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Review Article

Cognitive development in children: a pivotal ladder towards successful maturation – an overview

Debadrita Ghosh*, Chitrita Gupta Mukherjee

Department of Pediatric and Preventive Dentistry, B. I. D. S. H., Patna, Bihar, India

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***Correspondence:**
Dr. Debadrita Ghosh,
E-mail: debadrita.ghosh12@gmail.com

ABSTRACT

This paper depicts an overview by correlating Piaget's theory of 'cognitive development' with several 'psychological' perspectives of development during the various stages of life; with the onset, beginning, right from birth extending upto late adolescence. Chiefly, the far- improved, imaginary, magnificently integrated nature of mental representations, with its broad levels of development and maturation; associated with the humans during this tenure can be well appreciated. The 'cognitive model' as described by Jean Piaget also demonstrates a strong connection with the subsequent behavior management techniques in children. Piaget theorized that children's knowledge about reality is realized by 'touching' and 'observing'; he termed this phenomenon as 'constructivism'. Though, through the massive evolution of time, the 'theory of cognition' has suffered a waning of influence, because of it's gross list of short-comings and drawbacks, yet it remains one of the most sought-after concepts, even to this day, because of its impeccable contributions to the arena of both physical and mental maturation.

Keywords: Cognition, Knowledge, Temperament, Operational, Concepts, Development, Behaviour, Children

INTRODUCTION

Concept of cognition

The term cognition is derived from the latin word "cognoscere"; which means "to know" or "to recognize" or basically "to conceptualize".[1] It mainly relates to the mental processes, which mainly deals with remembering, understanding, perceiving and solving problems.[1] According to some researchers and scholars; 'cognitive development' basically considers the increasing levels of complexity; therefore helping the child to conceptualize the world at different age intervals.[2] "Cognitive development" describes how mental processes develop right from birth; until the very adulthood (Figure 1).[3]

The acquisition of the ability to think, reason and hence solution of the problems can be achieved.[3] It was thereby considered that the children's thought perceptions change gradually with increase in age.[4] It is growing apprehension and adaptation to the physical and social environment.[4] Assimilation and accommodation are both respectively ways of cognitive development.[5] Equilibration is the symbol of a new stage of the cognitive development.[5]

Figure 1: Stages of cognitive maturation in a child.

HISTORY

Jean Piaget was one of the 20th century's most eminent researchers in the field of developmental psychology.[6] He wanted to analyze the concept of development, concerning the study of knowledge; thereby he observed that the children's answers were qualitatively different in all aspects; when he conducted a research on children in about 60 universities across North America and Europe.[6] Piaget's theory is based on the idea that the developing child builds the cognitive structures, which was first introduced in 1952.[7]

Piaget derived his theory by asking questions to children.[7] He was less interested if the answers given were correct; but he was far more concerned with the way; the child arrived at the answer.[8]

Piaget did not accept the prevailing theory that knowledge was innate or a priori thereby, instead, he believed a child's knowledge and understanding of the world developed over time, through the child's interaction with the world, empirically.[8] His cogitations on cognitive development in parallel with his epistemological view gave birth to the study of genetic epistemology. Most famously, Piaget was able to perceive how children created schemas that shaped their perceptions, cognitions, and judgment of the world.[8]

He rather proposed that a child's development proceeds from an egocentric position through predictable expansion and incorporation of learned experiences.[9]

It deals with the cognitive development beginning with primitive reflexes and motor coordination of infancy to thinking and problem solving of adolescence till adulthood. [9]

He proposes that the "world is a stable environment", and the child acquires this through the 'knowledge of mathematics' and "logic as reality".[9]

SCHEMA

Definition

An internal representation of the world, which describes both the mental and cognitive structures; enabling a person to adapt and organize the environment.[10]

These are basically the categories of knowledge; helping one to interpret and understand the world.[10]

Intelligent behavior

It is a way of organizing knowledge; involving the aspect of obtaining and realizing it.[10] For example, at birth the schema of a baby is reflexive in nature; such as; "grasping" and "sucking".[11] Gradually; the infant acquires two types of "sucking schemas".[11]

Figure 2: Various schemas in children.

Different aspects of schema

Assimilation

It is used to deal with a new object or situation.[11] The process of detailing new information into the already existing schema is known as "assimilation".[11] It provides the child a new inception about the present conditions of the outside world.

Accommodation

Another part of adaptation involves changing or altering our existing schemas in light of new information, by a process well known as "accommodation".[12] Piaget believed that cognitive development does not progress at a steady rate; but rather to an adequate amount.[12]

Equilibration

"Equilibration" occurs when a child's schemas can deal with most new information through assimilation; however, an unpleasant state of "dis-equili-bration" occurs when new information cannot be fitted into the existing schemas (assimilation).[13] 'Equilibration exists as a balance between "assimilation" and "accomodation".[13] "Equilibration" helps explain how the children are able to move from one stage of thought into the next level.[13]

Adaptation

"Assimilation" and "accommodation" are the two sides of adaptation.[14]

Piaget's term for what most of us would consider "learning" through which awareness of the outside world is internalized.[14]

Although one may predominate at any one moment; they are considered as the two sides which are inseparable, thereby existing in a dialectical relationship (Figure 2).[14]

CATEGORIES OF TEMPERAMENT

Temperament has following categories-Activity level, rhythmicity, approach or withdrawal, adaptability, threshold of responsiveness, intensity of reaction, quality of mood, distractibility and attention span and persistence.[15]

Classification of temperament

Easy temperament

Easy temperament included-biological regularity, quick adaptability to change and tendency to approach new situations.

Difficult temperament

Difficult temperament included-Biological irregularity, withdrawal tendencies to the new and slow adaptability to change.

Slow-to warm up temperament

This mainly comprises withdrawal tendencies to the new, slow adaptability to change and frequent negative emotional reactions of low intensity. Such individuals are termed as "shy".[15]

STAGES OF COGNITIVE DEVELOPMENT

It has following stages-sensorimotor stage (0 to 2 years), pre-operational stage (2 to 7 years), concrete operational stage (7-12 years) and formal operational stage (11-15 years).[15]

Sensorimotor stage

During this stage; the child begins to develop the varied reflexes such as "grasping", "sucking", "crying"', etc.

There should be a proper "hand mouth coordination".[15] This period extends from birth upto the age of 2 years.

'Hand eye coordination" extends from the 4th month to the 8th month of life.[15]

"Coordination of reactions" begins from the 8th month after birth, lasting upto 12th month after birth.[16]

Coordination of two schemata; the object performance is attained eventually.

Tertiary circular reactions last from the 1st year after birth upto the 18th month after birth.[16] It is the unique method through experimentation following sequential displacements.[16]

"Representational thoughts" presents the period from 18th to 24th months, after birth; detailing about the objects and the events in terms of internal, mental entities/symbols.

Table 1: Various phases of sensorimotor stage.

Stages	Age (in months)	Schemata	Coordinated reflexes
1st stage	Birth-2	Automatic inborne reflexes of the infants	Uses inborne motor and sensory reflexes (sucking; grasping; looking) to interact and accommodate to the external world.
2nd stage	2-5	Coordination of reflexes improves.	Primary circular reactions- coordination activities of own body and five senses, (Eg: Sucking thumb); reality remains subjective- does not seek stimuli outside of its visual field; displays curiosity.
3rd stage	5-9	Infants try to perceive and maintain interesting experiences.	Secondary circular reactions; seeks out new stimuli in the environment; starts both to anticipate the consequences of own behaviour and to act purposefully as to change the environment; beginning of the intentional behaviour.
4th stage	9 months-1 year	Coordinate sensorimotor scheme	Shows preliminary signs of object permanence; has a vague concept that objects exist apart from itself; plays peck-a-boo imitates novel behaviour.
5th stage	1 year-18 months	New sensorimotor schemes are involved	Tertiary circular reactions- seeks out new experiences; produces novel behaviours.
6th stage	18 months-2 years	Invent new schemes through mental exploration; in which they can imagine certain events and outcomes.	Symbolic though-uses symbolic representations of events and objects; shows signs of reasoning. For e. g.: Uses one toy to reach for and get another; attains object permanence.

Major characteristics and developmental changes

The infant gets introduced to the world through their varied range of movements and sensations. Children learn about the world through basic reactions like sucking; grasping; looking and listening.[17] Infants learn that things continue to exist even though; they cannot be observed. They are separate entities from the people and the objects around them.[17] They gradually realize that their actions can cause varied things to happen around the world.[17]

Dental applications

The child gradually begins to interact with the environment; once he is given toys while sitting on a dental chair in his/ her hand (Figure 3).[17]

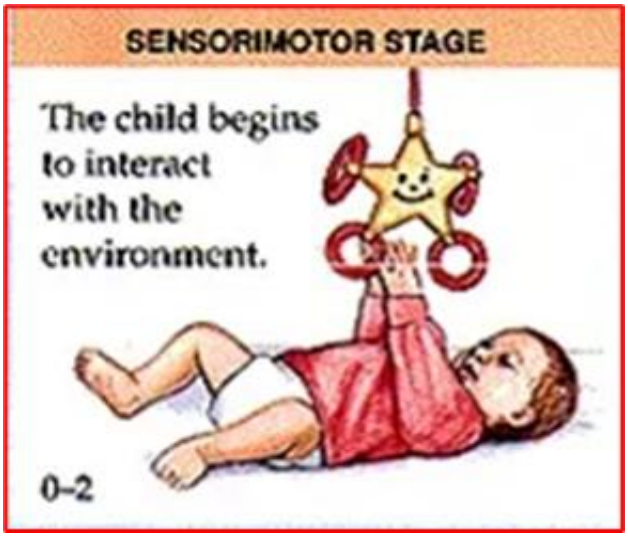

Figure 3: Sensorimotor stage of a child.

Pre-operational stage- age- (2-7 years),

It included-pre-conceptual stage- (2-4 years) and intuitive stage-(4-7 years).

Features of pre-operational stage

During this stage; the child begins to develop an ability to represent objects; with the help of images and words.[18] Language skills and imagination capacity, coupled with conceptual ideas develop simultaneously.[18] Children eventually learn through the process of imitation and play during this stage. They begin to use reasoning; however, it always doesn't remain logical.[18] Hence the child is now able to think in a complex manner. But the child is unable to use operations' i.e. Logical rules; such as the rules of arithmetic.[18]

Pre-conceptual stage- (2-4 years)

Here, the cognitive development becomes increasingly dominated by symbolic activity.[17] The child can use symbols to stand for actions; for e. g: the child plays the role of a "parent".[15] Language also develops during this stage (Figure 4).[11]

Figure 4: Preconceptual stage in a child.

Intuitive stage- (4-7 years)

This stage is characterized by the way; in which the children base their knowledge on what they feel or sense to be true; yet they cannot explain the underlying the principles behind what they feel or sense.[12]

Centration is noticed in conservation: the awareness that alters a substance's appearance does not change its basic properties.[16]

Major characteristics and developmental changes: Children begin to think symbolically; learning to use words and pictures to represent objects.[19]

They need to still think about various things in very concrete terms (Figure 5).[19]

Figure 5: Pre-operational stage in a child.

Dental applications of a child during the pre-operational stage

A pre-operational child will have trouble in understanding a chain of reasoning like brushing and flossing as to remove the food particles which in turn prevents the bacteria from forming acids which prevents tooth decay.[19]

But in this stage, he is much more likely to understand the phrases like; "brushing makes your teeth white, clear and smooth" (Figure 5).[20]

The three main areas of focus are: Constructivism, cognitive equilibrium and animism.[20]

Concrete operational stage- (7-11) years

During this stage, the child begins to develop: the fundamentals of logic: Ability to sort and thereby to classify the objects.[8] Understanding of conservation (physical quantities do not change based on the arrangement and / or the appearance of the object.[1]

Major characteristics and developmental changes

During this stage; the children begin to think logically about the concrete events. Their thinking capacity gets further enhanced; becomes more logical and organized.[2] Children begin using inductive logic, or reasoning from specific information to a general principle.[2]

Dental applications of concrete operational period

It includes giving certain concrete instructions like, "this is a retainer"; "brush like this", "allowed to hold the mirror" to visualize what is being done on his teeth; gets involved in the treatment; as for example, holds the suction tip himself (Figure 6).[21]

Figure 6: Concrete operational stage.

Formal operational stage-(11-15) years

During this stage; the child begins to develop an ability to hypothesize, test and re-evaluate the hypothesis.[8] Children begin thinking in a formal systematic way.[5] Ability to think logically about abstract principles and hypothetical situations-hypothetic deductive reasoning; inductive thinking and reflective thinking (Figure 7).[3]

Figure 7: Formal operational stage in a child.

Dental applications of formal operational stage

During this stage; the child's thought process becomes similar to an adult; and the child is capable of understanding the concepts like health diseases and preventive treatment.[21] The child can reason a hypothetical problem and perform a systematic search for solution (Figure 8).[22] Dental applications include the esthetic and corrective dental treatment.[22]

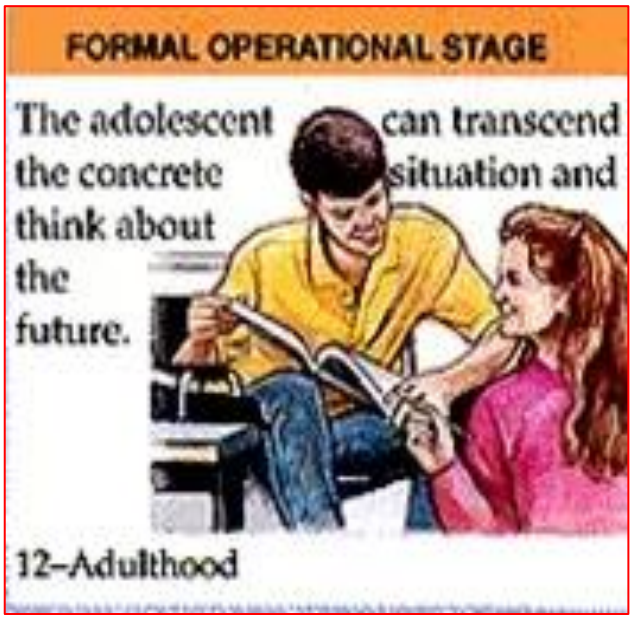

Figure 8: Formal operational stage in a child.

APPLICATIONS OF THEORY IN THE CLASSROOM

Jean Piaget's theories are so designed to teach the students; at the first stage and progressively teach new learning to change the schemas in order to move students through each stage.[23]

The curriculum is based to progressively highlight new learning patterns; while introducing a new subject; once the knowledge of that subject is mastered; a schema could be created.[23]

For transition into the next stage, the teacher would demonstrate how the student will change, modify or adapt their schema to the new method in order for new learning to take place (Figure 9).[24]

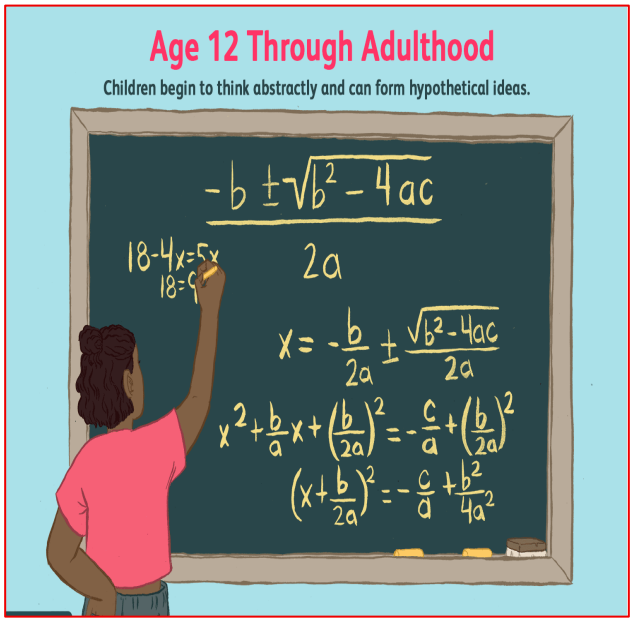

Figure 9: Cognitive progression in a child during formal operational stage.

MERITS AND DEMERITS OF THE COGNITIVE THEORY

Merits

Most comprehensive theory of cognitive development.[24] This theory propagated that we can learn as much about children's intellectual development from examining their incorrect answers to test items as from analyzing their correct answers.[25]

Demerits

Underestimates children's abilities, overestimates age differences in thinking, vagueness about the process of change and underestimates the role of the social environment.[26-28]

CONCLUSION

Contributions of Piaget's theories to current practice focus upon the active, hands-on learning play a pivotal role in rendering sensitivity to a child's current level of understanding and also the acceptance of individual differences.

Criticisms of Piaget's ideas research methods underestimated the overall abilities of the younger children; hence the role of culture and experience in children's undertaking of his tasks.

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