ignou
THE PEOPLE'S
UNIVERSITY

Indira Gandhi
National Open University
School of Social Sciences

GROUP A

MPCE-012
Psychodiagnostics

Block

3

TESTS OF COGNITIVE FUNCTIONS

UNIT 1
Measures of Intelligence and Conceptual Thinking 5

UNIT 2
The Measurement of Conceptual Thinking
(The Binet and Wechsler's Scales) 24

UNIT 3
Measurement of Memory and Creativity 37

UNIT 4
Utility of Data from the Test of Cognitive Functions 55

Expert Committee

Prof. A. V. S. Madnawat
Professor & HOD Department of Psychology, University of Rajasthan. Jaipur

Dr. Usha Kulshreshtha
Associate Professor, Psychology University of Rajasthan, Jaipur

Dr. Swaha Bhattacharya
Associate Professor
Department of Applied Psychology Calcutta University, Kolkata

Prof. P. H. Lodhi
Professor and Head of the Department of Psychology University of Pune, Pune

Prof. Amulya Khurana
Professor & Head Psychology Humanities and Social Sciences Indian Institute of Technology New Delhi

Prof. Waheeda Khan
Professor and Head Department of Psychology
Jamia Millia University
Jamia Nagar, New Delhi

Prof. Usha Nayar
Professor, Tata Institute of Social Sciences, Deonar, Mumbai

Prof. A.K. Mohanty
Professor, Psychology
Zakir Hussain Center for Education Studies, Jawaharlal Nehru University, New Delhi

Dr. Madhu Jain
Reader, Psychology
Department of Psychology
University of Rajasthan, Jaipur

Dr. Shailender Singh Bhati
Lecturer, G. D. Government Girls College, Alwar, Rajasthan

Prof. Vandana Sharma
Professor and Head of Department
of Psychology
Punjabi University, Patiala

Prof. Varsha Sane Godbole
Professor and Head of Department of Psychology
Osmania University, Hyderabad

Dr. S. P. K. Jena
Associate Professor and Incharge Department of Applied Psychology University of Delhi South Campus Benito Juarez Road. New Delhi

Prof. Manas K. Mandal
Director
Defense Institute of Psychological Research
DRDO, Timarpur, Delhi

Ms. Rosley Jacob
Lecturer, Department of Psychology, The Global Open University Nagaland, Paryavaran Complex, New Delhi

Dr. Vijay Kumar Bharadwas
Director
Academie Psychologie, Jaipur

Prof. Dipesh Chandra Nath
Head of Dept. of Applied Psychology, Calcutta University Kolkata

Dr. Mamta Sharma
Assistant Professor
Department of Psychology
Punjabi University, Patiala

Dr. Vivek Belhekar
Senior Lecturer
Bombay University, Mumbai

Dr. Arvind Mishra
Assistant Professor
Zakir Hussain Center for Educational Studics. Jawaharlal Nehru University, New Delhi

Dr. Kanika Khandelwal Associate Professor and Head of Department of Psychology
Lady Sri Ram College,
Kailash Colony, New Delhi

Prof. G. P. Thakur
Professor and Head of Department of Psychology (Rtd.)
M.G. Kashi Vidhyapeeth
Varanasi

Content Editor

Prof. Vimala Veeraraghavan
Emeritus Professor, Psychology
Department of Psychology
SOSS, IGNOU, New Delhi

Format Editor : Prof. Vimala Veeraraghavan & Dr. Shobha Saxena *(Academic Consultant)*, IGNOU, New Delhi

Programme Coordinator : Prof. Vimala Veeraraghavan, IGNOU, New Delhi

Block Preparation Team

Units 1-4 Ms. Kiran Rathore
Assistant Professor
Department of Psychology
Osmania University, Hyderabad

PRINT PRODUCTION

Shri Rajiv Girdhar
A.R. (Publication)
MPDD, IGNOU, New Delhi

Shri Hemant Kumar
S.O. (Publication)
MPDD, IGNOU, New Delhi

November, 2020 (Reprint)

© *Indira Gandhi National Open University, 2010*

ISBN-978-81-266-5535-9

All right reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from the Indira Gandhi National Open University.

Further information on Indra Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068.

Printed and published on behalf of the Indira Gandhi National Open University, New Delhi by Registrar, MPDD.
Printed at M/s Saraswati Offset Printer Pvt. Ltd., Saraswati House, A-5, Naraina Industrial Area, Phase-II, New Delhi-110028

BLOCK 3 INTRODUCTION

The assessment of intelligence was conceived in a theoretical void and born into a theoretical vacuum. During the last half of the nineteenth century, first Sir Francis Galton in England (1883) and then Alfred Binet in France (Binet & Henri, 1895) took turns in developing the leading intelligence tests of the day. Galton, who was interested in men of genius and in eugenics, developed his test from a vague, simplistic theory that people take in information through their senses, so the most intelligent people must have the best developed senses. His test included a series of sensory, motor, and reaction time tasks, all of which produced reliable, consistent results (Galton, the half cousin of Charles Darwin, was strictly a scientist, and accuracy was essential), but none of which proved to be valid as measures of the construct of intelligence.

The assessment of intelligence has tremendous potential for great use and great abuse. IQ tests can be used to categorize people into oblivion and misinterpreted to support a wide variety of racist and sexist ideologies. But they can also be used to examine and treat children once simply called 'stupid'. **Unit 1,** will briefly touch on the history of intelligence assessment and then focus on the Wechsler Scales, the most used tests of cognitive development, the Stanford–Binet V, the descendant of the first major test of cognitive development, and then describe more recent tests of cognitive development, such as the Kaufman tests, the Woodcock–Johnson, the Differential Ability Scales, and the Cognitive Assessment System.

Abstract reasoning or conceptual thinking is no doubt the most advanced of the cognitive abilities. Whereas animals may be capable of problem solving, only humans can abstract. Thus, abstraction and problem solving are not synonymous, and problems can be solved without abstraction. However, formation of an abstract concept is often the most elegant way of solving a problem. The word *abstraction* connotes abstracting some unifying idea or principle on the basis of observation of diverse material. It is therefore an activity that is removed from direct sensory experience and constitutes a representation of such experience. The term *abstraction* is often contrasted to *concreteness,* the latter term indicating cognitive activity associated with direct experience, and without such representation. Concreteness is direct interaction with the "real world" without additional processing.

Conceptual thinking or abstract reasoning is a recognised form of thinking that includes aspects of critical, creative, and meta cognitive thinking. Conceptual thinking requires the ability to critically examine factual information; relate to prior knowledge; see patterns and connections; draw out significant understandings at the conceptual level; evaluate the truth of the understandings based on the supporting evidence; transfer the understanding across time or situation; and, often, use the conceptual understanding to creatively solve a problem or create a new product, process, or idea. In **Unit 2**, we will be dealing with conceptual thinking and its measurement. We will present the various tests that could be used for the purpose and then discuss the applicability and limitations of these tests.

Webster's dictionary (1966) defines memory as the 'conscious or unconscious evocation of things past'. As such, the term 'memory' can refer to a variety of learned behaviours, and it could be argued that many aspects of perception and language involve the use of certain memory systems. A number of authors have alluded to the range of possible human memory systems but in the present context we will mainly be concerned with the more customary use of the term, that is the retention of specific information which has been acquired in the recent past. It is this aspect of memory which forms the basis of most of the memory symptoms reported by brain damaged patients and which is the main focus of this unit. The first half of this unit will cover in depth the various aspects of memory assessment.

What does it mean to be creative? Some might say thinking outside the box; others might argue it as having a good imagination, and still others might suggest creativity is a synergy that can be tapped through brainstorming. We take an empirical, psychological approach to this question. One of the first things we will cover in **Unit 3** is to define what creativity is. Secondly this unit will cover the different types of tests used in assessment of creativity.

Cognitive testing is a general term referring to the assessment of a wide range of information processing or thinking skills and behaviours. These comprise general neuro psychological functions involving brain-behavior relationships, general intellectual functions (such as reasoning and problem solving) as well as more specific cognitive skills (such as visual and auditory memory), language skills, pattern recognition, finger dexterity, visual perceptual skills, academic skills, and motor functions. Cognitive testing may include aptitude testing (which assesses cognitive potential such as general intelligence) and achievement testing (which assesses proficiency in specific skills such as reading or mathematics). Cognitive testing uses well known tests such as the Scholastic Aptitude Test (SAT) and intelligence quotient (IQ) tests of all kinds. Thus, cognitive testing is an umbrella term that refers to many different types of tests measuring many different types of thinking and learning skills.

The **Unit 4** expands the discussion of assessment in clinical psychology. Cognitive assessment measures a host of intellectual capacities and encompasses the subspecialty of neuropsychological assessment that examines brain-behaviour relationships. Once all the assessment data are collected and examined by the psychologist, decisions can be made regarding diagnosis, treatment plans, and predictions about future behaviour.

UNIT 1 MEASURES OF INTELLIGENCE AND CONCEPTUAL THINKING

Structure

1.0 Introduction

1.1 Objectives

1.2 History of Intelligence Assessment

1.3 Measures of Intelligence

- 1.3.1 Wechsler Scales
- 1.3.2 Wechsler Scales for Adults
- 1.3.3 WAIS-III
- 1.3.4 WAIS-IV
- 1.3.5 The Wechsler Scale for Children
- 1.3.6 The Wechsler Preschool and Primary Scale of Intelligence (WPPSI)

1.4 Stanford-Binet Scales

- 1.4.1 Characteristics of Stanford Binet Scale

1.5 Woodcock-Johnson Psycho Educational Battery-3rd Edition: Tests of Cognitive Ability (WJ-III)

1.6 Raven's Progressive Matrices

1.7 Kaufman Assessment Battery for Children (K-ABCII)

- 1.7.1 Kaufman Adolescent and Adult Intelligence Test (KAIT)

1.8 Differential Abilities Scales (DAS)

1.9 Cognitive Assessment System (CAS)

1.10 Questions and Controversies Concerning IQ Testing

1.11 Future Perspectives and Conclusions

1.12 Let Us Sum Up

1.13 Unit End Questions

1.14 Suggested Readings

1.0 INTRODUCTION

The assessment of intelligence via the conventional IQ test has tremendous potential for great use and great abuse. IQ tests can be used to categorize people into oblivion and misinterpreted to support a wide variety of racist and sexist ideologies. But they can also be used to examine and treat children once simply called 'stupid'. This unit will briefly touch on the history of intelligence assessment and then focus on the Wechsler Scales, the most used tests of cognitive development, the Stanford–Binet V, the descendant of the first major test of cognitive development, and then describe more recent tests of cognitive development, such as the Kaufman tests, the Woodcock–Johnson, the Differential Ability Scales, and the Cognitive Assessment System.

1.1 OBJECTIVES

After completing this unit, you will be able to:

- describe the history of intelligence assessment;
- describe some of the important measures used for intellectual assessment;
- explain the Stanford Binet scales;
- elucidate the Woodcock Jhonson battery;
- describe Raven's Progressive Matrices;
- explain Kaufman assessment battery for children and for adolescents and adults;
- elucidate the differential ability scales;
- explain the cognitive assessment system;
- analyse the controversies concerned with IQ testing; and
- discuss the future perspectives of intelligence testing.

1.2 HISTORY OF INTELLIGENCE ASSESSMENT

The assessment of intelligence was conceived in a theoretical void and born into a theoretical vacuum. During the last half of the nineteenth century, first Sir Francis Galton in England (1883) and then Alfred Binet in France (Binet & Henri, 1895) took turns in developing the leading intelligence tests of the day. Galton, who was interested in men of genius and in eugenics, developed his test from a vague, simplistic theory that people take in information through their senses, so the most intelligent people must have the best developed senses. His test included a series of sensory, motor, and reaction time tasks, all of which produced reliable, consistent results (Galton, the half cousin of Charles Darwin, was strictly a scientist, and accuracy was essential), but none of which proved to be valid as measures of the construct of intelligence.

Alfred Binet, with the assistance of the Minister of Public Instruction in Paris (who was eager to separate mentally retarded from normal children in the classroom), published the first 'real' intelligence test in 1905. Like Galton's test, Binet's instrument had only a vague tie to theory (in this case, the notion that intelligence was a single, global ability that people possessed in different amounts). In a stance antithetical to Galton's, Binet declared that because intelligence is complex, so, too, must be its measurement. He conceptualised intelligence as one's ability to demonstrate memory, judgment, reasoning, and social comprehension, and he and his colleagues developed tasks to measure these aspects of global intelligence.

Binet's contributions included his focus on language abilities (rather than the non-verbal skills measured by Galton) and his introduction of the mental age concept, derived from his use of age levels, ranging from 3 to 13 years, in his revised 1908 scale (mental age was the highest age level at which the child had success; the Intelligence Quotient, or IQ, became the ratio of the child's mental age to chronological age, multiplied by 100). In 1916, Lewis Terman of Stanford University translated and adapted the Binet–Simon scales in the US to produce the Stanford Binet (Terman, 1916).

Nearly coinciding with the Stanford Binet's birth was a second great influence on the development of IQ tests in the US: America's entry into World War I in 1917. Practical concerns superseded theoretical issues. Large numbers of recruits needed to be tested quickly, leading to the development of a group IQ test, the Army Alpha. Immigrants who spoke English poorly or not at all had to be evaluated with nonverbal measures, spearheading the construction of the nonverbal group test, the Army Beta.

The next great contributor to IQ test development was David Wechsler. While awaiting induction into the US Army in 1917, Wechsler obtained a job with E.G. Boring that required him to score thousands of Army Alpha exams. After induction he was trained to administer individual tests of intelligence such as the new Stanford Binet. These clinical experiences paved the way for his Wechsler series of scales. Wechsler borrowed liberally from the Stanford Binet and Army Alpha to develop his Verbal Scale and from the Army Beta and Army Performance Scale Examination to develop his non verbal Performance Scale. His creativity came not from his choice of tasks, all of which were already developed and validated, but from his insistence that everyone should be evaluated on both verbal and non-verbal scales, and that profiles of scores on a variety of mental tasks should be provided for each individual to supplement the global or aggregate measure of intelligence.

1.3 MEASURES OF INTELLIGENCE

There are hundreds of tests that propose to measure intelligence or cognitive ability. Different tests have been developed for use with various populations such as children, adults, ethnic minority group members, the gifted, and the disabled (e.g., visually, hearing, or motorically impaired individuals). Some tests are administered individually, while others are administered in groups. Some tests have used extensive research to examine reliability and validity, whereas others have very little research support. Some are easy to administer and score, while others are very difficult to use. Although there are many intelligence tests to choose from, only a small handful of tests tend to be used consistently and widely by most psychologists. Clearly, the most popular and frequently administered tests include the Wechsler Scales (i.e., the Wechsler Adult Intelligence Scale-Third Edition [WAIS-III], the WAIS-R as a Neuropsychological Instrument [WAIS-R NI], the Wechsler Intelligence Scale of Children-Fourth Edition [WISC-IV], the Wechsler Primary and Preschool Scale-Third Edition [WPPSI-III]). The second most frequently used intelligence test is the Stanford-Binet (Fifth Edition). Other popular choices include the Kaufman Assessment Battery for Children (K-ABC) and the Woodcock-Johnson Psycho educational Battery etc.

1.3.1 Wechsler Scales

While Wechsler (1974) defined intelligence as being a person's capacity to understand and cope with his or her environment, his tests were not predicated on this definition. Tasks developed were not designed from well-researched concepts exemplifying his definition. In fact virtually all of his tasks were adapted

from other existing tests. Wechsler did not give credence to one task above another, but believed that this global entity called intelligence could be ferreted out by probing a person with as many different kinds of mental tasks as one can conjure up. Wechsler did not believe in a cognitive hierarchy for his tasks, and he did not believe that each task was equally effective. He felt that each task was necessary for the fuller appraisal of intelligence. All of his scales yields IQs with a mean of 100 and standard deviation (SD) of 15, as well as subtest scaled scores with mean =10 and SD= 3.

1.3.2 Wechsler Scales for Adults

The Wechsler-Bellevue Intelligence Scale was developed and published by David Wechsler (1896–1981) in1939. The test was revised in 1955 and renamed the Wechsler Adult Intelligence Scale (WAIS) and revised again in 1981 as the Wechsler Adult Intelligence Scale Revised (WAIS-R; Wechsler, 1981). The third edition was published in 1997 (WAIS-III; Wechsler, 1997) and the most recent edition is the scale of the fourth edition published in 2008 (WAIS-IV; Wechsler, 2008) thus the WAIS-IV is the current version of the test in use today.

1.3.3 WAIS-III

The WAIS-III consists of seven individual verbal subtests (Information, Similarities, Arithmetic, Vocabulary, Comprehension, Digit Span, and Letter-Numbering Sequencing) and seven Performance (or nonverbal) subtests (Picture Completion, Picture Arrangement, Block Design, Object Assembly, Matrix Reasoning, Digit Symbol, and Symbol Search) (see table 1). Each subtest includes a variety of items that assess a particular intellectual skill of interest (e.g., the vocabulary subtest includes a list of words that the respondent must define). The WAIS-III generally takes about one to one-and-a-half hours to individually administer to someone between the ages of 16 and 74. Three IQ scores are determined using the WAIS-III: a Verbal IQ, a Performance IQ, and a Full Scale (combining both Verbal and Performance) IQ score. The mean IQ score for each of these three categories is 100 with a standard deviation of 15. Scores between 90 and 110 are considered within the average range of intellectual functioning. Scores below 70 are considered to be in the mentally deficient range, while scores above 130 are considered to be in the very superior range. The individual subtests (e.g., Vocabulary, Block Design) have a mean of 10 and a standard deviation of 3. These subtests form the basis for subtle observations about the relative strengths and weaknesses possessed by each individual. The table below gives the details of the subtests of WAIS III.

Table 1: Descriptions of the WAIS-III Subtests

Sub Tests	Description
1) Picture completion	A set of colour pictures of common objects and settings, each of which is missing an important part that the examinee must identify.
2) Vocabulary	A series of orally and visually presented words that the examinee orally defines.

3) Digit Symbol Coding	A series of numbers, each of which is paired with its own corresponding hieroglyphic- like symbol. Using a key, the examinee writes the symbol corresponding to its number.
4) Similarities	A series of orally presented pairs of words for which the examineeexplains the similarity of the common objects or concepts they represent
5) Block Design	A set of modeled or printed two-dimensional geometric patterns that the examinee replicates using two-color cubes.
6) Arithmetic	A series of arithmetic problems that the examinee solves mentally and responds to orally.
7) Matrix Reasoning	A series of incomplete gridded patterns that the examinee completes by pointing to or saying the number of the correct response from fivepossible choices.
8) Digit Span	A series of orally presented number sequences that the examinee repeat sverbatim for Digits Forward and in reverse for Digits Backward.
9) Information	A series of orally presented questions that tap the examinee's knowledgeof common events, objects, places, and people.
10) Picture Arrangement	A set of pictures presented in a mixed-up order that the examineerearranges into a logical story sequence.
11) Comprehension	A series of orally presented questions that require the examinee to understand and articulate social rule and concepts or solutions toeveryday problems.
12) Symbol Search	A series of paired groups, each pair consisting of a target group and asearch group. The examinees indicates, by marking the appropriate box,whether either target symbol appears in the search group.
13) Letter-Number Sequencing	A series of orally presented sequences of letters and numbers that the examinee simultaneously tracks and orally repeats, with the number in ascending order and the letters in alphabetical order.
14) Object Assembly	Set of puzzles of common objects, each presented in a standardized configuration that the examinee assembles to form a meaningful whole.

Source: From *Wechsler Adult Intelligence Scale,* Third Edition, by D. Wechsler, 1997, San Antonio, TX: Psychological Corporation.

Administration and Scoring of the WAIS-III

WAIS-III must be administered on an individual basis by a specially trained psychologist. Although the administration and scoring of some sub tests (e.g., arithmetic) is a relatively simple matter, many of the subtests, especially those comprising open-ended questions, call for informed professional judgment in scoring responses. A large part of the examiner's job is to establish and maintain rapport with the person taking the test. The sub tests of the WAIS III are given separately, alternating the verbal and performance subtests. The examinee first completes the picture completion subtest, which is simple and nonthreatening (this helps to capture the examinee's interest), then the vocabulary subtest, then the digit-symbol coding subtest, and so on. In each subtest, items are arranged in order of difficulty, with the easier items at the beginning of each subtest and the more difficult items given later. For most subtests, it is neither necessary nor useful to administer all test items to every subject. Instead, a fairly easy item is given first, and a subject who answers that item correctly receives credit for that item and for all the easier items of the subtest. If the subject fails the first item, the examiner administers all the easier items to determine what types of problems the subject can or cannot solve. Similarly, if a subject consecutively fails a number of the moderately difficult items, the examiner concludes the subtest, rather than administering the most difficult items. The rationale for this procedure is that subjects tend to lose interest in testing if they are forced to respond to a number of items that are either insultingly easy or impossibly difficult for them.

The WAIS III manual includes tables that are used to transform raw scores on each of the subtests to standard scores with a mean of 10 and a standard deviation of 3 (the same scale as used by the Stanford-Binet Fifth Edition). These standardized sub test scores provide a uniform frame of reference for comparing scores on the different sections of the WAIS III. For example, if a person receives a score of 16 on the digit span test and 9 on the block design test, one might reasonably infer that this person is relatively better at the functions measured by the digit span test than at those measured by the block design test.

Traditionally, interpretation of the WAIS focused on Verbal, Performance, and Full-Scale IQ. These scores are still reported in WAIS-III, but there is growing consensus that the Verbal-Performance dichotomy is not sufficient for understanding individuals' intelligence. The WAIS-III provides scores for four empirically supported indices: Verbal Comprehension (Vocabulary, Similarities, Information), Perceptual Organisation (Picture Completion, Block Design, Matrix Reasoning), Working Memory (Arithmetic, Digit Span, Letter-Number Sequencing),and Processing Speed (Digit-Symbol Coding, Symbol Search). The Picture Arrangement, Comprehension, and Object Assembly subtests do not contribute to these index scores. The WAIS-III manual provides tables for converting verbal, performance, and full-scale scores into deviation IQs based on a mean of 100 and a standard deviation of 15.

1.3.4 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, Information, the Block Design, Matrix Reasoning and Visual Puzzles subtests. The GAI is clinically useful because it can be used as a measure of cognitive abilities that are less vulnerable to impairment.

There are *four index* scores representing major components of intelligence:

1) Verbal Comprehension Index (VCI)
2) Perceptual Reasoning Index (PRI)
3) Working Memory Index (WMI)
4) Processing Speed Index (PSI)

The Verbal Comprehension Index includes *four* tests:

1) Similarities: Abstract verbal reasoning (e.g., "In what way are an apple and a pear alike?")
2) Vocabulary: The degree to which one has learned, been able to comprehend and verbally express vocabulary (e.g., "What is a guitar?")
3) Information: Degree of general information acquired from culture (e.g., "Who is the president of Russia?")
4) 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

1) Bock Design: Spatial perception, visual abstract processing & problem solving
2) Matrix Reasoning: Nonverbal abstract problem solving, inductive reasoning, spatial reasoning.
3) Visual Puzzles: non-verbal reasoning
4) Picture Completion (supplemental): Ability to quickly perceive visual details
5) Figure Weights (supplemental): quantitative and analogical reasoning

The Working Memory Index is obtained from *three* tests:

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

The Processing Speed Index includes three tests:

1) Symbol Search: Visual perception, speed
2) Coding: Visual-motor coordination, motor and mental speed
3) Cancellation (supplemental): visual-perceptual speed

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

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 standardization 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.

1.3.5 The Wechsler Scales for Children

The Wechsler Intelligence Scale for Children(WISC) was first published in 1949 and was revised in 1974 (and renamed the Wechsler Intelligence Scale for Children-Revised; WISC-R) and revised again in 1991(renamed the Wechsler Intelligence Scale for Children-Third Edition; WISC-III) and again in 2003 (now named the Wechsler Intelligence Scale for Children-Fourth Edition).

The WISC-IV is the version currently used today. The WISC-IV has both verbal and nonverbal subscales similar to those used in the WAIS-III. However, WISC-IV questions are generally simpler because they were developed for children aged 6 to 16 rather than for adults. Furthermore, they are clustered in four categories that represent different areas of intellectual functioning. These include;

i) Verbal Comprehension, ii) Perceptual Reasoning, iii) Working Memory, and iv) Processing Speed.

Each of these four areas of intellectual functioning include both "core" or mandatory subtests that must be administered to derive an index or IQ score as well as at least one "supplementary" or optional subtest that is not included in the index or IQ score. The Verbal Comprehension category consists of three core subtests including Similarities, Vocabulary, and Comprehension as well as two supplementary sub tests that include Information and Word Reasoning. The Perceptual Reasoning category also consists of three core subtests, including Block Design, Picture Concepts, and Matrix Reasoning as well as one supplementary subtest called Picture Completion. The working memory category consists of two core subtests including Digit Span and Letter-Number Sequencing as well as one supplementary subtest entitled Arithmetic. Finally, the Processing Speed category consists of two core subtests including coding and Symbol Search as well as one supplementary subtest entitled Cancellation.

The WISC-IV provides four index score IQs as well as an overall or full-scale IQ based on the scores from all of the four index scores. These IQ scores all are set with a mean of 100and a standard deviation of 15. The four factor scores (i.e., Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed) were developed using factor analytic techniques and numerous research studies to reflect human intellectual functioning. Each of the subtests uses a mean of 10 and standard deviation of 3. The WISC-IV has been shown to have excellent reliability, validity, and stability (Wechsler, 2003).

1.3.6 The Wechsler Preschool and Primary Scale of Intelligence (WPPSI)

WPPSI was developed and published in 1967 for use with children aged 4 to6. The test was revised in 1989 and became known as the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R) and revised again in 2002 as the WPPSI-III. The WPPSI-III is the current version of the test being used today. The WPPSI-III is used for children ranging in age from 2 to 7. Like the other Wechsler scales (WAIS-III, WAIS-III NI, and WISC-IV), the WPPSI-III has both Verbal and Performance scales resulting in four IQ scores: Verbal IQ, Performance IQ, Processing Speed IQ, and Full Scale IQ. Similar to the other Wechsler scales, IQ scores have a mean of 100 and a standard deviation of 15, while the subtest scores have a mean of 10 and a standard deviation of 3. The Verbal IQ score consists of the Information, Vocabulary, and Word Reasoning subtest while the Comprehension and Similarities subtests are not included in the calculation of the Verbal IQ score. The Performance IQ consists of the Block Design, Matrix Reasoning, and Picture Concept subtests while the Picture Completion and Object Assembly are not included in the calculation of the Performance IQ score.

The Processing Speed IQ score consists of the Symbol Search and Coding Subtest. The WPPSI-III has been shown to have satisfaction, reliability, validity, and stability (Wechsler, 2002).

Self Assessment Questions

1) Trace the history of intelligence assessment.

.....

.....

.....

2) Describe Wechsler Scales.

.....

.....

.....

3) Elucidate Wechsler scale for children.

.....

.....

4) What are the important features of Wechsler preschool and primary scale of intelligence.

.....

.....

5) Describe WAIS III and WAIS IV.

.....

.....

.....

1.4 STANFORD-BINET SCALES

The major impetus for the development of intelligence tests was the need to classify (potentially) mentally retarded school children. The scales developed for this purpose by Binet and Simon in the early 1900s was the forerunners of one of the most successful and most widely researched measures of general intelligence, the Stanford-Binet Intelligence Scale. The Stanford-Binet is used widely in assessing the intelligence of children and young adults, and it is one of the outstanding examples of the application of the principles of psychological testing to practical testing situations.

The scale developed by Binet and Simon in 1905 consisted of a set of 30 problems, varying from extremely simple sensory motor tasks to problems involving judgment and reasoning. The basic strategy followed in this test and in its many revisions was to observe the subject's reactions to a variety of somewhat familiar, yet challenging tasks. Terman and Merrill (1937) neatly summarize Binet's procedures, noting that this type of test is "not merely an intelligence test; it is a method of standardized interview which is highly interesting to the subject and calls forth his natural responses to an extraordinary variety of situations" (p. 4).

Binet's original scales have undergone several major revisions. The fifth edition of the Stanford-Binet (Roid, 2003) represents the cumulative outcome of a continuing process of refining and improving the tests. Following a model adopted with the release of the fourth edition of this test in 1986, the selection and design of the tests included in the Stanford-Binet is based on an increasingly well-articulated theory of intelligence. The fifth edition of the Stanford-Binet leans less heavily on verbal tests than in the past; the current version of the test includes equal representation of verbal and nonverbal sub tests. In this edition, both verbal and nonverbal routing tests are used to quickly and accurately adapt test content and testing procedures to the capabilities of the individual examinee.

Each subtest of the Stanford-Binet is made up of open-ended questions or tasks that become progressively more difficult.

1.4.1 Characteristics of the Stanford Binet Scale

Like many other tests of general mental ability, the Stanford-Binet samples a wide variety of taskstt that involve the processing of information and measures an individual's intelligence by comparing his or hers performance on these tests; the Stanford-Binet has employed a well-developed theory of intelligence to guide the selection and development of subtests. Drawing on the work of Vernon (1965), R. B. Cattell (1963), Sternberg (1977, 1981), and others, the authors of the Stanford-Binet have formulated a hierarchical model of cognitive abilities and have used this model in selecting subtests and in scoring the Stanford-Binet

The theoretical model used in developing and interpreting the Stanford-Binet is shown table 2. The current version of the Stanford-Binet measures five general factors (Fluid Reasoning, Knowledge, Quantitative Reasoning, Visual-Spatial Processing and Working Memory), using both verbal and nonverbal tasks. In table 2, the factors measured and the subtest names are shown in boldface, whereas the specific tasks that are used to measure each of these factors are shown in plain text. In several cases there are different sets of tasks that are appropriate at varying developmental levels. So, for example, in evaluating the

Verbal Fluid Reasoning of a young examinee (or an examinee who finds age-appropriate questions too difficult), you might use simple reasoning tasks, whereas verbal absurdities tasks might be used for more advanced examinees and verbal analogies tasks might be appropriate for the oldest and most advanced examinees.

Examinees receive scores on each of the ten subscales (scales with a mean of 10 and standard deviation of 3), as well as composite scores for Full Scale, Verbal and Nonverbal IQ, reported on a score scale with a mean of 100 and a standard deviation of 15.Historically, the IQ scale based on a mean of 100 and a standard deviation of 15 had been the norm for almost every other major test, but the Stanford-Binet had used a score scale with a standard deviation of 16. This might strike you as a small difference, but what it meant was that scores on the Stanford-Binet were hard to compare with scores on all other tests; a score of 130 on previous versions of the Stanford-Binet was not quite as high a score as a 130 on any other major test (if the standard deviation is16, 130 is 1.87 standard deviations above the mean, whereas on tests with a standard deviation of 15, it is 2 standard deviations above the mean). The current edition of the Stanford-Binet yields IQ scores that are comparable to those on other major tests.

Table 2: Theoretical Model for the Stanford-Binet (Fifth Edition)

	Verbal	**Non Verbal**
Fluid Reasoning	Verbal Fluid Reasoning Reasoning Early Reasoning (2-3) Verbal Absurdities (4) Verbal Analogies (5-6)	Nonverbal Fluid Object Series/ Matrices Nonverbal Knowledge Procedural Knowledge (2-3)
Knowledge	Verbal Knowledge Vocabulary	Picture Absurdities (4-6)
Quantitative Reasoning	Verbal Quantitative Reasoning Quantitative Reasoning (2-6)	Nonverbal Quantitative Reasoning Quantitative Reasoning (2-6)
Visual-Spatial Processing	Verbal Visual-Spatial Processing Position and Direction (2-6)	Nonverbal Visual-Spatial Processing Form Board (1-2) Form Patterns (3-6)
Working Memory	Verbal Working Memory Memory for Sentences (2-3) Last Word (4-6)	Nonverbal Working Memory Delayed Response (1) Block Span (2-6)

Administration and Scoring of the Stanford-Binet

Throughout its history, the Stanford-Binet has been an adaptive test in which an individual responds to only that part of thetest that is appropriate for his or her

developmental level. Thus, a young child is not given difficult problems that would lead only to frustration (e.g., asking a 5-year-oldwhy we have a Constitution). Similarly, an older examinee is not bored with questions that are well beneath his or her age level (e.g., asking a 10-year-old to add 4 + 5).Subtests in the Stanford-Binet are made up of groups of items that are progressively more difficult. A child taking the test may respond to only a few sets of items on each subtest.

One of the examiner's major tasks has been to estimate each examinee's mental age to determine the level at which he or she should be tested. The recent revisions of the Stanford-Binet include objective methods of determining each appropriate level for each examinee through the use of routing tests; the current edition uses both verbal (Vocabulary) and nonverbal (Matrices) routing tests.

Historically, the Stanford-Binet has been regarded as one of the best individual tests of a child's intelligence available. The recent revisions of the Stanford-Binet may increase its relevance in adult testing. This test draws on a long history of development and use, and it has successfully integrated theoretical work on the nature of intelligence. It is likely that the Stanford-Binet will remain a standard against which many other tests of general mental ability are judged.

1.5 WOODCOCK-JOHNSON PSYCHO EDUCATIONAL BATTERY (3rd EDITION): TESTS OF COGNITIVE ABILITY (WJ III)

The original Woodcock Johnson Psycho-Educational Battery: Tests of Cognitive Ability (WJ; Woodcock & Johnson, 1977) made a major contribution to test development because of its inclusion of a diversity of novel tasks that represented the first major departure from subtests originally developed by Binet or by World War I psychologists. The WJ, however, was developed from an entirely practical perspective, with no apparent emphasis on theory. All that changed with the publication of the WJ-R (Woodcock & Johnson, 1989), an expanded and reformulated test battery that is rooted firmly in Horn's modified gf–gc psychometric theory of intelligence, as is its recent successor, the third edition of the WJ (WJ III;Woodcock, McGrew & Mather, 2000).

The WJ III, for ages 2 to 90+ years and composed of Cognitive and Achievement sections, is undoubtedly the most comprehensive test battery available for clinical assessment. The WJ III Cognitive battery (like the WJ-R) is based on Horn's (1989) expansion of the fluid/crystallized model of intelligence and measures seven separate abilities: Long-Term Retrieval, Short-Term Memory, Processing Speed, Auditory Processing, Visual Processing, Comprehension-Knowledge and Fluid Reasoning. An eighth ability, Quantitative Ability, is measured by several subtests on the Achievement portion of the WJ III.

Self Assessment Questions

1) What is Stanford Binet scales and what are their characteristics?

.....

.....

.....

.....

2) Discuss the administration and scoring of Stanford Binet scale.

.....

.....

.....

3) Elucidate Woodcock Johnson Psycho educational battery.

.....

.....

.....

1.6 RAVEN'S PROGRESSIVE MATRICES

Raven's Progressive Matrices, probably the most widely cited culture-reduced tests, have had a long and distinguished history. Factor analyses carried out in Spearman's laboratory in the 1930s suggested that tests made up of simple pictorial analogies showed high correlations with a number of other intelligence tests and, more important, showed high loadings on Spearman's g.

Raven's Progressive Matrices (available in both paper and computer-administered forms) are made up of a series of multiple-choice items, all of which follow the same basic principle. Each item represents a perceptual analogy in the form of a matrix. Some valid relationship connects items in each row in the matrix, and some valid relationship connects items in each column of the matrix. Each matrix is presented in such a way that a piece of the matrix, located in the lower-right comer, is missing. The subject must choose from among six or eight alternatives the piece that best completes each matrix.

There are three forms of Raven's Progressive Matrices. The most widely used form, the Standard Progressive Matrices, consists of 60 matrices grouped into 5 sets. Each of the 5 sets involves 12 matrices whose solutions involve similar principles but vary in difficulty. The principles involved in solving the 5 sets of matrices include perceptual discrimination, rotation, and permutations of patterns. The first few items in each set are comparatively easy, but the latter matrices may involve very subtle and complex relationships.

The Standard Progressive Matrices are appropriate both for children above 5 years of age and adults; because of the low floor and fairly high ceiling of this test, the Standard Matrices are also appropriate for most ability levels. For younger children (ages 4 to 10), and for somewhat older children and adults who show signs of retardation, the Coloured Progressive Matrices seem to be more appropriate. This test consists of three sets of 12 matrices that employ color and are considerably less difficult than those that make up the Standard Progressive Matrices.

Finally, the Advanced Progressive Matrices are appropriate for intellectually advanced subjects who find the Standard Matrices too easy. The Advanced Matrices are made up of 3 sets of 12 matrices, many of which involve extremely subtle principles in their solutions. The test effectively discriminates among those who receive extremely high scores on the Standard Progressive Matrices

1.7 KAUFMAN ASSESSMENT BATTERY FOR CHILDREN (K-ABC II)

The K-ABC-II (Kaufman & Kaufman, 2004) is administered to children between the ages of 3 and 13 and has five global scales including Sequential Processing, Simultaneous Processing, Learning Ability, Planning Ability, and Crystallized Ability. Scores are then combined to create a Mental Processing Index (MPI) and a nonverbal index. The development of the K-ABC reflects a different theoretical approach to intellectual assessment relative to the Wechsler scales. The K-ABC-II was developed from research and theory in neuropsychology and, unlike both the Wechsler and Stanford-Binet scales, has achievement scores to measure skills such as reading ability. Many clinicians feel that the K-ABC-II is more enjoyable and engaging for children than the Wechsler scales and Stanford-Binet, as well as a less verbally dependent test. Furthermore, the K-ABC-II generally takes less time to administer than the Wechsler and Stanford-Binet.

The Sequential Processing/Short-Term Memory Scale is designed to measure the ability to solve problems by remembering and using an ordered series of images or ideas. The Simultaneous/Visual Processing Scale measures the ability to solve spatial, analogical, or organisational problems that require the processing of many stimuli at one time. The Learning Ability/Long-Term Storage and Retrieval Scale measures the ability to successfully complete different types of learning tasks. Immediate recall and delayed recall tasks are included in this scale. The Planning/Fluid Reasoning Scale measures the ability to solve nonverbal problems that are different from the kinds taught in school. Verbally mediated reasoning must be used to solve the problems. The Knowledge/Crystallized Ability Scale measures knowledge of words and facts using both verbal and pictorial stimuli and requiring either a verbal or pointing response. Means are set at 100 with standard deviations of 15.

1.7.1 Kaufman Adolescent and Adult Intelligence Test (KAIT)

The Kaufman Adolescent and Adult Intelligence Test (KAIT) (Kaufman & Kaufman, 1993) is an individually administered intelligence test for individuals between the ages of 11 and more than 85 years. It provides Fluid, Crystallized, and Composite IQs. It includes a Core Battery of six subtests (three Fluid and three Crystallized) and an Expanded Battery that also includes alternate Fluid and Crystallized subtests plus measures of delayed recall of information learned earlier in the evaluation during two of the Core subtests.

1.8 DIFFERENTIAL ABILITIES SCALES (DAS)

The DAS was developed by Elliott (1990) and is an individually administered battery of 17 cognitive and achievement tests for use with individuals aged 2 through to 17 years. The DAS Cognitive Battery has a preschool level and a school-age level. The school-age level includes reading, mathematics, and spelling achievement tests that are referred to as 'screeners'. The same sample of subjects was used to develop the norms for the Cognitive and Achievement Batteries; therefore, intra- and inter-comparisons of the two domains are possible. The DAS is not based on a specific theory of intelligence. Instead, the test's structure

is based on tradition and statistical analysis. Elliott (1990) described his approach to the development of the DAS as 'eclectic' and credited the work of researchers such as Cattell Horn, Das, Jensen, Thurstone, Vernon, and Spearman.

1.9 COGNITIVE ASSESSMENT SYSTEM (CAS)

The Das–Naglieri Cognitive Assessment System(CAS; Naglieri& Das, 1997), for ages 5 to 17 years, is based on, and developed according to, the Planning, Attention, Simultaneous, and Successive (PASS) theory of intelligence. The PASS theory is a multidimensional view of ability that is the result of the merging of contemporary theoretical and applied psychology (Das, Naglieri& Kirby, 1994). According to this theory, human cognitive functioning includes four components: planning processes that provide cognitive control, utilisation of processes and knowledge, intentionality and self-regulation to achieve a desired goal; attentional processes that provide focused, selective cognitive activity over time; and simultaneous and successive information processes that are the two forms of operating on information.

Self Assessment Questions

1) Describe Raven's Progressive Matrices.

.....

.....

.....

2) How are Kaufman Assessment Battery for children different from Kaufman adolescent and adult intelligence test?

.....

.....

.....

3) Describe Differential Abilities Scales.

.....

.....

.....

4) What is cognitive assessment system?

.....

.....

.....

1.10 QUESTIONS AND CONTROVERSIES CONCERNING IQ TESTING

Are We Born With A Certain IQ?

Often people assume that we are born with an innately determined level of intellectual ability that is not influenced by social, emotional, and environmental

factors. Some suggest that IQ differences found among different racial groups might be due to inborn differences in intelligence. A great deal of controversy has raged in this debate for many years. The publication of the book *The Bell Curve* (Herrnstein & Murray, 1994) reignited this controversy by suggesting that African Americans were innately less intelligent than Caucasians while Caucasians were less intelligent than Asians. Research examining genetic influences on intelligence generally studies the heritability (i.e., the estimate of genetic contribution to a given trait) of IQ using twin studies. Identical (monozygotic) and fraternal (dizygotic) twins reared together and reared apart present a unique research opportunity for examining the influence of both genetic and environmental contributions to a wide variety of traits. It has been estimated that the heritability of intelligence is between.40 and .80. Thus between 16% and 64% of the variance in intellectual ability is due to genetic influence. Research generally supports the notion of at least some significant genetic influence in intellectual ability. However, biological (e.g., prenatal care, genetics, nutrition), psychological (e.g., anxiety, motivation, self-esteem), and social (e.g., culture, socioeconomic status) influences all appear to be associated with intelligence or at least with IQ scores on standardized tests.

Is IQ Scores Stable Over Time?

Measures of attention, memory, and other cognitive abilities assessed during the first year of life generally are moderately associated (i.e., $r = .36$) with intelligence test scores assessed later in childhood. Often people assume that an IQ score obtained in childhood is stable over time. Thus, many people erroneously believe that someone who obtained an IQ of 120 in the first grade will also have an IQ of 120 in adulthood. Intelligence tests, however, provide an index of current functioning, and scores may change significantly over time. Many factors influence the stability of IQ scores. First, scores obtained when a child is very young (e.g., age 3) are likely to be less stable than scores obtained when a child is older (e.g., age 16). This is partially because early childhood tests focus on perceptual and motor skills, whereas tests for older children and adults focus more on verbal skills. Second, the longer the time between testing administrations, the more unstable the IQ score will appear. Thus, the difference between scores obtained at ages 3 and 30 is likely to be greater than the difference between scores obtained at ages 16 and 19. Furthermore, environmental factors such as stress, nutrition, educational opportunities, exposure to toxins such as lead, and illness, among other influences, all play a role in the determination of IQ scores.

Are IQ Scores Biased?

Many people are concerned about potential bias in intelligence testing. For example, many feel that IQ testing may be biased in that children from high socioeconomic-level homes tend to perform better on standardized tests than those from lower socioeconomic-level homes. Furthermore, some argue that currently available intelligence tests may not be appropriate for use with individuals from many ethnic minority groups. In fact, California passed legislation that prohibited intelligence testing from being used for school placement of African-American children (*Larry P vs Wilson Riles*). The ruling suggested that intelligence testing was biased against African Americans and that they were disproportionately represented in educable mental retardation (EMR) classrooms. Bias is determined by examining the test's validity across different groups. A test is biased if the validity of the test varies from group to group. Research suggests that most standardized IQ tests such as the Wechsler and Stanford-Binet scales are not biased. However, tests can be misused by both unqualified and well meaning people.

Should The Terms Intelligence Quotient or IQ Continue To Be Used?

A number of misconceptions and myths about IQ exist. These include the notion that the IQ measures an innate or genetically-determined intelligence level, that IQ scores are fixed and never change, and that IQ scores generated from different tests mean the same thing. These concerns have led some experts to suggest that general IQ scores be eliminated in favour of standard scores that more accurately describe specific skills. In fact, many recent tests of intellectual and cognitive abilityhave not used the terms *intelligence quotient* or *IQ* at all. These include the Woodcock-Johnson Psychoeducational Battery, the Kaufman Assessment Battery for Children, and the newest version of the Stanford-Binet.

1.11 FUTURE PERSPECTIVES AND CONCLUSIONS

The unchanging nature of IQ tests has begun to thaw. For the first three-quarters of a century, from Binet's 1905 scale until to about 1980, there was the Binet and there was the Wechsler and that was about it. Then came a series of tests that included novel tasks and an attempt to link theory to IQ assessment. Today, clinicians have more choice than ever before and these choices include a pick of theory – namely Horn–Cattell gf–gc, expanded Horn gf–gc, and Luria PASS.

The critics of IQ tests abound, especially among popular and influential theorists such as Sternberg (e.g. Sternberg & Kaufman, 1998), and these critics must be heard. It is partly because of the critics that the developers of IQ tests have constantly striven to improve the existing measures and to attempt to bring more theory and research into the development of new tests and the revision of old ones. Tests that are powerful psychometric tools that have a solid research history, and that are clinically and neuro psychologically relevant are valuable if used *intelligently* by highly trained examiners.

Clinicians who employ the intelligent testing philosophy as outlined in Kaufman (1994) can make a meaningful difference in a client's life when interpreting the results of a test profile in the context of clinical observations during the test session, background information about the client, research findings, and theoretical models. The array of instruments described in this entry, as well as others not included because of space constraints, can each serve quite well as the IQ test of choice for clinical evaluation. Perhaps when some of the highly respected theories of intelligence are translated into individual tests of intelligence it will be time to abandon existing instruments. But the test developers who attempt to translate the theories necessarily must be well versed in the clinical, neuropsychological, and psychometric aspects of assessment; otherwise, the perfect theory-based test will prove to be an imperfect clinical tool.

And what of the future? There has been considerable progress during the past two decades in providing options for clinicians apart from the Wechsler and Binet, and several of these options have impressive theoretical foundations. Yet progress has not been as rapid as most would wish. By their very nature, test publishers are conservative, investing their money in proven ventures rather than speculating on new ideas for measuring intelligence. Progress will likely continue to be controlled as the twenty-first century unfolds.

Eventually, new and improved high-tech instruments will be available that meet the rigours of psychometric quality and the demands of practical necessity. Hopefully

those tests will not abandon theory but will embrace it, continuing the trend in the development of IQ tests that began in the early 1980s and has continued to the present. But none of the excellent instruments that are now available for clinical assessment of intelligence – Wechsler or otherwise – should be left for dead until there is something of value to replace them.

1.12 LET US SUM UP

The assessment of intelligence has a long history in clinical psychology. Compulsory education and psychologists' ability to measure mental abilities contributed to the development and success of the field of intelligence testing. However, by the end of the 1960s, the validity of these tests was being challenged. To this day, there are many controversies about how intelligence is defined and how it is measured. Contemporary clinical psychologists appear to believe in both a general factor of intelligence, *g* and specific abilities that underlie the general intelligence factor. Intelligence scores are correlated with school success, occupational status, and job performance. In addition, there are group differences in intelligence test scores between males and females and among ethnic/racial groups. Although intelligence test scores are influenced by genetic factors, environment does play some role in the development of intelligence. IQ scores are more stable for adults than they are for children.

We have discussed some major intelligence tests in use today. The Wechsler Scales are the most commonly used tests of intelligence assessing preschool children (WPPSI-III), elementary and secondary school children (WISC-IV), and adults (WAIS-III and WAIS-IV). The Stanford-Binet, Kaufman Scales, and other intelligence tests are also frequently used. In addition to overall intellectual skills and cognitive strengths and weaknesses, these tests are frequently used to assess the presence of learning disabilities, predict academic success in school, examine brain dysfunction, and assess personality. Intelligence test results are used to quantify overall levels of general intelligence as well as specific cognitive abilities. This versatility allows clinical psychologists to use intelligence test scores for a variety of prediction tasks (e.g., school achievement).

1.13 UNIT END QUESTIONS

Multiple Choice Questions

1) Which of the following is nearly always the best predictor of academic achievement?

   a) overall intelligence or *g*

   b) nonverbal intelligence

   c) verbal intelligence

   d) mother's educational level

2) Reading skill of the examinee is often a confounding factor in the use of

   a) group- administered intelligence tests.

   b) comprehensive, individually administered intelligence tests.

   c) brief, individually administered intelligence tests.

   d) group- administered reading tests.

3) When screening for intellectual level

   a) G is the only important concern.

   b) verbal and nonverbal intelligence should be considered.

   c) memory assessments should nearly always be considered.

   d) working memory and processing speed are the best estimators inmost cases.

4) Test developers hoped to accomplish which of the following when revising the original K-ABC?

   a) update norms

   b) develop alternative subtests to measure verbal ability

   c) develop alternative subtests to measure nonverbal ability

   d) both a and b

5) Formula for IQ is

   a) MA/CA* 100

   b) CA*MA/ 100

   c) CA/MA*100

   d) None

Theoretical Questions

1) Describe the history of intellectual assessment?

2) What are some of the different tests used to measure IQ and how are they similar and different?

3) Will an IQ score obtained at age 5 be the same as an IQ score obtained at age 40 for the same person? Why or why not?

4) Discuss the controversies surrounding IQ testing

5) What are the future prospects of IQ testing?

1.14 SUGGESTED READINGS

Groth-Marnat, Gary. (2003). *Handbook of Psychological Assessment* (4th ed.). New Jersey: John Wiley & Sons, Inc.

Murphy, K.R., Davidshofer, C.O. (2005). *Psychological Testing:. Principles and Applications (6th ed.)*. New Jersey: Pearson Education International.

UNIT 2 THE MEASUREMENT OF CONCEPTUAL THINKING (THE BINET AND WECHSLER'S SCALES)

Structure

2.0 Introduction

2.1 Objectives

2.2 The "Abstract Attitude"

- 2.2.1 Characteristics of Abstract Attitude
- 2.2.2 Characteristics of Tests of Abstraction

2.3 Measurement of Conceptual Thinking

2.4 Overview of Tests

- 2.4.1 Analogies and Proverb Tests
- 2.4.2 Performance Tests (Sorting Tests)
- 2.4.3 Colour Sorting Tests
- 2.4.4 Halstead Category Tests
- 2.4.5 Tha Haufmann Kasanin Concept Formation Test (1937)
- 2.4.6 The Twenty Questions Tasks

2.5 Range of Applicability and Limitations

2.6 Cross-Cultural Considerations and Accommodations for Persons with Disabilities

2.7 Let Us Sum Up

2.8 Unit End Questions

2.9 Suggested Readings

2.0 INTRODUCTION

Abstract reasoning or conceptual thinking is no doubt the most advanced of the cognitive abilities. Whereas animals may be capable of problem solving, only humans can abstract. Thus, abstraction and problem solving are not synonymous, and problems can be solved without abstraction. However, formation of an abstract concept is often the most elegant way of solving a problem. The word *abstraction* connotes abstracting some unifying idea or principle on the basis of observation of diverse material. It is therefore an activity that is removed from direct sensory experience and constitutes a representation of such experience. The term *abstraction* is often contrasted to *concreteness,* the latter term indicating cognitive activity associated with direct experience, and without such representation. Concreteness is direct interaction with the "real world" without additional processing.

Conceptual thinking or abstract reasoning is a recognised form of thinking that includes aspects of critical, creative, and meta cognitive thinking. Conceptual

thinking requires the ability to critically examine factual information; relate to prior knowledge; see patterns and connections; draw out significant understandings at the conceptual level; evaluate the truth of the understandings based on the supporting evidence; transfer the understanding across time or situation; and, often, use the conceptual understanding to creatively solve a problem or create a new product, process, or idea. In this unit we will be dealing with conceptual thinking and its measurement. We will present the various tests that could be used for the purpose and then discuss the applicability and limitations of these tests.

2.1 OBJECTIVES

After completing this unit, you will be able to:

- discuss the concept of abstract reasoning or conceptual thinking;
- explain various tests of abstract reasoning;
- describe the applications and limitations of the tests of concept formation; and
- discuss the cross-cultural considerations and accommodations for per sons with disabilities in tests of concept formation.

2.2 THE "ABSTRACT ATTITUDE"

The relationship between brain function and abstract reasoning was probably first discussed during the late nineteenth century by the neurologists Henry Head and Hughlings Jackson. However, this relationship had its first full theoretical development in the work of Kurt Goldstein and Martin Scheerer and is best articulated in their 1941 monograph on abstract and concrete behavior (Goldstein & Scheerer, 1941).They characterised the abstract attitude with eight points.

2.2.1 Characteristics of Abstract Attitude

1) To detach our ego from the outer world or from inner experiences.
2) To assume a mental set.
3) To account for acts to oneself; to verbalize the account.
4) To shift reflectively from one aspect of the situation to another.
5) To hold in mind simultaneously various aspects.
6) To grasp the essential of a given whole; to break up a given whole into parts, to isolate and synthesize them.
7) To abstract common properties reflectively; to form hierarchic concepts.
8) To plan ahead ideationally; to assume an attitude towards the "mere possible" and to think or perform symbolically.

Based on these points, tests of abstraction can be said to have the following task characteristics.

2.2.2 Characteristics of Tests of Abstraction

1) Learning to identify a relevant attribute or multiple attributes to solve a problem or make an accurate generalisation.

2) Learning a rule or set of rules that solve a problem.

3) Concept formation or spontaneous generation of hypotheses that relate disparate material.

4) Inductive reasoning through spontaneous formation of hypotheses that rule out alternative possibilities for a solution, and that finally lead to a correct solution.

5) Having an "attitude toward the possible" or forming and manipulating a mental representation of an object that is not physically present.

6) Spontaneous generation of plans that lead to ultimate solution of a problem.

7) The ability to shift, or change hypotheses or plans when the current one or the pre potent response is not productive.

The large variety of cognitive and neuropsychological tests available makes it possible to identify procedures that provide assessments of all of these tasks. With respect to neuropsychology, patients with various forms of brain damage or disease lose all or some of these characteristics, as do some patients with psychiatric disorders, notably schizophrenia. Tests of abstract reasoning require to a greater or lesser degree the ability to maintain a mental set, to shift reflectively, to hold in mind simultaneously various aspects of a task (now known as dual processing), to abstract common properties, and to grasp essentials. Most scholars in the field would agree that these tests may be treated quantitatively, and would not agree with the relatively extreme view taken by Goldstein and Scheerer regarding numerical scoring. However, contemporary neuropsychology does not eschew the use of qualitative observation, and efforts are being made to make such observations objective, reliable, and perhaps quantifiable.

The distinction within abstract reasoning between those tasks in which the test-taker has to generate concepts and those in which an established concept has to be identified through experiencing a series of positive and negative instances needs to be emphasised. Whereas self initiated concept formation, attribute identification, and rule learning may all require the abstract attitude, they nevertheless appear to be separable cognitive abilities that may have differing clinical and adaptive implications. Absence of the abstract attitude, and consequent concreteness, may prevent solution of even the simplest conceptual tasks, but the capability of abstract reasoning can exist at numerous levels. Ability to identify relevant and irrelevant perceptual attributes and the ability to learn rules does not guarantee intact ability to generate conceptual strategies in "open-field" novel problem-solving situations.

The importance of flexibility is also important, because attainment of a perfectly correct concept may not be adaptive when environmental circumstances necessitate a change. The Wisconsin Card Sorting Test stresses this latter consideration. The symptom of fixed perseverative rigidity is perhaps the end point of this failure to re conceptualise under changing circumstances.

Self Assessment Questions

1) Define abstract attitud.

.....

.....

.....

2) What are the characteristics of abstract attitude?

.....

.....

.....

3) What are the characteristics of tests of abstraction?

.....

.....

.....

2.3 MEASUREMENT OF CONCEPTUAL THINKING

The measurement of conceptual thinking is based upon the principle that emotional disturbances and personality disorders interfere with thinking processes, particularly with the ability to form abstract concepts. The purpose of these tests are, therefore, to help the psychologist observe the subject's thought processes and to discover the extent to which maladjustment or mental illness has impaired his conscious thinking, as revealed in efforts to solve problems requiring the formation of concepts.

In particular, these tests are intended to evaluate the subject's ability to deal with objects and situations on the abstract or conceptual level, as compared with the concrete. Ability to form concepts implies conscious reasoning at the abstract level; that is, transcending the immediate specific sensory situation, abstracting the common property from particular instances, analysing and synthesizing, shifting from one aspect to another, keeping in mind several aspects simultaneously, planning ideationally, and self-criticism. An individual's behaviour at the concrete level, on the other hand, lacks these characteristics. The individual is then unreflective; he responds to the immediately given object or situation as something unique; he does not perceive an object or situation as one instance of a general class or category.

2.4 OVERVIEW OF TESTS

Within neuropsychological assessment, there are specialized tests of abstract reasoning as well as tests generally classed as assessing other abilities that can be interpreted from the standpoint of abstract and concrete behavior through qualitative observation. Although abstract reasoning may be involved in all these procedures, the specialised tests provide a direct assessment of the individual's ability to learn or form an abstract concept. Some of these procedures are paper and pencil tests that use language directly as the test medium.

2.4.1 Analogies and Proverb Tests

The most commonly used tests of this type are analogies and proverbs tests. The Raven Progressive Matrices Test (1982) contains analogy items that use pictorial material, but factor analytic studies have shown that the test has a strong verbal component, apparently because many of the pictures of objects are nameable (Lezak, 1995). Proverbs tests, such as the one developed by Gorham (1956), test the ability to form verbal abstractions in either a free-response or multiple choice form. Some items from the Comprehension subtest of the various Wechsler intelligence scales are proverbs that require a free verbal response. Interpretation of a proverb, such as "One swallow doesn't make a summer" requires the forming of an abstract generalization from a metaphor.

2.4.2 Performance Tests (Sorting tests)

The tests used most commonly in neuropsychological assessment are performance tests, which should not be characterised as nonverbal tests for various reasons, but which use nonverbal media, such as colored blocks, or geometric forms. The major reason for not characterising these tests as nonverbal is that although the media used are generally not linguistic symbols, the test solution process may place heavy reliance on language. We will refer to them as performance tests, for want of a better term.

The most commonly used of these performance tests are sorting tasks. Many years ago Egon Weigl (1927) invented the prototype of these tasks that are still referred to as Weigl type sorting tests. The first tests developed were of the free sorting type in which a variety of objects are placed on a table, and the subject is asked to group the objects through such instructions as "Sort those figures which you think belong together," or "Put those together which you think can be grouped together." After the first sorting, the subject isasked to put the objects together in another way.

The sorting tests first made generally available in a published form were those described in a monograph on abstract and concrete behavior written by Kurt Goldstein and Martin Scheerer (1941). This monograph contains what is essentially a test manual for a series of procedures now known as *The Goldstein-Scheerer tests*. In the Goldstein-Scheerer series, there is one relatively simple sorting task: The Weigl-Goldstein-Scheerer Color Form Sorting Test, and two more complex tasks: the Gelb-Goldstein Color Sorting Test and the Gelb, Goldstein, Weigl and Scheerer Object Sorting Test. The test method, however, is the same in all cases; the materials are set out, the subject is asked to sort them and then to re sort them. These tests assess the general capacities to form an abstraction or concept as the basis for the initial sorting and also evaluate cognitive flexibility, or the capacity to shift concepts.

2.4.3 Colour Sorting Tests

The administration of the Colour Sorting Test is some what different from the other sorting tests. The test material consists of many skeins of wool (Holmgren Wools) that vary in hue and brightness. The subject is asked to select a skein of her or his preference, and to pick out the other skeins that can be grouped with it (e.g., different shades of green). When this procedure is completed, the examiner picks out a skein of a different hue and asks the subject to pick out the other skeins that go with it. This procedure is followed by triple matching. Three skeins at a time are placed before the subject varying in hue and brightness. The left and center skeins have the same hue but different brightness, and the

right skein has the same brightness as the center skein, but differs in hue. The examiner points to the left and right skein and asks about where the center one belongs. The shift relates to whether the subject can sort according to hue and brightness. Shifting from hue to brightness is difficult for some normal people, and prompting about the idea of brightness is permissible, the point being whether the subject accepts the shift, and the idea of common brightness.

These free categorization tests provide abundant opportunity for qualitative assessment and variations of the procedure to elicit various features of concreteness. However, they differ from the concept identification procedures to be described later in this unit in the sense that they are true measures of *concept formation.* That is, the subject is provided with an array of diverse material out of which the abstraction has to be formed. The concept has to be self-initiated, and the subject makes up the rule that provides the basis for grouping. The rule may be simple (e.g., colour or shape) or quite complex as in the brightness or hue concept involved in the Color Sorting Test. Nevertheless, the subject is required to initiate his or her own categorization, or fail to do so.

2.4.4 Halstead Category Test

The Goldstein-Scheerer tests are no longer commonly used, but their theoretical descendants are in common use. The most widely used ones are the Halstead Category Test(Halstead, 1947) and the Wisconsin Card Sorting Test (Grant& Berg, 1948; Heaton et al., 1993).

Halstead (1947) was aware of Kurt Goldstein's theory of the abstract attitude, and it is historically important to note that the Wisconsin Card Sorting Test was first described as "a Weigl-type card sorting problem." In these tests that followed the Weigl type sorting tests and the Goldstein Scheerer tests, there was an important change. The concepts in these tests are not formed by the subject, but are inherent in the test materials themselves. The subject's task had changed from forming concepts to identifying concepts formed by the test maker.

Investigators in this area have therefore made a distinction between concept formation, which can be assessed with free sorting tests, and concept identification, which is what is involved in the Category and Card Sorting procedures.

In a series of experimental studies by Bourne and collaborators, the process of concept identification was intensively studied, mainly in normal individuals, to provide a detailed understanding of its relevant parameters, such as complexity and the role of informative feedback (Bourne,1966). In a sense, the difference between a concept formation and a concept identification procedure is analogous to the difference between a projective and an objective test. In the former, the subject can exercise free self expression; whereas the latter requires adherence to a particular structure. Perrine (1993) has made the important distinction in concept identification tests between attribute identification and rule learning. The Wisconsin Card Sorting Test stresses attribute identification. The correct answer is the stimulus attribute of form, colour, or number. In the case of the Category Test, the correct principle is a rule, regardless of the attributes of the stimuli. For example, the correct answer is the odd object in an array. Interestingly, Perrine reported only 30%shared variance between the two procedures.

Brief descriptions of these two tests are as follows:

1) **The Halstead Category Test** is administered through the use of an apparatus that displays the test stimuli and provides information to the subject regarding whether a response is correct. The subject looks at a screen below which are four numbered keys. The instructions are to look at the patterns on the screen and press the key that represents the right answer. If the correct key is pressed, the subject hears a pleasant chime. If the answer is incorrect, a rasping buzzer follows the response. The subject is told that he or she will be guessing at first, but when the concept or principle that unites the stimuli is learned, he or she will always get the chime. The test consists of seven subtests. The first of them is really a familiarisation trial, and the second is a simple counting task. The remaining subtests require identification or learning of a concept, such as oddity or spatial location. The most commonly used score for this test is total errors, but error scores can be obtained for each subtest and are sometimes useful clinically. For example, some of the concepts are spatial in nature and some are numerical, each of which may have different implications for brain function.

2) **The Wisconsin card sort test (WCST)** was developed to examine concept formation and the ability of participants to overcome the tendency to perseverate. The Wisconsin Card Sorting Test (see figure 1) in its original version consists of a deck of cards with colored geometric forms printed on them. The cards vary with regard to forms, colors, and number of forms. Four of the cards are laid out as models, and the subject is given the deck. The general instruction is to place each card below the correct model card. After each placement, the examiner tells the subject whether the correct response was made. The task is to learn to sort the cards by form, colour, or number based on the pattern of right and wrong answers. When ten consecutive correct responses are made, the examiner, unbeknown to the subject, changes the concept. For example, if colour was the correct response, the correct concept may be changed to form. The test continues until the subject correctly solves the six categories tested, or the supply of 128 cards is exhausted. Numerous scores are derived from this test, the most commonly used ones being the number of the six categories achieved, total errors, and preservative errors measuring persistence in sorting by a particular attribute after the relevant concept has been changed.

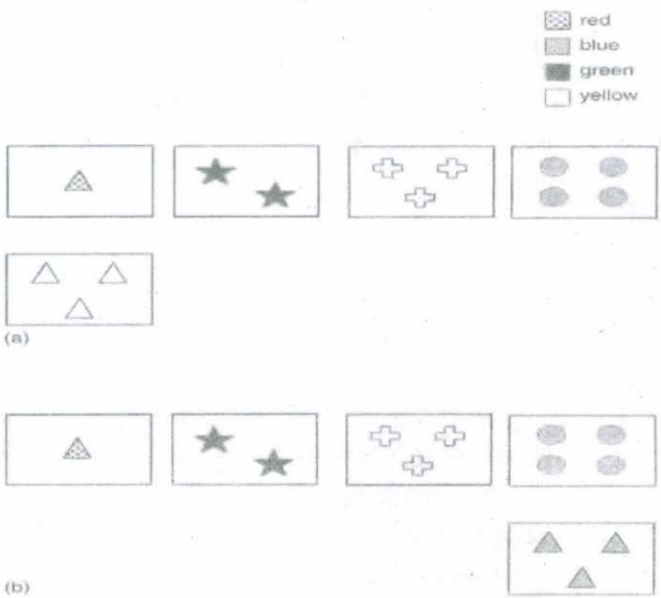


Fig. 1: Typical Responses in the WCST

In (a) the unstated rule was 'sort by colour'. The subject's response is incorrect because they actually sort by shape.

In (b) the unstated rule is 'sort by colour', which the respondent does correctly even though the card differs from the matching cards both in respect of shape and number.

Some tests incorporate aspects of concept formation and concept identification.

2.4.5 The Haufmann Kasanin Concept Formation Test (1937)

This is also known as *the Vygotsky Test*, and a recent modification called the Modified Vygotsky Concept Formation Test (MVCFT; Wang, 1983) represent tasks of that type. The Hanfman Kasanin is a challenging procedure in which the subject is asked to perform a number of sorts, much like the Color Form Sorting Test. However, there is a correct answer that the subject must learn through making sorts and obtaining information from the examiner concerning the correctness of the solution. The task is challenging because the concept is not a directly perceivable attribute, but is a second order principle that has to be derived from the characteristics of multiple attributes. The MVCFT modifies the original procedure. It consists of 22 different blocks varying in color, size, shape, and height. In the first part (convergent thinking),the examiner selects a target block and asks the participant to identify all other blocks that would belong with it, telling participants whether each response is right or wrong.

Participants are given correcting cues following each incorrect attempt. The procedure is repeated for four sets of blocks. A successful solution requires simultaneous consideration of the width and height of the blocks. Thus, the participant must combine abstract principles to determine the rule. When each complete set has been identified, the participant is then asked to state the sorting rule and then move on to the next set. Scores are based on the number of errors. After completion of this procedure, the examiner asks the participant to reclassify the blocks according to as many rules or ways as he/she can think of, one at a time (divergent thinking). After each classification, the examiner randomly mixes the blocks and asks for a new way of grouping. When the participant exhausts his/her means of classification, points are awarded for total number of logical principles. This test contains concept formation and concept identification elements.

2.4.6 The Twenty Questions Task (Minshew, Siegel, Goldstein and Weldy, 1994)

This also has a correct answer, but the subject has to self initiate sorting strategies to arrive at that answer. The procedure is much like the Twenty Questions parlor game in which a target object must be named based on questions that can be answered only yes or no. The strategy for narrowing the possibilities and arriving at the right answer has to be formed by the player.

Another way of studying abstraction is through the examination of generalization. When the same response is made to a continuum of stimuli, the phenomenon is referred to as stimulus generalisation. At a conceptual level, stimulus generalisation allows for classification, such that all objects with the same invariant characteristics may be classed into specific categories. Thus, a table is still a

table regardless of wide variations in size, colour, shape, and other characteristics. When tasks are of a conceptual nature, stimulus generalisation is referred to as equivalence range (Gardner & Schoen, 1962).

Equivalence range problems assess an individual's tolerance for variability in stimulus characteristics within some category. In the case of the Colour Sorting Test, for example, the equivalence range is the amount of variation in brightness accepted to categorize a skein as being of a common hue. Generalisation procedures have been used mainly in research investigations.

In a study by Olson, Goldstein, Neuringer, and Shelly (1969), the task involved presenting geometric figures, half of which were permutations of a circle and the other half of which were permutations of a diamond. The permutations reduced the figures in width in the direction of a common shape. Subjects were shown the figures one at a time and asked to indicate whether it was a circle, a diamond, or neither. The measure of equivalence range was correctly classified figures. A modified version of the Color Sorting Test was also administered. The literature suggested that brain damaged individuals have narrow equivalence ranges, and that was what was found for both the color sorting and visual forms tasks. Thus, it would appear that abstraction of common properties by brain damaged individuals has a narrow focus, probably limited to specific, concrete, stimulus properties.

Another aspect of abstract reasoning relates to what K. Goldstein and Scheerer (1941) referred to as an "attitude toward the possible." It consists of the ability to form a central representation of an object that is not perceptually present. They used the Block Design Test (Kohs Blocks) for evaluating this aspect of abstract and concrete behaviour, because it is necessary to form a changing representation of the individual blocks in space to match the model. As the model presented in their version of the test becomes more like the desired production with the blocks, by making it larger or drawing in lines between the blocks, the task becomes more concrete and simpler for patients.

Another form of abstract reasoning is challenged when a problem must be solved through logical inference. Situations requiring such processes generally require forming a plan or developing a strategy that ultimately leads to a solution. When lost in a forest, what is the best way of finding the way out? When shopping, what is the best way of completing errands in minimal time?

In trying to reach a solution to a problem, what inductive methods are best for reaching the solution in the fewest steps? Psychological testing models for these abilities include searching strategy tests, the recently developed multiple errands tests (McCue et al., 1995), and game procedures in which a correct identification must be made with the fewest possible number of steps. The twenty questions game task, in which the test taker must identify an object contained in a large array of objects by asking as few questions as possible would be an example of a strategy task. (Minshew et al., 1994). The Tower of Hanoi or London problem is another strategy formation task. It is a puzzle in which rings are placed on pegs and the participant has to move the rings, one at a time, from one peg to another and put them in the same arrangement using the fewest possible moves (Shallice, 1982). The number of moves and time to solution are typically used as scores.

Recently, we have seen the development of more practical strategy tasks in

which the participant is given a task to perform and must form a strategy to do it in an optimally effective and successful way. The Multiple Errands Test and the Modified Six Elements Test from the Behavioural Assessment of the Dysexecutive Syndrome tests (Wilson, Alderman, Burgess, Emslie, & Evans, 1996) are examples of such procedures. In both of them, the participant is assigned practical tasks and is scored for efficiency and success with which these tasks are performed. For example, on the Modified Six Elements subtest, the subject is rated for how he or she divides time among three assigned tasks.

Self Assessment Questions

1) How is conceptual thinking measured?

.....

.....

.....

2) Describe analogies and proverb tests.

.....

.....

.....

3) What are sorting tests how do these measure conceptual thinking?

.....

.....

.....

4) What is colour sorting test?

.....

.....

.....

5) Describe Halstead category test.

.....

.....

.....

6) Elucidate the concept formation test of Haufmann asanin.

.....

.....

.....

7) What is the role of the twenty questions task?

.....

.....

.....

2.5 RANGE OF APPLICABILITY AND LIMITATIONS

Tests of abstraction and problem solving ability are commonly used in neuropsychological assessment of children and adults. However, limits of applicability exist at each end of the continuum of cognitive function. Severely impaired or disorganised patients typically cannot cooperate for these procedures. At the other extreme, because these tests were designed for assessment of brain-damaged patients, they do not have the complexity or difficulty level of tests developed for normal individuals. Therefore, unlike the intelligence tests that are often used as part of a neuropsychological assessment, these tests are not really useful for assessment of level of ability within the normal range. Furthermore, they are particularly susceptible to practice effects. Therefore retesting is difficult to interpret particularly among individuals who initially do reasonably well on these tests. For example, once a near normal or normal performance on the Wisconsin Card Sorting Test is obtained, retesting is compromised, because the individual already knows the right answers and may remember that the examiner changed the relevant concept after a series of correct responses.

2.6 CROSS CULTURAL CONSIDERATIONS AND ACCOMMODATIONS FOR PERSONS WITH DISABILITIES

These tests would appear to be reasonably culture fair, because they do not rely heavily on language or knowledge of some specific environment or culture. The stimuli used, usually geometric forms, do not include artifacts associated with some particular culture. Obviously, instructions written in English would have to be interpreted for patients who do not speak English. The major socio cultural limitation would therefore relate mainly to general considerations concerning the meaning and acceptability of testing in different cultures.

These tests were designed for individuals with reasonably intact vision, hearing, and motor abilities. Typically, ad hoc accommodations are made for various disabilities where possible. There are two major issues with regard to accommodation : testing of patients with severe sensory or motor handicaps of the upper extremities and of patients who are not ambulatory. In general, the former matter is dealt with on an adhoc basis. There are no formal versions of the Category Test or the Wisconsin Card Sorting Test for the blind or the deaf.

However, the Wisconsin Card Sorting Test can be administered at bedside, and this can be accomplished for the Category Test as well if one wishes to use the booklet version of this test, or a version that can be administered with a lap top computer. In the case of individuals who are severely visually impaired, the traditional methodology has been to substitute auditory modality tests. In the case of abstract reasoning, proverbs or analogies tests may be used. Using tests based upon tactile perception is another useful strategy. The Halstead Tactual Performance Test may be administered to an individual who is blind and provides a good assessment of problem solving ability. For patients with profound hearing loss, spoken instructions may be presented visually or any technology that provides sufficient amplification may be used. The absence of standard neuropsychological tests for individuals with severe sensory deficits is a limitation of the field that is in need of correction.

For patients with impaired mobility, the use of laptop computers and related software has greatly expanded the capability of bedside testing and testing of patients in their homes. Such technologies as head sticks, voice activation, and application of robotics should become increasingly viable methods of accommodating individuals with physical handicaps, or who are too ill to travel to an assessment laboratory.

2.7 LET US SUM UP

Neuropsychological assessment of abstract reasoning may be accomplished with specialised tests of conceptual ability, or with a variety of tasks that may be accomplished abstractly or concretely. The former tasks are generally quantitative procedures; whereas the latter method typically involves qualitative observation. In assessment of abstraction ability, it is important to ascertain that the patient passes or fails the task because of a deficit in abstract reasoning ability. Some tasks appear to measure that ability, but may actually be accomplished through a variety of other methods. Impairment of abstraction ability in brain damaged patients may be a qualitative loss of the abstract attitude, or a quantitative impairment of level of ability. Furthermore, there are varying levels of abstraction. We have characterised two of these levels as concept formation and concept identification. Concept formation refers to those tasks in which the subject must self initiate concepts; concept identification describes the situation in which the subject must learn an established concept. Within concept identification, learning may involve identifying relevant attributes or learning rules that organise diverse stimuli.

2.8 UNIT END QUESTIONS

1) Tick the True/ False Statements

   i) The majority of tests used by neuropsychologists were not usually developed for the purpose of assessing brain damage. (True / False)

   ii) Translation of a test is sufficient to correct potential inaccuracies that can occur in testing bilingual individuals. (True/ False)

   iii) Wisconsin Card Sorting Test was first described as "aWeigl-type card sorting problem". (True /False)

   iv) The Goldstein-Scheerer tests are one of the most commonly used tests today. (True/ False)

   v) An important aspect of abstract reasoning relates to what K. Goldstein and Scheerer referred to as an "attitude toward the possible". (True / False)

2) Discuss the concept of abstract reasoning or concept formation?

3) Describe the characteristics of tests of abstract reasoning?

4) Describe in detail the various measures of abstract reasoning?

5) Critically analyse the range of applicability and limitations of tests of concept thinking

2.9 SUGGESTED READINGS

Lezak, M.D. (1995). *Neuropsychological Assessment* (3rd ed.). New York: Oxford University Press.

Sterling, J. (2002). *Introducing Neuropsychology*. New York: Taylor & Francis Inc.

UNIT 3 MEASUREMENT OF MEMORY AND CREATIVITY

Structure

3.0 Introduction

3.1 Objectives

3.2 Memory

- 3.2.1 Explicit and Implicit Memory
- 3.2.2 Memory Assessment
- 3.2.3 Tests of Explicit Memory
- 3.2.4 Tests of Implicit Memory
- 3.2.5 Assessment of Different Memory Systems

3.3 Future Perspectives and Conclusions

3.4 Creativity

- 3.4.1 Assessment of Creativity
- 3.4.2 Product Measures
- 3.4.3 Process Measures
- 3.4.4 Person Measures
- 3.4.5 The SOI Assessments (Structure of Intellect Assesssments)
- 3.4.6 Torrance Test of Creative Thinking (TTCT)
- 3.4.7 Person Measures

3.5 Future Perspectives and Conclusions

3.6 Let Us Sum Up

3.7 Unit End Questions

3.8 Suggested Readings

3.0 INTRODUCTION

Webster's dictionary (1966) defines memory as the 'conscious or unconscious evocation of things past'. As such, the term 'memory' can refer to a variety of learned behaviours, and it could be argued that many aspects of perception and language involve the use of certain memory systems. A number of authors have alluded to the range of possible human memory systems but in the present context we will mainly be concerned with the more customary use of the term, that is the retention of specific information which has been acquired in the recent past. It is this aspect of memory which forms the basis of most of the memory symptoms reported by brain damaged patients and which is the main focus of this unit. The first half of this unit will cover in depth the various aspects of memory assessment.

What does it mean to be creative? Some might say thinking outside the box; others might argue it as having a good imagination, and still others might suggest creativity is a synergy that can be tapped through brainstorming. We take an empirical, psychological approach to this question. One of the first things we will cover in this unit is to define what creativity is. Secondly this unit will cover the different types of tests used in assessment of creativity.

3.1 OBJECTIVES

After completing this unit, you will be able to:

- explain the concept of memory and creativity;
- describe explicit and implicit memory;
- delineate the tests of Explicit memory;
- delineate tests of implicit memory;
- explain assessment of different memory systems;
- define creativity;
- explain Assessment of creativity;
- discuss the product and process measures of creativity;
- describe Torrance test of creativity; and
- discuss the future perspectives in assessment of memory and creativity.

3.2 MEMORY

By a simple definition, memory is the capability to acquire, retain, and make use of knowledge and skills. Since the early 1980s, the way that cognitive scientists think about memory has dramatically changed. Today, memory is more often viewed not as a unitary entity but as comprising different components or systems. Neuro cognitive research has indicated that it is more appropriate to consider the human memory as a collection of multiple but closely interacting systems than as a single and indivisible complex entity (e.g. Tulving, 1985a; Squire, 1992; Schacter & Tulving, 1994a). Different memory systems differ from one another in terms of the nature of representations they handle, the rules of their operations, and their neural substrates (e.g. Tulving, 1984; Weiskrantz, 1990; Tulving & Schacter, 1992; Schacter & Tulving, 1994b; Willingham, 1997).

Various classificatory schemes of human memory have been proposed so far. Undoubtedly, the two most influential and extended classifications are those postulated by Squire (1992) and Schacter and Tulving (1994a). Squire distinguishes two long term memory systems: declarative and non declarative (or procedural) memory; whereas Schacter and Tulving identify five major systems: procedural memory, perceptual representation system, semantic memory, short term working memory and episodic memory. Related distinctions include explicit versus implicit memory, direct versus indirect memory, and memory with awareness versus memory without awareness. However, these latter dichotomies may not be memory systems, but rather forms of expression of memory. According to the Schacter and Tulving classification, retrieval operations in the procedural, perceptual representation and semantic systems are implicit, whereas in the working memory and episodic memory they are explicit. On the other hand, Squire considers declarative memory as an explicit system, whereas non declarative memory is viewed as a heterogeneous collection of implicit abilities.

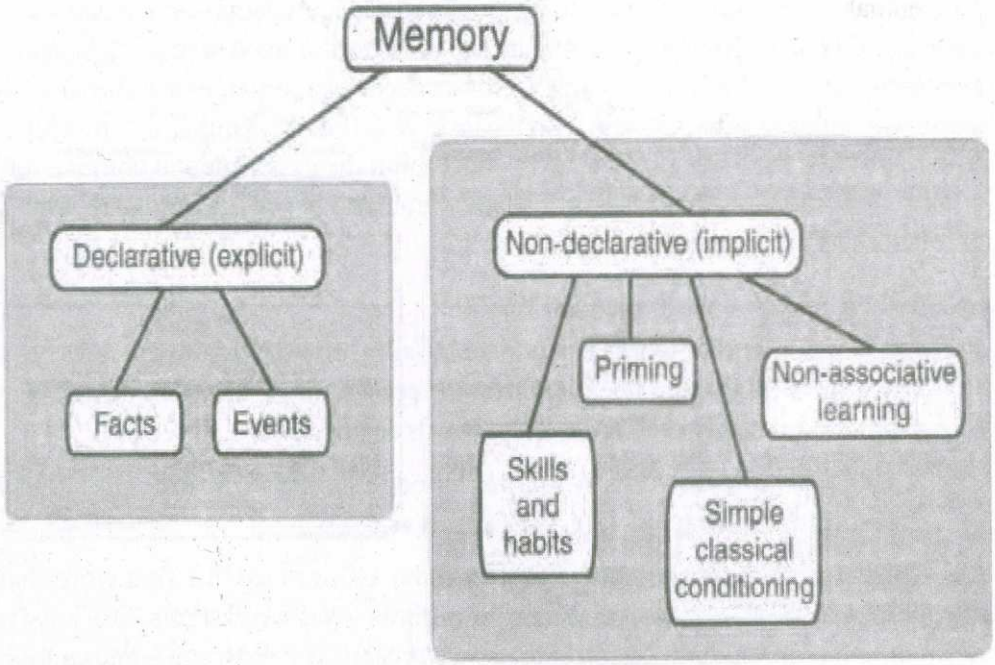


Fig. 1: The Subdivisions of Long-Term Memory

3.2.1 Explicit and Implicit Memory

Compelling evidence for the existence of multiple memory systems is provided by experimental findings of numerous convergent dissociations (functional, developmental, pharmacological, neuro psychological, neuro anatomical) between tasks of *explicit* and *implicit* memory (Schacter, 1987; Ruiz-Vargas, 1993; Nyberg &Tulving, 1996; Schacter, Wagner & Buckner,2000).

1) **Explicit Memory**

This is revealed by intentional or conscious recollection of specific previous information, as expressed on traditional tests of free recall, cued recall and recognition. Although the relationships between cued recall, free recall, and recognition are highly complex, these three memory tests share an essential property: Success in them is predicated upon the subject's knowledge of events that occurred when he/she was personally present in a particular spatio temporal context. Because the task instructions make explicit reference to an episode in the subject's personal history, such tasks have been referred to as autobiographical, direct, episodic, explicit or intentional memory tests.

2) **Implicit Memory**

This is revealed by a facilitation or change of performance on tests that do not require intentional or conscious recollection, such as perceptual identification, word stem completion, lexical decision, identification of fragmented pictures, mirror drawing, and so on. These tasks, classified as implicit, indirect, or incidental tests of memory, involve no reference to an event in the subject's personal history but are none the less influenced by such events. For example, prior experience with a particular word might later improve a subject's ability to identify that item under conditions of perceptual difficulty, restore deleted letters in order to complete that item, or make a decision concerning that item's lexical status. In general, such tasks require the subject to demonstrate

conceptual, factual, lexical, perceptual, or procedural knowledge, or to make some form of affective or cognitive judgment. The measures of interest reflect change in performance (e.g. change in accuracy and/or speed) as a function of some form of prior experience (e.g. experience with the task, with the test stimuli, or with related stimuli). When the prior experience occurs within the experimental context, it is possible to compare such measures of behavioural change with traditional measures of memory for the events causing that change.

Consider these *two experimental situations*:

1) A list of 20 familiar words is presented to subjects who are instructed to pay attention to each word because, after the presentation, they will be asked to reproduce as many of the presented words as possible.

2) A list of 20 familiar words is also presented to subjects who are instructed to perform an orienting task (e.g. pleasantness ratings).

3) After this study phase, the subjects will be asked to say the first word that comes to mind in response to a series of three letter word stems. Obviously, some word stems can be completed with presented words, and some cannot.

The first experimental situation reflects one of the ways in which psychologists have traditionally measured human memory: by assessing deliberate or *explicit memory* of subjects for items studied in a specific learning episode with a recall test.

In the second situation, it is often observed that subjects show an enhanced tendency to complete word stems corresponding to studied words in comparison to 'new' word stems. This phenomenon is known as *repetition priming or perceptual priming*.

Priming does not involve intentional or explicit recollection of the study episode, and thus it is assumed to reflect *implicit memory* for previously acquired information.

Distinction between explicit and implicit memory has had a profound impact on contemporary research and theorizing of human memory. The finding that some products of memory are expressed with conscious awareness of the previous experience, and other ones without conscious awareness of the source of the information, has constituted 'a revolution in the way that we measure and interpret the influence of past events on current experience and behaviour' (Richardson-Klavehn & Bjork,1988: 475–476). Therefore, both experimenters and clinicians should take into account this distinction whenever they assess human memory.

3.2.2 Memory Assessment

The German philosopher Hermann Ebbinghaus(1850–1909) was the first to demonstrate that memory can be measured. His main contribution was methodological in nature. Among his most important contributions were the *study/test paradigm* for the study of memory, the basic foundation of any memory experiment and test, and *the savings method*, currently considered as an implicit memory test, which were a couple of inventions of very large influence. Since then, memory assessment has undergone an extraordinary quantitative and qualitative advance.

Both the evolution and the accumulation of new memory tasks have defined the progress throughout the last century. The Ebbinghausian measure of serial

recall led to new forms of testing recall (free recall, cued recall), and these measures fuelled new theoretical developments in the 1980s. Today, two major classes of memory measures are distinguished: tests of explicit memory and tests of implicit memory.

3.2.3 Tests of Explicit Memory

Explicit memory tests are those in which the instructions in the test phase make explicit reference to an episode or experience in the subject's personal history. Thus, they require intentional or conscious recollection of previous information. Traditionally, these tests have been considered as *the only* memory tests. Table below rovides a relatively extensive list of tests of explicit memory currently in use.

Table 1: Tests for Explicit Memory

1.	Adult Memory and Information Processing Battery (AMIPB)
2.	The Benton Revised Visual Retention Test (BVRT)
3.	The Buschke Selective Reminding (SR) Test
4.	The California Verbal Learning Test (CVLT)
5.	The Luria Nebraska Memory Scale (LNMS)
6.	The Memory Assessment Clinic (MAC) Battery
7.	The Misplaced Objects Test
8.	The Rey Auditory Verbal Learning Test (AVLT)
9.	The Rey–Osterreith Complex Figure Test (CFT)
10.	The Rivermead Behavioural Memory Test (RBMT)
11.	The Warrington Recognition Memory test
12.	The Wechsler Memory Scale–Revised (WMS-R)

(Source: Baddeley, Wilson and Watts (1995)

Table 2: Memory and Meta Memory Questionnaires

(Memory Questionnaires (MQs) ask people to recall or recognise knowledge or events.

Meta Memory Questionnaires (MMQs) ask people to indicate how well they recall or recognise knowledge or events.)

MQs

1.	The Autobiographical Cueing Technique or TheCrovitz–Schiffman Technique
2.	The Autobiographical Memory Interview (AMI)
3.	The Boston Remote Memory Battery (BRMB)
4.	The 'Dead-or-Alive' test
5.	The Famous Faces Test
6.	The Famous Personalities Test
7.	The Price Estimation Test

MMQs

1. The Cognitive Failures Questionnaire (CFQ)
2. The Everyday Memory Questionnaire (EMQ)
3. The Inventory of Memory Experiences (IME)
4. The Memory Assessment Clinic Self-Rating Scale(MAC-S)
5. The Self-Rating Scale of Memory Function (SRSMF)
6. The Short Inventory of Memory Experiences (SIME)
7. The Subjective Memory Questionnaire

The RBMT is one of the few memory tests to have aversion for children. However, recently some memory tests for use with children have been presented [e.g. The Children's test of Non word Repetition (CNRep) constructed by Gathercole, Baddeley, Willis and Emslie; The Story Recall Test developed by Beardsworth and Bishop].

The tests of explicit memory include *free recall*, *cued recall* and recognition memory tasks. Prototypically, in tasks of free recall, subjects are shown a list of items (words, pictures, sentences) and are later asked to recall the items in any order that they choose. In cued recall, subjects are given explicit retrieval cues. The retrieval cues are prompts, reminders or any additional information that guides the search processes in memory (e.g. FRUITS for the to be recalled words 'apple', 'plum', 'grape', 'kiwi'). In free and cued recall, memory performance is assessed simply by counting the number of to be remembered items recalled.

An exception to the prototypical tasks outlined above is *serial recall*, in which the subject is asked to recall the items in the order of presentation, and performance is assessed by the number of items recalled in the correct sequential order. This procedure allows the assessment of memory for order or temporal memory, one kind of memory especially relevant, for instance, in language perception and comprehension. Serial recall is also used in the well-known short-term memory task called *digit span* that has been traditionally included in tests of general intelligence such as Wechsler-batteries.

A typical *recognition* task involves presenting a list containing the to-be-remembered or old items (e.g. words) just as in the presentation phase of recall tasks. However, in the subsequent test phase, subjects are shown a series of words, that is, old items mixed with *new* items or *distractors* and they are required to decide which the old ones are.

In the last few years, much research has also been devoted to the study of the subjective states of awareness associated with recognition memory. Tulving (1985b) introduced a new methodology to distinguish 'remember' (R) and 'know' (K) responses in recognition memory tests. An R response represents recognition with conscious recollection of the item's prior occurrence; a K response represents recognition associated with feelings of familiarity in the absence of conscious recollection. Tulving proposed that these two states of awareness reflect two kinds of consciousness, autonoetic and noetic, which are respectively properties of episodic and semantic memory. The *remember/know paradigm* merits its consideration because a number of studies have demonstrated that the recollective experience of

remembering is affected in different ways by many independent variables. For our purposes, its results are especially relevant to focus on different subject variables. There is now considerable evidence that age, Alzheimer's disease, amnesia, epilepsy, schizophrenia and autistic disorders have dissociative effects on R and K responding. The general finding has been that, in the conditions mentioned, 'remember' responses are selectively impaired and 'know' responses are relatively spared (Gardiner & Richardson-Klavehn, 2000).

Finally, it cannot be ignored that an unlimited number of memory judgment tasks are also explicit memory tasks. For example, judgments of presentation frequency, judgements of temporal order or recency, judgements of input modality, judgements of source/reality monitoring, feeling-of-knowing judgements, and so on.

3.2.4 Tests of Implicit Memory

Implicit memory tests are those in which subjects are asked to respond to test stimuli (e.g. generate a word, classify an object, perform a motor task) without making reference to prior events. The impressive experimental evidence available about dissociations between implicit and explicit memory tasks warrants the assumption that there are fundamental differences between mnemonic information assessed by implicit and explicit memory tests.

For example, numerous studies have documented across diverse tasks that amnesic patients (and other special populations) exhibit preserved mnemonic functioning when they are assessed with tests of implicit memory, and a memory severely impaired when tests of explicit memory are given. Studies with normal subjects have also shown that under some conditions (e.g. effects of alcohol, psychoactive drugs, general anesthesia, or certain experimental manipulations) normal's exhibit implicit memory for information that they cannot explicitly remember. The most important and theoretically relevant conclusion from these findings is that implicit memories are explicitly inaccessible and vice versa, because (a) different aspects of events are encoded by distinct but interacting neuro cognitive systems, and (b) diverse tasks tap different memory systems. Therefore, an adequate memory assessment requires of experimenters and clinicians to make use of explicit memory tests as well as implicit memory tests.

There are many implicit memory tests currently in use, and new tests are created every year. A general classification scheme that includes most of them has been recently proposed by Toth (2000). Implicit memory tests could be roughly organised in two major categories: *verbal* and *non verbal tests*, and each one of them in its turn into three subclasses:

1) **Perceptual tests** (e.g. perceptual identification, word stem completion, degraded word naming, object/non-object decision),

2) **Conceptual tests** (e.g. word association, category instance generation, object categorization, person/trait attributions), and

3) **Procedural tests** (e.g. reading mirror inverted text, probability judgements, mirror drawing, motor tracking). Generally speaking, the perceptual tests challenge the perceptual representation system, the conceptual tests involve the semantic memory system, and the procedural tests tap the procedural memory system.

3.2.5 Assessment of Different Memory Systems

From the multiple memory systems view, memory assessment must evolve to assess every single memory system. According to the five-fold classification system proposed by Schacter and Tulving, such systems are defined and could be assessed as follows:

1) **The procedural memory system:** This is a behavioural action system concerned with the acquisition, retention and retrieval of motor, perceptual and cognitive skills, simple conditioning, and non associative forms of learning. These kinds of memory are measured by tests of implicit memory, such as the pursuit rotor task, maze learning, mirror reading, artificial grammar learning, tower of Hanoi, and so on.

2) **The perceptual representation system (PRS):** This encompasses various domain-specific subsystems that process and represent information about the form and structure of words and objects. The PRS is assessed with implicit memory tests, such as perceptual identification, word stem completion, homophone spelling, picture fragment completion, object / non object decision, possible / impossible object decision, and many others.

3) **The semantic memory system**: This is the system involved in the acquisition, retention and retrieval of general knowledge of the world. Therefore, the task of assessing the status of this complex and multi-faceted system seems an impressive one. This challenge could be overcome by using a multiplicity of types of tests, such as word fluency, vocabulary, word association, naming tasks (animals, objects, etc.), recognition of famous faces, category instance generation, fact generation, category verification, semantic anomaly detection, K responses in recognition tests, and so on.

4) **The working memory system (WM):** This is a short term system that makes possible the temporary maintenance and processing of information, and to manipulate that information. The WM is measured by explicit memory tests such as the Brown–Peterson task, various memory span tests (e.g. forward and backward digit span, word span, alpha span), the size of the recency effect, the release from proactive inhibition task, the Dobbs and Rule task, mental arithmetic, and others.

   As Craik et al. (1995) emphasise, because WM tests do not all measure the same component processes it is advisable to assess WM by using several tests rather than one global test.

5) **The episodic memory system:** This is the system for personally experienced episodes. Episodic memories are assessed with tests of explicit memory for verbal and non-verbal materials, such as free recall (immediate and delayed), cued recall, recognition, R responses in recognition tests, generation task, and others. Different tasks may be used to assess autobiographical memory, considered as a subtype of episodic memory, such as recall and recognition of famous events, the Crovitz–Schiffman technique or the cueing method, etc. In clinical contexts, the Auto biographical Memory Interview (AMI) provides relevant information about the deterioration of this kind of memory in patients.

At this point, it should be noted that remembering and the different memory systems summarized above all refer to the past. However, as everybody knows, people are

also capable of remembering what they must do in the future. The former is called *retrospective memory*, and the latter, *prospective memory*.

Prospective memory is defined as the timely remembering of a planned action; everyday tasks such as remembering to phone one's sister at eleven o'clock, remembering to take medication after lunching, or remembering to reply to an e-mail this evening are all significant memory acts common to everyday living. Because both observations in the real world as well as laboratory studies show that prospective memory declines with age, brain damages and progressive brain diseases, prospective memory tasks should be given whenever memory is assessed.

Self Assessment Questions

1) Define Memory.

.....

.....

.....

2) Differentiate between explicit and implicit memory.

.....

.....

.....

3) How would you assess memory?

.....

.....

.....

4) What are the various tests of explicit memory?

.....

.....

.....

5) Elucidate the tests of implicit memory.

.....

.....

.....

6) Describe the assessment of different memory systems.

.....

.....

.....

3.3 FUTURE PERSPECTIVES AND CONCLUSIONS

During the last decade, students of memory have witnessed a colossal progress in scientific understanding of this capacity. However, scientists have also discovered that 'the complexity of memory far exceeds anyone's imagination' (Tulving, 2000: 727). Thus, it is not unusual for the very term 'memory' to mean many things to many people and, consequently, for the concept of 'memory impairment' to be utilised in many different ways by researchers, clinicians and patients and their families. This idea has been masterly captured by Tulving (2000: 728) when he said: 'Any claim about "memory" or "memory impairment" immediately requires clarification: About which kind of memory, memory task, memory process, or memory system are we talking?'

One fundamental reason for this lack of agreement is that memory is not a monolithic entity but a collection of different systems with multiple processes which are expressed in different ways. This idea should be assumed not only by researchers but also by clinicians and neuropsychologists in order to reduce the undesirably great distance existing between experimental research and clinical assessment.

Currently, most neuropsychological batteries are still focused on traditional memory tests; that is, free recall, cued recall and recognition tasks. However, implicit memory tests must be included without delay into explorations of special populations such as brain-damaged individuals, patients with Alzheimer's disease and other degenerative brain diseases, the elderly, etc., who have already showed sharp dissociations between explicit and implicit memory task performances.

Fortunately, the incipient convergence between psychologists and neuropsychologists favoured by the new Cognitive Neuroscience framework (Kosslyn& Koenig, 1992; Gazzaniga, 1995) undoubtedly will result in an impressive change in the ways human memory will be assessed in the years to come.

3.4 CREATIVITY

Creativity is usually defined as the capacity to generate ideas that are jointly original and adaptive. Original ideas are those that have a low statistical likelihood of occurring in the population, whereas adaptive ideas are those that satisfy certain scientific, aesthetic, or practical criteria. An idea that is original but maladaptive is more likely to be considered a sign of mental disturbance than creativity, while an idea that is adaptive but unoriginal will be dismissed as mundane or perfunctory rather than creative. Although almost universal consensus exists on this abstract definition of the phenomenon, much less agreement is apparent regarding how best to translate this definition into concrete instruments or tests.

3.4.1 Assessment of Creativity

Psychologists wishing to assess individual differences in creativity have a tremendous range of instruments to choose from.

Therefore, before investigators can settle on any single test or battery of tests, it is first necessary that they address four major questions:

i) What is the age of the target population? Some measures are specifically designed for school-age populations, whether children or adolescents, whereas other measures are targeted at adult populations.

ii) Which domain of creativity is to be assessed? Not only may creativity in the arts differ substantially from creativity in the sciences, but also there may appear significant contrasts within specific arts (e.g. music vs. literature) or sciences (e.g. mathematics vs. invention).

iii) What is the magnitude of creativity to be evaluated? At one extreme is everyday problem solving ability ('little c' creativity) where at the other extreme is eminent creativity that earns awards and honours appropriate to the domain ('Big C' Creativity, or genius).

iv) Which manifestation of creativity is to be targeted? That is, the investigator must decide whether creativity manifests itself primarily as a product, a process, or a person. Some instruments postulate that creativity takes the form of a concrete product; others assume that creativity involves a particular type of cognitive process, while still others posit that creativity entails a personal disposition of some kind.

Of these four questions, it is the last that is perhaps the most crucial. Assessment strategies differ dramatically depending on whether creativity is best manifested as a product, process, or person. As a consequence, the description of creativity measures that follows will be divided into three subsections.

3.4.2 Product Measures

Ultimately, a creative idea should take some concrete form, such as a poem, story, painting, or design. Hence, one obvious approach to creativity assessment is to measure the quantity or quality of productive output. A case in point is the Consensual Assessment Technique devised by Amabile (1982). Here a research participant is asked to make some product, such as a collage or a poem, which is then assessed by an independent set of experts. This technique has proven especially useful in laboratory experiments on the social circumstances that are most likely to favour creative behaviour.

However, this approach has at least two disadvantages.

i) First, the creativity of an individual is decided according to performance on a single task.

ii) Second, the assessment is based on a task that may not be representative of the domain in which the individual is most creative. For instance, a creative writer will not necessarily do well on a task in the visual arts, such as making collages.

iii) An alternative is to assess individual differences in creativity according to products that the person has spontaneously generated. For example, the Lifetime Creativity Scales assess creative behaviour by asking participants to self identify examples of their own creative achievements (Richards et al., 1988).

According to this approach, creativity assessment is based on multiple products in the domain that the individual finds most germane to personal creative expression. Although this instrument has proven validity and utility, it can be objected that a product's creativity requires an external assessment, such as that provided in the Consensual Assessment Technique. Further more, this instrument is clearly aimed at everyday creativity rather than creative output that is highly valued professionally or socially.

One way to assess such Big-C Creativity is to use some variety of productivity measure. Thus, the creativity of scientists may be gauged by journal articles and that of inventors by patents. Often such measures of pure quantity of output are supplemented by evaluations of quality. For example, the quality of a scientist's productivity may be assessed by the number of citations to his or her work. Another approach is to assess creative impact in terms of awards and honours received or the evaluations of experts in the field, which tactic dates back to Francis Galton (1869). One especially innovative strategy is Ludwig's (1992) Creative Achievement Scale, which provides an objective approach to evaluating a creator's life work. This scale has proven useful in addressing the classic question of whether exceptional creativity is associatedwith some degree of psychopathology (the 'mad-genius' debate).

3.4.3 Process Measures

One major drawback of all product measures of creativity is that they appear barren of truly psychological content. These measures stress outward behaviour and its impact rather than internal mental states. Yet presumably there exists some special thought processes that underly these creative products. Accordingly, psychologists can instead devise instruments that tap into these crucial processes. For example, Mednick (1962) theorized that creativity requires the capacity to generate remote associations that can connect hitherto disparate ideas. He implemented this theory by devising the Remote Association Test, or RAT, that has seen considerable use in subsequent research. A person taking the RAT must identify a word that has an associative linkage with three separate stimulus words (e.g. associating the word 'chair' with the given words 'wheel, electric, high').

An even more popular set of measures was devised by Guilford (1967) in the context of his multidimensional theory of intelligence. These measures assess various kinds of *divergent thinking*, which is supposed to provide the basis for creativity. Divergent thinking is the capacity to generate a great variety of responses to a given set of stimuli. Unlike *convergent thinking*, which aims at the single most correct response, ideational productivity is emphasized. A specific instance is the Unusual Uses test, which asks research participants to come up with as many uses as possible for ordinary objects, such as a toothpick or paperclip. The participants' responses can then be scored for fluency (number of responses), flexibility (number of distinct categories to which the responses belong), and originality (how rare the response is relative to others taking the test).

Guilford's development of Divergent Thinking (DT) tests in the 1950s and 1960s is usually considered to be the launching point for serious development efforts and large- scale application. Among the first measures of divergent thinking were Guilford's (1967) Structure of the Intellect (SOI) divergent production tests, Wallach and Kogan's (1965) and Getzels and Jackson's (1962) divergent thinking tests, and Torrance's (1962, 1974) Tests of Creative Thinking (TTCT).

3.4.5 The SOI Assessments (Structure of Intellect Assessments)

Guilford's (1967) Structure of the Intellect Model proposed 24 distinct types of divergent thinking: One type for each combination of four types of content (Figural, Symbolic, Semantic, Behavioural) and six types of product (Units, Classes, Relations, Systems, Transformations, Implications).

For example, the SOI DT battery (Structure of Intellect and Divergent Thinking) consists of several tests on which subjects are asked to exhibit evidence of divergent production in several areas, including divergent production of semantic units (e.g., listing consequences of people no longer needing to sleep), of figural classes (finding as many classifications of sets of figures as is possible), and of figural units (taking a simple shape such as a circle and elaborating upon it as often as possible).

Another example is the Match Problem, which represented the divergent production of figural transformations. The Match Problem has several variations, but they tend to be variations on the basic theme of Match Problem I. In this test, 17 matches are placed to create a grid of two rows and three columns (i.e., six squares). Participants are asked to remove three matches so that the remaining matches form four complete squares.

Guilford noted that such tasks are characterised by the need for trial and error strategies and flexible thinking. Several other tests were also used to study figural transformations, all with the same basic requirements to come up with multiple ways to transform visual spatial objects and relationships. Guilford believed that this particular group of tests assesses flexibility. Guilford's entire SOI divergent production battery consists of several dozen such tests corresponding to the various divergent thinking components.

3.4.6 Torrance Tests of Creative Thinking (TTCT)

The Torrance Tests of Creative Thinking which are also based upon many aspects of the SOI battery are by far the most commonly used tests of divergent thinking and continue to enjoy widespread international use.

Over several decades, Torrance refined the administration and scoring of the TTCT, which may account for its enduring popularity. The battery includes Verbal (Thinking Creatively with Words) and Figural tests (Thinking Creatively with Pictures) that each includes a Form A and Form B that can be used alternately.

The Figural forms have *three subtests:*

i) **Picture Construction**, in which a participant uses a basic shape and expands on it to create a picture;

ii) **Picture Completion**, in which a participant is asked to finish and title incomplete drawings; and

iii) **Lines / Circles**, in which a participant is asked to modify many different series of lines (Form A) or circles (Form B).

The Verbal form has seven subtests. For the first three tasks, the examinee is asked to refer to a picture at the beginning of the test booklet. For example, in Form A, the

picture is of an elf staring at its reflection in a pool of water. These first three tasks are considered part of the Ask and Guess section:

Asking, in which a participant asks as many questions as possible about the picture;

Guessing Causes, in which a participant lists possible causes for the pictured action;

Guessing Consequences, in which a participant lists possible consequences for the pictured action.

The final four verbal subtests are self- contained:

Product Improvement, in which a participant is asked to make changes to improve a toy (e.g., a stuffed animal)

Unusual Uses, in which a participant is asked to think of many different possible uses for an ordinary item (e.g., a card board box)

Unusual Questions, in which a participant asks as many questions as possible about an ordinary item (this item does not appear in later editions); and

Just suppose, in which a participant is asked to "just suppose" that an improbable situation has happened then list possible ramifications.

Administration, scoring, and score reporting of the various tests and forms are standardized, and detailed norms were created and revised accordingly. The original test produced scores in the traditional four DT areas, but the streamlined scoring system introduced in the 1984 revision made significant changes to the available scores. Under the stream lined system, the Figural tests can be scored for resistance to premature closure and abstractness of titles in addition to the familiar scores of fluency, elaboration, and originality. Flexibility was removed because those scores tended to be largely undifferentiated from fluency scores. Resistance to premature closure is determined by an examinee's tendency to not immediately close the incomplete figures on the Figural Picture Completion test. Torrance believed this tendency reflected the examinee's ability "to keep open and delay closure long enough to make the mental leap that makes possible original ideas. Less creative persons tend to leap to conclusions prematurely without considering the available information" (Torrance & Ball, 1984, p. 20).

3.4.7 Person Measures

Process measures of creativity operate under the assumption that creativity requires the capacity to engage in somewhat distinctive cognitive processes. Not all psychologists agree with this position. In the first place, often performance on process instruments can be enhanced by relatively straightforward training procedures, and sometimes performance enhancements can occur by changing the instructional set when administering the test (i.e. the command to 'be creative!'). In addition, creative individuals appear to have distinctive non cognitive characteristics that set them apart from persons who fail to display creativity. This has led some psychologists to propose that creativity be assessed by person based measures.

The most frequently used instruments assess creativity via the personality characteristics that are strongly correlated with creative behaviour. These personality assessments are of three kinds. First, the assessment may simply depend on already established scales of standard tests, such as the Minnesota Multiphasic Personality Inventory or Eysenck's Personality Questionnaire. These measures will tend to yield the lowest validity coefficients.

Second, the assessment may be based on the construction of a specialised subscale of an already established personality test. For instance, Gough (1979) devised a Creative Personality Scale from his more general Adjective Check List. Third, the assessment may rely on a measure that is specially constructed to gauge individual differences in creative personality. An example is the How Do You Think questionnaire that gauges whether a person has the interests, values, energy, self confidence, humour, flexibility, playfulness, unconven-tionality, and openness associated with creativity (Davis, 1975).

An alternative person based approach is predicated on the assumption that creative potential emerges by means of a particular set of developmental experiences. These experiences may reflect either genetic predilections (nature)or acquired inclinations (nurture). For example, Schaefer and Anastasi (1968) designed a biographical inventory that identifies creativity in adolescent boys (see also Schaefer, 1970). The items tap such factors as family background, school activities, and extracurricular interests. Moreover, the inventory discriminates not only creative from non creative adolescents,but also between scientific and artistic creativity. Similar biographical inventories have been devised for both children and adults. The box below presents a summary of representative creativity measures.

Table 3: Summary Table of Representative Creativity Measures

Product Measures Consensual Assessment Technique (Amabile, 1982)
Lifetime Creativity Scales (Richards et al., 1988)
Creative Achievement Scale (Ludwig, 1992)
Process Measures Remote Associates Test (Mednick, 1962)
Unusual Uses Test (Guilford, 1967)
Torrance Tests of Creative Thinking (Torrance, 1966; Crammond, 1994)
Person Measures Creative Personality Scale of the Adjective Check List (Gough, 1979)
How Do You Think Inventories (Davis, 1975)
Biographical Inventory – Creativity (Schaefer, 1970; Schaefer & Anastasi, 1968)
The above list by no means exhausts the inventory of tests that purport to measure creativity. The instruments listed are merely chosen as representative of the various types of tests that have been developed since the 1960s.

Self Assessment Questions

1) What are the future perspectives and conclusions in regard to memory?

.....

.....

.....

2) Define creativity.

.....

.....

.....

3) How would you assess creativity?

.....

.....

.....

4) What are product measures of creativity?

.....

.....

.....

5) What are process measures of creativity?

.....

.....

.....

6) What are person measures of creativity?

.....

.....

.....

7) Which of the three is more applicable to measuring creativity?

.....

.....

.....

8) Explain Torrance test of creativity.

.....

.....

3.5 FUTURE PERSPECTIVES AND CONCLUSIONS

Ideally, scores on the diverse creativity measures should inter correlate so highly that all alternative instruments could be said to assess the same underlying latent factor. The various measures can then be said to display convergent validity. Yet many empirical studies have found that alternative instruments often fail to converge on a single, psychometrically cohesive dimension. Even worse, many measures seem to lack divergent validity as well. For instance, some of the process type instruments exhibit unacceptably high correlations with scores on intelligence tests. These correlations have driven some researchers to question whether creativity can be reliably separated from the problem solving ability associated with general intelligence (i.e. 'Spearman's G'). In contrast, other creativity researchers have advocated more positive conclusions, believing that there indeed exists a sub set of instruments that have the desired convergent and divergent validity as well as the requisite predictive validity. Whether this optimistic position will receive empirical justification in future research remains to be seen.

Clearly, psychologists who want to assess creativity must confront a tremendous number of alternative creativity measures. Not only do the various instruments differ in their respective reliabilities and validities, but also the alternative measures are often based on rather contrary conceptions about what has to be measured. Even within a single approach there is available several rival measurement tools. Thus, the person type measures include both biographical inventories and personality questionnaires, and the latter may be subdivided into more than one kind. Complicating matters even more, the choice of instrument is contingent on such criteria as the age of the target population, the domain of creativity involved, and the magnitude of creativity to be assessed. Creativity assessment is no easy task, and may even require some creativity.

3.6 LET US SUM UP

Memory tests need to be grounded in theory and research with the ability to assess all components of the memory process. It is only through a broad, comprehensive approach to memory assessment that neuropsychologists can obtain valid, clinically meaningful conclusions and recommendations for their patients.

Creativity is a key component of human cognition that is related yet distinct from the construct of intelligence. One way of organising creativity assessment is in terms of person, process, product, and press (i.e., environment).

3.7 UNIT END QUESTIONS

1) Which of the following is *Not part* of the "Four P" model?

   1) Process
   2) Product
   3) Possibility
   4) Person

2) Which of the following is most commonly associated with creativity?

   1) Intrinsic motivation
   2) Extrinsic motivation
   3) Anticipation of rewards
   4) Anticipation of evaluation

3) The Torrance Tests of Creative Thinking assess:

   1) task motivation
   2) domain- specific knowledge
   3) artistic ability
   4) divergent thinking

4) "Flow" refers to:

   1) the speed at which one works
   2) consistency among items in a divergent- thinking test
   3) similarities between intelligence and creativity test scores
   4) the experience of being intensely engaged in an activity

5) Tick the *True or False* statements.

   i) The Structure of Intellect model looks at both the types of content and the types of product in divergent thinking. (True/False)

   ii) Serial recall is also used in the well-known short-term memory task called digit span. (True/ False)

   iii) Explicit memory is revealed by a facilitation or change of performance on tests that do not require intentional or conscious recollection. (True/False)

   iv) Prospective memory is defined as the timely remembering of a planned action. (True /False)

6) What is memory? Describe in detail the different tests for assessment of memory?

7) Define creativity? Discuss the various ways of assessing creativity?

8) What are the future perspectives and conclusion in regard to creativity?

9) What are SOI assessments? Elucidate.

3.8 SUGGESTED READINGS

Kaufman, James C., Plucker, Jonathan A.,Baer, John.(2008). *Essentials of Creativity Assessment.* New Jersey: John Wiley & Sons, Inc.

Lezak, M.D. (1995). *Neuropsychological Assessment* (3rd ed.). New York: Oxford University Press.

UNIT 4 UTILITY OF DATA FROM THE TEST OF COGNITIVE FUNCTIONS

Structure

4.0 Introduction

4.1 Objectives

4.2 Cognitive Testing

4.3 Utility of Data from Tests of Cognitive Functions

- 4.3.1 Clinical Use of Intelligence Tests
- 4.3.2 The Estimation of General Intellectual Level
- 4.3.3 The Case of Harold
- 4.3.4 Prediction of Academic Success
- 4.3.5 Occupational Performance
- 4.3.6 The Appraisal of Style

4.4 Uses of Neuropsychological Assessment

- 4.4.1 Determining the Biological (I.E., Neuroanatomical, Physiological) Correlates of Test Results: Detection, Gradation, and Localisation of Brain Damage
- 4.4.2 Determining Whether Changes Are Associated With Neurological Disease, Psychiatric Conditions, Developmental Disorders, or Non-Neurological Conditions
- 4.4.3 Assessing Changes over Time and Developing a Prognosis
- 4.4.4 Offering Guidelines for Rehabilitation, Vocational / Educational Planning, or A Combination of These
- 4.4.5 Providing Guidelines and Education for Family and Caregivers
- 4.4.6 Planning for Discharge and Treatment Implementation

4.5 Overview of Instruments

- 4.5.1 Behaviour Rating Inventory of Executive Function (BRIEF)
- 4.5.2 Behaviour Rating Inventory of Executive Function-Preschool Version (BRIEF-P)
- 4.5.3 Comprehensive Test of Nonverbal Intelligence (CTONI)
- 4.5.4 Comprehensive Test of Phonological Processes (CTOPP)
- 4.5.5 Das Naglieri Cognitive Assessment System (CAS)
- 4.5.6 Detroit Tests of Learning Aptitude-Fourth Edition (DTLA-4)
- 4.5.7 Differential Ability Scales-Second Edition (DAS-II)
- 4.5.8 Kaufman Assessment Battery for Children-Second Edition (KABC-II)
- 4.5.9 Leiter International Performance Scale-Revised (Leiter-R)
- 4.5.10 NEPSY, Second Edition (NEPSY-II)
- 4.5.11 Stanford-Binet Intelligence Scales-Fifth Edition (SB5)
- 4.5.12 Universal Nonverbal Intelligence Test (UNIT)
- 4.5.13 Wechsler Abbreviated Scale of Intelligence (WASI)
- 4.5.14 Wechsler Adult Intelligence Scale-Third Edition (WAIS-III)
- 4.5.15 Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV)
- 4.5.16 Wechsler Intelligence Scale for Children-Fourth Edition Integrated (WISC-IV Integrated)
- 4.5.17 Wechsler Nonverbal Scale of Ability (WNV)

4.5.18 Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III)

4.5.19 Wide Range Assessment of Memory and Learning-Second Edition (WRAML-2)

4.5.20 Woodcock-Johnson Tests of Cognitive Abilities-Third Edition/ Normative Update (WJ-III COG/NU)

4.6 Let Us Sum Up

4.7 Unit End Questions

4.8 Suggested Readings

4.0 INTRODUCTION

This unit expands the discussion of assessment in clinical psychology. Cognitive assessment measures a host of intellectual capacities and encompasses the subspecialty of neuropsychological assessment that examines brain-behaviour relationships. Once all the assessment data are collected and examined by the psychologist, decisions can be made regarding diagnosis, treatment plans, and predictions about future behaviour.

4.1 OBJECTIVES

After reading this unit, you should be able to:

- describe the uses of intelligence and neuropsychological tests in assessing cognitive functions; and
- provide an overview of various instruments for assessing cognitive functions.

4.2 COGNITIVE TESTING

Cognitive testing is a general term referring to the assessment of a wide range of information processing or thinking skills and behaviours. These comprise general neuro psychological functions involving brain-behavior relationships, general intellectual functions (such as reasoning and problem solving) as well as more specific cognitive skills (such as visual and auditory memory), language skills, pattern recognition, finger dexterity, visual perceptual skills, academic skills, and motor functions. Cognitive testing may include aptitude testing (which assesses cognitive potential such as general intelligence) and achievement testing (which assesses proficiency in specific skills such as reading or mathematics). Cognitive testing uses well known tests such as the Scholastic Aptitude Test (SAT) and intelligence quotient (IQ) tests of all kinds. Thus, cognitive testing is an umbrella term that refers to many different types of tests measuring many different types of thinking and learning skills.

4.3 UTILITY OF DATA FROM TESTS OF COGNITIVE FUNCTIONS

In the preceding units, we have described several of the more commonly used cognitive tests. It is time to take a closer look at how such tests are used in the clinical setting.

4.3.1 Clinical Use of Intelligence Tests

The intelligence test is a special measure that primarily helps to assess a wide spectrum of cognitive features. The manner in which such cognitive features operate for the patient needs to be delineated. One of the main assets of intelligence tests is their accuracy in predicting future behavior. Initially, Binet was able to achieve a certain degree of predictive success with his scales, and, since that time, test procedures have become progressively more refined and accurate. More recent studies provide ample support that intelligence tests can predict an extremely wide number of variables. In particular, IQ tests are excellent predictors of academic achievement, occupational performance and are sensitive to the presence of neuropsychological deficit.

4.3.2 The Estimation of General Intellectual Level

The most obvious use of an intelligence test is as a means for arriving at an estimate of the patient's general intellectual level. Frequently, the goal is the determination of how much general intelligence (*g*) a given person possesses. Often, the question is stated a bit differently—for example, what is the patient's intellectual potential? Posing the question in this way suggests that perhaps the person is not functioning as well as his or her potential would indicate. The potential can form a baseline against which to measure current achievements, thus providing information about the patient's current level of functioning. Many pitfalls and fallacies are associated with the pursuit of these goals. The following is an example.

4.3.3 The Case of Harold

Harold was being routinely evaluated prior to transfer to a special class for advanced junior high school students. Rather surprisingly, his Full Scale WISC-IV IQ turned out to be 107. This score was in the average range but below the cut off point for admission to the class. It was also considerably below what his teachers had estimated based on his classroom performance. A closer look at his subtest scores revealed that his performances on Block Design and Coding were significantly below those on the other sub tests. A follow-up interview with Harold was quite revealing. Since early childhood, he had suffered from muscular weakness in both arms and hands. This weakness prevented him from making fine, quick motor responses. However, he had developed a number of clever compensations to prevent others from guessing his limitation. For example, what had appeared to be slow, deliberate, even confused responses on Block Design were really not that at all. He was feigning confusion to mask his difficulty with fine motor functions. Clearly, then, Harold's IQ score had been unduly affected by a motor weakness that had nothing to do with his ability to perform intellectually.

This example is but the tip of the iceberg. It does suggest, however, that obtaining an IQ is not the end of a clinician's task, but it is only the beginning. The IQ score must be interpreted. Only through knowledge of the patient's learning history and by observations made during the testing situation can that score be placed in an appropriate interpretive context and adequately evaluated.

4.3.4 Prediction of Academic Success

As mentioned previously, there are data that demonstrate a relationship between intelligence test scores and school success (Neisser et al., 1996). To the extent that intelligence should logically reflect the capacity to do well in school, we are justified in expecting intelligence tests to predict school success. Not everyone would equate intelligence with scholastic aptitude, but the fact remains that a major function of intelligence tests is to predict school performance. One must remember, however, that intelligence and academic success are not conceptually identical.

4.3.5 Occupational Performance

In addition to predicting academic achievement, IQ scores have also been correlated with occupation, ranging from highly trained professionals with mean IQs of 125, to unskilled workers with mean IQs of 87 (Reynolds, Chastain, Kaufman, & McLean, 1987). Correlations between job proficiency and general intelligence have been highest in predicting relatively more complex jobs rather than less demanding occupations. J. Hunter (1986) reported moderately high correlations between general intelligence and success for managers (.53), salespersons (.61), and clerks (.54). For intellectually demanding tasks, nearly half the variance related to performance criteria can be accounted for by general intelligence (F. Schmidt, Ones, & Hunter, 1992). The use of intelligence tests for personnel selection has demonstrated financial efficacy for organisations (F. Schmidt & Hunter, 1998). In addition, the accuracy of using IQ tests can be incrementally increased by combining the results with integrity tests, work samples, and structured interviews (F. Schmidt & Hunter, 1998).

4.3.6 The Appraisal of Style

As we have noted, what is important is not only whether the client succeeds or fails on particular test items but also how that success or failure occurs. One of the major values of individual intelligence tests is that they permit us to observe the client or patient at work. Such observations can help us greatly in interpreting an IQ. For example, did this child do as well as possible? Was there failure avoidance? Did the child struggle with most items, or was there easy success? Was the child unmotivated, and could this have detracted from the child's performance? Such questions and the ensuing interpretations breathe life into an otherwise inert IQ score.

The following simulated questions from the WAIS-III and a hypothetical patient's responses to them are examples of the data that can be obtained beyond the sheer correctness or incorrectness of a response.

Query: Who wrote *Paradise Lost*? (Information subtest)

Answer: Probably a Catholic. But since the Pope began changing things around, they retitled it.

Query: What is the advantage of keeping money in a bank? (Comprehension subtest)

Answer: There isn't. There's so damn many crooks. But they'll get theirs someday.

Query: In what ways are a lion and a tiger alike?(Similarities subtest)

Answer: Well, now, that's a long story. Do they look alike? They really can't breed together, you know.

(These simulated items were provided courtesy of The Psychological Corporation. The answers are based on responses to actual items.)

Some clinicians have ventured considerably beyond making a few limited personality inferences that would inject some added meaning into IQs and have based mental disorder diagnoses on the Stanford Binet and Wechsler scales. They believed that by examining patterns of scores (known as inter-test scatter); they could apply diagnostic labels to patients (e.g., schizophrenia or depression). Over the years, however, studies purporting to show the validity of these interpretations of inter test scatter could rarely be replicated. Thus, diagnoses cannot be reliably inferred from patterns of test performance.

Another important asset of intelligence tests, particularly the WAIS-III and WISCIII, is that they provide valuable information about a person's cognitive strengths and weaknesses. They are standardized procedures whereby a person's performance in various areas can be compared with that of age-related peers. In addition, useful comparisons can be made regarding a person's pattern of strengths and weaknesses. The WAIS-III, WISC-III, and other individually administered tests provide the examiner with a structured interview in which a variety of tasks can be used to observe the unique and personal ways the examinee approaches cognitive tasks. Through a client's interactions with both the examiner and the test materials, an initial impression can be made of the individual's self-esteem, behavioural idiosyncrasies, anxiety, social skills, and motivation, while also obtaining a specific picture of intellectual functioning.

Intelligence tests often provide clinicians, educators, and researchers with baseline measures for use in determining either the degree of change that has occurred in an individual over time or how an individual compares with other persons in a particular area or ability. This may have important implications for evaluating the effectiveness of an educational program or for assessing the changing abilities of a specific student. In cases involving recovery from a head injury or readjustment following neurosurgery, it may be extremely helpful for clinicians to measure and follow the cognitive changes that occur in a patient. Furthermore, IQ assessments may be important in researching and understanding more adequately the effect on cognitive functioning of environmental variables, such as educational programs, family background, and nutrition. Thus, these assessments can provide useful information about cultural, biological, maturational, or treatment-related differences among individuals.

Self Assessment Questions

1) Define cognitive testing and describe the characteristics.

.....

.....

.....

.....

2) What are the uses of tests of cognitive functions in clinical setting?

.....

.....

.....

3) What are the uses of intelligence tests in clinical settings?

.....

.....

.....

4) How do we estimate the general intellectual level?

.....

.....

.....

5) Discuss the case of Harold.

.....

.....

.....

6) Can intelligence test scores be used for predicting academic success?

.....

.....

.....

7) Can occupational performance be predicted through IQ scores?

.....

.....

.....

8) What is appraisal style?

.....

.....

.....

4.4 USES OF NEUROPSYCHOLOGICAL ASSESSMENT

One can identify at least seven different but related purposes or uses of neuropsychological assessment. These categories are derived from what are

probably the most common clinical referral questions presented to neuropsychologists as well as from the information presented in many neuropsychological reports. These categories of use can arise in a number of different contexts, including medicine, law, education, and research. These categories are presented here in the order reflecting the logic in which clinical inferences are typically made.

Describing and identifying changes in psychological functioning (cognition, behaviour, emotion) in terms of presence/absence and severity. Although the raison d'être of clinical neuropsychology is to predict the presence of brain damage, the ability to describe function precedes this seemingly core purpose of neuropsychological tests. Neuropsychologists are usually expected to provide a description of a patient or client by identifying cognitive strengths and weaknesses and then by making the basic inference of whether the patient's current status represents a change from some previous, usually not precisely defined, baseline or pre morbid level of functioning. When children are evaluated and there is little basis to estimate pre morbid abilities, clinicians may attempt to infer change from expected developmental milestones. The issues of strengths and weaknesses and the presence or absence of change are addressed before any other inferences regarding brain function or recommendations for interventions may be considered. The neuropsychologist must try to infer what part of the current observations reflects the patient's "normal" allocation of intellectual functions versus what parts of the current observations show changes attributable to brain dysfunction. Accurate description and reference to correct normative standards for the individual are the most basic and critical purposes of neuropsychological assessment.

4.4.1 Determining the Biological (I.E., Neuroanatomical, Physiological) Correlates of Test Results: Detection, Gradation and Localisation of Brain Damage

After they have described the patient's behaviour, neuropsychologists typically try to determine whether the pattern of test results, clinical behaviour, and particular historical context of the observations can be attributed to abnormal brain function. Such abnormalities may be the presence of a structural brain lesion, a developmental disorder, or in some cases, neuro chemical lesion. Part of this determination is trying to ascertain what region of the brain is involved.

4.4.2 Determining Whether Changes are Associated with Neurological Disease, Psychiatric Conditions Developmental Disorders, or Non-Neurological Conditions

The next kind of inference that clinical neuropsychologists often try to make or are asked to make concerns the likely etiology or etiologies that produced the changes described. In the case of neurological disorder and known history, this can sometimes be done accurately. This is particularly true in cases in which the behavioural changes involve unusual and dramatic phenomena that have historically been related to the presence of lesions in specific parts of the brain and are usually caused by a highly limited set of etiologies. For example, non-fluent aphasia symptoms (e.g., hesitant, a grammatic speech) are most likely related to a limited

set of diseases that, if present by history, can be considered causative of the observed changes in language.

Many changes in neuropsychological functions, however, may be caused by psychiatric, motivational, developmental, or cultural factors and may not be attributable to a specific neurological etiology even when present by history. Often, neuropsychological test findings are nonspecific to etiology and may be related to a host of factors, such as depression, anxiety, sleep deprivation, or even chronic pain. In these instances, the neuropsychologist must work as an investigator to review the test findings thoroughly in the context of the patient's history.

4.4.3 Assessing Changes over Time and Developing a Prognosis

One of the most useful applications of neuropsychological assessment is to track improvements and decrements in performance over time. This helps in determining the etiology and progression of a disease, developing social or financial plans for a patient, and tracking whether treatment or efforts toward rehabilitation are effective.

4.4.4 Offering Guidelines for Rehabilitation, Vocational / Educational Planning, or A Combination of These

The ability to provide inferences regarding etiology and descriptive power has made neuropsychological assessment a popular tool in rehabilitation and educational planning. Therapists and teachers can often use a patient's profile of strengths and weaknesses to develop and optimize rehabilitation and educational programs. Knowledge of which problems or weaknesses are attributable to brain damage and which are likely the result of non neurological sources can help a therapist allocate time and resources toward the treatment priorities that are most likely to be effective.

4.4.5 Providing Guidelines and Education for Family and Caregivers

In a similar vein, neuropsychological data can help families and caregivers to understand the strengths and weaknesses of their loved ones and to cope with patients who may suffer from challenging limitations on independent functioning. Beleaguered family members are less likely to be angry with a patient when they understand that symptoms that appear to be related to motivation or personality are actually causally related to a disease state. An understanding of the prognosis of the illness can also be invaluable to families who must plan their use of finances and future care.

4.4.6 Planning for Discharge and Treatment Implementation

Neuropsychological deficits can sometimes be insidious and difficult to describe, even for sophisticated clinicians. An understanding of a patient's capabilities can help the clinician assess the degree to which a patient is going to comply with treatment recommendations and medication use, as well as the extent to which the patient or the patient's family may need continued supervision after discharge.

Self Assessment Questions

1) Define and describe neuropsychological tests.

.....

.....

.....

2) Can behaviour be related to abnormal functions through neuropsychological tests?

.....

.....

.....

3) Can neuropsychological test provide etiology for diagnosis and prognosis?

.....

.....

.....

4) What are the various functions of neuropsychological tests?

.....

.....

.....

4.5 OVERVIEW OF INSTRUMENTS

Assessing cognitive functioning in students or patients can yield valuable data that inform instruction through identification of a pattern of strengths and weaknesses, thus giving insight into learning styles and preferences. This, in turn, can help a multidisciplinary team develop comprehensive instructional programs.

The following is a list of measures spanning all age ranges and levels of cognitive functioning. Nonverbal measures are included as they may be appropriate for students demonstrating limited language ability or limited English proficiency. Measures used to assess various types of cognitive processing and executive functions have also been included, as results of such assessment can facilitate a cross-battery analysis of cognitive processes and positively impact instructional decision-making.

4.5.1 Behaviour Rating Inventory of Executive Function (BRIEF)

The Behaviour Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Ken-worthy, 2000) is an individualised, norm-referenced measure of executive function behaviours designed for school-aged students from 5 to 18 years of age. The BRIEF is a questionnaire that is completed by parents or teachers (two different forms), who rate behaviours related to executive functions

in eight scales (Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organise, Organisation of Materials, and Monitor).

Results of the scales are combined to generate two index scores, Behavioural Regulation/BRI (based on three scales) and Meta cognition/MI (based on five scales), and an overall composite score, the Global Executive Composite/GEC. Standardization of the BRIEF included individuals with a variety of developmental or neurological conditions, allowing for use of the inventory with a broad range of students. A Self-Report Form is also available for use with students 13 through 18 years of age, the Behavior Rating Inventory of Executive Function-Self-Report Version (BRIEF–SR; Guy, Isquith, & Gioia, 2005).

4.5.2 Behaviour Rating Inventory of Executive Function-Preschool Version (BRIEF-P)

The Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003) is an individualised, norm-referenced measure of executive function behaviours for preschool-aged children from 2 years to 5 years-11 months of age. The BRIEF-P, a questionnaire designed to be completed by parents or teachers (single form), rates behaviors related to various executive functions observed in the home and in the preschool setting in five scales (Inhibit, Shift, Emotional Control, Working Memory, and Plan/Organise). Items are rated on a Likert scale (never, sometimes, often) comparing the significance of the child's behaviours to those of other children of the same age over a specified period of time.

Results of the scales are combined to generate three index scores, Inhibitory Self-Control, Flexibility, and Emergent Meta cognition (each based on two scales), and an overall composite score, the Global Executive Composite/GEC. Standardization of the BRIEF-P included individuals with a variety of developmental or neurological conditions and children considered at risk, allowing for use of the inventory with a broad range of students. Use of the BRIEF-P may facilitate early identification of children with potential problems in areas of self-regulation.

4.5.3 Comprehensive Test of Nonverbal Intelligence (CTONI)

The Comprehensive Test of Nonverbal Intelligence (CTONI; Hammill, Pearson, & Wiederholt, 1997) measures the nonverbal reasoning abilities of individuals aged 6-0 to 18-11. No oral responses, reading, writing, or manipulation of objects are required. The CTONI is useful for testing individuals with difficulties in language or fine-motor skills, including those who are bilingual, non-English-speaking, or have motor or neurological disabilities. The test can be administered orally or through pantomime.

The six subtests of the CTONI require subjects to view a group of pictures or designs and to solve problems involving analogies, categorizations, and sequences. The viewer simply indicates an answer by pointing to the answer. A computer-administered version of the test is available, the CTONI-CA. This is an interactive multimedia test that can be taken entirely on a computer. The program gives all the instructions using a human voice; the examinee points the mouse and clicks on the answer.

4.5.4 Comprehensive Test of Phonological Processes (CTOPP)

The Comprehensive Test of Phonological Processes (CTOPP; Wagner, Torgesen, & Rashotte, 1999) is an individually administered, norm-referenced measure of phonological awareness, phonological memory, and rapid naming, all foundational skill areas that are critical in learning to read. One form of the CTOPP is administered to children aged 5 and 6 years, focusing on the skills generally needed in kindergarten and first grade. It consists of seven core subtests and one supplemental subtest. A second form for individuals ranging from ages 7 through 24 years consists of six core subtests and eight supplemental subtests.

The purposes of the CTOPP include identifying students who are behind in developing phonological skills and determining which skills have not been acquired or adequately developed. The supplemental tests allow for assessing specific strengths and weaknesses related to phonological processes. Subtests include subtests to measure rapid naming, blending and segmenting words and non-words, sound matching, and memory for digits. All subtests and composites (Phonological Awareness, Phonological Memory, and Rapid Naming) are reported in scaled scores, standard scores, and percentiles.

Self Assessment Questions

1) Describe Behaviour Rating Inventory of Executive Function (BRIEF).

.....

.....

.....

2) How does Behaviour Rating Inventory of Executive Function-Preschool Version (BRIEF-P) differ from BRIEF?

.....

.....

.....

3) Describe the Comprehensive Test of Nonverbal Intelligence (CTONI).

.....

.....

.....

4) Explain the Comprehensive Test of Phonological Processes (CTOPP).

.....

.....

.....

4.5.5 Das Naglieri Cognitive Assessment System (CAS)

The Das Naglieri Cognitive Assessment System (CAS; Naglieri& Das, 1997) is an individually administered measure of cognitive ability designed to assess Planning,

Attention, and Simultaneous and Successive (PASS) processes in individuals 5 years to 24 years-11 months old. Planning tasks require the test taker to develop an approach to solving a task in an efficient and effective manner. Attention tasks require the individual to selectively attend to one and ignore the other aspect of a two-dimensional stimulus. Simultaneous tasks require the individual to interrelate the component parts of a particular item to arrive at the correct answer. Finally, successive tasks require the individual to either reproduce a particular sequence of events or answer questions that require correct interpretation of the linearity of events.

There are 8 subtests in the Basic Battery and 12 subtests in the Standard Battery. The CAS may be used for diagnosis, eligibility, determination of discrepancies, reevaluation, and instructional planning.

4.5.6 Detroit Tests of Learning Aptitude-Fourth Edition (DTLA-4)

The Detroit Tests of Learning Aptitude-Fourth Edition (DTLA-4; Hammill, 1998) is an individually administered measure of mental ability for individuals 6 to 17 years of age. It includes 10 subtests that may be combined to form 16 composites measuring both general intelligence and discrete ability areas. This test not only measures basic abilities but also shows the effects of language, attention, and motor abilities on test performance.

The DTLA-4 yields an Overall Composite comprised of standard scores of all 10 subtests in the battery. This composite is probably the best estimate of general intelligence. The Optimal Level Composite includes the four highest standard scores on the subtests and is the best estimate of a person's overall "potential." The Domain Composites are contrasting composites provided for three domains: language, attention, and manual dexterity. DTLA 4 includes the following: Verbal Composite, Nonverbal Composite, Attention-Enhanced Composite, Attention-Reduced Composite, Motor-Enhanced Composite, and Motor-Reduced Composite.

4.5.7 Differential Ability Scales-Second Edition (DAS-II)

The Differential Ability Scales-Second Edition (DAS-II; Elliott, 2007) is an individually administered norm-referenced battery of cognitive subtests for children and adolescents ages 2-6 through 17-11. Although most cognitive measures are truly language-free, the DAS-II controls for language loading by providing a special Nonverbal Index, and can be used easily with very young children and English Language Learners. It consists of two overlapping batteries, the Early Years Battery and the School-Age Battery. Several subtests within each battery can be used out of level for individuals working above or below typical levels by age.

The DAS-II yields (a) a composite score focused on reasoning and conceptual abilities, the General Conceptual Ability (GCA) score; (b) lower-level composite scores called cluster scores; and (c) diverse, specific-ability measures, including the core subtests, which comprise the GCA and diagnostic subtests. Verbal Ability measures the child's acquired verbal concepts and knowledge. Nonverbal Ability represents complex, nonverbal, inductive reasoning requiring mental processing. Spatial Ability measures complex visual processing. Diagnostic Clusters include Working Memory, Processing Speed, and School Readiness. The DAS-II yields *t*-scores for sub-tests and standard scores and percentiles for cluster and index scores and the GCA.

4.5.8 Kaufman Assessment Battery for Children-Second Edition (KABC-II)

The Kaufman Assessment Battery for Children-Second Edition (KABC-II; Kaufman & Kaufman, 2004) is an individually administered measure of the cognitive processing abilities of children and adolescents aged 3 through 18. The KABC-II is a theory-based clinical instrument that contributes to culturally fair assessment. The KABC-II offers two global summaries: the Fluid-Crystallized Index (FCI), which includes all five scales, and the Mental Processing Index (MPI), which includes the first four scales but not the Knowledge/Crystallized Ability Scale. The test manual states: "Measures of Gc (general cognition) should be excluded from any score that purports to measure a person's intelligence or overall cognitive ability whenever the measure of Gc is not likely to reflect that person's level of ability."

The KABC-II offers a Nonverbal Scale (NVI), which yields a nonverbal index to assess the processing and cognitive abilities of children with whom a nonverbal measure of cognitive ability is appropriate. The Sequential Processing/Short-Term Memory Scale is designed to measure the ability to solve problems by remembering and using an ordered series of images or ideas. The Simultaneous/Visual Processing Scale measures the ability to solve spatial, analogical, or organisational problems that require the processing of many stimuli at one time. The Learning Ability/Long-Term Storage and Retrieval Scale measures the ability to successfully complete different types of learning tasks. Immediate recall and delayed recall tasks are included in this scale. The Planning/Fluid Reasoning Scale measures the ability to solve nonverbal problems that are different from the kinds taught in school. Verbally mediated reasoning must be used to solve the problems. The Knowledge/Crystallized Ability Scale measures knowledge of words and facts using both verbal and pictorial stimuli and requiring either a verbal or pointing response.

Self Assessment Questions

1) Give a description of Das Naglieri Cognitive Assessment System (CAS).

.....

.....

.....

2) What is the role of Detroit Tests of Learning Aptitude-Fourth Edition (DTLA-4).

.....

.....

.....

3) What are the characteristic features of Differential Ability Scales-Second Edition (DAS-II).

.....

.....

.....

.....

4) Discuss Kaufman Assessment Battery for Children-Second Edition (KABC-II)

.....

.....

.....

4.5.9 Leiter International Performance Scale-Revised (Leiter-R)

The Leiter International Performance Scale-Revised (Leiter-R; Roid& Miller, 1998) is a standardized, individually administered, nonverbal test designed to assess cognitive functions in children and adolescents ages 2-0 to 20-11 years. The Leiter-R includes two groupings of subtests: the Visualization and Reasoning Battery with 10 subtests of nonverbal intellectual ability related to visualization, reasoning, and spatial ability; and the Attention and Memory Battery with 10 subtests of nonverbal attention and memory function.

The Fluid Reasoning composite is comprised of subtests that show evidence of providing a unique fluid measure of seriation, reasoning, and pattern generation. The Full IQ score represents a measure of general nonverbal intelligence. The IQ is the sum of the subtests that compose the IQ estimate, and the subtests represented vary depending on the age of the student. The IQ score includes diverse aspects of cognition and is comprised of highly correlated subtests to obtain a single measure of intellectual ability.

4.5.10 NEPSY, Second Edition (NEPSY-II)

The NEPSY-II (Korkman, Kirk, & Kemp, 2007) is a comprehensive instrument designed to assess neuropsychological development in preschool and school-age children from 3 years to 16 years, 11 months. It has a strong theoretical foundation that emphasises the interrelatedness of brain operations. The full assessment evaluates six domains, including Executive Function and Attention, Language, Memory and Learning, Sensorimotor, Visuospatial Processing, and Social Perception. The Social Perception domain has been added to the original NEPSY. It includes Affect Recognition and Theory of Mind, which would be beneficial particularly for children with possible autism. Performance is reported in standard (scaled) scores, process scores, and percentiles. Behavioural observations are presented as cumulative percentages or base rates.

4.5.11 Stanford-Binet Intelligence Scales-Fifth Edition (SB5)

The Stanford-Binet-Fifth Edition (SB5; Roid, 2003) provides comprehensive coverage of five factors of cognitive ability: Fluid Reasoning, Quantitative Reasoning, Visual-Spatial Reasoning, Working Memory, and Knowledge. The SB5 scoring provides a Full Scale IQ score, a Nonverbal IQ score, and a Verbal IQ score, which are reported in standard scores and percentiles and can be used to assess individuals from 2 years of age through 85 years. The SB5 Nonverbal IQ (NVIQ) is based on the nonverbal subtests of the five-factor index scales. It measures skills in solving abstract, picture-oriented problems; recalling facts and figures; solving quantitative problems shown in picture form; assembling designs; and

recalling tapping sequences. The NVIQ measures the general ability to reason, solve problems, visualize, and recall information presented in pictorial, figural, and symbolic form, as opposed to information presented in the form of words and sentences.

The SB5 Verbal IQ (VIQ) provides a composite of all the cognitive skills required to solve the items in the five verbal subtests. The VIQ measures general ability to reason, solve problems, visualize, and recall important information presented in words and sentences (printed and spoken). In addition, it reflects the examinee's ability to explain verbal response clearly, present rationale for response choices, create stories, and explain spatial directions. General verbal ability, measured by VIQ, is one of the most powerful predictors of academic success in classrooms, because of the heavy reliance on language, reading, and writing.

Fluid Reasoning is the ability to solve verbal and nonverbal problems using inductive or deductive reasoning. Quantitative Reasoning is an individual's facility with numbers and numerical problem solving, whether word problems or picture relationships. Activities in the SB5 emphasise applied problem solving more than specific mathematical knowledge acquired through school learning. Visual-Spatial Processing measures an individual's ability to see patterns and relationships. Working Memory is a class of memory processes in which diverse information stored in short-term memory is inspected, sorted, or transformed. Knowledge is a person's accumulated fund of general information acquired at home, school, or work. Also called crystallized ability, it involves learned material such as vocabulary that has been acquired and stored in long-term memory. Verbal knowledge subtests fall under the narrow abilities of Lexical Knowledge and General Knowledge.

4.5.12 Universal Nonverbal Intelligence Test (UNIT)

The Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) is a set ofindividually administered tasks that measure the general intelligence and cognitive abilities of children and adolescents from ages 5 through 17 years who may be disadvantaged by traditional verbal and language-loaded measures. As such, the UNIT provides a comprehensive assessment of general intelligence.

The UNIT offers three administration options: abbreviated battery (2 subtests), standard battery (4 subtests), and extended battery (6 subtests). The Nonverbal Intelligence Quotient (NIQ) is, in most instances, the best index for measuring the ability to solve problems, or to reason, not requiring words. The Nonverbal Quotient (NIQ) measures three cognitive abilities (analogical reasoning, categorical classifying, and sequential reasoning), all assessed in two contexts (pictorial objects and geometric designs). The Memory Quotient is an index of attending, organising, encoding, storing, and recalling information and experiences. The Reasoning Quotient provides a measurement of thinking skills, including the ability to use information to solve problems. The Symbolic Quotient measures symbolic processing or mediation. Symbolic mediation represents the verbal component of a nonverbal task. The Nonsymbolic Quotient measures abilities of perception, recognition, sequencing, organisation, and integration. These skills encompass all aspects of cognition including reasoning and memory. Subtest scores are reported in standard scores and percentiles.

Self Assessment Questions

1) Describe Leiter International Performance Scale-Revised (Leiter-R).

.....

.....

.....

.....

2) In what ways the NEPSY, Second Edition (NEPSY-II) cab used?

.....

.....

.....

.....

3) Describe states the functions of Stanford-Binet Intelligence Scales-Fifth Edition (SB5).

.....

.....

.....

.....

4) What is Universal Nonverbal Intelligence Test (UNIT)? Describe the test.

.....

.....

.....

.....

4.5.13 Wechsler Abbreviated Scale of Intelligence (WASI)

The Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) is an individuallyadministered, brief intelligence scale consisting of either two or four subtests designed to be used with individuals age 6 to 89. Subtests (from the WISC-IV and WAIS-III) are Vocabulary, Block Design, Similarities, and Matrix Reasoning. Subtest raw scores are converted to *t*-scores (mean of 50 and a standard deviation of 10). If two subtests are given, a Full Scale IQ (reported as a standard score) can be derived. If four subtests are given, a Verbal IQ, Performance IQ, and Full Scale IQ can be derived. The manual states that, "The WASI is appropriate for screening, estimating IQ when a full evaluation is not possible, reevaluations when time is limited, research estimates of IQ, and other situations when a more comprehensive evaluation is not needed or not possible."

4.5.14 Wechsler Adult Intelligence Scale-Third Edition (WAIS-III)

The Wechsler Adult Intelligence Scale-Third Revision (WAIS-III; Wechsler, 1997) is an individually administered, standardized test designed to measure general intelligence, or the overall ability of the individual "to act purposefully, to think rationally and to deal effectively with his environment" (Wechsler, 1999, p. 3). The WAIS-III covers an age range from 16 to 89 years. It contains 14 subtests, each yielding scaled scores with a mean of 10 and a standard deviation of 3. From these subtest scores, the WAIS-III provides three separate intelligence quotients (IQs): a Verbal Scale IQ, a Performance Scale IQ, and a Full Scale IQ. Alternately, it may be scored using the Full Scale IQ and the four Index Scores model used with the WISC-IV (Verbal Comprehension Index, Perceptual Organisation Index, Working Memory Index, and Processing Speed Index).

4.5.15 Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV)

The Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV; Wechsler, 2003) provides a measure of general intellectual functioning (Full Scale Intelligence Quotient [FSIQ]) and four index scores. It can be used to assess individuals between the ages of 6 and 16 years, 11 months. Its framework is based on theory and supported by clinical research and factor-analytic results. The four index scores are the Verbal Comprehension Index (VCI), the Perceptual Reasoning Index (PRI), the Working Memory Index (WMI), and the Processing Speed Index (PSI). The WISC-IV consists of 10 core subtests and five supplemental subtests. The VCI is composed of subtests measuring verbal abilities utilising reasoning, comprehension, and conceptualisation. The PRI is composed of subtests measuring perceptual reasoning and organisation. The WMI is composed of subtests measuring attention, concentration, and working memory. The PSI is composed of subtests measuring the speed of mental and grapho motor processing.

4.5.16 Wechsler Intelligence Scale for Children-Fourth Edition Integrated (WISC-IV Integrated)

The Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV Integrated; Kaplan, Fein, Kramer, Delis, & Morris, 2004) enhances the WISC-IV by adding 16 process sub-tests, as well as qualitative and quantitative observations and error scores. The addition of more measures of cognitive processes allows for a broader definition of intelligence for individuals aged 6 years through 16-11. All or selected process subtests may be used when a low scaled score is obtained on a corresponding subtest or when a child displays inconsistent or atypical performance. Results may be used to investigate low scores and identify strengths and weaknesses in the corresponding areas.

To supplement the Verbal domain (VCI on WISC-IV), subtests include (a) Similarities Multiple Choice, (b) Vocabulary Multiple Choice, (c) Picture Vocabulary Multiple Choice, (d) Comprehension Multiple Choice, and (e) Information Multiple Choice. To supplement the Performance domain (PRI on WISC IV), subtests include (a) Block Design Multiple Choice, (b) Block Design Process Approach, and (c) Elithorn Mazes. The six process subtests that

enhance the Working Memory domain (WMI on WISC IV) include (a) Visual Digit Span, (b) Spatial Span, (c) Letter Span, (d) Letter-Number Sequencing Process Approach, and (e) Elithorn Mazes. Finally, process subtests used to enhance the Processing Speed (PSI on WISC-IV) include Coding Recall and Coding Copy.

4.5.17 Wechsler Nonverbal Scale of Ability (WNV)

The Wechsler Nonverbal Scale of Ability (WNV; Wechsler &Naglieri, 2006) is an individually administered test of nonverbal intelligence for individuals from ages 4 through 21 years. When language poses a barrier to typical administration, or if traditional intellectual assessment results are questionable due to language-related difficulties, the WNV is appropriate.

The WNV uses subtests to determine a full-scale measure of cognitive ability. The subtests yield a raw score that is converted to a *t*-score, allowing a student's performance to be compared to that of his peers. *T*-scores have a mean of 50 and a standard deviation of 10. The *t*-scores of the subtests are totaled and converted to a full-scale score that is a standard score, with a mean of 100 and a standard deviation of 15. The subtests consist of (a) Matrices, (b) Coding, (c) Spatial Span (a visual memory measure corresponding to the auditory task in Digit Span), (d) Spatial Span Forward, (e) Spatial Span Backwards, (f) Picture Arrangement, (g) Object Assembly, and (h) Recognition.

4.5.18 Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III)

The Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WWPSI-III; Wechsler, 2002) is an individually administered, standardized instrument for assessing the intelligence of children aged 2-6 through 7-3. It includes short, game-like tasks that engage young children. The WPPSI-III provides a Full Scale IQ (FSIQ), Verbal IQ (VIQ), and Performance IQ (PIQ) for ages 2-6 through 3-11 using four subtests. For ages 4-0 through 7-3, seven subtests are used to yield a FSIQ, VIQ, and PIQ. Optional subtests may be given to obtain a General Language Composite for younger children or a Processing Speed Quotient for older children.

Self Assessment Questions

1) Describe Wechsler Abbreviated Scale of Intelligence (WASI).

.....

.....

.....

2) How does the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) differ from the abbreviated scale?

.....

.....

.....

3) Explain the test items in the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV).

.....

.....

.....

4) How is the Wechsler Intelligence Scale for Children-Fourth Edition Integrated (WISC-IV Integrated) differing from the IV edition of WISC?

.....

.....

.....

5) Describe Wechsler Nonverbal Scale of Ability (WNV).

.....

.....

.....

6) Explain the Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III).

.....

.....

.....

4.5.19 Wide Range Assessment of Memory and Learning-Second Edition (WRAML-2)

The Wide Range Assessment of Memory and Learning-Second Edition (WRAML-2; Sheslow& Adams, 2004) is an individually administered measure of memory functions that may have a significant impact on learning and school-related problems. The WRAML-2 may be used with individuals from age 5 through 90. It provides a General Memory Index, three additional index scores (Verbal Memory, Visual Memory, and Attention and Concentration), and three supplemental index scores (Working Memory, Delayed Memory, and Recognition). Each index score is derived from performance on from two to four subtests, and all are reported in standard scores and percentile ranks. Standard scores have a mean of 100 and a standard deviation of 15.

4.5.20 Woodcock-Johnson Tests of Cognitive Abilities-Third Edition/Normative Update (WJ-III COG/NU)

The Woodcock-Johnson III Tests of Cognitive Abilities (WJ-III COG/NU; Woodcock, McGrew, & Mather, 2005) is a comprehensive set of individually administered co-normed tests for measuring cognitive ability. The tests may be used from ages 2 through adult. The battery assesses general intellectual ability as well as specific cognitive abilities. Twenty individual tests and 20 Cluster scores provide broad estimates of cognitive abilities.

The Verbal Ability Cluster Score is a measure of language development that includes the comprehension of individual words and the comprehension of relationships among words. The Thinking Ability Cluster Score represents a sampling of the thinking processes that may be invoked when information in short-term memory cannot be processed automatically. The scale includes samples of long-term retrieval, visual-spatial thinking, auditory processing, and fluid reasoning. The Cognitive Efficiency Cluster is derived from a sampling of two factors of automatic cognitive processing, processing speed, and short-term memory.

4.6 LET US SUM UP

Tests of cognitive ability are use to answer a wide variety of important clinical questions. In addition to identifying over all intellectual skills and cognitive strengths and weaknesses, these tests are frequently employed to assess the presence of learning disabilities, predict academic success in school, examine brain dysfunction, and assess personality. Any competent psychologist must be cautious in the use of intellectual, neuropsychological, achievement, and all other forms of cognitive testing. Professionals must be aware of the limitations of the testing situation and the limitations of the particular test they have chosen. They must be careful to use tests for the purpose for which the test was developed and researched and in conjunction with other appropriate tests. They must also be able to understand the results in terms of the context of the individual's testing response style and the bio psychosocial influences that might affect particular scores. For instance, scores may not accurately reflect potential if a child is distracted due to severe stress or family conflict, chronic illness; compromised by poor nutrition; or disadvantaged due to poverty or frequent school disruption. In fact, some research as indicated that stress level and coping abilities are significantly associated with performance on intelligence and other tests of cognitive abilities.

4.7 UNIT END QUESTIONS

1) True and False Questions

   i) Cognitive testing is a general term referring to the assessment of a wide range of information processing or thinking skills and behaviours. (True/False)

   ii) IQ tests are excellent predictors of academic achievement, occupational performance and are sensitive to the presence of neuropsychological deficit. (True/False)

   iii) When children are evaluated, clinicians attempt to infer change from pre morbid abilities. (True/False)

   iv) One of the most useful applications of neuropsychological assessment is to track improvements and decrements in performance over time. (True/False)

   v) Quantitative Reasoning is the ability to solve verbal and nonverbal problems using inductive or deductive reasoning. (True/False)

   vi) The Leiter International Performance Scale-Revised is a verbal test designed to assess cognitive functions in children and adolescents ages 2-0 to 20-11 years. (True/False)

2) Discuss the clinical use of intelligence tests?

.....

.....

.....

3) Discuss in detail the uses of neuropsychological tests?

.....

.....

.....

4) Provide an overview of various instruments to assess cognitive functions?

.....

.....

.....

5) Describe the test Wide Range Assessment of Memory and Learning-Second Edition (WRAML-2)

.....

.....

.....

6) How are the Woodcock-Johnson Tests of Cognitive Abilities-Third Edition/ Normative update (WJ-III COG/NU) useful?

.....

.....

.....

4.8 SUGGESTED READINGS

Groth-Marnat, Gary. (2003). *Handbook of Psychological Assessment* (4thed.). New Jersey: John Wiley & Sons, Inc.

Murphy, K.R., Davidshofer, C.O. (2005). *Psychological Testing: Principles and Applications (6thed.)*. New Jersey: Pearson Education International.

References

Amabile, T.M. (1982). Social psychology of creativity: a consensual assessment technique. *Journal of Personality and Social Psychology*, 43(5), 997–1013.

Baddeley, A.D., Wilson, B.A. & Watts, F.N. (1995). Handbook of Memory Disorders. Chichester: Wiley.

Binet, A. & Henri, V. (1895). La psychologieindividuelle. *L'AnneePsychologique*, 2, 411–465.

Bourne. L.E. Jr. (1966). *Human conceptual behavior.* Boston: Allyn& Bacon.

Bracken, B. A., & McCallum, R. S. (1998). *Universal Nonverbal Intelligence Test.* Itasca, IL: Riverside Publishers.

Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology, 54,* 1–22.

Craik, F.I.M., Anderson, N.D., Kerr, S.A. & Li, K. (1995). Memory changes in normal ageing. In Baddeley, A.D., Wilson, B.A. & Watts, F.N. (Eds.), Handbook of Memory Disorders (pp. 211–241). Chichester: Wiley.

Crammond, Bonnie (1994). The Torrance tests of creative thinking: from design through establishment of predictive validity. In Subotnik, R.F. & Arnold, K.D. (Eds.), *Beyond Terman: Contemporary Longitudinal Studies of Giftedness and Talent* (pp. 229–254). Norwood, NJ: Ablex.

Das, J.P., Naglieri, J.A. & Kirby, J.R. (1994). *Assessment of Cognitive Processes: The PASS Theory of Intelligence.* Boston, MA: Allyn& Bacon.

Davis, G.A. (1975). In frumious pursuit of the creative person. *Journal of Creative Behaviour,* 9(2), 75–87.

Elliott, C. D. (2007). *Differential Ability Scales, Second Edition.* San Antonio, TX: Psychological Corporation.

Elliott, C.D. (1990). *Differential Ability Scales (DAS) Administration and Scoring Manual.* San Antonio, TX: Psychological Corporation.

Galton, Francis (1869). *Hereditary Genius: An Inquiry into its Laws and Consequences.* London: Macmillan.

Gardiner, J.M. & Richardson-Klavehn, A. (2000). Remembering and knowing. In Tulving, E. &Craik, F.I.M. (Eds.), The Oxford Handbook of Memory (pp. 229–244). New York: Oxford University Press.

Gardner, R.W. & Schoen, R.A. (1962). Differentiation of abstraction in concept formation. *Psychological Monographs, 76,* No. 41 (While No. 560).

Gazzaniga, M.S. (1995). The Cognitive Neurosciences. Cambridge, MA: The MIT Press.

Getzels, J. W., & Jackson, P. W. (1962). *Creativity and intelligence: Explorations with gifted students.* New York: Wiley.

Gioia, G. A., Espy, K. A., &Isquith, P. K. (2003). *Behavior Rating Inventory of Executive Function–Pre-School version.* Lutz, FL: Psychological Assessment Resources, Inc.

Gioia, G. A., Isquith, P. K., Guy, S. C., &Kenworthy, L. (2000). *Behavior Rating Inventory of Executive Function.* Lutz, FL: Psychological Assessment Resources, Inc.

Goldstein, K. &Scheerer, M. (1941). Abstract and concrete behavior: An experimental study with special tests. *Psychological Monographs, 53,* (2, Whole No. 239).

Gorham, D.R. (1956). A Proverbs Test for clinical and experimental use. *Psychological Reports, 2,* 1–12.

Gough, H.G. (1979). A creative Personality Scale for the Adjective Check List. *Journal of Personality and Social Psychology*, 37(8), 1398–1405.

Graf, P. &Schacter, D.L. (1985). Implicit and explicit memory for new associations in normal subjects and amnesic patients. Journal of Experimental Psychology: Learning, Memory and Cognition, 11, 501–518.

Grant, D.A., & Berg, E.A. (1948). A behavioral analysis of the degree of reinforcement and ease of shifting to new responses in a Weigl-type card sorting problem. *Journal of Experimental Psychology, 38,* 404–411.

Guilford, J.P. (1967). *The Nature of Human Intelligence*. New York: McGraw-Hill.

Guy, S. C., Isquith, P. K., &Gioia, G. A. (2005). *Behavior Rating Inventory of Executive Function®-Self-Report Version*. Lutz, FL: Psychological Assessment Resources, Inc.

Halstead, W.C. (1947). *Brain and intelligence.* Chicago: University of Chicago Press, 1947.

Hammill, D. D. (1998). *Detroit Tests of Learning Aptitude, Fourth Edition.* Austin, TX: Pro-Ed.

Hammill, D. D., Pearson, N., &Wiederholt, J. L. (1997). *Comprehensive Test of Nonverbal Intelligence*. Austin, TX: Pro-Ed.

Hanfmann, E., &Kasanin, J. (1937). A method for the study of concept formation. *Journal of Psychology, 3,* 521–540.

Heaton, R.K., Chelune, C.J., Talley, J.L., Kay, G.G., & Curtiss, G. (1993). *Wisconsin Card Sorting Test manual, revised and expanded.* Odessa, FL: Psychological Assessment Resources.

Herrnstein, R. J., & Murray, C. (1994). *The bell curve: Intelligence and class structure in American life.* New York: Free Press.

Horn, J.L. (1989). Cognitive diversity: a framework of learning. In Ackerman, P.L., Sternberg, R.J. & Glaser, R. (Eds.), *Learning and Individual Differences* (pp. 61–116). New York: Freeman.

Hunter, J. E. (1986). Cognitive ability, cognitive aptitudes, job knowledge, and job performance. *Journal of Vocational Behavior, 29,* 340–362.

Kaplan, E., Fein, D., Kramer, J., Delis, D., & Morris, R. (2004). *Wechsler Intelligence Scale for Children, 4th Edition Integrated.* San Antonio, TX: Psychological Corporation.

Kaufman, A. S., & Kaufman, N. L. (2004). *Kaufman Assessment Battery for Children, Second Edition*. Circle Pines, MN: Pearson (AGS).

Kaufman, A.S. & Kaufman, N.L. (1993). *Manual for Kaufman Adolescent & Adult Intelligence Test (KAIT).* Circle Pines, MN: American Guidance Service, Inc.

Korkman, M., Kirk, U., & Kemp, S. (2007). *NEPSY, Second Edition*. San Antonio, TX: Psychological Corporation.

Kosslyn, S.M. & Koenig, O. (1992). Wet Mind. The New Cognitive Neuroscience. New York: The Free Press.

Lezak, M.D. (1995). *Neuropsychological assessment* (3rd ed.). New York: Oxford University Press.

Ludwig, A.M. (1992). The Creative Achievement Scale. Creativity Research Journal, 5(2), 109–124.

McCue, M. (1995). Ecologically valid assessment of problem: The American Multiple Errands Test (Abstract). *Journal of the International Neuropsychological Society, 1,* 149.

Mednick, S.A. (1962). The associative basis of the creative process. Psychological Review, 69(3), 220–232.

Minshew, N.J., Siegel, D.J., Goldstein, G., &Weldy, S. (1994). Verbal problem solving in high functioning autistic individuals. *Archives of Clinical Neuropsychology, 9,* 31–40.

Naglieri, J. A., & Das, J. P. (1997). *Das Naglieri Cognitive Assessment System.* Itasca, IL: Riverside Publishing.

Neisser, U., Boodoo, G., Bouchard, T. J., Jr., Boykin, A. W., Brody, N., Ceci, S. J., et al. (1996). Intelligence: Knowns and unknowns. *American Psychologist, 51,* 77–101

Nyberg, L. &Tulving, E. (1996). Classifying human long-term memory: evidence from converging dissociations. The European Journal of Cognitive Psychology, 8, 163–183.

Olson, J.L., Goldstein, G., Neuringer, C. & Shelly, C.H. (1969). Relation between equivalence range and concept formation ability in brain-damaged patients. *Perceptual and Motor Skills, 28,* 743–749.

Perrine, K. (1993). Differential aspects of conceptual processing in the Category Test and Wisconsin Card Sorting Test. *Journal of Clinical and Experimental Psychology, 15,* 461–473.

R.R. & Reynolds, C.R. (Eds.), *Handbook of Creativity* (pp. 53–75). New York: Plenum Press.

Raven, J.C. (1982). *Revised manual for Raven's Progressive Matrices and Vocabulary Scale.* Windsor, U.K.: NFER Nelson.

Reynolds, C. R., Chastain, R. L., Kaufman, A. S., & McLean, J. E. (1987). Demographic characteristics and IQ among adults: Analysis of the WAIS-R standardization sample as a function of the stratification variables. *Journal of School Psychology, 25,* 323–324

Richards, R., Kinney, D.K., Lunde, I., Benet, M. &Merzel, A.P.C. (1988). Assessing everyday creativity: characteristics of the Lifetime Creativity Scales and validation with three large samples. *Journal of Personality and Social Psychology*, 54(3), 476–485.

Richardson-Klavehn, A. & Bjork, R.A. (1988). Measures of memory. Annual Review of Psychology, 39, 475–543.

Roid, G. H. (2003). *Stanford-Binet Intelligence Scales, Fifth Edition*. Itasca, IL: Riverside Publishing.

Roid, G. H., & Miller, L. J. (1998). *Leiter International Performance Scale-Revised*. Wood Dale, IL: Stoelting Company.

Ruiz-Vargas, J.M. (1993). Disociaciones entre pruebasimplý´citas y explý´citas de memoria: significado e implicacionesteo´ ricas [Dissociations between implicit and explicit memory tests: theoretical significance and implications]. Estudios de Psicologý´a, 49, 71–106.

Schacter, D.L. & Tulving, E. (1994a). Memory Systems 1994. Cambridge, MA: The MIT Press.

Schacter, D.L. & Tulving, E. (1994b). What are the memory systems of 1994? In Schacter, D.L. &Tulving, E. (Eds.), Memory Systems 1994 (pp. 1–38). Cambridge, MA: The MIT Press.

Schacter, D.L. (1987). Implicit memory: history and current status. Journal of Experimental Psychology: Learning, Memory and Cognition, 13, 501–518.

Schacter, D.L., Wagner, A.D. & Buckner, R.L. (2000). Memory systems of 1999. In Tulving, E. &Craik, F.I.M. (Eds.), The Oxford Handbook of Memory (pp. 627–643). New York: Oxford University Press.

Schaefer, C.E. &Anastasi, A. (1968). A biographical inventory for identifying creativity in adolescent boys. *Journal of Applied Psychology*, 58, 42–48.

Schaefer, C.E. (1970). *Biographical Inventory –Creativity*. San Diego, CA: Educational and Industrial Testing Service.

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin, 124,* 262–274.

Schmidt, F. L., Ones, D. S., & Hunter, J. E. (1992). Personnel selection. *Annual Review of Psychology, 43,* 627–670.

Shallice, T. (1982). Specific impairments of planning. *Philosophical Transactions of the Royal Society of London, 298,* 199–209.

Sheslow, D., & Adams, W. (2004). *Wide Range Assessment of Memory and Learning, Second Edition.* Lutz, FL: Psychological Assessment Resources, Inc.

Squire, L.R. & Knowlton, B.J. (2000). The medial temporal lobe, the hippocampus, and the memory systems of the brain. In Gazzaniga, M.S. (Ed.), The New Cognitive Neurosciences (2nd ed., pp. 765–779). Cambridge, MA: The MIT Press.

Squire, L.R. (1992). Memory and the hippocampus: a synthesis from findings with rats, monkeys and humans. Psychological Review, 99, 195–231.

Sternberg, R J. (1981b). Toward a unified componential theory of human intelligence, I. Fluid abilities. In M. Friedman, J. Das, & N. O'Connor (Eds.), *Intelligence and learning*. New York: Plenum.

Sternberg, R. J. (1977). *Intelligence, information processing, and analogical reasoning: The componential analysis of human abilities*. Hillsdale, NJ: Erlbaum.

Terman, L.M. (1916). *The Measurement of Intelligence*. Boston, MA: Houghton-Mifflin.

Torrance, E. P. (1962). *Guiding creative talent*. Englewood Cliffs, NJ: Prentice- Hall.

Torrance, E. P. (1974). *Torrance Tests of Creative Thinking—Directions manual and scoring guide. Verbal test booklet A*. Bensenville, IL: Scholastic Testing Service.

Torrance, E. P., & Ball, O. E. (1984). *Torrance Tests of Creative Thinking:Streamlined administration and scoring manual* (Rev. ed.). Bensonville, IL: Scholastic Testing Service.

Torrance, E.P. (1966). *Torrance Tests of Creative Thinking*. Princeton, NJ: Personnel Press.

Toth, J.P. (2000). Nonconscious forms of human memory. In Tulving, E. &Craik, F.I.M. (Eds.), The Oxford Handbook of Memory (pp. 245–261). New York: Oxford University Press.

Tulving, E. &Schacter, D.L. (1992). Priming and memory systems. In Smith, B. & Adelman, G. (Eds.), Neuroscience Year. Supplement 2 to the Encyclopedia of Neuroscience (pp. 130–133). Boston: Birkhauser.

Tulving, E. (1984). Multiple learning and memory systems. In Lagerspetz, K.M.J. &Niemi, P. (Eds.), Psychology in the 1990's (pp. 163–184). Amsterdam: North-Holland.

Tulving, E. (1985a). How many memory systems are there? American Psychologist, 40, 385–398.

Tulving, E. (1985b). Memory and consciousness. Canadian Psychology, 26, 1–26.

Tulving, E. (2000). Introduction (Section VI: Memory). In Gazzaniga, M.S. (Ed.), The New Cognitive Neurosciences (2nd ed., pp. 727–732). Cambridge, MA: The MIT Press.

Vernon, P. E. (1965). Ability factors and environmental influences. *American Psychologist,* 20, 723-733.

Wagner, R., Torgesen, J., & Rashotte, C. (1999). *Comprehensive Test of Phonological Processes.* Austin, TX: Pro-Ed, Inc.

Wallach, M. A., &Kogan, N. (1965). *Modes of thinking in young children: A study of the creativity- intelligence distinction.* New York: Holt, Rinehart and Winston.

Wang, P.L. (1983). *Modified Vygotsky Concept Formation Test: Instruction manual.* Wood Dale, IL: Stoelting.

Wechsler, D. (1974*). Manual for the Wechsler Intelligence Scale for Children –*

Revised (WISC-R). San Antonio, TX: The Psychological Corporation.

Wechsler, D. (1981). *Wechsler Adult Intelligence Scale—Revised.* San Antonio, TX: Psychological Corporation.

Wechsler, D. (1997). *Wechsler Adult Intelligence Scale* (3rd ed.). San Antonio, TX: Psychological Corporation.

Wechsler, D. (1999). *Wechsler Abbreviated Scale of Intelligence*. San Antonio, TX: Psychological Corporation.

Wechsler, D. (2002). *Wechsler Preschool and Primary Scales of Intelligence, 3rd Edition (WPPSI-III).* San Antonio, TX: Psychological Corporation.

Wechsler, D. (2003). *Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV).* San Antonio, TX: Psychological Corporation.

Wechsler, D., &Naglieri, J. A. (2006). *Wechsler Nonverbal Scales of Intelligence (WNV).* San Antonio, TX: Psychological Corporation.

Weigl, E. (1927). Zurpsychologiesogenannterabstraktionsprozess. *Zeitschriftfu¨rpsychologie, 103,* 1–45.

Weiskrantz, L. (1990). Problems of learning and memory: one or multiple memory systems? Philosophical Transactions of the Royal Society of London (B), 329, 99–108.

Willingham, D.B. (1997). Systems of memory in the human brain. Neuron, 18, 5–8.

Wilson, B.A., Alderman, N., Burgess, P.W., Emslie, H., & Evans, J.J. (1996). *Behavioural assessment of dysexecutive syndrome.* Bury St. Edmunds, England (1996).

Woodcock, R. W., McGrew, K. S., & Mather, N. (2005). *Woodcock-Johnson Tests of Cognitive Abilities, Third Edition/Normative Update*. Itasca, IL: Riverside Publishing.

Woodcock, R.W & Johnson, M.B. (1977). *Woodcock–Johnson Psycho-Educational Battery.* Allen, TX: DLM/Teaching Resources.

Woodcock, R.W., McGrew, K.S. & Mather, N. (2000). *Woodcock-Johnson Psycho-Educational Battery – Third Edition (WJ III).* Chicago, IL: Riverside.

NOTES