
UNIT 3 COGNITIVE DEVELOPMENT

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Attention
 - 3.2.1 Cognitive Inhibition
 - 3.2.2 Determinants of Attention
 - 3.2.3 Types of Attention
- 3.3 Language
 - 3.3.1 Characteristics of Language
 - 3.3.2 Functions of Language
 - 3.3.3 Language as a Means of Socialisation
- 3.4 Executive Functions
- 3.5 Intelligence
 - 3.5.1 Types of Intelligence
 - 3.5.2 Mental Age
 - 3.5.3 Intelligence Quotient
 - 3.5.4 Measurement of Intelligence
 - 3.5.5 Uses of Intelligence Tests
- 3.6 Theories of Intelligence
- 3.7 Heredity and Environment Influences
- 3.8 Let Us Sum Up
- 3.9 Unit End Questions
- 3.10 Suggested Readings

3.0 INTRODUCTION

Cognitive development aims at studying a child's development specifically information processing, conceptual resources, perceptual skill, language learning, and other aspects related to the development of the brain. Research in this field mainly has been focused on understanding how a child conceptualises the world. *Jean Piaget* was a major force in the founding of this field, and his theory is known as "theory of cognitive development".

Piaget Stages of Cognitive Development

The sensorimotor stage (Birth to 2 years)

The preoperational stage (Age 2 to 6)

The concrete operational stage (Age 7 to 11)

The formal operational stage (12yrs and up)

Cognitive Development contains empirical and theoretical work on the development of attention, language, executive functions, intelligence, heredity and environmental influences.

3.1 OBJECTIVES

After going through this unit, you should be able to:

- Explain the meaning of cognitive development;
- Describe cognitive development in your own words;
- Define and describe attention;
- Explain the role of attention in development;
- Discuss the role of language in human development;
- Identify executive functions;
- Define intelligence and IQ;
- Elucidate the measurement of intelligence; and
- Explain the importance of heredity and environment in development.

3.2 ATTENTION

Attention is the cognitive process of selectively concentrating on one aspect of the environment while ignoring other things. Attention has also been referred to as the allocation of processing resources. For example while watching TV our senses are glued to the screen and we do not pay attention to the surroundings and similarly we do not listen to a cell phone conversation while driving a car.

Attention has been a major area of investigation in the field of education, psychology and neuroscience. Often we find that young children remain involved in tasks for short interval of time, have difficulty in focusing on details, and are easily distracted. Researches conducted have focused on determining the source of the signals that generate attention, and their effects on the tuning of sensory neurons, and the relationship between attention and other cognitive processes like reasoning, memory and vigilance.

Attention may be differentiated according to its status as ‘overt’ versus ‘covert.’ Overt attention is the act of directing sense organs towards a stimulus source. Covert attention is the act of mentally focusing on one of several possible sensory stimuli. Covert attention is thought to be a neural process that enhances the signal.

3.2.1 Cognitive Inhibition

Attention depends on *cognitive inhibition* that is the ability to control distracting stimuli within and outside environment. Individuals capable of cognitive inhibition are able to keep their mind from other thoughts. They are also able to prevent unrelated stimuli from interfering with the task at hand. Capacity for cognitive inhibition increases with age and it develops markedly during middle childhood. It receives further impetus during adolescence. It is believed that frontal lobe is largely responsible for this.

3.2.2 Determinants of Attention

Nature of stimulus: By nature of stimulus we mean whether the stimulus is auditory or visual. Generally compared to auditory stimulus a visual stimulus attracts attention more easily. It happens because visual stimulus makes more

impressive projection upon the brain. For example, when passing by the side of a cinema hall we are more easily drawn to the poster on the wall than to the sound coming from within.

Change in stimulus: Any sudden change in the stimulus present before you is bound to attract your attention. For example, you are studying and table fan is running at your side, you will pay any attention to it if it stops suddenly, immediately your attention will be drawn toward it.

Novelty of stimulus: When a stimulus appears before us in a routine manner we stop paying attention to it for we get accustomed to it and it loses its novelty. But when it renews itself, our attention is immediately drawn to it. For Example, when one of your classmates who usually wears pant and shirt, suddenly comes in kurta pajama, your attention is suddenly attracted to him. Thus novelty of a stimulus is one factor that determines your attention.

Movement of a stimulus: Moving objects attract our attention more easily than static ones. Perhaps this is the reason that big emporiums and cinema halls decorate their hoardings with moving lights. Or when a motor cycle suddenly zooms past us our attention is drawn to it.

Duration of stimulus: We pay more attention to a stimulus that stays for longer duration before us than the one which is present for a short while. For example, if a photograph is placed before us for only a few seconds we may not pay attention to it but when it is there for minutes together we are more likely to pay attention to it.

Position of stimulus: Change in the position of stimulus also attracts our attention. Other things being equal, why is it that, a stimulus sometimes attracts our attention and sometimes not. The best example of this is the newspaper. If a heading is printed on the front page it attracts our attention but if it is on inside pages it does not attract our attention.

Isolation of stimulus: When a stimulus stands isolated from other stimulus it is more likely to draw our attention towards it. For example, if in a party you find a person who is standing isolated from others, he all of a sudden draws your attention. He compels you to think to why is he standing like this?

Intensity of stimulus: Intensity of stimulus is another factor that determines our attention. Greater the intensity of stimulus the more likely it is to attract our attention. For example, in a dark night our attention is immediately drawn toward the bright twinkling stars in the sky. Similarly, during day time we hardly pay attention to a tick tick sound of a watch but in the silence of night it is clearly audible to us.

Habit: Every person has some characteristic habits. Some people chew tobacco, some have smoking habit and still others have the habit of drinking. You will find that smokers easily pay attention to shops of cigarettes.

Need: Our biological needs also to some extent determine our attention. When hungry and moving through the market our attention is easily drawn by foodshops.

Expectation: Expectation also decides our attention. For example, if your father daily returns home in the evening at 7 P.M., you will immediately pay attention when the door opens at around this time.

3.2.3 Types of Attention

- a) **Focused attention:** Being able to respond discretely to a specific object in one's environment is called focused attention. During the first year infants pay more attention to novel eye catching object and quickly orient to them.
- b) **Sustained attention (vigilance):** Being able to maintain a focused response to an object is termed as sustained attention. During the second year child becomes capable of intentional , goal directed behaviour which in turn contributes to improvement in sustained attention. For example when a child is asked to put toys in the basket attention needs to be maintained to accomplish the task. Sustainability of attention increases with complexity of the task.
- c) **Selective attention:** Being able to maintain a behavioural or cognitive set in the face of distracting or competing stimuli. Selectivity of attention improves markedly around 6 and 9 years of age. Children are able to pay deliberate attention to relevant aspects while ignoring other information.

Example: pick out numbers which are multiples of 3 from amongst many numbers.

- d) **Alternating attention:** Being able to shift focus of attention between objects having different cognitive requirements. Example children of sixth grade in judging whether pairs of stimuli are the same or different. They quickly shift their basis of judgement form size to shape to color when asked to do so.
- e) **Divided attention:** Ability to pay attention and respond simultaneously to multiple tasks or multiple task demands.

3.3 LANGUAGE

A **language** is a system of signs (indices, icons, symbols) for encoding and decoding information established through social conventions.

Some of the areas of the brain involved in language processing include Broca's area (Blue), Wernicke's area (Green), Supramarginal gyrus (Yellow), Angular gyrus (Orange), and Primary Auditory Cortex (Pink)

Human languages are usually referred to as natural languages. A common progression for natural languages is that they are considered to be first spoken and then written, and then an understanding and explanation of their grammar is attempted

Language is very important for the development of personality of a child. Development of language is closely related to an individual's physical, social and mental development. This is the reason a child is able to learn language only after attaining a certain level of physical maturity. For example, the child is able to pronounce some words clearly only after his vocal organs reach maturity.

3.3.1 Characteristics of Language

Language is acquired and the acquisition is influenced by the child's ability to make necessary improvements in his behaviour. Understanding of language comes

months before speaking. For example, the child expresses his happiness through smiles or laughing when he sees his mother calling him through a specific sound.

The first sound produced by a child is natural and undifferentiated called, “*babbling*”. A child first produces vowel sounds such as, “aa”, “oo”. After this he produces vowel-consonant mixed sounds like, “ma”, “pa” etc.

Though individual differences are found in the development of language of children, yet the development of language in children follows a pattern as is given below:

Phase 1: In this phase the child utters incoherent sounds.

Phase 2: In this phase, the child uses some primary words.

Phase 3: In phase 3, the child develops power to make sense of meaning of words.

Phase 4: In this phase the child develops power to express ideas.

Phase 5: In this phase the child develops control over adult language.

3.3.2 Functions of Language

Children’s activities relating to language are often self-centered in that the child talks to self and listens to self. Thus the child is a talker and a listener at the same time. For example, you might have noticed that while playing, very young children keep talking to themselves. They use language for asserting themselves and for attracting attention of others.

3.3.3 Language as Means of Socialisation

As the child begins to show signs of social consciousness the language the child speaks also matures. By the time the child is 7 or 8 years old the proficiency over language reaches a stage where it appears that the child has been adequately socialised. This mastery over language enables the child enter into interactions with others and the child receives the first lesson of cooperation and is compelled to think how the child is related to other persons in the society. This knowledge facilitates the child’s personal and social adjustment.

As is well known, initial language of the child is characterised by self centeredness but with advancement in age he attains greater proficiency over language, is able to enter into meaningful dialogues with significant others in the environment , put queries, gives answers, discusses things, takes suggestion and also gives suggestions,etc. All these processes over a period of time makes the child more mature in terms of language and behaviour. According to Piaget language development in the context of socialisation passes through following stages:

Stage 1: Ability to communicate properly to listener as per demands of the occasion.

Stage 2: Ability to evaluate, criticize, condemn other’s behaviour on some parameters.

Stage 3: Pray, threaten and order.

Stage 4: Ask questions to seek information.

Stage 5: Answer questions asked by others.

Stage 6: Ability to involve in courtesy conversation with others.

Stage 7: To imitate voices in the environment.

Self Assessment Questions

Tick mark the alternatives given against the statements given below :

- | | |
|------------------------------------------------------------------|-----|
| 1) Attention is motor process. | T/F |
| 2) Attention involves focusing one aspect while ignoring others. | T/F |
| 3) Attention develops over a period of time. | T/F |
| 4) Language is not a system of signs. | T/F |
| 5) Language is an innate property of child. | T/F |
| 6) Language plays no role in socialisation. | T/F |
| 7) Language is acquired in phases. | T/F |

3.4 EXECUTIVE FUNCTIONS

The executive system is a theorised cognitive system in psychology that controls and manages other cognitive processes. It is also referred to as the executive function. The executive functions are also known as supervisory attentional system, or cognitive control. The concept is used by psychologists to describe a loosely defined collection of brain processes which are responsible for planning, cognitive flexibility, abstract thinking, rule acquisition, initiating appropriate actions and inhibiting inappropriate actions, and selecting relevant sensory information

Hypothesized Role

The executive system plays vital role in handling novel situations outside the domain of some of our ‘automatic’ psychological processes that could be explained by the reproduction of learned schemas or set behaviours. Include the following:

A situation that demands planning and decision making

A situation which requires correction or troubleshooting

When the responses are not learned and some new actions are required.

Situations containing element of danger or are technically difficult.

Any situation which demands breaking of a habit and resisting temptation.

The executive functions are often invoked when responses automatically elicited by stimuli in the external environment have to be inhibited. For example let us suppose that your class teacher asks you to prepare a project on a topic that you know nothing about. What will you do? You will chalk out a plan as to how to proceed on this project.

To take another example, let us say you are attempting a lengthy question in mathematics and in the end when you compare your answer with the solution given at the end, you find that your answer is wrong. What do you do? Let me

tell you. You will go for a revision of the entire question to check to see where you need any correction and that too in which step.

One could take yet another example, let us say that you have the habit of driving gearless scooter. Let us say now you purchased motorbike with gears. You will drive it with great hesitation and caution till the time you master the combination and coordination of new responses brought in by the geared bike.

To cite another example, on being presented with a potentially rewarding stimulus, such as a tasty piece of chocolate cake, the automatic response might be to take a bite. However, where this behaviour conflicts with internal plans (such as having decided not to eat chocolate cake while on a diet), the executive functions might be engaged to inhibit this response.

Thus many of our responses get inhibited or changed due to many situations.

3.5 INTELLIGENCE

Intelligence is an umbrella term describing a property of the mind including related abilities, such as the capacities for abstract thought, reasoning, planning, problem solving, communication, and learning. Intelligence derives from the Latin verb *intellegerere*. However, intelligence being rational or understanding (intelligence) is different from being “smart” (capable of adapting to the environment).

Intelligence has been defined variously by different psychologists which are given below:

Ability to adjust: initially it was assumed that a person’s ability to adjust himself in his environment is intelligence .

Ability to learn: the faster an individual was able to learn a given task, the more intelligent he was assumed to be.

Abstract thinking: intelligence was thought of as an individual’s capacity to think abstractly.

However, later on psychologists realised that all these definitions are lacking something in common. In other wordseach defginition is addressing only one aspect of intelligence and this was against common observation that intellectual behaviour includes much more than the above mentioned qualities. Thus Wechsler came out with a new definition of intelligence. He stated that “Intelligence is the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment.”

3.5.1 Types of Intelligence

Social intelligence: By social intelligence we mean the ability of a person to understand others and get along well with them. Such people enjoy good social relations due to higher social skills. Usually social intelligence is reflected in abundance among leaders.

Abstract intelligence: It refers to a person’s ability understand verbal and mathematical signs and codes and is able to properly interpret them. Painters, artists, mathematicians often show higher levels of abstract thinking.

Concrete intelligence: Ability to understand concrete things/ objects, to use them deftly in different situations. Such type of intelligence is required in business and other professions

Robinson & Robinson defined intelligence as, “ Intelligence refers to the whole class of cognitive behaviours which reflect an individual’s capacity to solve problems with insight, to adapt himself to new situations, to think abstractly and to profit from his experiences.”

3.5.2 Mental Age

Psychologists divide an individual’s age in two parts, viz., Chronological Age i.e. age of a person from the time of his birth. And the other is Mental age, a concept propounded by Binet and Simon.

Tuckman defined Mental Age as, “ a score that is determined by comparing a child’s score with the average scores of his or her age-mates and with the score obtained by younger and older children in the norming group.”

For example if a child with 6 years of chronological age gets success on an intelligence test meant for an 8 year old child, then his mental age would be 8 years. Mental age can be equal to, less than or greater than chronological age.

3.5.3 IQ or Intelligence Quotient

The first test to measure intelligence was developed by Binet and Simon in 1905. They used the concept of mental age to express intelligence. But Terman in 1916 revised the test and devised the concept of IQ which is as given below.

$$IQ = MA/CA \times 100$$

Here the IQ = Intelligence Quotient

MA = Mental Age

CA = Chronological Age

For example a child’s mental age on an intelligence test comes out to be 5 years while his chronological age is 4 years then his IQ would be $5/4 \times 100 = 125$

IQ score and its meaning.

Value of IQ	Meaning
140 and above	Genius
120 to 139	Very Superior
110 to 119	Superior
80 to 109	Normal
80 to 89	Dull
70 to 79	Borderline
60 to 69	Moron
20 to 59	Imbecile
20 and less	Idiot

3.5.4 Measurement of Intelligence

Measurement of intelligence started with Sir Francis Galton, who attempted to study gifted children. However the first standardised test of intelligence was developed by Binet and Simon in 1905. It was an individual test.

The first group test was Army Alpha Test developed in 1916 during the First World War for mass recruitment of soldiers.

Intelligence test can be classified into many categories and these are:

- Individual intelligence test – administered on one person at a time.
- Group intelligence test – administered on more than one person at a time.
- Verbal intelligence test – requires the use of language by the testee.
- Non-verbal intelligence test – involves doing some task by the testee which do not necessitate use of language.
- Culture fair tests of intelligence – involves items which are devoid of bias toward any culture.

3.5.5 Uses of Intelligence Tests

Intelligence tests are used for various purposes. However these purposes can be broadly categorised as under:

Estimation of general intelligence: Most obvious use of intelligence tests is to determine the general intelligence level of an individual. Intelligence tests are used to determine the current potential of a person and evaluate his present achievements on this basis.

Prediction of academic success: No matter what is the type of intelligence test, it can be used to predict academic success of an individual. If the intellectual estimation according to the test is high we can expect a person to excel in academics.

Appraisal of personality: Scores of an individual on intelligence tests tell not only about his intellectual capabilities but his personality as well. For example, if a person fails on items of a test. Then what reasons he ascribes for his failure tell a lot about his personality. Does he invent some excuse for that? Does he fail on easy items but is able to pass the difficult ones. Recent studies reveal that a lot many psychological problems can be diagnosed on this basis.

3.6 THEORIES OF INTELLIGENCE

G factor and S factor theory of Intelligence

Charles Spearman is generally credited with defining general intelligence. Based on the results of a series of studies collected in Hampshire, England, and other places, Spearman concluded that there was a common function (or group of functions) across intellectual activities including what he called intelligence. This common function became known as “g” or general intelligence.

To objectively determine and measure general intelligence, Spearman invented the first technique of factor analysis (the method of Tetrad Differences) as a mathematical proof of the Two-Factor Theory.

The Two-Factor Theory of Intelligence holds that every test can be divided into a “g” factor and an “s” factor. The g-factor measures the “general” factor or common function among ability tests. The s-factor measures the “specific” factor unique to a particular ability test.

Theory of Multiple Intelligence

Howard Gardner defined intelligence in terms of distinct set of processing operations that permit individuals to solve problems, create products, and discover new knowledge in a wide range of culturally valued activities. Gardner declined the idea of Spearman’s “g”. His theory of multiple intelligences is based on studies not only of normal children and adults but also based on studies of gifted individuals (including so-called “savants”), of persons who have suffered brain damage, of experts and virtuosos, and of individuals from diverse cultures. This led Gardner to break intelligence down into at least eight different components: logical, linguistic, spatial, musical, kinesthetic, interpersonal, intrapersonal. Gardner further stated that each intelligence has unique biological basis and course of development, and different performance.

Triarchic Theory of Intelligence

Robert Sternberg proposed the Triarchic Theory of Intelligence to provide a more comprehensive description of intellectual competence. The Triarchic Theory describes three fundamental aspects of intelligence. Analytic intelligence includes mental processes through which intelligence is manifested. Creative intelligence is necessary to deal with novel situations or when an individual is automatizing performance of a task. Practical intelligence finds expression in social situation. It includes adaptation to, selection of, and shaping of the environment to fit the social situation. It considers general intelligence as part of analytic intelligence, and only by considering all three aspects of intelligence can the full range of intellectual functioning be fully understood.

Sternberg defined intelligence as an individual’s assessment of success in life by the individual’s own (idiographic) standards and within the individual’s sociocultural context. Success depends upon combinations of analytical, creative, and practical intelligence.

3.7 HEREDITY AND ENVIRONMENT INFLUENCES

The nature versus nurture debates concern the relative importance of an individual’s innate qualities (“nature”, i.e. nativism, or innatism) versus personal experiences (“nurture”, i.e. empiricism or behaviourism) in determining or causing individual differences in physical and behavioural traits.

Heredity is the passing of traits to offspring (from its parent or ancestors). Human offspring receives 46 or 23 pairs of chromosomes from parents out of which 23 come from mother and other 23 come from father. Physical characteristics and structures are transmitted to the child through genes contained in chromosomes. Through heredity, variations exhibited by individuals can accumulate and cause a species to evolve.

Biological factors correlating with IQ include ratio of brain weight to body weight and the volume and location of gray matter tissue in the brain. Because intelligence is at least partly dependent on brain structure and the genes shaping brain development, it is argued that genetic engineering can be exploited to enhance intelligence of animals through process of biological uplift. Experiments to this effect on mice have demonstrated superior ability in learning and memory. Besides these, the adoption studies reveal that, by the time adoptive siblings achieve adulthood they are no more similar in IQ than strangers, while twins and full siblings show an IQ correlation of 0.60. Twin studies reinforce this pattern: monozygotic (identical) twins raised separately correlate to 0.74, while fraternal twins raised together correlate only 0.60.

Environment and Intelligence

The word “nurture” include in it all the influences on development arising from prenatal, parental, extended family, and peer experiences, as well as factors such as media, marketing, and socio-economic status..

Studies reveal that family environmental factors may have an effect upon childhood IQ, accounting for up to a quarter of the variance. However, in middle age, intelligence is influenced by life style choices.

Cultural factors also play a role in intelligence. For example, in one study, instead of grouping food and tools into separate categories, a particular community participant stated “the knife goes with the orange because it cuts it”

Traits chiefly determined by environment	Traits determined by interaction of genetics and environment	Traits chiefly determined by genetics
Specific Language	Height, wieght	Blood type
Specific Religion	Skin color	Eye color

3.8 LET US SUM UP

In the preceding paragraphs we explored the meaning of cognitive development. Now we know that cognitive development includes higher mental processes like reasoning, perceptual development and acquisition of language etc. We also studied the phenomenon of attention, how it develops and it’s different types. What role it plays in the development of the child. We discussed what we understand by the word language. How a child comes to acquire language. We now also know what role language has in the development of a child. Besides we have discussed the concept of executive functions and when are they called in action by the individual. We studied intelligence and various concepts related to it. We tried to acquaint our selves with relative importance of heredity and environment in our development.

3.9 UNIT END QUESTIONS

- 1) Discuss the concept of cognitive development and it’s components.
- 2) What do mean by “attention”? discuss development of attention over times.

- 3) Discuss with example the concept of executive functions.
- 4) Define intelligence. What are the different theories of intelligence?
- 5) Discuss the relative importance of heredity and environment in our behaviour.

3.10 SUGGESTED READINGS

Anne Anastasi (1997). (7th edition). *Psychological Testing*. Prentice Hall, New Jersey.

Frank S. Freeman (2001). *Theory and Practice of Psychological Testing*. Inter Science Publishers, NY.