UNIT 3 MEASUREMENT OF INTELLIGENCE

Structure

3.0 INTRODUCTION

Need to measure intelligence arise to trap individual differences in general mental ability for a variety of purposes, such as academic classification, occupational counseling and personnel selection. Intelligence tests can be defined as a test to evaluate general level of cognitive functions and intellectual ability. In this unit we will discuss theoretical background and evolution of intelligence tests. We will also present an account of some of the widely used intelligence tests. The unit will be concluded by highlighting the issues related to intelligence testing.

3.1 OBJECTIVES

After reading this unit, you will be able to:

- Define intelligence tests;
- Describe the concepts of IQ and deviation IQ;
- Explain the theoretical background of measurement of intelligence;
- Elucidate the history of intelligence tests;
- Explain the types of intelligence tests; and
- Describe various widely used intelligence tests.

3.2 THEORETICAL BACKGROUND OF MEASUREMENT OF INTELLIGENCE

Intelligence tests differ a lot in the content and the way of measurement. These differences arrive from the theoretical background they follow and also from defining intelligence. Therefore, before discussing specific intelligence tests we must understand the theoretical background they follow.

3.2.1 General Factor Theories

On the basis of factor analysis of scores on a number of tests, general factor theories claim that intelligence is basically a general intellectual capacity which is common for a number or all of activities. One of such theories was proposed by Charles Spearman (1904) who claimed that there is a *general* or *g-factor* which is essentially common in all the intellectual activities. Spearman suggested that two tests truly measuring *g* would account for high positive correlation. In a revision of the theory, he proposed a number of *specific* or *s-factors* required for specific activities. Tests measuring distinct *s-factors* should account for zero-correlation.

Jensen (1998) further advocated this viewpoint by arguing that *g-factor* is manifested in behaviour in a number of ways and can be tested by almost unlimited variety of conceptually independent items. Therefore, a number of distinct tests can be constructed to measure *g-factor* with completely different form and content of the items. However, Jensen's idea that *g* is largely inherited and rarely influenced by the environment was highly controversial and criticized.

Binet and Simon (1916) also conceptualised intelligence as a general intellectual capacity. But he differed from Spearman and Jensen and proposed that this can be measured by a variety of test items measuring several discrete abilities. An integrated score, termed as intelligence quotient (IQ), on all of these ability tests would account a true measurement of intelligence. According to Binet a general intellectual capacity consists of the abilities of (a) abstract reasoning (b) comprehension (c) clear direction of thought (d) purposeful thinking and (e) self-corrective judgment.

3.2.2 Multi-factor Theories

Contrary to Spearman, multi-factor theories neglect the existence of *g-factor* and state that intelligence is not an expression of innumerable highly specific factors, nor is it the expression primarily of a general factor that pervades all mental activities. Such theories describe intelligence on the basis of groups of traits or factors.

3.2.2.1 Thurstone's Primary Mental Abilities/Group Factor Theory

The analysis of interpretation of Spearman's and others' general factor theories led Thurstone to conclude that 'certain' mental operations have in common a 'primary' factor that gives them psychological and functional unity and that differentiates them from other mental operations. These mental operations then constitute a group. A second group of mental operation has its own unifying primary factor, and so on. In other words, there are a number of groups of mental abilities, each of which has its own primary factor, giving the group a functional unity and cohesiveness. Each of these primary factors is said to be relatively independent of the others.

Thurstone has given the following seven primary factors:

i) The Number Factor (N) refers to the ability to do rapid and accurate numerical calculations.

ii) The Verbal Factor (V) refers to the ability of verbal comprehension.

iii) The Space Factor (S) is involved in a task requiring manipulation of the imaginary objects in space.

iv) Memory (M) involves ability to memorize quickly.

v) Word Fluency (W) refers to the ability to think of isolated words at a rapid rate.

vi) Reasoning (R) refers to the ability to discover a rule or principle involved in a series or groups of letters.

vii) Perceptual Speed (P) is the ability to note visual details rapidly.

Based on these factors Thurstone constructed a new test of intelligence known as "Test of Primary Mental Abilities (PMA)."

3.2.2.2 Guilford's Model of Structure of Intellect

Guilford (1967) proposed a three dimensional structure of intellect model. According to Guilford every intellectual task can be classified according to its (1) content, (2) the mental operation involved and (3) the product resulting from the operation. He further classified content into five categories, namely, visual, auditory, symbolic, semantic and behavioural. He classified operations into five categories, namely, cognition, memory retention, memory recording, Divergent production, Convergent production and evaluation. He classified products into six categories, namely, units, classes, relations, systems, transformations and implications.

3.2.2.3 Gardener's Theory of Multiple Intelligences

Howard Gardner in his book "Frames of Mind: The Theory of Multiple Intelligence" (1983), puts forth a new and different view of human intellectual competencies. He argues boldly and cogently that we are all born with potential to develop a multiplicity of Intelligence, most of which have been overlooked in our testing society, and all of which can be drawn upon to make us competent individuals. The multiple intelligence theory states that people possess eight types of intelligence: (i) Linguistic, (ii) Logical, (iii) Spatial, (iv) Musical, (v) Motor ability, (vi) Interpersonal, (vii) Intrapersonal and (viii) Naturalistic intelligence.

3.2.2.4 Sternberg's Triarchic Theory

Psychologist Robert Sternberg (1985) has constructed a three-pronged or triarchic theory of intelligence. The Three types are:

i) Analytical Intelligence is what we generally think of as academic ability. It enables us to solve problems and to acquire new knowledge. Problem-solving skill includes encoding information, combining and comparing pieces of information and generating a solution.

ii) Creative Intelligence is defined by the abilities to cope with novel situations and to profit from experience. The ability to quickly relate novel situations to familiar situations (that is, to perceive similarities and differences) fosters adaptation. Moreover, as a result of experience, we also become able to solve problems more rapidly.

iii) Practical Intelligence enables people to adapt to the demands of their environment. For example, keeping a job by adapting one's behaviour to the employer's requirements is adaptive. But if the employer is making unreasonable demands, reshaping the environment (by changing the employer's attitudes) or selecting an alternate environment (by finding a more suitable job) is also adaptive.

3.2.2.5 Vernon's Hierarchical Theory

Vernon's description of different levels of intelligence may fill the gaps between two extreme theories, the two-factor theory of Spearman, which did not allow for the existence of group factors, and the multiple-factor theory of Turstone, which did not allow a "g" factor. Intelligence can be described as comprising abilities at varying levels of generality:

i) The highest level: "g" (general intelligence) factor with the largest source of variance between individuals. (Spearman)

ii) The next level: major group factors such as verbal-numerical-educational (v.ed) and practical-mechanical-spatial-physical (k.m.) ability.

iii) The next level: minor group factors are divided from major group factors.

iv) The bottom level: "s"(specific) factor. (Spearmen)

Beginning in 1969, Vernon became increasingly involved in studying the contributions of environmental and genetic factors to intellectual development. Vernon continued to analyse the effects of genes and the environment on both individual and group difference in intelligence. He concludes that individual difference in intelligence are approximately 60 percent attributable to genetic factors, and that there is some evidence implicating genes in racial group differences in average levels of mental ability.

3.3 HISTORY OF MEASUREMENT OF INTELLIGENCE

At the time of early development of discipline psychologists were much more interested in searching of generalised principles of human behaviour and subsequently formulating universal theories. Measurement of individual differences received attention very late in the nineteenth century.

3.3.1 Galton and Cattell

The first institutional effort to measure individual differences came from the British biologist Sir Francis Galton who administered simple tests of visual discrimination, determining highest audible pitch and kinesthetic discrimination. He thought that intelligence could be measured by the tests of sensory discrimination. He believed that the ability to discriminate among heat, cold and pain could discriminate the intelligent persons from the mentally retarded ones.

The term 'mental test' was used first time in the psychological literature by the American psychologist James McKeen Cattell in 1890. He described a number of tests to measure intellectual level of persons which included measures of muscular strength, speed of movement, sensitivity to pain, keenness of vision and of hearing, weight discrimination, reaction time, memory etc.

3.3.2 Contribution of Alfred Binet

Alfred Binet (1857-1911) set out to develop a series of tasks designed to measure individual differences on the request of the French government due to the need for a reliable diagnostic system to identify children with mental retardation. The differences that he intended to delineate included a number of complex mental facilities, such as memory, imagery, imagination, attention, comprehension, aesthetic sentiment, moral sentiment, muscular strength, motor ability, and hand-eye coordination. Together with physician Theodore Simon, Binet created the Binet-Simon scale, which was published in 1905.

The 1905 Binet-Simon scale differed greatly from the scale that we use today. The original scale consisted of 30 pass/fail items. The tasks were also different from today's items and required a combination of mental and physical strategies to complete each task.

The major breakthrough of the Binet-Simon scale was the complexity of the tasks and the breadth of mental abilities measured. Furthermore, intelligence was finally able to be measured during a clinical interview, as opposed to in laboratories or by using physical measurements.

Although the Binet-Simon scale is quite antiquated with regard to today's intelligence scale standards, many current day innovations were derived from this scale. The concepts of strict administration, age-graded norms, and a rank order of items ranging from least to most difficult, are but a few. Furthermore, the inclusion of age-graded norms provided for the first estimate of mental age.

The first revision of the Binet scale was in 1908; however, the majority of the scale was left unchanged. By 1911, the scale was in its second revision and the age range had been extended through adulthood, as opposed to its previous use for the diagnosis of mental retardation in children. With the inclusion of adults, the scales needed to be rebalanced, which Binet did by including five items for each age level.

The abilities targeted by the 1911 edition were language, auditory processing, visual processing, learning and memory, and problem solving. By 1912, Lewis

M. Terman of Stanford University began revisions on the 1911 Binet scale which was published in 1916 and was entitled the *Stanford-Binet Intelligence Scale*.

The advantages that the Stanford-Binet had over other intelligence scales of the time were many. The first, and seemingly most simplistic, was that the 1916 version was the most comprehensive revision of Binet's original scale. The second, and perhaps the most important, was that the standardisation procedure used by Terman was the most rigorous of the time. The third advantage was the inclusion of an extensive manual, both for administration of the test as well as for use as a teaching aide for understanding the test.

3.3.3 The Concept of IQ

The most important development in the area of intelligence testing was adaptation of Stern's (1912) concept of an intelligence quotient in the Stanford-Binet Intelligence Scale. Stern put forth the notion that to derive an intelligence quotient (IQ) and Terman incorporated this concept into the 1916 version of Stanford-Binet Scale. To obtain the IQ a person's mental age is divided by his/her chronological or real age. This product is further multiplied by hundred to avoid decimal fractions.

$$IQ = \frac{\text{Mental Age}}{\text{Chronological Age}} \times 100$$

3.3.4 World War I and Army Personnel Selection

During World War I in 1917 a committee of American Psychological Association, under leadership of Robert M. Yerkes, prescribed the use of intelligence tests for rapid classification of army personnel. In view of this, American Army psychologists developed two tests: (i) Army Alpha and (ii) Army Beta. Both the tests were group tests in which the first was a language test, while the second was a non-language-performance test.

Self Assessment Questions

1) Describe the contributions of Galton and Cattell in the development of measurement of individual differences.

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2) Explain first Simon-Binet Test and its improvement over earlier tests.

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3) Illustrate the concept of IQ.

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3.4 MAJOR INTELLIGENCE TESTS

Intelligence tests are classified on several bases.

i) Individual and Group tests (Target)

ii) Verbal and Non verbal tests

Individual and Group Tests

The first of these classification, individual and group tests, is based on their administration. An individual test is one that can be administered only at one person at a time (Simon-Binet). During World War I rapid and mass classification of army personnel was required and such tests could not fulfil these needs. Therefore, group intelligence tests were developed which could be administered on a group of individuals at one go (Army Alpha and Army Beta).

Verbal / non verbal tests

Another classification of intelligence tests based on the form and content of the test items is verbal/paper-pencil tests and non-verbal/performance tests. Verbal tests use written language for its items and therefore, require the examinees to be literate. Items of performance tests do not use language at all and are manipulative in form and nature. Examinees are required to manipulate the items in a particular and desired manner. Hence, such tests can be effectively administered on illiterates, children and deaf persons also. Some of the performance tests claim to be suitably used at persons from different cultures and prefer to be called as culture-free, culture-fair, culture-reduced and cross-cultural tests.

3.4.1 Types of Intelligence Scales

There are many types of intelligence a few of which are presented below.

3.4.1.1 Stanford-Binet Test

Terman had revised the Stanford Binet with the help of Maud Merrill in 1937 as the *Revised Stanford-Binet Intelligence Scale*. The revision included two alternate forms, the L form and the M form, each with 129 items.

The third revision of the Stanford-Binet came after Terman's death in 1960 and was constructed primarily by Merrill. The *Stanford-Binet Intelligence Scale*, *Form L-M*, was different from its predecessor in that it included a deviation intelligence quotient with a normative mean of 100 and a standard deviation of 16. This version also included the 142 most pertinent items from the two previous forms of the test (Roid, 2003).

The fourth revision of the Stanford-Binet, the Stanford-Binet Intelligence Scales (SB4) came in 1986 and retained much of the content of the Form L-M edition. The same age range was covered; many of the same items and tasks were retained, and the basal and ceiling procedures were quite similar.

The greatest advance of the fourth edition was that, like the fifth edition, the fourth edition was based on a hierarchical model of intelligence. The four main areas assessed were verbal reasoning, abstract/visual reasoning, quantitative reasoning, and short-term memory. The fourth edition not only provided an overall intelligence quotient, but composite scores as well. Furthermore, to establish a basal level, the Vocabulary subtest of the fourth edition was used as a routing subtest, along with the subject's chronological age (Roid, 2003).

The latest version of the test, the Stanford- Binet Intelligence Scales–Fifth Edition (SB5) differs significantly from the SB4 with regard to theoretical structure, as the SB5 adheres rather strictly to the Cattell-Horn-Carroll (CHC) cognitive theory and the SB4 adheres to a less strict psychometric design.

The changes between the fourth and the fifth editions of the Binet scale included changes in the layout of the test, norm standards, and the underlying theoretical structure of the instrument. (Roid, 2003).

The SB5 is used to assess intellectual ability in individuals between the ages of two and 89 years, is individually administered, and contains 10 subscales. The three areas assessed by the SB5 are: general cognitive functioning, verbal and nonverbal intelligence and five CHC factors formed into groups along verbal/ nonverbal measures. The nonverbal portion of the SB5 accounts for 50% of the test and ranges across all factors, which is unique to the SB5 among cognitive batteries.

The five CHC factors that the SB5 measures are Fluid Reasoning, Knowledge, Quantitative Reasoning, Visual-Spatial Processing, and Working Memory. Together, the ten subtests yield an overall estimate of cognitive functioning, which is the Full Scale Intelligence Quotient (Roid, 2003) and nonverbal contrast, an abbreviated version, and a nonverbal form of the test.

Composites and subtests of the SB5

The SB5 is comprised of 5 composite scores each with a verbal and a nonverbal test-let, for a total of 10 subtests. Structure of the test is given below:

Factor Indices	**Domains**	
	Nonverbal	**Verbal**
Fluid Reasoning	*Activity: Object-Series/ Matrices* Requires the ability to solve novel figural problems and identify sequences of pictured objects or matrix-type figural and geometric patterns.	*Activities: Early Reasoning, Verbal Absurdities, Verbal Analogies* Requires the ability to analyse and explain, using deductive and inductive reasoning, problems involving cause effect connections in pictures, classification of objects, absurd statements, and interrelationships among words.

Knowledge	*Activity: Procedural Knowledge, Picture Absurdities* Requires knowledge about common signals, actions, and objects and the ability to identify absurd or missing details in pictorial material.	*Activity: Vocabulary* Requires the ability to apply accumulated knowledge of concepts and language and to identify and define increasingly difficult words.
Quantitative Reasoning	*Activity: Nonverbal Quantitative Reasoning* Requires the ability to solve increasingly difficult pre-mathematic, arithmetic, algebraic, or functional concepts and relationships depicted in illustrations.	*Activity: Verbal Quantitative Reasoning* Requires the ability to solve increasingly difficult mathematical tasks involving basic numerical concepts, counting, and word problems.
Visual-Spatial Processing	*Activity: Form Board, Form Patterns* Requires the ability to visualise and solve spatial and figural problems presented as "puzzles" or complete patterns by moving plastic pieces into place.	*Activity: Position and Direction* Requires the ability to identify common objects and pictures using common visual-spatial terms such as "behind" and "farthest left," explain spatial directions for reaching a pictured destination, or indicate direction and position in relation to a reference point
Working Memory	*Activity: Delayed Response, Block Span* Requires the ability to sort visual information in short-term memory and to demonstrate short-term and working memory skills for tapping sequences of blocks.	*Activity: Memory for Sentences, Last Word* Requires the ability to demonstrate short-term and working memory for words and sentences and to store, sort, and recall verbal information in short-term memory.

Scoring and Interpretation

The SB5 can be hand-scored or scored with optional scoring software. At the most granular level of the norm-referenced scores are the ten subtest scores (scaled scores have a mean of 10, SD=3, score range 1-19).

These subtest scores combine to form four types of composite scores: factor index, domain, abbreviated, and full scale (each with scaled score means of 100, SD=15, score range 40-160). Two subtests (one verbal, the other its nonverbal complement) combine to form each factor index.

There are two domain scales: Nonverbal IQ (combines the five nonverbal subtests) and Verbal IQ (combines the five verbal subtests). Two routing subtests combine to form the Abbreviated Battery IQ. Finally, the Full Scale IQ combines all ten subtests.

The Change-Sensitive Scores (CSSs) use item response theory scaling to convert the raw score totals on the composite scales described above into criterion-referenced levels of ability. These scales, as with the norm-referenced scores, have excellent measurement properties. Because the CSSs reference absolute levels of ability, they provide a means to compare changes in an individual's scores over time. Scores range from the 2-year-old level (about 430) to the adult level (about 520). All of the SB5 items have been calibrated to this scale, and the difficulty of each item has a location along that scale. The scores will be particularly useful for the evaluation of extreme performance levels.

The SB5 also offers age-equivalent scores derived from CSSs, along with a CSS-based abbreviated battery score making use of raw scores from the Nonverbal Reasoning and Verbal Knowledge subtests. Finally, the Interpretive Manual describes a hand-scoring procedure for deriving an extended Full Scale IQ score that allows for scores below 40 and above 160. A variety of interpretive frameworks, such as Examiner's Manual, Interpretive Manual, or the SB5 Scoring Pro software, can be applied to the results of this test.

3.4.1.2 Wechsler Intelligence Scales

The first Wechsler intelligence scale came in 1939. After that Wechsler scales have gone through several successive revisions for three different categories: (i) for adults (16-90 years), (ii) for school-going children (6-16 years) and (iii) for pre-schoolers (2½-7 years). Year-wise development of these scales is given below:

Wechsler Adult Intelligence Scale (WAIS)	Wechsler Intelligence Scale for Children (WISC)	Wechsler Preschool and Primary Scale of Intelligence
Wechsler-Bellevue-I:1939	Wechsler-Bellevue-II: 1946	WPPSI: 1967
WAIS: 1955	WISC: 1949	WPPSI-R: 1989
WAIS-R: 1981	WISC-R: 1974	WPPSI-III: 2002
WAIS-III: 1997	WISC-III: 1991	
WAIS-IV: 2008	WISC-IV: 2003	

Since its publication, the Wechsler intelligence scales have been the most used instruments among clinical and school psychologists for assessing the cognitive abilities of children, adolescents and adults. Wechsler viewed the construct of intelligence not only as a global entity but also as an aggregate of specific abilities that are qualitatively different. Intelligence is global because it characterises the individual's behaviour as a whole.

3.4.2 Wechsler's Intelligence Scales

Wechsler (1944) defined intelligence in a general behavioural term as the capacity to act purposefully, to think rationally and to deal effectively with the environment. He also believed that intelligence is specific because it is made up of elements or abilities that are qualitatively different and can be measured by a variety of tests. Factor analytic researches of intelligence test scores also suggest that intelligence is composed of specific abilities that form clusters of higher order ability domains.

3.4.2.1 Structure of WAIS-IV

The current version of the test, the WAIS-IV, which was released in 2008, is composed of 10 core subtests and five supplemental subtests, with the 10 core subtests comprising the Full Scale IQ. With the new WAIS-IV, the verbal/ performance subscales from previous versions were removed and replaced by the index scores. The General Ability Index (GAI) was included, which consists of the Similarities, Vocabulary and Information subtests from the Verbal Comprehension Index and the Block Design, Matrix Reasoning and Visual Puzzles subtests from the Perceptual Reasoning Index. The GAI is clinically useful because it can be used as a measure of cognitive abilities that are less vulnerable to impairment.

Indices and scales

There are four index scores representing major components of intelligence:

- Verbal Comprehension Index (VCI)
- Perceptual Reasoning Index (PRI)
- Working Memory Index (WMI)
- Processing Speed Index (PSI)

Two broad scores are also generated, which can be used to summarize general intellectual abilities:

- Full Scale IQ (FSIQ), based on the total combined performance of the VCI, PRI, WMI, and PSI
- General Ability Index (GAI), based only on the six subtests that comprise the VCI and PRI

3.4.2.2 Subtests

The Verbal Comprehension Index includes four tests:

- Similarities: Abstract verbal reasoning (e.g., “In what way are an apple and a pear alike?”)
- Vocabulary: The degree to which one has learned, been able to comprehend and verbally express vocabulary (e.g., “What is a guitar?”)
- Information: Degree of general information acquired from culture (e.g., “Who is the president of Russia?”)
- Comprehension [Supplemental]: Ability to deal with abstract social conventions, rules and expressions (e.g., “What does *Kill 2 birds with 1 stone* metaphorically mean?”)

The Perceptual Reasoning Index comprises five tests

- Block Design: Spatial perception, visual abstract processing and problem solving
- Matrix Reasoning: Nonverbal abstract problem solving, inductive reasoning, spatial reasoning
- Visual Puzzles: non-verbal reasoning
- Picture Completion [Supplemental]: Ability to quickly perceive visual details
- Figure Weights [Supplemental]: quantitative and analogical reasoning

The Working Memory Index is obtained from three tests

- Digit span: attention, concentration, mental control (e.g., Repeat the numbers 1-2-3 in reverse sequence)
- Arithmetic: Concentration while manipulating mental mathematical problems (e.g., “How many 45-cent stamps can you buy for a dollar?”)

- Letter-Number Sequencing [Supplemental]: attention and working memory (e.g., Repeat the sequence Q-1-B-3-J-2, but place the numbers in numerical order and then the letters in alphabetical order)

3.4.2.3 The Processing Speed Index Includes Three Tests

- Symbol Search: Visual perception, speed
- Coding: Visual-motor coordination, motor and mental speed
- Cancellation [Supplemental]: visual-perceptual speed

Interpretation

Wechsler scales use an innovative deviation IQ score for interpretation of an individual's score. The deviation IQ is based on standard scores computed with the same distributional characteristics at all ages and makes comparison among peers more meaningful and the interpretation more straightforward. The WAIS-IV was standardized on a sample of 2,200 people in the United States ranging in age from 16 to 90. An extension of the standardisation has been conducted with 688 Canadians in the same age range. The median Full Scale IQ is centered at 100, with a standard deviation of 15. In a normal distribution, the IQ range of one standard deviation above and below the mean (i.e., between 85 and 115) is where approximately 68% of all adults would fall.

3.4.3 Kaufman Assessment Scales

The first Kaufman Scale, Kaufman Assessment Battery for Children (K-ABC; Kaufman & Kaufman, 1983) was developed in the late 1970s and early 1980s and was published in 1983, during a time when IQ was largely a Wechsler-Binet monopoly. This scale intended to bridge the gap between theories of intelligence and measures of intelligence. Two important tests of this series are given below:

3.4.3.1 Kaufman Assessment Battery for Children

The second revision of K-ABC, the KABC-II was published in 2004 for the Age range of 3 to 18 years. This test measures learning (long-term retrieval), sequential processing (short-term memory), simultaneous processing (visualisation), planning (fluid ability) and verbal knowledge (crystallised ability). The KABC-II is founded in two theoretical models: Luria's (1973) neuropsychological model, featuring three blocks, and the Cattell-Horn-Carroll (CHC) approach to categorising specific cognitive abilities (Carroll, 1997). The KABC-II yields a separate global score for each of these two theoretical models: The global score measuring general mental processing ability from the Luria perspective is the Mental Processing Index (MPI), and global score measuring general cognitive ability from the CHC perspective is the Fluid-Crystallised Index (FCI). The key difference between these two global scores is that the MPI (Luria's theory) *excludes* measures of acquired knowledge, whereas the FCI (CHC theory) *includes* measures of acquired knowledge. Only one of these two global scores is computed for any examinee. Prior to testing a client, examiners choose the interpretive system (i.e., Luria or CHC) that best fits with both their personal orientation and the reason for referral. Deciding which interpretive system to use will dictate which global score is reported and also whether measures of acquired knowledge are included from the core battery. The authors of the KABC-II clearly state in the manual that "the CHC model should generally be the model of choice, except in cases where the examiner believes that including measures of acquired knowledge/crystallised ability would compromise the validity of the Fluid-Crystallised Index." In those cases, the Luria global score (MPI) is preferred.

3.4.3.2 Structure of the KABC-II

The complete scale description of KABC-II is given in the table below:

Scales	**Subtests Description**
Sequential/*Gsm*	
Word Order	The child touches a series of silhouettes of common objects in the same order as the examiner said the names of the objects; more difficult items include an interference task (colour naming) between the stimulus and response
Number Recall	The child repeats a series of numbers in the same sequence as the examiner said them, with series ranging in length from two to nine numbers; the numbers are single digits, except that 10 is used instead of 7 to ensure that all numbers are one syllable.
Hand Movements	The child copies the examiner's precise sequence of taps on the table with the fist, palm, or side of the hand.
Simultaneous/*Gv*	
Rover	The child moves a toy dog to a bone on a checkerboard like grid that contains obstacles (rocks and weeds) and tries to find the "quickest" path—the one that takes the fewest moves.
Triangles	For most items, the child assembles several identical rubber triangles (blue on one side, yellow on the other) to match a picture of an abstract design; for easier items, the child assembles a different set of colourful plastic shapes to match a model constructed by the examiner.
Conceptual Thinking	The child views a set of four or five pictures and identifies the one picture that does not belong with the others; some items present meaningful stimuli and others use abstract stimuli.
Face Recognition	The child attends closely to photographs of one or two faces that are exposed briefly and then selects the correct face or faces, shown in a different pose, from a group photograph.
Gestalt Closure	The child mentally fills in the gaps in a partially completed inkblot drawing and names (or describes) the object or action depicted in the drawing.
Block Counting	The child counts the exact number of blocks in various pictures of stacks of blocks; the stacks are configured such that one or more blocks is hidden or partially hidden from view.

Planning/*Gf*	
Pattern Reasoning	The child is shown a series of stimuli that form a logical, linear pattern, but one stimulus is missing; the child completes the pattern by selecting the correct stimulus from an array of four to six options at the bottom of the page (most stimuli are abstract, geometric shapes, but some easy items use meaningful stimuli).
Story Completion	The child is shown a row of pictures that tell a story, but some of the pictures are missing. The child is given a set of pictures, selects only the ones that are needed to complete the story, and places the missing pictures in their correct location.
Learning/*Glr*	
Atlantis	The examiner teaches the child the nonsense names for fanciful pictures of fish, plants, and shells; the child demonstrates learning by pointing to each picture (out of an array of pictures) when it is named.
Atlantis Delayed	The child demonstrates delayed recall of paired associations learned about 15–25 minutes earlier during Atlantis by pointing to the picture of the fish, plant, or shell that is named by the examiner.
Rebus Learning	The examiner teaches the child the word or concept associated with each particular rebus (drawing), and the child then “reads” aloud phrases and sentences composed of these rebuses.
Rebus Learning Delayed	The child demonstrates delayed recall of paired associations learned about 15–25 minutes earlier during Rebus by “reading” phrases and sentences composed of those same rebuses.
Knowledge/*Gc*	
Riddles	The examiner provides several characteristics of a concrete or abstract verbal concept, and the child has to point to it (early items) or name it (later items).
Expressive Vocabulary	The child provides the name of a pictured object.
Verbal Knowledge	The child selects from an array of six pictures the one that corresponds to a vocabulary word or answers a general information question.

(*Source: KABC-II Manual*; Kaufman & Kaufman, 2004).

3.5 STANDARD SCORES AND SCALED SCORES

The KABC-II’s two global scores, the MPI and FCI, both are standard scores with a mean of 100 and a standard deviation (SD) of 15. However, only *one* of these two global scores is computed and interpreted for any child or adolescent who is evaluated, based on the examiner’s choice of the Luria or CHC model for that individual. Like the MPI and FCI, the KABC-II Nonverbal Index is also a standard score with a mean of 100 and SD of 15. The five additional KABC-II scales offered for ages 4–18 each have a mean of 100 and SD of 15 (but only the MPI and FCI are offered at age 3). All KABC-II subtests have a mean of 10 and SD of 3. The Core subtest standard scores contribute to the scales, but the Supplementary scaled scores do not (except for the special Nonverbal scale).

3.5.1 The Kaufman Adolescent and Adult Intelligence Test

The Kaufman Adolescent and Adult Intelligence Test (KAIT) was developed by Alan S. Kaufman and Nadeen L. Kaufman in 1993 and is an individually administered intelligence test for individuals ranging from 11 to 85-plus years of age. It has a strong theoretical base integrating Horn and Cattell's concept of fluid and crystallised intelligence, Luria and Golden's notion of frontal lobe planning ability, and Piaget's construct of formal operational thought. The test is comprised of crystallised scale (measuring concepts acquired from schooling and acculturation) and fluid scale measuring (ability to solve new problems). Core battery of test is composed of three subtests from each of the scales. The expanded battery is used with persons having neurological damage. For the persons with cognitive impairment, who cannot take the full battery, mental status test is administered to assess the person's attention and orientation.

Self Assessment Questions

1) Describe the development of Stanford-Binet Scales. Explain the structure and interpretation of SB5.

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2) What are the variants of Wechsler Scales? Describe the structure and interpretation of WAIS-IV.

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3) What are the theoretical bases of Kaufman Assessment Scales? Describe KABC-II and KAIT.

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3.6 LET US SUM UP

Intelligence tests measure individual differences in terms of cognitive functions and intellectual abilities. Some of the intelligence tests theoretically incline to measure a general intellectual ability and give an integrated intelligence score (IQ), while, other tests are focussed on measuring groups of factors for a variety of mental activities. Tests also differ in the ways of administration (individual and group tests) and form and nature of their items (verbal/paper-pencil tests and non-verbal/performance tests). Culture-free tests claim to be usable to the persons from different cultures. Modern intelligence testing started with Simon-Binet test in 1905. A series of revisions of the test has been published by Terman and the currently used version of the test is SB5. A number of variants of Wechsler scales have been most used instruments of cognitive assessment and very useful tool for clinical and neuro-psychological practitioners and researchers. The test introduced an innovative deviation IQ based on the standard scores. The currently used Kaufman assessment scales, KABC-II, is the most theoretically grounded and psychometrically rigorous test. The test is based on two theoretical models: Luria's neuropsychological model and the Cattell-Horn-Carroll (CHC) approach to categorising specific cognitive abilities. The provides separate global scores for each of these two theoretical models: The global score measuring general mental processing ability from the Luria perspective is the Mental Processing Index, and global score measuring general cognitive ability from the CHC perspective is the Fluid-Crystallised Index.

3.7 UNIT END QUESTIONS

1) Define intelligence tests and explain the theoretical background of measurement of intelligence.
2) Describe the history of intelligence tests and present an account of the concepts of IQ and deviation IQ.
3) Explain the types of intelligence tests with their relative advantages and disadvantages.
4) Describe the development of Simon-Binet tests. Also present a detailed account of SB5.
5) Provide a historical account of development of variants of Wechsler Scales. Describe the nature, structure and interpretation of WAIS-IV.
6) By explaining theoretical grounds of Kaufman's Scales present a complete description of structure and interpretation of KABC-II and KAIT.

3.8 GLOSSARY

Intelligence tests : Tests defined as a test to evaluate general level of cognitive functions and intellectual ability.

General factor : Factor which is essentially common in all the intellectual activities.

Specific factors : Factors required for specific intellectual activities.

IQ : Intelligence quotient is an integrated intelligence score obtained by dividing person's mental age by his/her chronological or real age and further multiplied by hundred ({MA/CA} X 100).

Individual test : Test that can be administered at only one person at a time.

Group tests : Tests that can be administered on a group of individuals at one go.

Verbal/Paper-pencil tests : Tests that use written language for its items.

Non-verbal/ Performance tests : Items of performance tests do not use language, are manipulative in nature and examinees are required to manipulate the items in a particular and desired manner.

Culture-free tests : Performance tests that claim to be suitably used at persons from different cultures.

Deviation IQ : The deviation IQ is based on standard scores computed with the same distributional characteristics at all ages and makes intra-group comparison meaningful.

3.9 SUGGESTED READINGS AND REFERENCES

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