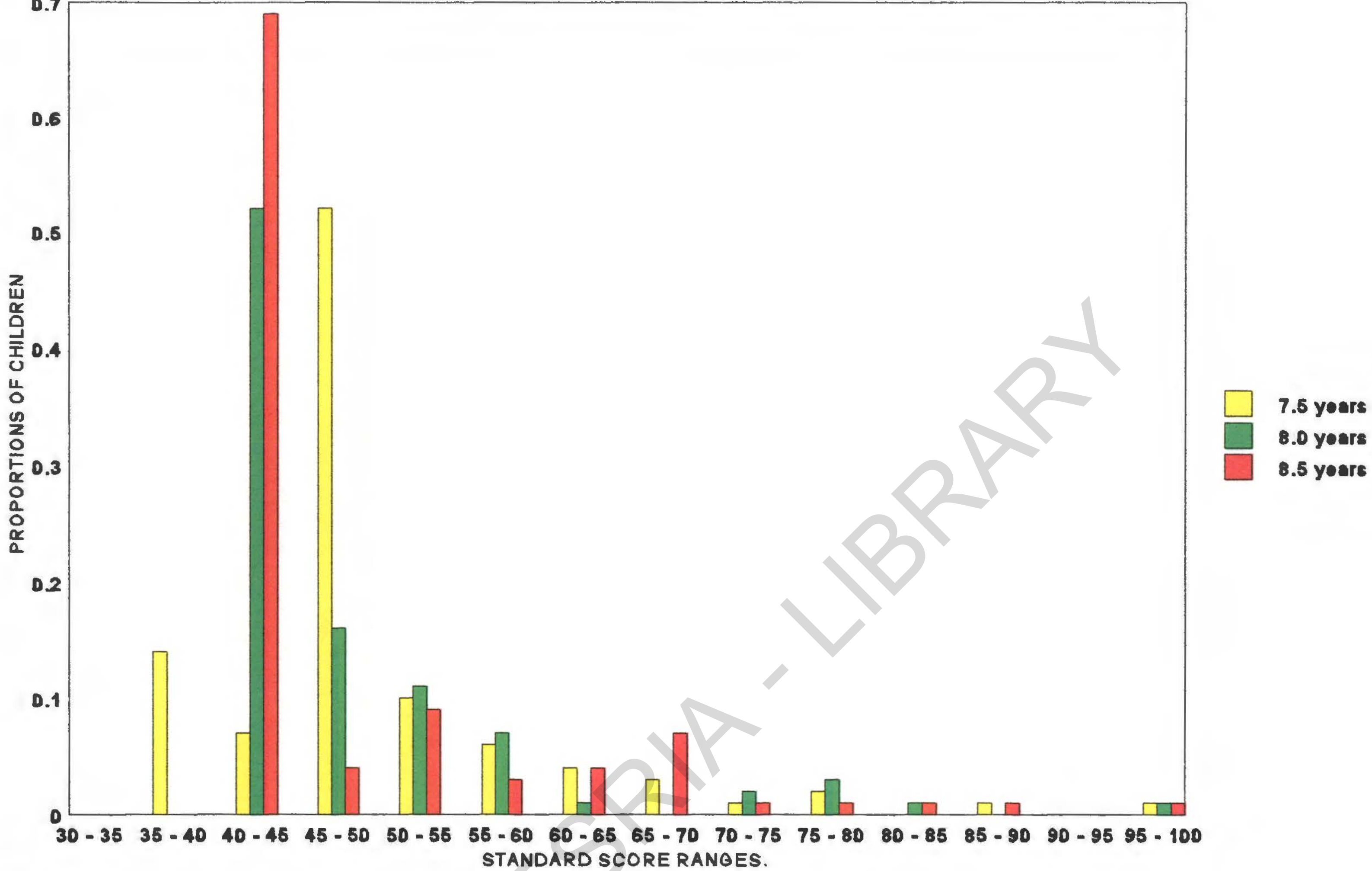


**FIG 2: PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN THE CPM TEST FOR AGES 7.5 YEARS TO 8.5 YEARS**

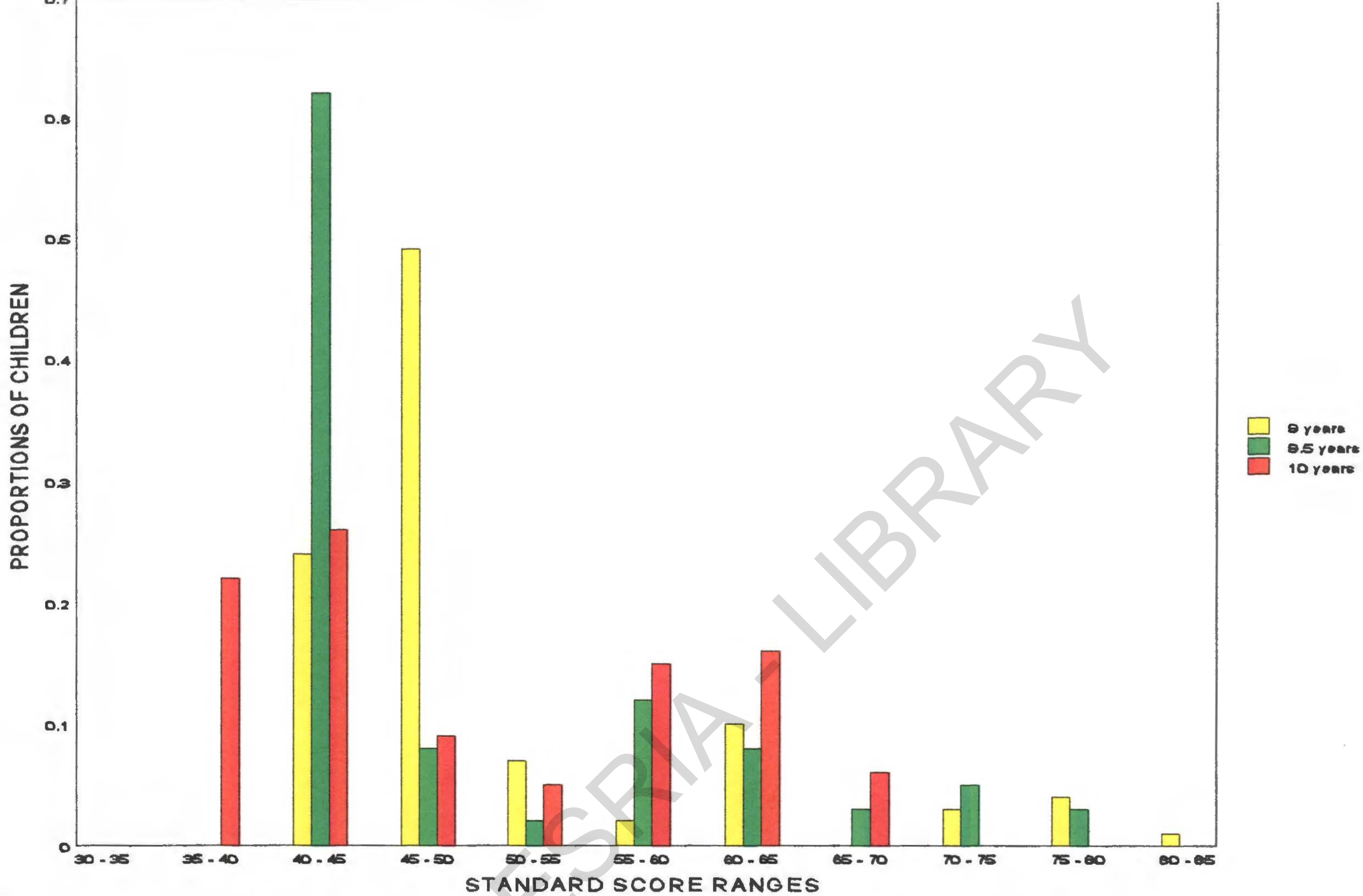


**FIG 3: PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN CPM TEST FOR AGES 9 YEARS TO 10 EARS**

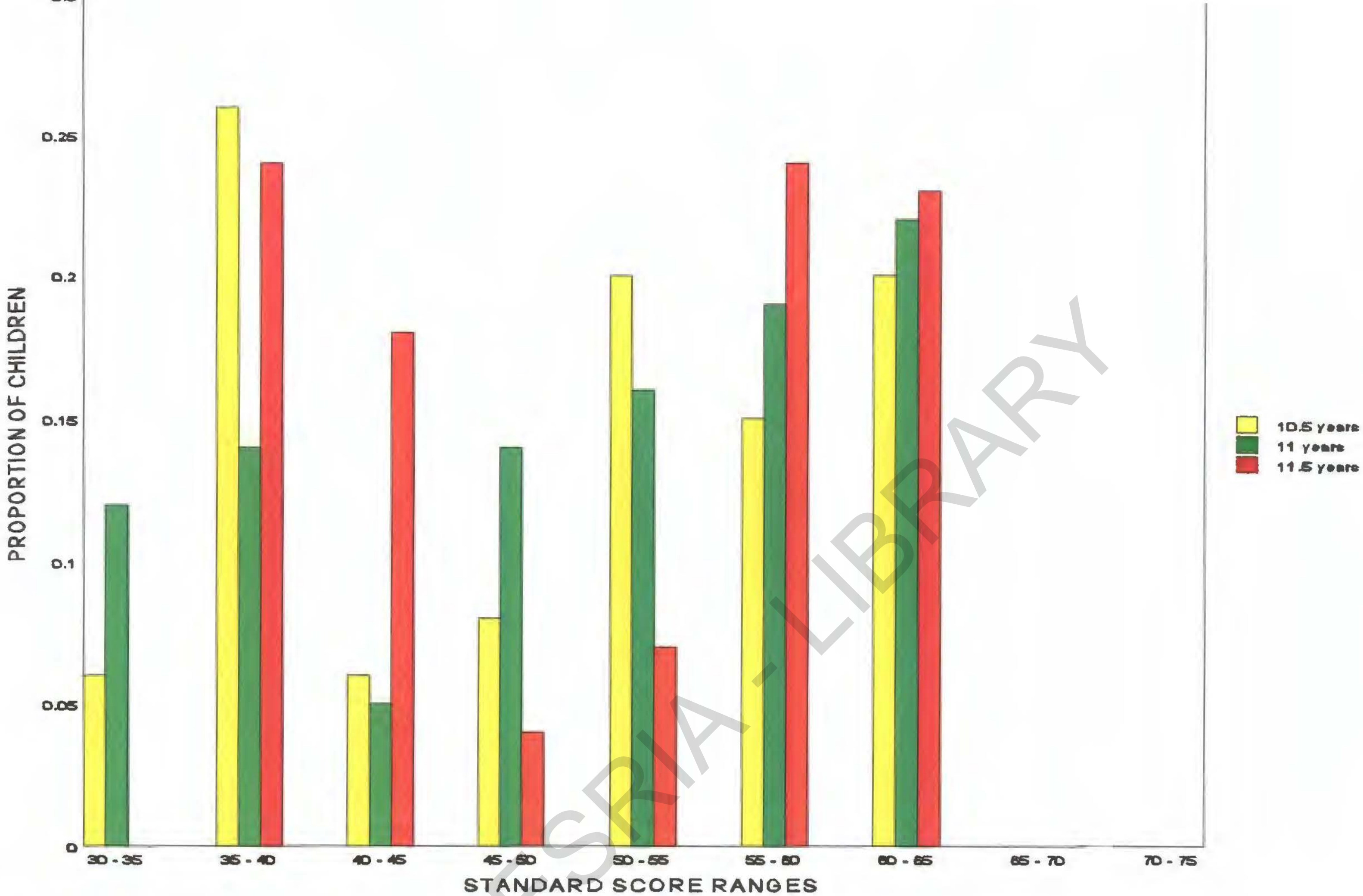


**FIG. 4: PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN CPM TEST FOR AGES 10.5 YEARS TO 11.5 YEARS**

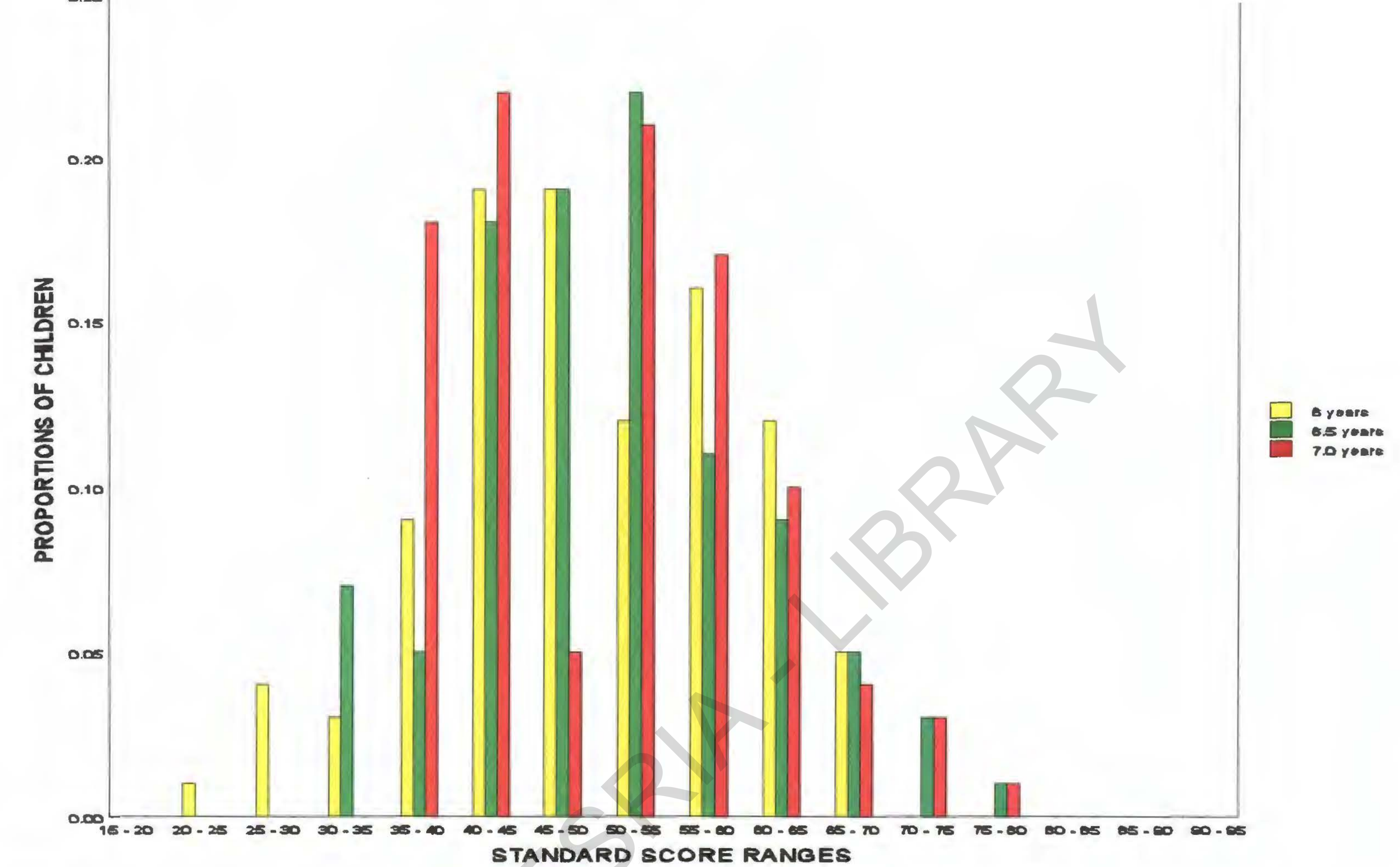


**FIG 5:** PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN VMI TEST FOR AGES 6 YEARS TO 7 YEARS

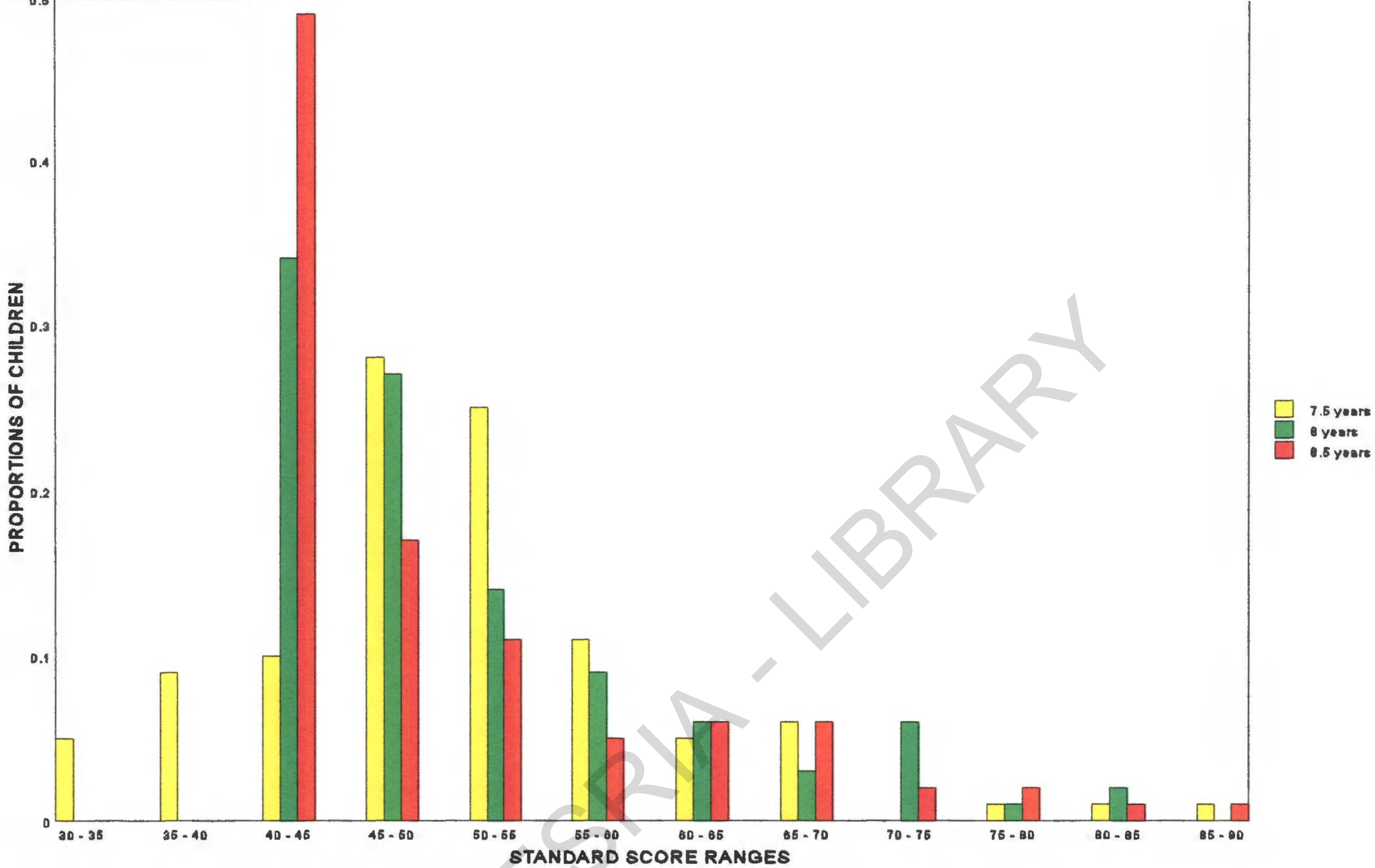


**FIG 6:** PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN VMI TEST FOR AGES 7.5 YEARS TO 8.5 YEARS

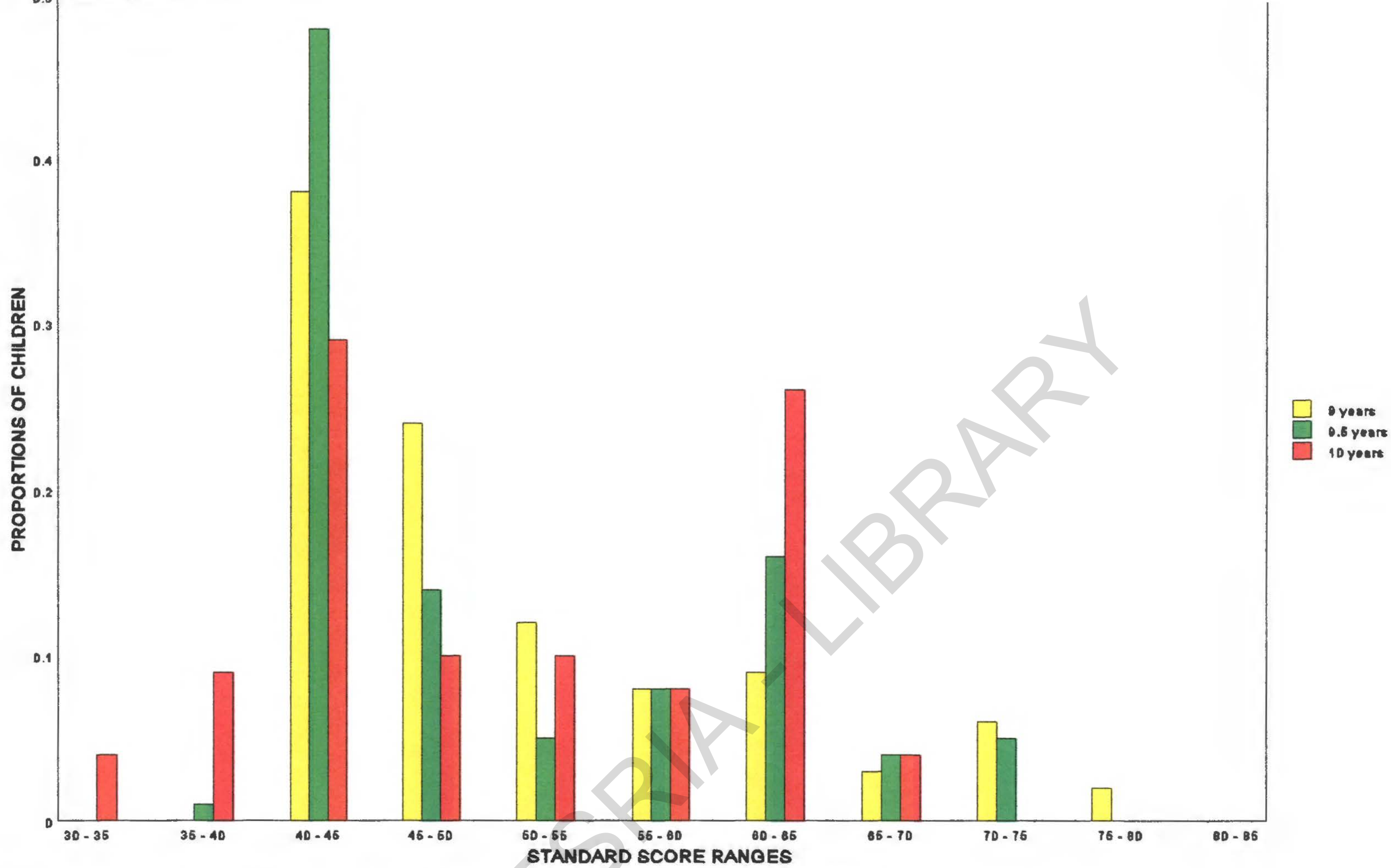


**FIG 7: PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN VMI TEST FOR AGES 9 YEARS TO 10 YEARS**

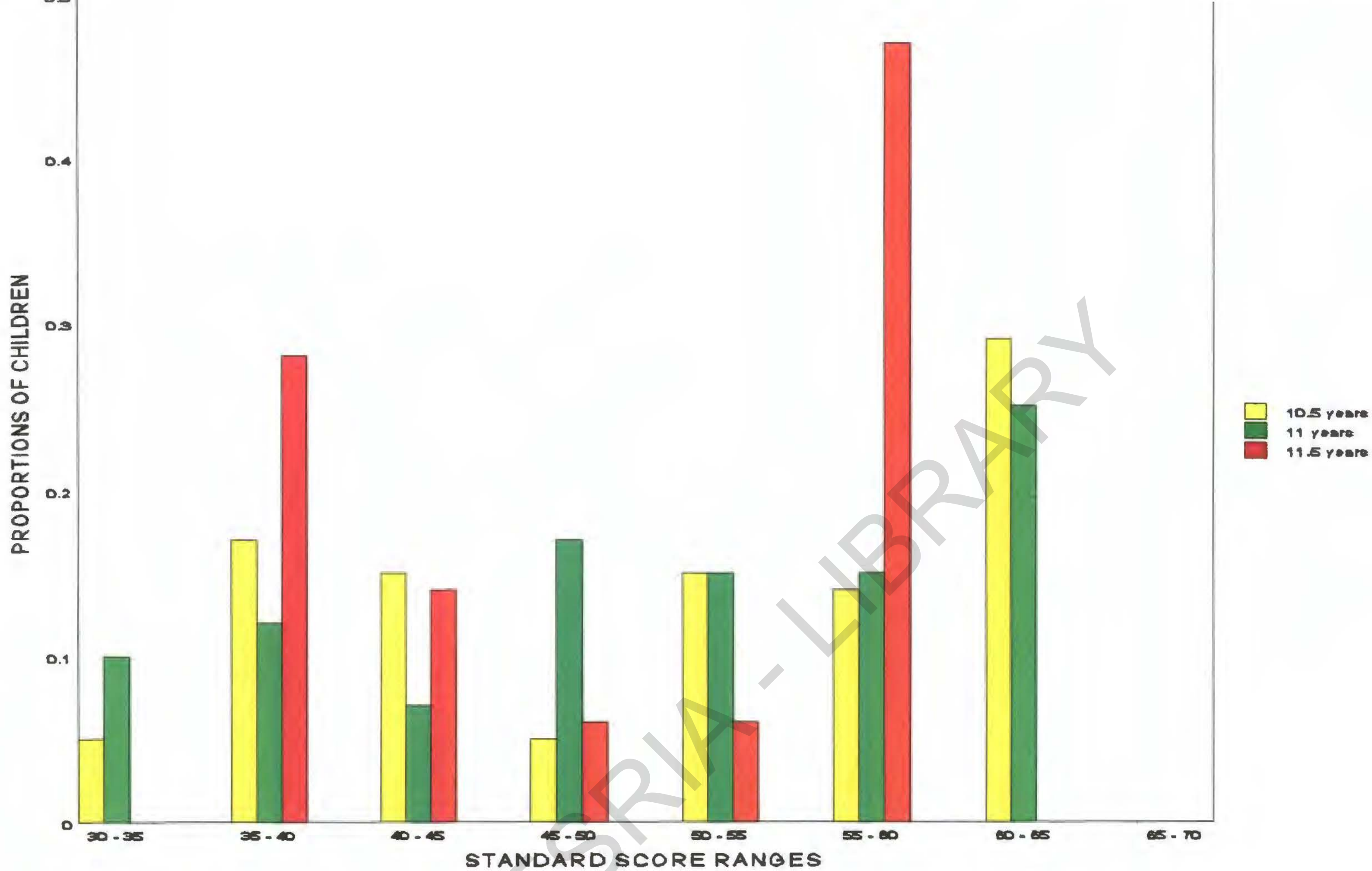


**FIG 8: PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN VMI TEST FOR AGES 10.5 YEARS TO 11.5 YEARS**

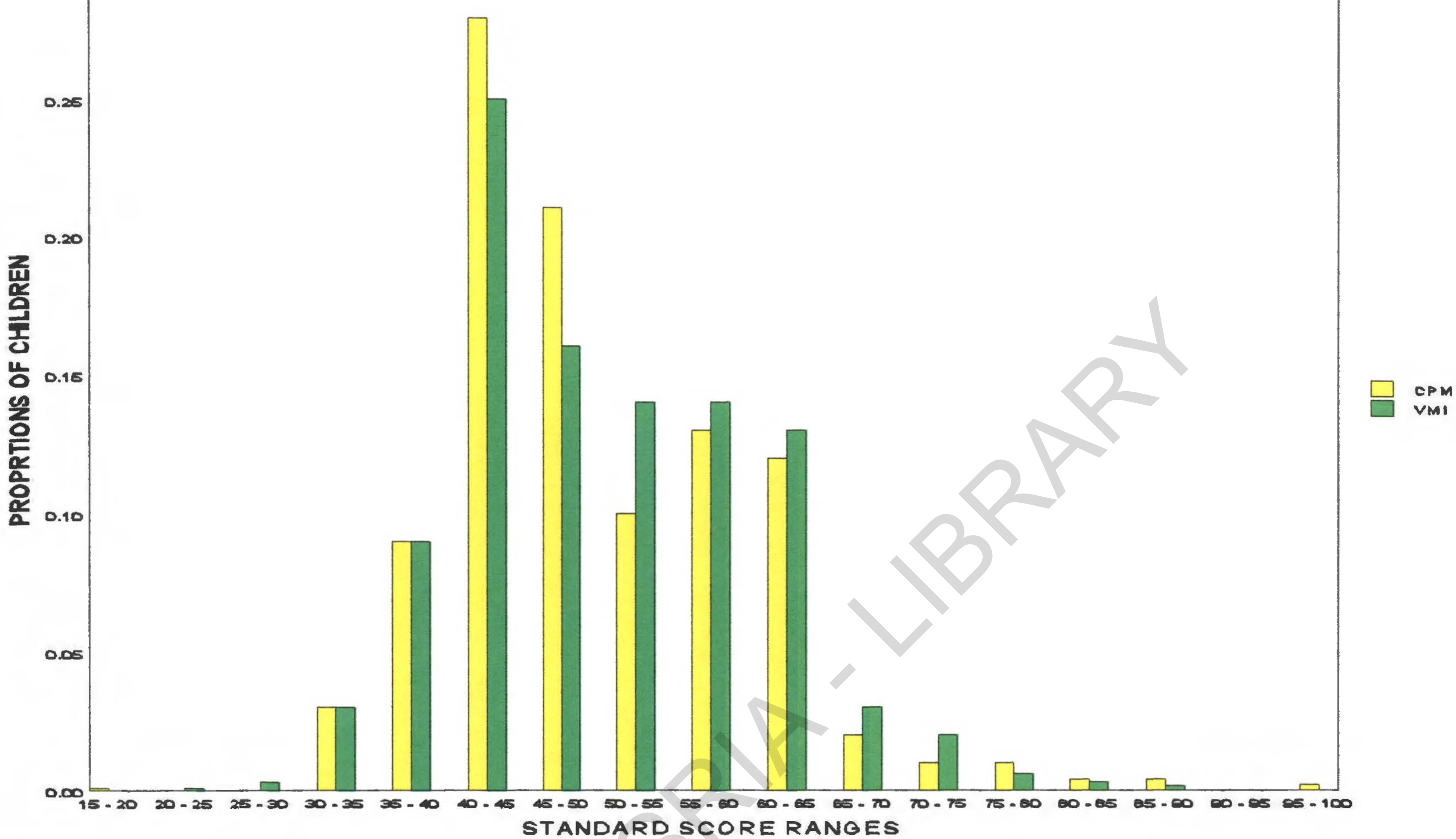


**FIG 9: PROPORTIONS OF CHILDREN WITHIN STANDARD SCORE RANGES IN CPM AND VMI TESTS FOR ALL THE AGES (6 YEARS TO 11.5 YEARS)**

## Discussion

The first study was carried out to standardize and validate the CPM (an intelligence test), and VMI (an achievement test), and to establish local age trends in performance in these tests.

It was hypothesized that: **(i) Children's scores in CPM test will increase with age; and (ii) Children's scores in VMI test will also increase with age.**

From the results, scores of children tested increased progressively with age in both tests indicating a developmental progression in intellectual capacity and achievement potential and status. These results confirmed the two hypotheses which predicted increasing performances of children in the two tests as age increased. The increasing performances with advancing age revealed that the two tests are developmental in nature, and that they are assessing related factors that increase with age.

The CPM is an intelligence test that assess cognitive functions. So the increasing trend in performance in CPM test agrees with the maturational theory of sequential progression in the maturation of cognitive skills and the fact that the child's ability to learn depends on his/her current maturational status,(Lerner,1993). The developmental trends in the children's performances are in consonant with the stage theory of Piaget, (1952,1970). According to Piaget, intellectual growth proceeds through invariant stages, from sensori-motor stage to pre-operational, to concrete operational, and then to formal operational stage, with each successive stage building on the previous stage, and representing a more complex way of thinking,(Piaget,1952;Shaffer,1993). Since the CPM and the VMI test items are arranged in increasing order of difficulty, that requires more complex way of thinking, the increasing performances of the children with increasing age is a reflection of better understanding on the part of the children and increasing capacity for more complex thought processes.

The fact that performance in CPM increases with age is one way of validating the CPM as an intelligence test. This is because age differentiation is one of the criteria for validating many intelligence tests,(Anastasi,1988).

Previous researches have established the CPM as a viable non-verbal developmental test of intelligence (Ravens,1947; Ravens et al.,1977;).The CPM has been standardized in many countries including USA, Germany, Australia, Czechoslovakia, and Netherlands,(Research Supplement No.3 of CPM manual). Evidences from these standardization studies have shown the CPM to be a good measure of non-verbal general intelligence. The results of the present study re-affirm these findings, and confirm the CPM to be an instrument suitable for assessing non-verbal intelligence.

In comparing the British and Nigerian children's performance trends in CPM test using percentile points, it was observed that performances of children from both countries are similar , but at the lower end of the percentile scale, the Nigerian scores were higher than the British scores from the 5th percentile point up to the 50th percentile point. A possible reason for this may be the fact that the first five items of the three sets A, Ab, and B, were answered especially by the younger children through guided responses. This probably put the minimum score for all children including the dull and the bright at 15. As such for the entire sample studied, there was no score that was less than 15. This has to be noted when the test is used as a screening device among Nigerian school children's population. If this procedure is adopted in all screening, then it can be safely assumed that any child who score below the average for his/her age group by whatever amount, big or small is truly below average in intellectual capacity. For percentiles higher than 50th, the British scores were higher than Nigerian scores from age 6yrs, and tappers off from age 10yrs. From age 10yrs, the Nigerian scores were again higher than their British equivalents.

A critical look at the performances of children in CPM test cross culturally (e.g Britain vs Nigeria), revealed an undulating pattern. The reason of guided or assisted responses given earlier for the improved performance on the Nigerian side at the lower end of the percentile scale may not be tenable because such guided responses are expected to be common to all CPM test takers. What seems to be a more tenable explanation is the CPM test"s sensitivity to functional fluctuations in the output of intellectual activity in early childhood,(Raven, et al.1977). This was the explanation given by Raven et al to account for lower value of test retest reliability at younger age when compared to higher values at older age levels. What this means is that consistency in performance varies from age to age and the progression in performance across age levels does not occur in a constant proportion. It is this type of fluctuations in performance which Piaget referred to as decalage. Decalage according to Piaget is the child's inability to solve certain problems while he/she solves other similar problems probably because these problems differ in complexity with some being more complex and thus requiring higher operational skill. This inconsistent progression in cognitive functions must have been responsible for the undulating trend observed in children's performances in CPM test and the fact that it occurs both in the British and Nigerian samples confirms that decalage is a universal problem in developing children.

It was also hypothesized that (i) **there will be a high and significant correlation between test and retest performance scores of children in CPM test; and (ii) a high and significant correlation between (odd and even numbered items), performance scores of children in CPM test.**

The results indicated a significant correlation between test and retest performance scores in CPM test. This shows that the CPM is very reliable, and because the sample of children for the reliability study cut across the age levels used in the research, the reliability coefficient was shielded away from decalage effect, that the effect was not visible. There was also a significant correlation between odd and even numbered items' test scores of the children in CPM test. This shows that the test scores are internally consistent, and similarly the reliability coefficient was shielded away from decalage effect. These results confirmed the two hypotheses about the reliability of CPM test stated above.

The DAMT and BGT, (both are developmental & aptitude tests), were used to validate the CPM test as an intelligence test.

It was hypothesized that: **(i) there will be positive and significant correlation between performances in CPM and BGT tests; and (ii) positive and significant correlation between performances in CPM and DAMT tests.**

Inter-correlations between the performance scores of children in these tests were high and significant. This reveals that the CPM test has high construct validity as an intelligence test and is a good predictor of academic achievement.

Since the CPM test has the Spearman's "g" factor as its conceptual base it is assumed that it would serve as a predictor of general academic achievement, and its correlation with a non-specific achievement test would attest to this. It was therefore hypothesized that **(I) there will be positive and significant correlation between performance scores in CPM and VMI tests.**

In support of this hypothesis, there was a high and significant correlation between VMI, (non-specific achievement test), and CPM test scores . This correlation coefficient serves two purposes. Firstly it provides concurrent validity for both tests since they were administered at the same time. Secondly it provides construct validity for them in that high correlation between them signifies that they are tapping related factors derived from a common repertoire of behaviours. The high correlation of VMI with CPM test also establishes the current achievement status of the testees as high achievers, which fortunately increases as intelligence increases. This observation agrees with the maturational theorists' position as reported by Lerner,(1993), that the child's ability level which is determined by maturation determines the achievement status of the child.

These results confirmed the three hypotheses stated above concerning the construct, predictive and concurrent validities of the CPM test.

The VMI is a non specific achievement test that can predict future achievement and assess current achievement status. Increased performance with age in this test shows that it measures age related factors which increase with intelligence, implying that achievement potential and status increase with intellectual capacity. The comparison of U.S. and Nigerian percentile norms for VMI test (Table 11), revealed higher scores for Nigerian children.One possible explanation for this performance trend may be that Nigerian children are exposed to drawing with pencils quite early, and probably much earlier than U.S. children. It seems more common for Western preschool children, (including U.S.), to use plasticine to make figures and pictures, and crayons to colour drawn diagrams. In fact their children are not exposed to much structured school work before the age of 6yrs. This derives from a personal observation made by this author while in Canada for two years. She worked with preschool children in day care centres and primary school children. In Nigeria, the story is different. Children are exposed to structured school work quite early, as early as from 3yrs, and sometimes earlier than 3yrs, especially in the case of playgroup classes. At this early age they use pencils to draw figures and pictures and copy drawn ones before they colour with crayons or colour pencils, and often they draw their own pictures. This practice would have sufficiently exposed many Nigerian children to the use of pencils in copying things, resulting in some level of mastery by the time they are in primary school. This explains the higher performances of Nigerian children in VMI test, implying that they are advanced in visual motor integration functions. Besides, the undulating performances observed in the CPM test are absent in VMI test. This might be because the functions tapped by the VMI test are not as complex as those in CPM test and thus not affected by decalage.

It was hypothesized that **(i) there will be positive and significant correlation between test retest performance scores of children in VMI test; and (ii) positive and significant correlation between (odd & even numbered items) performance scores of children in VMI test.**

There was a significant correlation between test retest scores of children in VMI test indicating that the VMI test is very reliable and resistant to random daily fluctuations. There was also a high and significant correlation between odd and even numbered items test scores indicating high internal consistency of the test scores. These results confirmed the two hypotheses about the reliability of the VMI test stated above.

The increased performances in VMI test with age discussed earlier, (page 209) is one way of validating VMI as a developmental test. Another way is using the DAMT and BGT (which were pre-established as developmental, predictor and achievement tests), to validate it. It was hypothesized that **(i) there will be a positive and significant correlation between performances in VMI and BGT tests; and (ii) a positive and significant correlation between performances in VMI and DAMT tests.**

Inter-correlations between the children's performance scores in these tests were positive, high, and significant. The high correlation coefficients reveal that the VMI has high predictive validity. Test scores in BGT have been shown to correlate highly with reading achievement,(Koppitz,1975). So high correlation between the VMI and BGT proves that VMI test can also predict reading achievement, and since achievement potential is expected to increase as intelligence increases, high correlation between VMI and DAMT,(intelligence & predictor test), affirms the current achievement status of the testee, and proves the VMI to be a good predictor of achievement. These results confirmed the two hypotheses above and the predictive validity of the VMI test.

From the results it can be seen that the Nigerian children's performances in CPM and VMI tests compare favourably to those from Britain and the U.S. This reveals that what the two tests measure are universal. A look at the results of the Scheffe tests carried out on the mean scores revealed that not all the mean scores are significantly different from one another, especially those that are 6months apart, giving the impression that half-year intervals are too close for any significant differences in the mean scores. However at one year intervals the mean scores are significantly different, implying that, though the performances of the children improve with age,such improvement becomes significant mostly at one year intervals. The increase in performances confirms the developmental trend of the children's abilities. The trend analysis indicated that about 99.2% (for CPM),and 99.5% (for VMI),were predictable from linear age trend in performance. The values of the Omega Squared,(0.63,for CPM),(0.67,for VMI), indicated the strength of association between the age variable and the performances in the tests. These results further buttress the developmental progression of the children's general and non-verbal intellectual ability and achievement potential assessed in this research.

# CHAPTER FOUR

## STUDY II: IDENTIFICATION AND CLASSIFICATION OF LEARNING DISABILITY

### Introduction

One of the major criteria for the identification of learning disabilities is a discrepancy between expected and actual performance. The assumption behind this criterion is that learning disability, being a handicap will have a negative effect upon school functioning such that students with these disabilities will not achieve as well as would be expected from their general intellectual level. The Identification guideline therefore demands the establishment of a severe discrepancy between ability and achievement in one or more of the subject areas, which include oral expression, written expression, reading comprehension, and mathematical calculations and reasoning, (McLoughlin & Lewis,1986)

The discrepancy notion appears simple and straight forward on the surface but it becomes problematic when it comes to operationalizing it. Some of these problems include the choice of measures of ability and achievement and the setting of standards to determine how large a difference between the ability and achievement scores will have to be, to indicate a discrepancy and how large the discrepancy has to be to be considered severe. In current practice, ability is assessed with tests of intellectual performance and achievement is assessed with achievement tests.

The early attempts at analyzing significant discrepancy between ability and achievement involved calculating the number of grades a student was behind in a particular subject by subtracting the current grade level of performance from the current grade placement. This method called the years-below-grade-level procedure is often combined with an IQ score cut off level. In this procedure a discrepancy is indicated when the student is more than 1 year below grade level for lower primary, 1.5 years for upper primary, 2 years for junior secondary, and 2.5years for senior secondary,(McLoughlin & Lewis,1986).

However, this technique has fallen into disuse because of the limited usefulness of grade scores, the inappropriateness of the procedure with certain students (e.g. first graders), and the problem with the assumptions about the abilities of the students being assessed.Though it is recognized that this technique is easy to use, the procedure is seen as an inappropriate way of analyzing discrepancies,because (I) it does not take into account differences in ability, in that it does not recognize giftedness, and identifies only slow learners and not learning disabled,(Cone & Wilson,1981), (ii) it assumes average ability by making actual grade placement the standard of comparison, and besides there is a problem with its use of grade scores, because grade equivalents are not equal-interval scores and as such they may not be legitimately added or subtracted. Due to these deficiencies and other limitations, the years-below-grade-level method is not recommended for discrepancy analysis (McLoughlin & Lewis,1986).

A second method makes use of expectancy formulas to estimate the student's expected level of achievement. In this procedure one or more factors are considered in establishing what a student is supposed to do and then the derived number is compared to the measure of actual achievement in a specific skill area. One approach to deriving expectancy formula is to convert the student's intelligence test (IQ) score into a mental age score and subtract the constant numeral 5. This is done because it is assumed that the child begins formal schooling from/after age five and the expected achievement should be estimated from this period to correct for standard error of measurement and make it more reliable. This calculation is assumed to provide an estimated level of ability to be compared with the student's actual performance (Wallace, & McLoughlin,1988). For a normally functioning student, the estimated level of achievement should match the actual/current level of achievement.

A variation of this approach is the Myklebust's learning quotient method which involves averaging the mental age, the chronological age,and years in school to give a derived number to compare to an actual skill age such as reading or spelling age (Myklebust,1968).The learning quotient (LQ) is the ratio between the present achievement age and the expectancy age, and a learning quotient of 89 or below is the accepted cutoff for declaring a significant discrepancy.

Unfortunately, expectancy formulas tend to share one of the major limitations of the years-below-grade-level approach which is that the current achievement is expressed in grade equivalent scores. Also age equivalent scores such as mental age scores are subject to the same deficiencies as grade equivalent scores.Both are said to lack precision.It is argued that the methods do not consider the reliability of either the compared scores or the obtained discrepancy score,and that there are no criteria by which to judge whether the observed number of years or grade level is significantly below what is expected,(Lerner,1993).

One way by which the limitations of age and grade level scores are bypassed is to replace them with standard scores.

Standard scores are interval data that may be manipulated arithmetically by addition or subtraction. Standard scores are distributed with the same mean and standard deviation to make them comparable from one measure to another. The norm groups that are used to derive the standard scores must be comparable too. This is ensured if measures used in the identification process are the same as those used on the standardization sample. As such the most current procedures used to establish the existence of a significant discrepancy make use of the standard test scores taken from normative tests. These tests permit the comparison of measures of intelligence, academic achievement and other areas for which scores are reported with the same mean and standard deviation. If the difference between the two standard scores is greater than a standard deviation then the discrepancy is judged to be significant(Reynolds,1985, Cone, & Wilson,1981). According to Reynolds, this procedure is more reliable if the tests used are standardized on a sample drawn from the population from which those to be identified come from, and that greater confidence is reposed on the procedure if the reliability of the tests and the tests scores is considered. One way of analyzing discrepancy is to consider the range into which a score falls. If the ranges of scores from two different tests do not overlap, a true discrepancy is said to exist. Another approach is to calculate the amount of difference necessary to judge two test scores as truly different, using standard scores. The calculation takes into account the standard deviation and the reliability of the two tests. A difference score is obtained by subtracting one score from another(Wallace & McLoughlin 1988; McLoughlin & Lewis,1986). A third discrepancy analysis procedure is regression analysis.This procedure makes appropriate adjustment in the calculations to account for the tendency of test score numbers to move toward the mean when a test is administered a second time (Cone & Wilson,1981).An emphasis is placed on the existence of a significant discrepancy between a child's expected and actual achievement in a specific area as a necessary but not a totally sufficient condition for establishing a learning disability. Despite this the discrepancy criterion is taken as a first step in the identification process, followed by a confirmation of the extent and nature of a child's disability in the actual school environment (Wallace & McLoughlin, 1988).

Presently there is no agreement about the most appropriate method of discrepancy analysis, but the criticism of expectancy formulas and the years-below-grade-level methods which has been consistent made those methods unpopular.,Berk,1982,1984; Cone & Wilson,1981; Sattler, 1982).As such the procedure that is mostly used currently is the use of standard test scores taken from normative intelligence and achievement tests. Intelligence tests are used to establish the intellectual level of the students. Those that are identified as learning disabled must have at least average intelligence. This most frequently used standard score approach is also adopted in the present research. The test used here as the intelligence test (CPM) is standardized on a sample drawn from the population from which the disabled children are sampled. Also the test used as the achievement test is standardized on a sample of children drawn from the same population from which the disabled children are sampled. The norms from the tests are used to identify children who have discrepancies in ability and achievement levels and determine if these discrepancies are significant. Also pupils who have at least average intelligence test scores and a significant discrepancy between ability and achievement using the standard score procedure would be classified as learning disabled. Those with below average intelligence and achievement test scores would be classified as slow learners. Those with at least average intelligence and achievement test scores would be classified as normally achieving pupils. The first two categories of pupils above would be in one group:- the Experimental group and the last category of pupils would be in the Control group. There would be two groups of children participating in study II.

**Research Objectives for study II**

The objectives of study II include the following:

1) To use the resulting norms in Tests 1 and 2 (CPM: Intelligence test and VMI: achievement test), to identify: (a) pupils whose scores are at least average in Tests 1 and 2, in reference to their age group's average; (b) pupils whose scores are at least average in Test 1 but below average in Test 2 when compared to their age group's average score; © pupils whose scores are below average in Tests 1 and 2.

(2) To confirm that the VMI test can detect underachievement in primary school children.

(3) To classify the groups of pupils identified in (1) above.

**Hypotheses:**

(1) The achievement test(VMI) scores of pupils identified and classified as learning disabled would be significantly lower than their intelligence test (CPM) scores.

(2) Those pupils with below average CPM and VMI test scores will be classified as slow learners.

(3) There will be a positive and significant correlation between CPM and VMI test scores of normally achieving children in study II to re-validate the concurrent validity of the two tests.

(4) There will be a positive and significant correlation between the children's CPM test scores and their current classroom achievement (CAT) test scores denoted by their preceding year aggregate percentage scores.

(5) There will be a positive and significant correlation between the children's VMI test scores and their current classroom achievement (CAT) test scores denoted by their preceding year aggregate percentage scores..



## METHOD

**Participants**

One hundred and seventy participants were selected from primary schools in Mushin, Ikeja and Yaba areas of Lagos for the study in this section. The participants were made up of 85 normally achieving children and 85 others who were having problems in few subject areas in the school. In selecting these pupils, teachers'diaries containing records of pupils' performances in the 1st, 2nd, & 3rd terms of the preceding academic year were collected and scrutinized by the researcher.

Three groups of children were identified and extracted from the diaries. The first group consisted of those children who consistently failed one or two subjects through out the year,(that is they failed the same one or two subjects in the 1st, 2nd, & 3rd terms, and passed the rest of their subjects). In addition the scores of these children in the failed subject(s), fell below the 30th percentile of the class performance. The second group consisted of those children who consistently failed more than three subjects during the year and whose performances fell within the last ten in their classes. The groups' poor performances were corroborated by their class teachers' observations and verbal reports. These two groups were put together to form the experimental group. The next group of pupils identified consisted of children who performed well in the three terms of the year and they formed the control group. The participants were made up of 56 boys and 29 girls for the experimental group, 42 boys and 43 girls for the control group, making a total of 98 boys and 72 girls, and their ages ranged from 6yrs to 11.5yrs, thus cutting across the age groups in the standardization sample. The participants were made up of children from Yoruba (n=118), Igbo (n=27), Edo & Delta (n=25), parentage who are living in Lagos. The majority of the participants were assumed to come from the low socio-economic levels going by the proportion of participants from the public schools and the socio-economic background data collected from the participants.

**Instruments**

The testing instruments used for study II are: an intelligence test, and an achievement test. The tests are: (a) Coloured Progressive Matrices (CPM) for intelligence, and (b) Visual Motor Integration (VMI) for achievement, (pages 174-175).

**Design**

The design used in study II is stratified randomized two groups design. The two groups consisted of Experimental group and Control group. The experimental group consisted of children who were performing poorly in school and the control group consisted of children who were performing well in school.

**Procedure**

The identified pupils were tested by giving them the Coloured progressive matrices (CPM), and the visual motor integration (VMI) tests to do, following the same procedure used in study I, (see page 176 for details). The resulting scores were subjected to statistical analysis.

**Data Analysis**

1. The participants' scores in CPM and VMI were compared to the corresponding age group averages obtained in study I to determine those whose scores are average and above and those whose scores are below average.
2. The participants' raw scores were transformed to T standard scores, (see page 139 for details).
3. Discrepancy analysis was carried out on the transformed scores to determine the categories of underachievement.
4. Based on the discrepancy analysis the participants were classified as either LD; slow learner or normal.
5. Pearson product moment statistic was used to correlate the children's scores in CPM and VMI tests to re-establish their concurrent validity.
6. Pearson product moment statistic was also used to correlate children's scores in CPM and VMI tests with their preceding year aggregate percentage scores which was taken as the criterion measure of achievement, to see if the two tests would predict scholastic performance.

## RESULTS

### Discrepancy Analysis

Discrepancy analysis was carried out by calculating the differences between the T scores for CPM and VMI for each of the participants. As part of the classifying criteria, (a) the LD child must score at least average in CPM test, and (b), there must be a significant discrepancy between his/her CPM and VMI test scores. The consensus for a significant discrepancy is at least one standard deviation, (Wallace & McLoughlin, 1988), which for T standard scores is equivalent to 10 points. Therefore any difference in T scores that is 10 or more is considered significant. For a child to be classified as learning disabled, the child must have a minimum T score of 50 in CPM test, less than 50 in VMI test and a discrepancy score between CPM and VMI of at least 10. To be classified as a slow learner, the child must have a T score of less than 50 in both the CPM and VMI tests. For normally achieving children their T scores in both tests must be at least 50. The results of the discrepancy analyses are presented in Table 14 below.

**Table 14**

**Summary table for classification of underachieving and normally achieving children.**

| category | L/D BDA | L/D ADA | S/L BDA | S/L ADA | ADA n=85 | C.P N=85 |
|---|---|---|---|---|---|---|
| LD | 26 | 13,50 | - | 7,12 | 20,23.5% | - |
| SL | - | 3 12 | 59 | 48,81 | 51,60% | - |
| NL | - | 7 27 | - | 1,2 | 8,9.4% | 100% |
| UC | - | 3 12 | - | 3,5 | 6, 7.1% | - |
| TOTAL | 26 | 26 | 59 | 59,100 | 85 | 85 |

**Note: BDA = Before Discrepancy analysis. ADA = After Discrepancy analysis. LD = Learning Disabled; SL = Slow Learner; NL = Normal Learner; UC = Unclassified.**

In table 14 above, the summary of the classification for the experimental group is given in column 6. From this column it can be seen that 20 participants representing 23.5% were classified as learning disabled (LD); 51 participants representing 60% were classified as slow learners (SL); and 8 participants representing 9.4% were classified as normally achieving pupils. These are the participants that met the criteria for the classifications, (see appendices X & XI for discrepancy analysis details).

Six or 7.1% of the participants in the experimental group were not classified because the differences between their CPM and VMI T scores were not up to one standard deviation of ten points.

Columns 2&3 of Table 14 showed the numbers, categories, and percentages of LD classification before and after discrepancy analyses. Thirteen or 50% of those initially classified as LD before discrepancy analyses were confirmed after discrepancy analyses. The rest were re-classified as either slow learners,(12%), normals,(27%), or unclassified,(12%). Columns 4&5 of Table 14 showed the numbers, categories, and percentages of slow learners' classification before and after discrepancy analyses. Forty eight or 81% of those classified as slow learners before discrepancy analyses were confirmed while the remaining were re-classified as either learning disabled,(12%), normals,(2%), or unclassified, (5%). The classification of the control group is shown in column 7 of Table 14. All the participants in this group met the criteria for classification as normally achieving children after discrepancy analyses. With these results hypotheses 1,and 2, in this section of the research which predicted a significantly lower VMI scores for LD children when compared to their CPM scores, and below average CPM and VMI scores for slow learners are hereby supported and confirmed.

Some striking features were noticed in the discrepancy analyses for both the experimental and control groups. For the experimental group, (see appendix X), there were 49 cases in which the ability (CPM) scores were higher than the achievement (VMI) scores.Discrepancies between such scores were positive, while there were 33 cases in which the achievement (VMI) scores were higher than ability (CPM) scores, and in this case discrepancies between the scores were negative. There were no differences between ability and achievement scores in three cases. For the control group,(see appendix XI), 33 cases had ability scores that were higher than achievement scores, with positive discrepancy scores, and 44 cases that had achievement scores higher than ability scores, with negative discrepancy scores, and eight of them had equal ability and achievement scores. This analysis revealed that the pattern of differences between ability and achievement scores are similar for both groups. For the experimental group (see appendix X), ability scores were mostly higher than achievement scores regardless of whether the ability scores were above average, average, or below average. This might have accounted for why there were more positive than negative discrepancy scores.

For the control group however the reverse was the case. Achievement scores were higher than ability scores for more subjects. All the subjects scored at least average in CPM test, but the VMI test scores were higher than CPM test scores with more negative than positive discrepancy scores.

The CPM and VMI test scores of 100 of the participants in this second study were correlated to re-establish the concurrent validity of the two tests. The results gave a concurrent validity coefficient of 0.93, $P < .001$, $DF(2,98)$. The correlation coefficient was high and significant. With this result hypothesis 3 in study II, which predicted a positive and significant correlation between the children's CPM and VMI test scores is supported and confirmed.

The CPM and VMI test scores of 100 of the participants in this second study were randomly selected and correlated with their current classroom achievement test scores (CAT) as denoted by their preceding year aggregate percentage scores to determine the degree of their relationship. The results gave a predictive validity coefficient of 0.39, $P<.001$, $DF(2,98)$, between CPM and CAT scores, and a concurrent validity coefficient of 0.35, $P<.001$, $DF(2,98)$ between VMI and CAT scores. These results support and confirm the 4th & 5th hypotheses that predicted a positive and significant correlation between the sets of scores.

**Discussion**

The objective of study II was to confirm and classify children who have been identified as having learning problems in school. The identification was done through the use of the children's past performance records extracted from their teachers' diaries, observations, and reports about the children in question. The information obtained from the school were used to identify and classify the children into groups of either learning disabled or slow learners. The classification was confirmed using CPM (intelligence),and VMI (achievement) tests.

It was hypothesized that: **(I) the VMI test scores of children classified as LD would be significantly lower than their CPM test scores; and (ii) those classified as slow learners would score below average in both CPM and VMI tests.**

The results obtained here supported and confirmed these hypotheses. The results are discussed within the frame work of past empirical findings concerning the identification and classification of learning disabilities.

Some researches (e.g. Wilson 1985), that classified learning disabled children on the basis of discrepancy analysis using standard score difference procedure, reported significant percentages of children as meeting the discrepancy criterion. Wilson for instance reported that 75% of the children studied met the criterion. Further more he reported that his findings were consistent with the conclusions that the widely used definition of LD can be successfully and consistently applied to Special Education populations. Results of the present study also point in this direction and agree with the above conclusions. The standard score discrepancy formula was used here to successfully classify learning disabled children and slow learners. The findings thus reinforced the assertion that the current and widely accepted definition of learning disability can be consistently and successfully applied in LD classification studies. Of the 85 subjects identified as having learning problems, 93% were classified, 23.5% as learning disabled, 60% as slow learners, and 9.4% as normals. The remaining 7.1% were not classified. The fact that some of the children were not classified suggests that academic discrepancy is only a part of the LD definition, and classification procedure. The implication is that it may be possible to use some other criterion in the LD definition to classify these unclassified subjects. Such criterion may include behavioural manifestation or indications of strengths and weaknesses in learning in academic and language areas. This would involve the analysis of the specific academic subjects of the children. The fact that some of the children were not classified also suggests that learning disability may not be the only possible cause of underachievement.The unclassified subjects might have become victims of the exclusion clause.

It was observed that in any referral population, a substantial number of the referred are likely to be underachievers and the bases for discriminating between learning disabled and other underachievers are the degree of underachievement, and the amount of discrepancy between ability and achievement, (Wilson, 1985). In the present study, 93% of the referral children have been so discriminated and classified. The 7% that were not classified also recorded discrepancies between ability and achievement, but the discrepancies were not large enough to merit being classified as learning disabled. These children may be having difficulties with their school work, not because of learning disability but because of some of the exclusion factors such as educational deprivation, personality or motivational problems(Lerner,1993). Actually in the course of this research, the researcher interacted with the families of few of them by interviewing some of the parents and their children. After the interviews it became apparent that some of them lack the necessary motivation for high school performance because there was nobody in the family to encourage them, partly because both parents are illiterates or semi-illiterates,(can not read & write,or obtained education not beyond primary six); and partly because they are preoccupied with how to make ends meet and they neglected the children. **Some of these children are frustrated to the extent that they have given up trying, because of the hostile postures of their parents, teachers,and siblings toward them,and the abuses rained on them for performing poorly in school. To worsen the problems of these children some parents and teachers**

**indulge in calling them names such as "the crux or the black sheep of the family" by parents, and "the dullard or the never do well of the class" by teachers. This is where parents and teachers contribute to stigmatized labelling of these children, and actually the siblings and peers of these poorly achieving children learn to copy the name calling by parents and teachers and their attitudes towards them.**

The inference that can be made from this interview experience is that the exclusionary factors may be part of the important determinants of underachievement among Nigerian primary school children.

Some other researches, (e.g.Algozine & Ysseldyke, 1988), reported similar difference patterns in students exhibiting average overall performances across grade levels and achievement tests. In the present study, similar patterns of differences between ability and achievement were also observed in the control group. The present findings thus support the proposal that scores from average performing students should serve as controls when evaluating the demography of a discrepancy estimate. This exactly happened in the present research. Average performing children were used as controls and similar patterns of differences between ability and achievement were observed in the experimental and control groups. In some cases ability scores were higher than achievement scores, and in other cases achievement scores were higher than ability scores. In particular, for the experimental group, ability scores tended to be higher than achievement scores regardless of whether the scores were above average, average, or below average. For the control group, the reverse was the case. Achievement scores tended to be higher than ability scores.

Some researchers examined the theoretical and educational implications of the use of severe discrepancy formula in the classification of learning disabilities. One of such researchers, (Hessler,1987), argued for the conceptualization of severe discrepancy in terms of a prediction model. This according to him would have educational relevance and significance. The prediction model is based on the premise that the ability measure used for severe discrepancy should be a good predictor of academic achievement, but should not directly measure academic achievement,(Hessler,1987). The rationale behind this is that tests of intelligence are said to be the best concurrent predictors of academic achievement, without directly measuring academic achievement.It is further argued that concurrent prediction is necessary because one has to predict what can be expected academically of an individual at a particular time and not necessarily in the future. And that it is sensible to use tests of intelligence that measure the type of cognitive strategies, abilities and processing required in the academic areas, but which do not directly measure these academic areas, (Hessler, 1987). This argument was upheld in this study, in that the tests used did not measure directly academic achievement. Both tests were predictors of ability and achievement potential and they were found to be good and valid predictors.

In support of the use of discrepancy model for LD classification, some studies, (e.g. Scruggs, 1987), highlighted the advantages of the discrepancy models which included the fact that discrepancy models free the user from reliance on assessment instruments of questionable reliability and validity. In the present study, the reliability and validity of the testing measures are not in any way questionable. As a matter of fact the tests used are very reliable and valid measures. Besides, Scruggs,(1987), argued further that discrepancy models allow one to focus on academic achievement as an integral part of the classification process. He noted that the identification and classification process begins with the classroom teachers, and when mounted, LD remediation programmes are executed by the LD teachers. He therefore concluded that any model that ignores the critical role of education, and especially the teachers in Special education is destined to fail. In the present study, it was acknowledged that identification and classification process starts with the classroom teachers. They were the ones who identified the children who were having problems in the classroom, and they described the children's classroom behaviour. It was suggested that it is best to rely on the referral teachers' report, which will be supported by discrepancy data, to identify the presence of LD. This procedure was followed in this research and it was possible to classify the children identified as having problems with school learning as either learning disabled or slow learners.

One of the theories used to explain learning disability is the theory of developmental lag. According to this theory, learning disabled children are considered too young for the academic rigours of school, (Ames, 1983). According to Wong, (1988), the educational implications of the developmental lag hypothesis are straight forward, and that studies, (e.g. Tarver et al, 1976; 1977) which support the hypothesis consistently indicate that the learning disabled and the normal children show qualitatively similar developmental patterns. She therefore presumed that instructional methods which promote learning in the normal child would also promote learning in the learning disabled child. The fact that normal children and learning disabled children have similar developmental patterns is reflected in the results of the present study. The pattern of differences between ability and achievement were similar for both the experimental and control groups. The major difference between the two groups was the fact that the learning disabled children were achieving below the average of their age groups and they recorded significant discrepancies between ability and achievement. For the control group however, the trend observed was that more of them had higher achievement scores. The implication of this is that either the children are possibly pushing themselves harder at their school work than their present level of ability dictates, or they are being pushed by the school as indicated by their syllabus or curriculum. This self imposed or forced acceleration is equally evident in the performances of slow learners. For example, 33,(64.7%) of the slow learners had higher achievement scores. This trend in the results is not surprising especially when put within the concept of educational practice in Nigeria. **It is only in the public school that the age of school entry is put at 6yrs. In the private schools the age of entry into primary 1 is 5yrs. Even with this some parents still do false declaration of age for children less than 5yrs just because they want to accelerate the education of their children. Besides neglect, this is another area where parents contribute to poor academic performance of their children. This is because such acceleration is not based on normal developmental pace, and as such it does not last, and in the long run results in deceleration and frustration on the part of the children.**

From another perspective, the fact that a number of the slow learners in this study had higher achievement scores than ability scores indicated that main streaming is good for them and remains the best educational approach for special children. Main streaming is a classroom situation in which the special children are not separated from their colleagues. Rather they remain in the class and are taught in the same way as their colleagues, except in those subjects in which they are weak. For these subjects, they are given special training and teaching in resource rooms and the teaching is tailored to their level of understanding and pace of learning.It has been found that regular school attendance produced improved behaviour in slow learners and tended to help them make greater gains in mental age compared to those with lower IQS and those who are not in regular school, (Semmel, Abernathy, Butera, & Lesar, 1991, Bateman, 1992; Smith, 1991). The results of the present research further confirms this finding. The slow learners made greater gains in achievement while in the regular classroom. Though the slow learners tend to have lower rate of ability development, being in the regular classroom allows them to improve their achievement potential.

It was also hypothesized in study II that: **(I)there will be positive and significant correlation between children's CPM and CAT test scores; and (ii) positive and significant correlation between children's VMI and CAT test scores to indicate that both tests can predict scholastic achievement.**

From the results, significant but low correlations were recorded between CPM and CAT test scores, and between VMI and CAT test scores especially when compared to other coefficients obtained in the research. It was also observed that the coefficient for CAT and CPM was bigger than that for CAT and VMI. These results confirmed the two hypotheses above and affirmed that CPM and VMI tests are good predictors of scholastic achievement.

The reason for the low coefficients discussed above may be that the CAT is assessing specific knowledge while the CPM and the VMI are assessing general knowledge. The fact that the correlation between CAT and CPM is bigger than that between CAT and VMi may mean that the factors being assessed by CAT and CPM are more related than that being assessed by CAT and VMI. The implication of this is that the underlying functions and knowledge areas being assessed by the three tests do not perfectly match. This supports the argument that content related standardized achievement tests may bring about the problem of mismatch between the content of the test and the local school curriculum content and its sequence, (Gickling, & Thompson 1985; Anastasi, 1988). This means that if content related tests have been used in this study the correlations between them and CAT would have been much lower than what they are now and possibly not significant or might have even be negative values especially if they are assessing very dis-similar knowledge areas. Another reason for the low correlation between CAT, CPM and VMI scores might be that at the time they were being tested the children were not at their optimal performance level or they were not achieving at their expected level of achievement, and this might have lowered their performance scores. Their inability to achieve at their expected level may be due to many factors including fatigue, sickness, emotional disturbance, lack of motivation, family disorganisations to mention a few. Their level of preparedness at the time of the current testing might have been higher and better. From the researcher's observation many of the children were very excited about the CPM and VMI tests being devoid of the usual academic contents. This made the children to be relaxed and composed when doing the tests.

It was also hypothesized in study II that: **there will be a positive & significant correlation between children's CPM & VMI test scores to re-affirm the concurrent validity of the tests.**

The results indicated a high, positive, and significant correlation between the children's scores in these tests, thereby confirming this hypothesis and re-affirming the concurrent validity of CPM and VMI tests.

A critical look at table 14 revealed that the un-empirical method of classification of children with learning problems though reliable to some extent can lead to misclassification if used alone. Half or 50% of those classified by this method as learning disabled were wrongly classified and 19% of those classified as slow learners were wrongly classified such that some normal children were classified wrongly.The implication here is that to eliminate this problem the empirical method must accompany the un-empirical method.This will ensure that any suspect children are adequately diagnosed and classified.

To summarize therefore the standard score procedure combined with discrepancy analysis made it possible to identify and classify children with learning difficulties into either the learning disabled group or the slow learner group. Since the identification and classification of LD children using the standard score approach is the initial step in the classification process, the testing instruments used in this research have been found to be useful in accomplishing this initial task.

# CHAPTER FIVE

# GENERAL DISCUSSION AND CONCLUSION

## Discussion

The main objectives of this research were:

(I) to establish assessment and classification procedures applicable in Nigeria for school based learning problems

(ii) and use the established procedures to classify some school children identified as having learning problems.

Two studies were conducted to realize these objectives. In establishing the assessment and classification procedures, two tests namely Raven's Coloured Progressive Matrices (CPM), and Beery's Visual Motor Integration (VMI), Tests were standardized among Lagos primary school children. The CPM was standardized as an Intelligence Test and the VMI was standardized as an Achievement Test. Both Tests are non verbal and non numerical. They do not measure intelligence and achievement directly, rather intelligence and achievement are inferred from the performances of children in these tests. Developmental trends were documented for Nigerian primary school children in these tests. Validity and Reliability studies were carried out on both tests. The Bender Visual Gestalt Test and the Draw a Man Test were used to establish the construct, predictive, and concurrent validities of CPM and VMI tests using the Pearson Product Moment Correlation Statistic. Test retest and odd and even correlation coefficients were calculated to establish the reliabilities of the two tests. The current classroom achievement test scores of children were correlated with their scores in CPM and VMI tests to establish the degree of their relationship and validate CPM and VMI tests as predictors of scholastic achievement. Discrepancy analyses were carried out on test scores of children identified as having learning problems and based on the analyses they were classified.

The first study therefore dealt with the establishment of developmental trends for the two tests using age as the independent variable. Thus the first was a standardization study, and the following results were obtained:

(1) Performances of children aged 6 to 11.5yrs in Coloured Progressive Matrices (CPM) and Visual Motor Integration (VMI) Tests increased with age.

(2) A positive and significant correlation was found between the performances of these children in Coloured Progressive Matrices and Visual Motor Integration tests.

(3) Positive, high, and significant correlations were found between the children's performances in Coloured Progressive Matrices test, Goodenough Draw a Man Test, and Bender Visual Gestalt Test.

(4) Positive high and significant correlations were found between the children's performances in Beery's Visual Motor Integration Test,Goodenough Draw a Man Test, and Bender Visual Gestalt Test.

(5) Positive and significant correlations were found between children's test and retest scores in CPM and VMI Tests.

(6) There were positive and significant correlations between odd & even numbered item scores in CPM & VMI Tests.

(7) The inter-scorer reliability coefficient for the VMI Test was high and significant.

These results confirmed that:

The two tests (CPM)&(VMI) are developmental tests with high concurrent validity. The (CPM) has high construct validity, as a non verbal test of intellectual ability.

The(VMI) test has high concurrent validity as a measure of achievement, and high predictive validity as a predictor of achievement.

The Cpm and the VMI tests are very reliable with high split half and test-retest reliability coefficients. The implication of these results is that the CPM and the VMI can be consistently used for screening children with learning problems with the aim of classifying them.

Theoretically, the developmental progression in children's performances recorded for both the CPM and VMI supports Piaget's theory of stages of maturational development. Piaget postulated the following:

I That cognitive growth occurs in a series of invariant and interdependent stages;

ii That the child's ability to think and learn changes with age through a series of developmental stages;

iii That the quantity, quality, depth and breadth of learning that occurs are a function of the stages during which the learning takes place.

The fact that the items in the two tests were arranged in increasing order of difficulty and the children's performances increased in this order reflected the increasing maturational development of children's ability as postulated by Piaget,with increasing quality, depth, and breadth of thinking and learning in the children. This trend also confirmed the hierarchical nature of children's mental development.In terms of application, the fact that the Nigerian norms in the two tests CPM and VMI compare favourably with norms established in other places in the

West and East like UK, USA, Germany, reflects the universal nature of non-verbal general intelligence and the fact that this measure of general intelligence is as good as any other measure of general intelligence. These results also support the claim of the "culture fair" nature of these tests which make them applicable any where in the world.

Similarly the certification of CPM and VMI as valid predictors of intellectual capacity and achievement potential, and the fact that they measure the current functioning of the children tested made the tests to be useful and adoptable screening instruments, for intellect and achievement, and since the VMI assesses current functioning and achievement potential, it can be used to detect underachievement. This was part of the study II.

The objective of study II was to confirm the under-achievement of children identified as under-achievers. The discrepancy analysis was used to classify them into groups. In doing this, the following results were obtained:

I Children who scored at least average in intelligence test and below average in achievement test, and who had significant discrepancy between ability and achievement scores were classified as learning disabled.

ii Children who scored below average in both ability and achievement tests were classified as slow learners.

iii Those children whose discrepancy scores were not significant were not classified.

iv Those children who scored at least average in both the ability and achievement tests were classified as normally achieving children.

v A positive and significant correlation was found between the CPM and VMI test scores of children in study II. This re-established the concurrent validity of the two tests.

vi A positive and significant correlation was found between the current classroom achievement test (CAT) scores of the children as denoted by the preceding year aggregate percentage scores and their CPM and VMI test scores.

It was observed that in the Experimental group some of the subjects were classified as normals.This suggested that under-achievement can be caused by other factors beside LD. It has actually been stated that some psychological factors may consciously or unconsciously interact with school experiences to produce a condition of under-achievement. Such factors may include the fact that:

(a) The child may not wish to excel more than the parents (no motivation to do better).

(b) The family environment may be too chaotic to allow the child to study at home.

© Under-achievement may be a means by which a child retaliates against parents who press too strongly for achievement

(d) The child's energies may be overcommited in dealing with family conflicts such that little time is left for school, (Gardner, & Sperry, 1974; Surran, & Rizzo, 1979).

It is possible therefore that any of the above listed psychological factors or a combination of them may be responsible for the under-achievement of the normal children identified as under-achievers in the experimental group. Sometimes in the absence of the above stated factors, the child may still be consistently not mentally ready for terminal examinations.They may suffer from test anxiety and if there is nobody to allay the child's fear of examination and failure it becomes a constant source of under-achievement. Emotional upset arising from stressful situations such as hunger, waking up very early, travelling long distances to school, forcing them to do academic tasks for which they are not mentally ready in school, and some children have lost interest or they are just not interested in going to school, and with no encouragement from others, such children are not likely to do well in school even if they are bright. These and other problems of everyday living can be constant sources of under-achievement for normally achieving children and can compound the problems of the LD children. It is necessary however to remember that while these conditions affect some children drastically, it may not affect others so much because of different levels of stress endurance.

On the other hand, the under-achievement of the normally achieving children may be a reflection of the repercussion of forced acceleration imposed on them earlier. It was observed in the results that for the normally achieving children in the control group, achievement scores were higher than ability scores for more subjects. This indicated that these children are achieving higher than their ability level, and this may be due to the forced acceleration imposed on them by (a) parents through false declaration of age; (b) the school curriculum, through the coercion of their teachers. Initially such children would perform well up to a point until frustration begins to set in and they become dis-interested, and they begin to perform poorly.

By looking at the theory of maturational lag from a perspective different from the one discussed earlier, the fact that the learning disabled children's achievement scores were lower than their ability scores also indicated maturational lag on their part. Maturational lag in this sense is reflected in a slowness in certain aspects of neurological development, and that each individual has a preset rate of growth for various human functions including cognitive abilities, (Bender, 1957). Discrepancies among the various abilities are said to reflect the different rates of maturing of these abilities (Lerner,1993), and since general and not specific ability was addressed in this research, discrepancies between ability and achievement scores evidenced by higher ability scores suggested maturational lag, and support the maturational lag theory. It was reasoned that because there were maturational delays in some cognitive abilities, these affected the general achievement levels of the children concerned and were achieving below their ability levels. It is evident from the explanation above that there was no specification as to which abilities were developing at a slower rate, but if one examines the subjects which these LD children were performing poorly in, one would identify the abilities that are developing slowly. For example in the LD sample in this study it was evident from their classroom achievement records that many of them have problems with some aspects of English language, such as comprehension, vocabulary and reading. Others have problems with aspects of mathematics, such as group inclusion, calculation and number positions. For such children one can assume that their language and mathematical abilities are developing slowly. The fact that the Nigerian children are bilingual made their language problem worse. The exposure of these children to a minimum of two languages simultaneously made them to be master of none for an appreciable length of time, (Opoku,1985; Akinsola,1993). This is because the stronger language, (the mother tongue) interferes with the weaker one, (English), during comprehension activities, and this interference affects the mastery of the two languages.

It has been suggested, and the above observation supported this suggestion that a maturational lag can actually intensify the learning problem,(Kirk, 1967). It was argued that during the growing stages, a child normally tend to perform in functions that are comfortable and avoids those that are uncomfortable. And because certain processes lagged in maturation and are not functioning adequately, the child avoids and withdraws from activities requiring those abilities. As a result the neglected functions fail to develop and the disability becomes intensified and exaggerated. In the present research, this argument was true for some of the children. From the reports obtained from the teachers of the children that have learning problems, some of them were reported to be inactive and inattentive in class especially during the periods for those subjects in which they are weak. Also some of them were reported to be generally inactive and inattentive during teaching periods for most subjects. The first description fitted the learning disabled group, and the second description fitted the slow learner group. It was further reported that the children deteriorate from one term to another, and this also is reflected in their scores for the failed subjects across the terms. This was an indication that their learning problems were getting worse and intensified.
Also the encounter of the researcher with one LD boy who was 14yrs old and could not read a word that is more than three letters confirmed the argument that some lagging processes may fail to develop and thereby intensify the learning disability. For this boy, his reading ability was lagging and must have been neglected to the extent that it has intensified his learning problem such that he could no longer cope in the secondary school in which he was, without intensive remediation programme.

Closely related to the theory of maturational lag is the concept of readiness. The concept of readiness refers to the state of maturational development that is needed before some desired skill can be learned,(Lerner, 1993). For instance, a child must be able to speak before he/she can learn to pronounce words correctly. So teaching a child who can not speak to pronounce words is futile. Similarly, a student must have acquired certain mathematics skills and knowledge to be able to gain from a special course in mathematics called calculus. It was further stated that readiness skills are picked up in an incidental fashion by normal learners, and that those with learning problems would need special attention to help them gain and strengthen the readiness abilities they would need for their next step of learning,(Lerner, 1993). For the children with learning problems in this study this special attention was not provided, rather, what they were experiencing was forced pushing either from themselves as a result of pressure from their parents, or from the school curriculum operated by their teachers, which forces them to perform academic tasks for which they were not ready. In the process they get frustrated, dis-interested and become emotionally over burdened. This emotional situation is usually called " Emotional Overlay". Emotional overlay is used to describe adverse emotional and behavioural problems that develop as a function of a learning disorder. The term "overlay" is used to indicate that the emotional and behavioural problems are literally superimposed on the learning disorder. So emotional overlay may either manifest as a conduct-behaviour problem, or as an emotional problem. Those who exhibit conduct behaviour problems as a result of their inability to learn easily are those who are aggressive with peers, unresponsive to conventional classroom management, or are seen as clowns by teachers, or they constantly seek attention from teachers and peers. Those who exhibit emotional problems are those who show anxiety, frustration, and anger towards the learning situation,(Suran, & Rizzo, 1979). The children's poor performances generate unfavourable attitudes and reactions from others around them. **Such attitudes and reactions include disappointment and name calling or labelling on the part of parents, mis-understanding and labelling on the part of teachers, and ridicule from peers. Indeed, interviews conducted by the researcher with some of the parents of the children, revealed that the parents are unhappy about the situation.Some of them see the children as the "black sheep of the family" or "the cross of the family" or "the headache of the family" and so on.Some of the teachers see the children as playful, not pulling their weight or they are "the never do well" of the class especially the slow learners. This is where parents and teachers contribute to the labelling of such children and encourage other children (siblings & peers) to do likewise.** The emotional burden imposed on the children by the attitude of others, described above, towards them can affect their sense of pride, self esteem and self worth. It is maintained that the longer the children with learning problems remain un-identified, mis-understood and not helped, the greater the likelihood of possible adverse emotional consequences. This possibility bring into focus the danger in the current system of Nigerian Educational practice and the urgent need for change so as to alleviate the sufferings of these children and others like them and in the long term harness the national human resources.

Another theory that is relevant to the explanation of the performances of the children in study II is the cognitive behaviour modification model, and in particular the learning styles of the children studied. A child's learning style refers to his/her general behaviour, attitude and temperament when presented with a learning task. It is argued that the learning styles in an academic situation influence the effectiveness of learning, and that a child may have an active/passive or reflective/impulsive learning style. It is assumed that efficient learners have active and reflective learning styles,(Lerner, 1993). In the present research, active and reflective learning styles were observed among the control group participants. When they were doing the CPM test, they were very active in the demonstration section where the problems were collectively solved together. They were very eager to participate, looked very well at the pictures and compared them before they chose their answers. They continued with the reflective approach when solving the rest of the problems.

The contrary was the case for the participants in the experimental group. Most of them were impulsive and passive in their approach to problem solving. They were not eager to participate in the demonstration section of the CPM test, and they were impatient to wait for others to do the exercise collectively, not because they know the answers but because, that is their approach to learning,(impulsive approach). So they just went ahead and impulsively filled in their own answers until they were slowed down by the examiner, and by so doing they demonstrated both passiveness and impulsiveness.

**Implications of the Research**

This research has documented developmental trends in Coloured Progressive Matrices (CPM), and Visual Motor Integration (VMI) tests for Lagos urban primary school children. The documentation has provided a new, valid, and reliable approach to diagnosing, identifying, and classifying learning problems in Nigerian primary school children.

The results obtained in this research has brought into focus the urgent need for the establishment of educational therapy and resource centres that will provide special education services for Nigerian children. The special services will be directed at:

(I) identifying, confirming and classifying learning problems,

(ii) implementing realistic and effective intervention strategies for rectifying the learning problems.

The results of this research have also brought into focus the urgent need for the expansion of special education programmes already in the Nigerian educational policy to accommodate special programmes for the groups of children identified and classified in this research, and to include these programmes in the Nigerian school curriculum. By so doing:

1) It will be possible as a first step to identify on a large and national scale children with learning difficulties.
2) The identification in (1) above will allow for the categorization of learning difficulties.
3) The categorization in (2) above would lead to the determination of the specific nature of the problems encountered by these children, through further and more detailed assessment procedures.
4) The determination of the children's specific problems would lead to the identification of causes of these problems, and

the determination of effective intervention procedures that can remediate the learning problems.

5) The identification of such intervention procedures would encourage its inclusion in the school curriculum, and its implementation at the national level.

The implementation of special Educational programmes of the kind enumerated above would help in sensitizing parents about the need for them to take more active interest in the development of their children by following closely their children's progress, so that they can team up with the teachers to identify early, children that are susceptible to under-achievement, and put in place the necessary remediation programmes.

The identification of causes of learning problems in school especially those due to developmental lag would help parents to realize the dangers in some of their practices of attempting to speed up the education of their children, since such children are not mentally ready for acceleration. The identification of causes of learning problems due to emotional upset would sensitize parents toward adjusting their disposition towards their children and help them to overcome the problems. The identification of causes of learning problems due to mass instruction would help teachers to recognize the problems inherent in the current instructional methods adopted by them, and the need to modify these methods for the greater benefits of their students and for them to achieve better results from their efforts.

The implementation of this type of educational programme nationally would sensitize both parents and teachers to motivate their children and pupils and make learning interesting, enjoyable, and worthwhile for these children. A corollary to this would be that the success of this type of programme requires adequate funding and remuneration of teachers and educators that would implement the programmes, as well as the dedication of the executors of the programmes.

The short term effect of the implementation of the above programmes is the alleviation of the sufferings of children with learning problems by classifying them and helping them out through differential intervention programmes. The long term effect would be an appreciable reduction in the present high rate of "school drop outs", and consequently crime, and a better utilization of the national human resources.

**Limitations of the Research**

One of the limitations of this research has to do with the constraints imposed by the large number of children per group per testing session, time duration imposed by the various schools sampled, and non availability of space and furniture. Concerning time constraint, the authorities of all the schools sampled gave permission to carry out the testing for a maximum period of one week each, and they restricted the time of testing each day to about two hours and usually after lunch break. Concerning space, all the public schools sampled were over crowded and there was shortage of furniture. In most cases pupils' chairs meant for two pupils were being used by four or five pupils with over fifty pupils in each class. As such it was not easy for the schools to make many classrooms available for the testing since there would be no place to put the pupils displaced. In most cases only one or at most two classrooms were provided for the testing with two pupils sitting on a chair. The ideal situation would have been one pupil per chair. This would have allowed for total independent working and comfort on the part of the pupils, and this would have enhanced their performances. This was not attainable in the prevailing situation and this must have adversely affected the children's performances in the tests, and lower their performance scores. Further more the size of 25 per group was too large for effective management in such a testing situation most especially at the younger age levels (primaries 1 to 3). It is therefore suggested that the size should be reduced to ten in case of further research involving group testing and these tests.

In the study II there were similar constraints of time, space, and furniture. So the testing was carried out in groups of twenty. It was however observed that most of the participants had to be individually attended to. This was because of the many mistakes which they made that indicated that they did not benefit from group instructions. So the testing sessions took much longer than usual and the sessions were energy sapping on the part of the examiners. So for further studies such children must be tested individually.

Another limitation of this research was that for few of the subjects both in the standardization and classification samples, their exact ages could not be determined. This was because for these few children only the year of birth was obtainable both from the school and the parents. As such their ages were determined according to year and not date of birth. This has to be guarded against in future studies.

**Conclusion**

The general conclusion to be drawn from these results is that children with learning problems especially those with special instructional needs ,(the learning disabled & the slow learners), are present in Nigerian school children population. These groups of children can be identified and classified. To make these children to be useful to themselves and the society at large, they need immediate attention and help in terms of identification, classification, and intervention. The results of this research have thus brought into focus an awareness of the presence of these children in the society and the urgent need to address their problems. This can only be achieved if the Nigerian educational policy makers make provisions in the policy for the identification and classification of these children, and the remediation of their problems. This should not be difficult to achieve because there is already in existence a policy on special education that caters for the physically disabled and the gifted. What is needed is to expand and modify this policy to include and incorporate these other groups of special children. Fortunately the first step has been achieved by the results of this research. The government and other educational agencies only need to build on this and follow it up. If this can be achieved it will go a long way in reducing the alarming rate of incidences of "school drop outs" and crime in the nation, reduce the human resources waste and maximize the usefulness of the available national human resources.

For further studies, there would be need to identify other characteristics besides intelligence & achievement that differentiate between LD, slow learners, and normal children. This would make identification and classification easier and clearer. It would also be necessary to explore intervention strategies that would be most beneficial for these children. This would require, the identification of academic weak areas, to pave way for adequate intervention planning and remediation.

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# APPENDIX I.
## Short Scoring Guide* For Draw A Man Test.

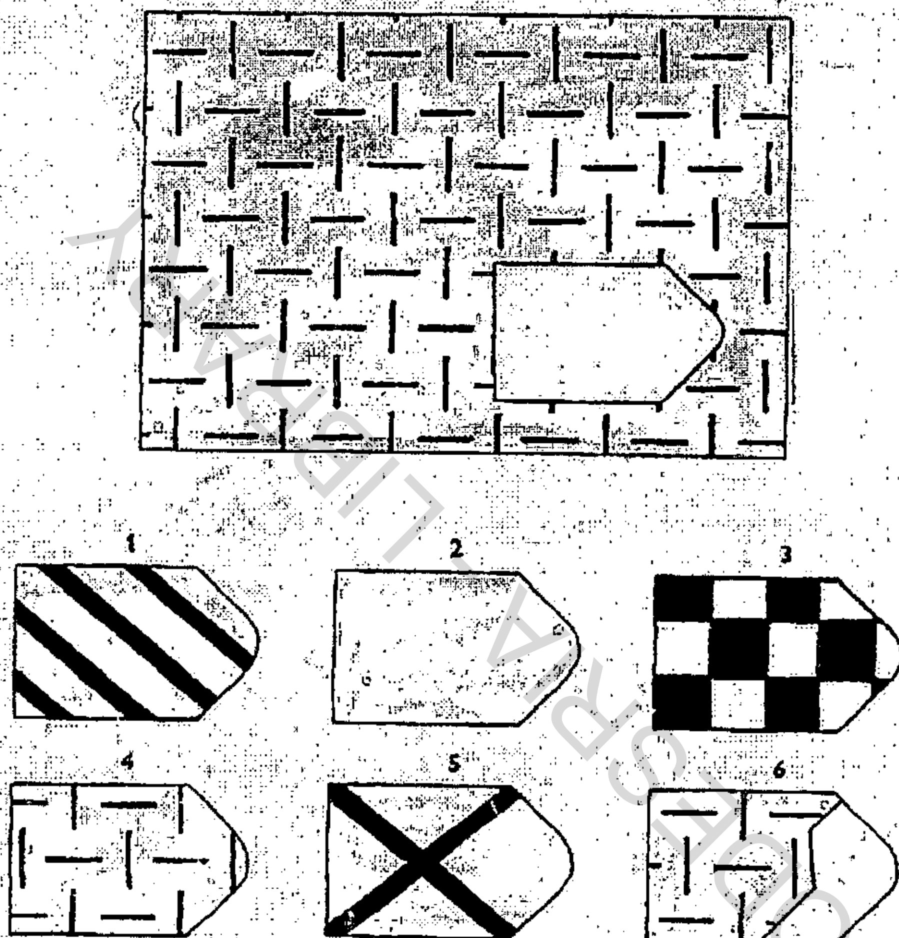
MAN POINT SCALE

1. Head present
2. Neck present
3. Neck, two dimensions
4. Eyes present
5. Eye detail: brow or lashes
6. Eye detail: pupil
7. Eye detail: proportion
8. Eye detail: glance
9. Nose present
10. Nose, two dimensions
11. Mouth present
12. Lips, two dimensions
13. Both nose and lips in two dimensions
14. Both chin and forehead shown
15. Projection of chin shown; chin clearly differentiated from lower lip
16. Line of jaw indicated
17. Bridge of nose
18. Hair I
19. Hair II
20. Hair III
21. Hair IV
22. Ears present
23. Ears present: proportion and position
24. Fingers present
25. Correct number of fingers shown
26. Detail of fingers correct
27. Opposition of thumb shown
28. Hands present
29. Wrist or ankle shown
30. Arms present
31. Shoulders I
32. Shoulders II
33. Arms at side or engaged in activity
34. Elbow joint shown
35. Legs present
36. Hip I (crotch)
37. Hip II
38. Knee joint shown
39. Feet I: any indication
40. Feet II: proportion
41. Feet III: heel
42. Feet IV: perspective
43. Feet V: detail
44. Attachment of arms and legs I
45. Attachment of arms and legs II
46. Trunk present
47. Trunk in proportion, two dimensions
48. Proportion: head I
49. Proportion: head II
50. Proportion: face
51. Proportion: arms I
52. Proportion: arms II
53. Proportion: legs
54. Proportion: limbs in two dimensions
55. Clothing I
56. Clothing II
57. Clothing III
58. Clothing IV
59. Clothing V
60. Profile I
61. Profile II
62. Full face
63. Motor coordination: lines
64. Motor coordination: junctures
65. Superior motor coordination
66. Directed lines and form: head outline
67. Directed lines and form: trunk outline
68. Directed lines and form: arms and legs
69. Directed lines and form: facial features
70. "Sketching" technique
71. "Modeling" technique
72. Arm movement
73. Leg movement

* For use only after the scoring requirements have been mastered.

# SET A

A1



## COLOURED PROGRESSIVE MATRICES
## ANSWER SHEET

NAME: ______________________ SEX: ________

SCHOOL: ______________________ CLASS: ________

EXAMINER: ______________________

DATE OF TEST: ________ DAY ________ MONTH ________ YEAR

AGE: ________ YEARS ________ MONTHS

DATE OF BIRTH: ________ DAY ________ MONTH ________ YEAR

| A | | AB | | B | | C | | D | | E | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 2 | | 2 | | 2 | | 2 | | 2 | | 2 | |
| 3 | | 3 | | 3 | | 3 | | 3 | | 3 | |
| 4 | | 4 | | 4 | | 4 | | 4 | | 4 | |
| 5 | | 5 | | 5 | | 5 | | 5 | | 5 | |
| 6 | | 6 | | 6 | | 6 | | 6 | | 6 | |
| 7 | | 7 | | 7 | | 7 | | 7 | | 7 | |
| 8 | | 8 | | 8 | | 8 | | 8 | | 8 | |
| 9 | | 9 | | 9 | | 9 | | 9 | | 9 | |
| 10 | | 10 | | 10 | | 10 | | 10 | | 10 | |
| 11 | | 11 | | 11 | | 11 | | 11 | | 11 | |
| 12 | | 12 | | 12 | | 12 | | 12 | | 12 | |
| | | | | | | | | | | | |

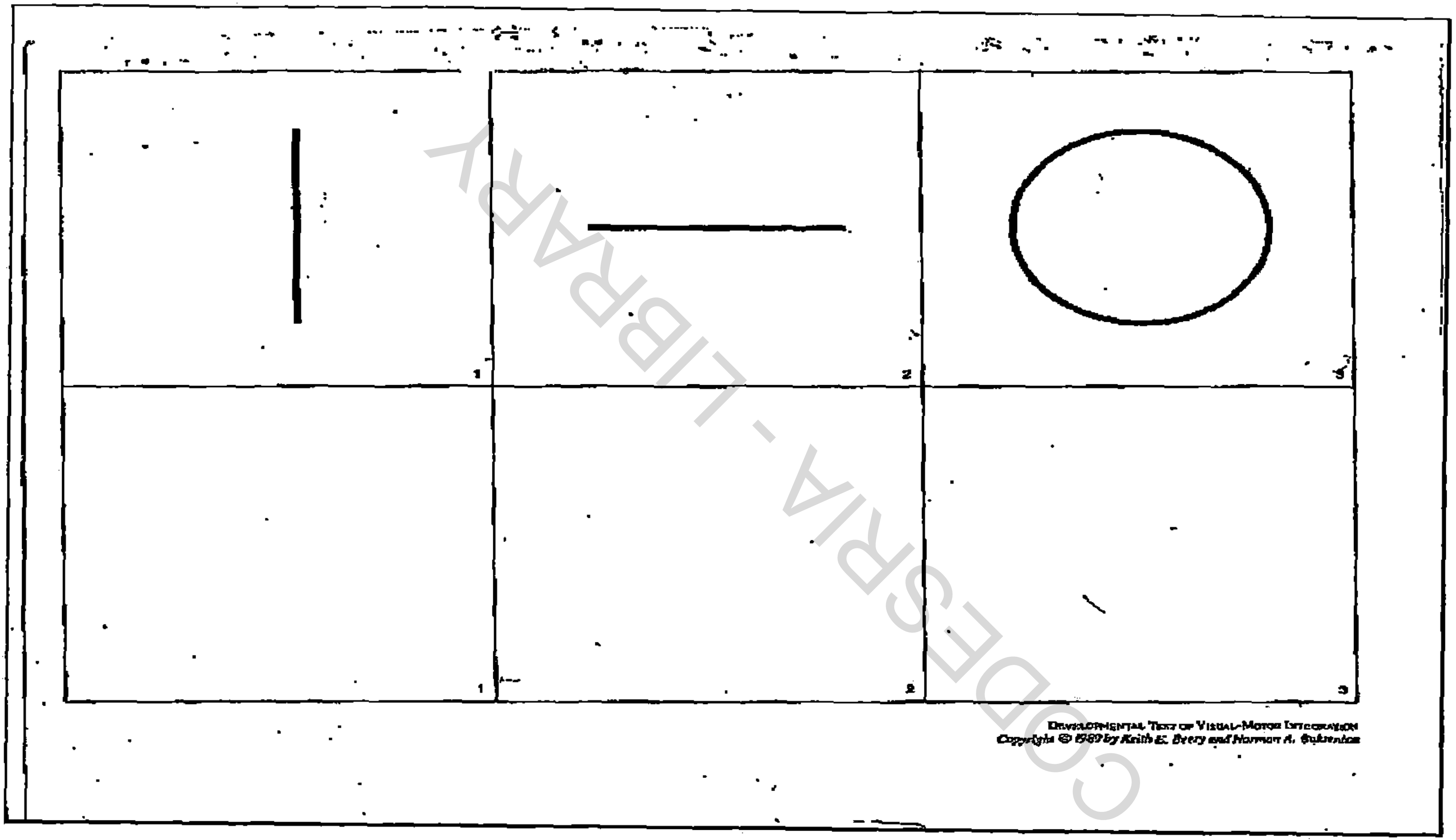
TIME TEST BEGIN ______________________

TIME TEST ENDED ______________________

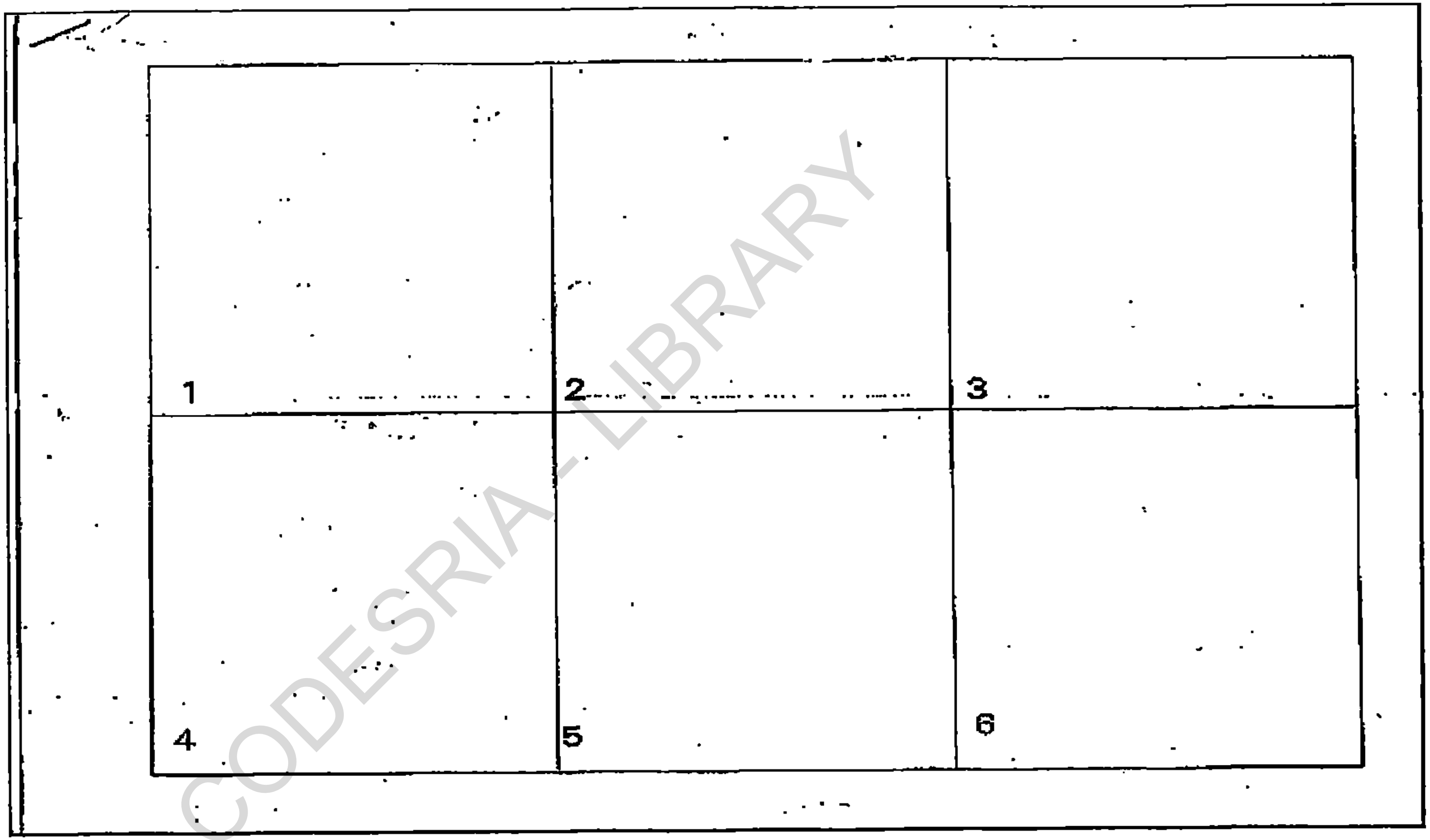
TOTAL SCORE ______________________

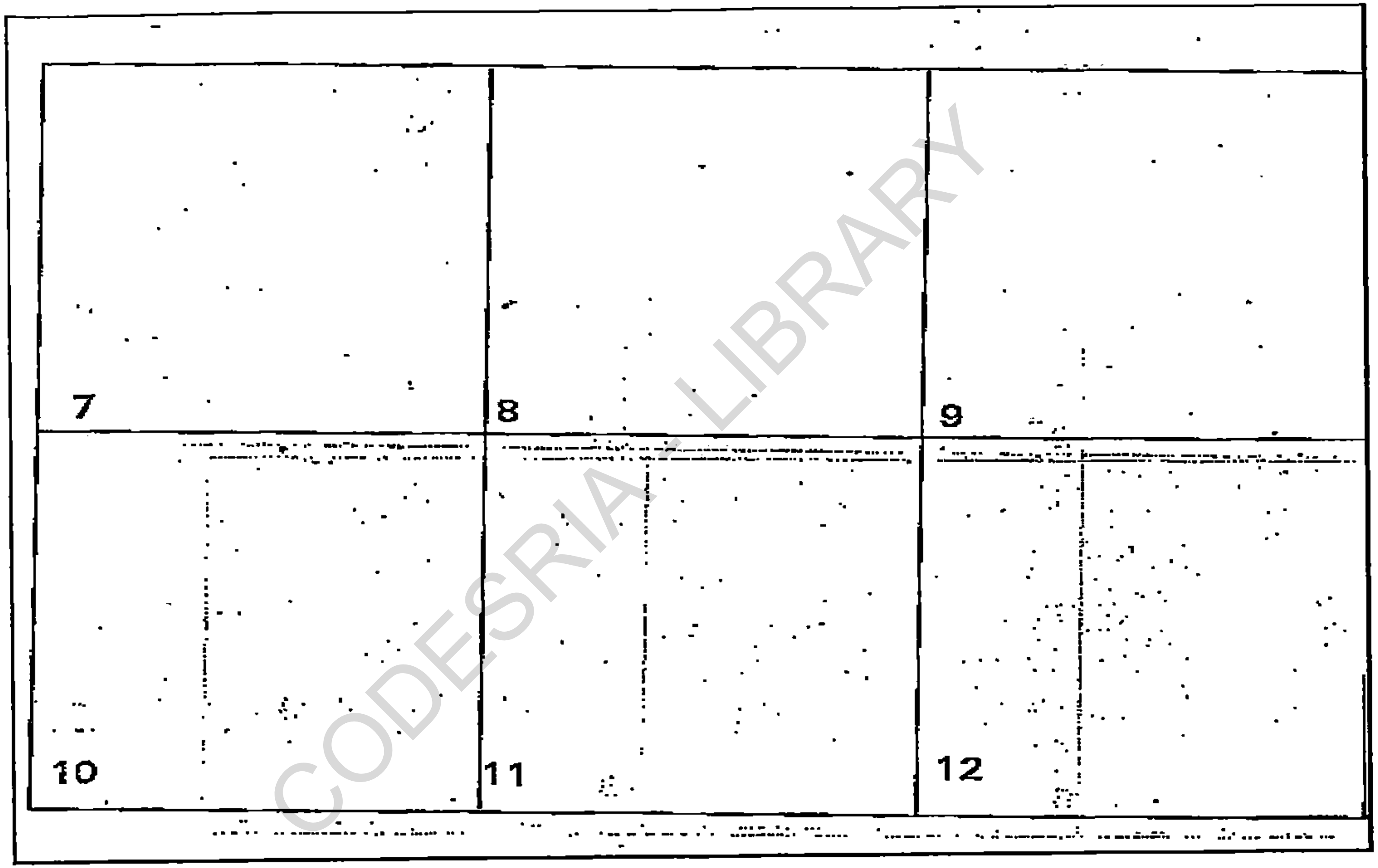
PERCENTILE ______________________

APPENDIX IV.


1
2
3
1
2
3
Developmental Test of Visual-Motor Integration
Copyright © 1989 by Keith E. Beery and Norman A. Buktenica

APPENDIX V.




7
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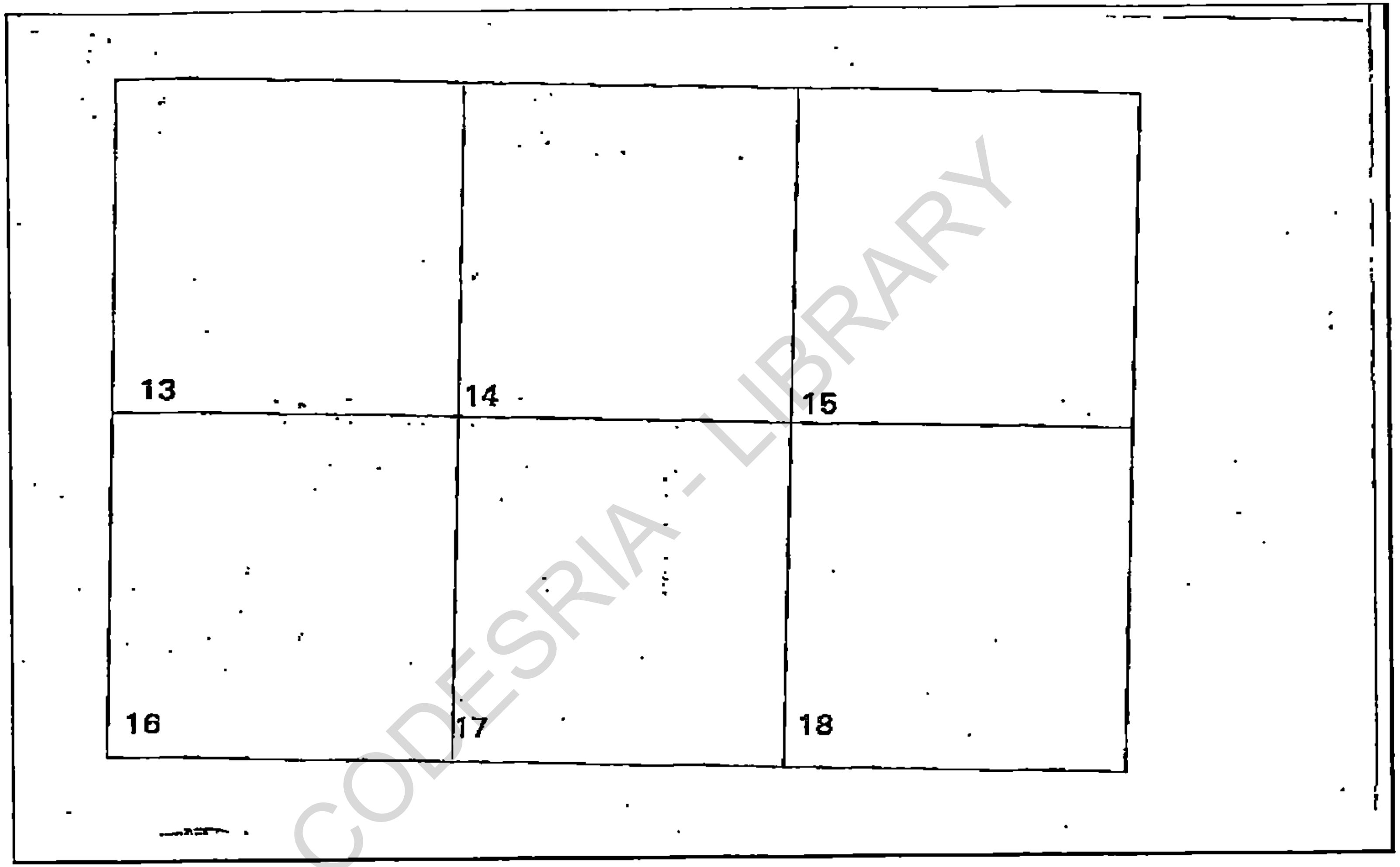
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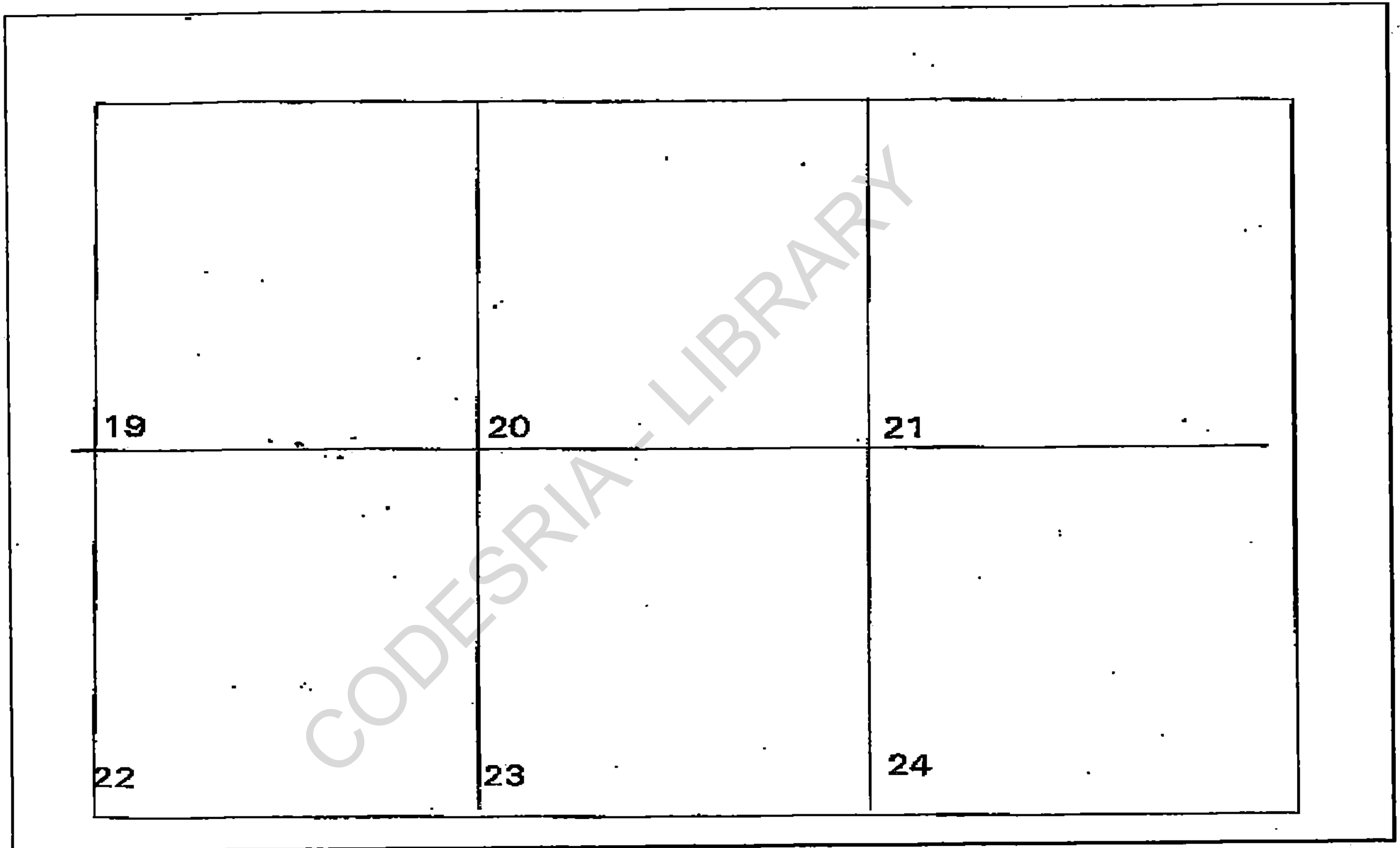
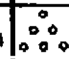
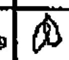
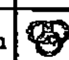
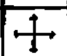
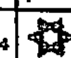

19
20
21
22
23
24

APPENDIX VI.

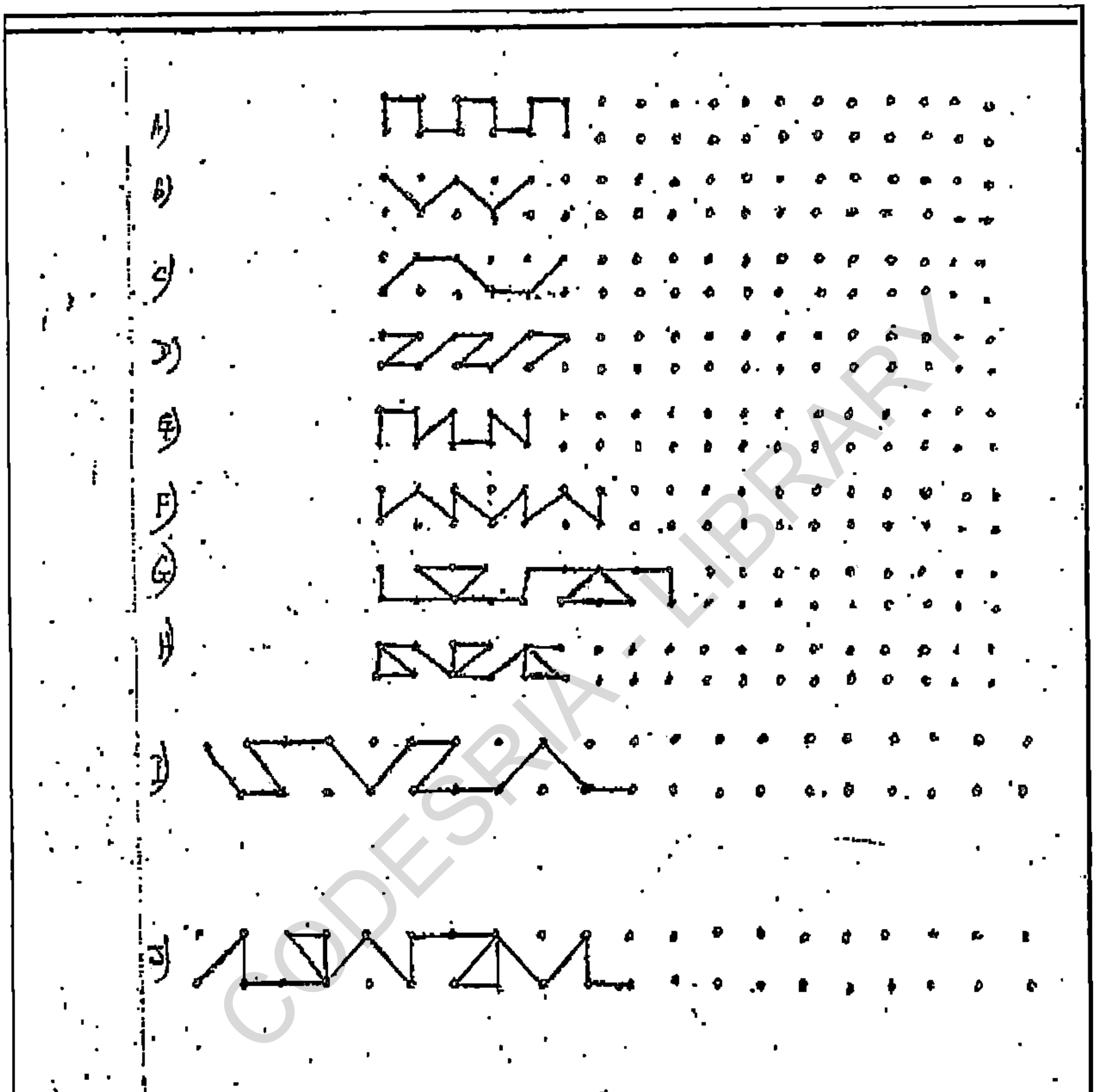
## VMI Recording and Scoring

| No. | Form | Age Norm Value | Score | Observations | No. | Form | Age Norm Value | Score | Observations |
|---|---|---|---|---|---|---|---|---|---|
| 1 |  | 2-10 1 | | | 13 |  | 6-8 2 | | |
| 2 |  | 3-0 1 | | | 14 |  | 7-5 4 | | |
| 3 |  | 4-0 1 | | | 15 |  | 7-11 2 | | |
| 4 |  | 4-1 1 | | | 16 |  | 8-1 3 | | |
| 5 |  | 4-4 1 | | | 17 |  | 8-11 3 | | |
| 6 |  | 4-6 1 | | | 18 |  | 9-6 3 | | |
| 7 |  | 4-7 1 | | | 19 |  | 10-2 3 | | |
| 8 |  | 4-11 1 | | | 20 |  | 10-11 3 | | |
| 9 |  | 5-3 1 | | | 21 |  | 11-2 3 | | |
| 10 |  | 5-6 1 | | | 22 |  | 12-8 4 | | |
| 11 |  | 5-9 2 | | | 23 |  | 13-2 4 | | |
| 12 |  | 6-5 2 | | | 24 |  | 13-8 4 | | |

VMI Raw Score = total points scored up to 3 consecutive No Scores: [ ] See the 1989 VMI Manual for norms.

## APPENDIX VII
## BENDER-GESTALT TEST SAMPLE

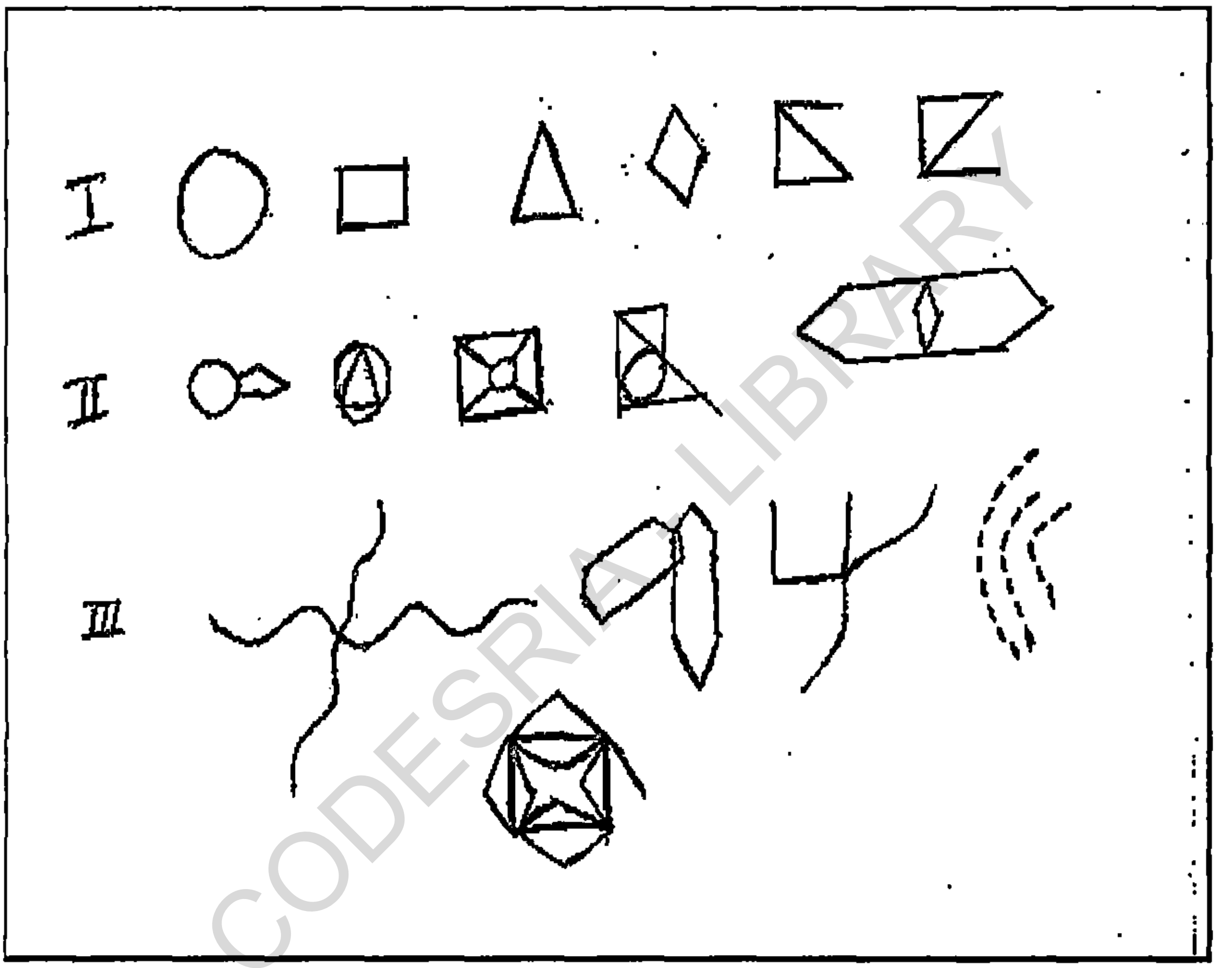
Continue the patterns drawn below by linking the dots using pencil.




Name:---
Date of Birth:---
Data Date:-----

## APPENDIX VIII
## GESTALT DESIGN COPYING TEST.

Given the difference designs below, copy exactly the same designs on your answer sheets. Make sure that what you copy resembles very much what you see.



## APPENDIX IX

The calculation of the strength of association between the independent and dependent variables in the first phase of the study are shown below: Source: Shavelson, 1988, pp 361-364.

The strength of association is denoted by "OMEGA - SQUARED ( $W^2$)". The formula for calculating the OMEGA - SQUARED is given below:

$$W^2 = \frac{\text{SSbetw.} - (K-1)\ \text{MSwithin}}{\text{SStotal} + \text{Mswithin}}$$

where Ssbetw. = Sums of Squares between groups
K = Number of treatment groups.
MS = Mean square for within treatment groups.
SStotal = Sums of Squares total.

For the Coloured Progressive Matrices Test (CPM) :

Ssbetw = 27863.09
K = 12
Mswithin = 11.74
Sstotal = 43864.21

$$W^2 = \frac{27863.09 - (12 - 1)\ 11.74}{43864.21 + 11.74}$$

$$= \frac{27863.09 - 129.14}{43875.95}$$

$$= \frac{27733.95}{43875.95}$$

$$= 0.63$$

$$W^2_{CPM} = \underline{0.63}$$

For the Visual - Integration Test (VMI) :

Ssbetw. = 79206.45
K = 12
Mswithin = 27.89
Sstotal = 117220.86

$$W^2 = \frac{79206.45 - (12-1)\ 27.89}{117220.86 + 27.89}$$

$$= \underline{79206.45 - 306.79}$$

$$117248.75$$

$$= \frac{78899.66}{117248.75}$$

$$= 0.67$$

$$W^2_{VMI} = \underline{0.67}$$

**Table for Discrepancy Analyses of Test Scores of Children having Learning Problems,(Experimental Group**

| Sub.No. | CPM Tscore | VMI Tscore | Difference | Status | Classification |
|---|---|---|---|---|---|
| 1 | 23 | 40 | - | - | SL |
| 2 | 64 | 35 | 29 | Sig. | LD |
| 3 | 104 | -13 | 91 | Sig | LD |
| 4 | 91 | 55 | - | - | NL |
| 5 | 50 | 45 | 5 | NS | NCL |
| 6 | 64 | 69 | - | - | NL |
| 7 | 31 | 41 | - | - | SL |
| 8 | 50 | 43 | 7 | NS | NCL |
| 9 | 38 | 46 | - | - | SL |
| 10 | 56 | 23 | 33 | Sig | LD |
| 11 | 50 | 14 | 36 | Sig | LD |
| 12 | 38 | 39 | -1 | - | SL |
| 13 | 50 | 71 | - | - | NL |
| 14 | 38 | 41 | - | - | SL |
| 15 | 66 | 59 | - | - | NL |
| 16 | 35 | 38 | - | - | SL |
| 17 | 39 | 44 | - | - | SL |
| 18 | 52 | 34 | 18 | Sig | LD |
| 19 | 54 | 28 | 26 | Sig | LD |
| 20 | 58 | 64 | - | - | NL |
| 21 | 30 | 36 | - | - | SL |
| 22 | 26 | 36 | - | - | SL |
| 23 | 50 | 41 | 9 | NS | NCL |
| 24 | 30 | 41 | - | - | SL |
| 25 | 30 | 23 | - | - | SL |
| 26 | 30 | 30 | - | - | SL |
| 27 | 26 | 36 | - | - | SL |
| 28 | 30 | 16 | - | - | SL |
| 29 | 52 | 27 | 25 | Sig | LD |
| 30 | 30 | 39 | - | - | SL |
| 31 | 50 | 30 | 20 | Sig | LD |
| 32 | 26 | 39 | - | - | SL |
| 33 | 30 | 14 | - | - | SL |
| 34 | 52 | 23 | 29 | Sig | LD |
| 35 | 33 | 36 | - | - | SL |
| 36 | 21 | 9 | - | - | SL |
| 37 | 29 | 26 | - | - | SL |
| 38 | 87 | 40 | 47 | Sig | LD |
| 39 | 58 | 36 | 22 | Sig | LD |
| 40 | 33 | 38 | - | - | SL |
| 41 | 29 | -10 | - | - | SL |
| 42 | 25 | -5 | - | - | SL |
| 43 | 29 | 14 | - | - | SL |
| 44 | 51 | 40 | 11 | Sig | LD |
| 45 | 25 | 21 | - | - | SL |
| 46 | 29 | 31 | - | - | SL |
| 47 | 25 | 24 | - | - | SL |
| 48 | 30 | 41 | - | - | SL |

| | | | | | |
|---|---|---|---|---|---|
| 49 | 33 | 33 | - | - | SL |
| 50 | 33 | 20 | - | - | SL |
| 51 | 33 | 38 | - | - | SL |
| 52 | 33 | 31 | - | - | SL |
| 53 | 50 | 50 | - | - | NL |
| 54 | 58 | 59 | - | - | NL |
| 55 | 50 | 39 | 11 | Sig | LD |
| 56 | 30 | 13 | - | - | SL |
| 57 | 29 | 41 | - | - | SL |
| 58 | 29 | 38 | - | - | SL |
| 59 | 50 | 45 | 5 | NS | NCL |
| 60 | 23 | 38 | - | - | SL |
| 61 | 29 | 43 | - | - | SL |
| 62 | 23 | 39 | - | - | SL |
| 63 | 50 | 38 | 12 | Sig | LD |
| 64 | 26 | 32 | - | - | SL |
| 65 | 29 | 38 | - | - | SL |
| 66 | 17 | 20 | - | - | SL |
| 67 | 29 | 11 | - | - | SL |
| 68 | 35 | 24 | - | - | SL |
| 69 | 27 | 10 | - | - | SL |
| 70 | 35 | 37 | - | - | SL |
| 71 | 29 | 17 | - | - | SL |
| 72 | 52 | 37 | 15 | Sig | LD |
| 73 | 27 | 18 | - | - | SL |
| 74 | 56 | 36 | 20 | Sig | LD |
| 75 | 50 | 31 | 19 | Sig | LD |
| 76 | 37 | 40 | - | - | SL |
| 77 | 35 | 15 | - | - | SL |
| 78 | 50 | 41 | 9 | NS | NCL |
| 79 | 50 | 14 | 36 | Sig | LD |
| 80 | 50 | 34 | 16 | Sig | LD |
| 81 | 55 | 34 | 21 | Sig | LD |
| 82 | 50 | 43 | 7 | NS | NCL |
| 83 | 32 | 10 | - | - | SL |
| 84 | 21 | -2 | - | - | SL |
| 85 | 21 | 25 | - | - | SL |

SUMMARY:

Classified LD =20 (23.5%).
Not classified = 6 (7.1%).
Classified Slow learners =51 (60%).
Normal = 8 (9.4%).
Total = 85.
CPM> VMI scores =49 (57.6%)
CPM< VMI scores =33 (38.8%)
CPM=VMI scores = 3(3.5%).

NOTE:
LD =Learning disabled
SL =Slow learner
NCL = Not classified
NL = Normal

## CPM & VMI T scores for Normal Children (Control Group)

| Sub.No. | CPM Tscore | VMI Tscore | Difference | Status | Classification |
|---|---|---|---|---|---|
| 1 | 50 | 60 | – | – | NL |
| 2 | 50 | 74 | – | – | NL |
| 3 | 50 | 65 | – | – | " |
| 4 | 50 | 84 | – | – | " |
| 5 | 104 | 89 | – | – | " |
| 6 | 77 | 65 | – | – | " |
| 7 | 56 | 55 | – | – | " |
| 8 | 56 | 73 | – | – | " |
| 9 | 56 | 50 | – | – | " |
| 10 | 56 | 70 | – | – | " |
| 11 | 56 | 64 | – | – | " |
| 12 | 50 | 54 | – | – | " |
| 13 | 54 | 52 | – | – | " |
| 14 | 54 | 50 | – | – | " |
| 15 | 50 | 59 | – | – | " |
| 16 | 54 | 50 | – | – | " |
| 17 | 50 | 52 | – | – | " |
| 18 | 50 | 56 | – | – | " |
| 19 | 50 | 60 | – | – | " |
| 20 | 50 | 73 | – | – | " |
| 21 | 50 | 61 | – | – | " |
| 22 | 50 | 64 | – | – | " |
| 23 | 50 | 50 | – | – | " |
| 24 | 50 | 59 | – | – | " |
| 25 | 82 | 82 | – | – | " |
| 26 | 58 | 71 | – | – | " |
| 27 | 54 | 50 | – | – | " |
| 28 | 62 | 71 | – | – | " |
| 29 | 58 | 57 | – | – | " |
| 30 | 66 | 64 | – | – | " |
| 31 | 58 | 61 | – | – | " |
| 32 | 54 | 59 | – | – | " |
| 33 | 50 | 59 | – | – | " |
| 34 | 54 | 61 | – | – | " |
| 35 | 67 | 67 | – | – | " |
| 36 | 58 | 67 | – | – | " |
| 37 | 54 | 52 | – | – | " |
| 38 | 50 | 62 | – | – | " |
| 39 | 67 | 62 | – | – | " |
| 40 | 54 | 57 | – | – | " |
| 41 | 58 | 50 | – | – | " |
| 42 | 62 | 70 | – | – | " |
| 43 | 58 | 67 | – | – | " |
| 44 | 54 | 52 | – | – | " |
| 45 | 67 | 64 | – | – | " |
| 46 | 58 | 55 | – | – | " |
| 47 | 75 | 62 | – | – | " |

| | | | | | |
|---|---|---|---|---|---|
| 48 | 53 | 59 | - | - | " |
| 49 | 50 | 52 | - | - | " |
| 50 | 53 | 59 | - | - | " |
| 51 | 62 | 55 | - | - | " |
| 52 | 62 | 59 | - | - | " |
| 53 | 50 | 50 | - | - | " |
| 54 | 50 | 54 | - | - | " |
| 55 | 53 | 61 | - | - | " |
| 56 | 53 | 54 | - | - | NL |
| 57 | 50 | 57 | - | - | " |
| 58 | 65 | 57 | - | - | " |
| 59 | 53 | 57 | - | - | " |
| 60 | 74 | 68 | - | - | " |
| 61 | 56 | 52 | - | - | " |
| 62 | 59 | 55 | - | - | " |
| 63 | 50 | 55 | - | - | " |
| 64 | 50 | 52 | - | - | " |
| 65 | 65 | 55 | - | - | " |
| 66 | 74 | 69 | - | - | " |
| 67 | 74 | 66 | - | - | " |
| 68 | 71 | 68 | - | - | " |
| 69 | 60 | 63 | - | - | " |
| 70 | 60 | 57 | - | - | " |
| 71 | 56 | 60 | - | - | " |
| 72 | 54 | 54 | - | - | " |
| 73 | 52 | 59 | - | - | " |
| 74 | 58 | 62 | - | - | " |
| 75 | 56 | 53 | - | - | " |
| 76 | 50 | 50 | - | - | " |
| 77 | 60 | 57 | - | - | " |
| 78 | 63 | 57 | - | - | " |
| 79 | 57 | 55 | - | - | " |
| 80 | 57 | 59 | - | - | " |
| 81 | 57 | 57 | - | - | " |
| 82 | 61 | 61 | - | - | " |
| 83 | 55 | 61 | - | - | " |
| 84 | 56 | 59 | - | - | " |
| 85 | 59 | 61 | - | - | " |

SUMMARY:

VMI scores > CPM scores =44 (51.8%).
CPM scores > VMI scores = 33 (38.8%).
CPM scores = VMI scores =8 (9.4%).