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Piaget's Stages of Cognitive Development of the Child

Neeru Rathee
Assistant Professor (Sr. Grade), Department of Education, M.D. University, Rohtak (Haryana).

Nurul Islam
Assistant Professor, Department of Education, Yingli College, Longleng, Nagaland.
Email: *nurulislamyc1972@gmail.com*
He is also a research scholar in the department of Education, M.D. University, Rohtak, Haryana.

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Abstract

The paper attempts to analyse how Piaget and his associates conducted a number of longitudinal studies in order to understand the process of cognitive development of the child. On the basis of these studies, Piaget observed that children develop concepts as a result of their interaction with the physical and social environment. Child's cognitive growth and development can be seen to take place in four more or less distinct phases. It is obvious from his studies that these phases or stages do not indicate specific age norms. The age ranges which Piaget has given for different stages vary from culture to culture but the sequence of these stages is fixed and invariant in the cognitive development of the child. He identified four broad stages. These four stages are:- (1) Sensorimotor Stage (2) Pre-operational stage (3) Concrete operational stage (4) Formal operational stage. An attempt has also been made here in this paper to trace that mental operations are not abrupt but gradually develop during child's growth from infancy to adolescence. The most significant stage for such mental operation to take place is the concrete operational stage during which the child shifts from a trans-deductive logic to "reversibility" and "equilibration", and thus marks the beginning of real logic as used by adults in day-to-day life.

Key words: *cognitive,development,apriori,sensorimotor,pre-operational,concrete,formal, conservation, non-conservation, transitional stage etc.*

Introduction

In the history of Psychology, Piaget is known for his developmental psychology and equally for genetic epistemology. In his genetic epistemology, he emphasizes the activities of the child in coming to an understanding of the world. In the process of knowledge, he strikes a balance between sensual experience and reason. There has always been a controversy between rationalism and empiricism focusing on the comparative effectiveness of the senses and of reason in the process of acquiring knowledge. Plato was highly sceptical about sense experience. He claims that sense data have two major flaws. First, perceptions are often distorted and observations are always subjective illusions, and, moreover the observers never know when their perceptions are distorted and when not. Second, even if no distortion occurs, it is a fact that things are always changing. Therefore, it seemed obvious to Plato that a study of science and sense data could never lead to certain and permanent truth. For him the ideas are true and do not depend on our perceptions of objectives.

On the other hand, empiricists claimed that only knowledge worth having originates in sense experience. According to Locke, knowledge based on sense data could be certain. Objects create sensations which in turn lead to perceptions, which then lead to impressions and finally to ideas. Berkeley carried empiricism a step beyond Locke. It is not simply that materials for knowledge come from sense perception all knowledge is founded on sense perception.

The controversy between empiricists and rationalists was to a greater extent resolved by Kant's formulations who attempted a synthesis between rationalist theory and empiricist theory. In fact, rationalists' view that ideas can be certain, or, we can have knowledge which is certain provides no new information. For example, 5+7=12 is a logically certain proposition but the right side of the proposition tells what is already implicit in the analysis of the left side.

So, apriori propositions of rationalists are in fact tautologies. On the other hand, the empiricists' propositions about the world of perception do provide information which is useful in our day to day living but such information cannot be permanent and certain. So, rationalists' knowledge is apriori, but never new. Empiricists' knowledge is a posteriori, synthetic, new but never certain. Kant was interested in knowledge which is prior to experience (therefore certain) and still tells us something new about the world. He was successful in giving proposition which is synthetic and apriori. He argued that we cannot make inferences about causal relations unless we already have prior notions of time and space in which to organize our perceptions. The judgments of experience and judgments of reason must be evaluated in the light of formal principles or rules which he called "categories". These "categories" of understanding go far beyond the limits of reason in allowing us apriori synthetic approach to human judgment. This understanding is never independent of sense data. And understanding is not possible without apriori categories. A category has no meaning without sensory input. In fact, neither exists without the other. In his synthesis of rationalism and empiricism Kant argues that some important knowledge is a product of interaction between them. In this hierarchy, then, comes Piaget who is an intellectual descendant of Kant. He uses Kant's interactional approach to knowledge. Piaget wants to add empirical verification as a strategy in helping to make choices among alternatives each of which may be logically coherent. He implicitly argues that both logical consistencies and correspondence with facts should be accepted as criterion for truth.

Stages of Cognitive development of the Child

In order to understand the process of cognitive development, Piaget and his associates conducted a number of longitudinal studies. On the basis of these studies, he observed that children develop concepts as a result of their interaction with the physical and social environment. Child's cognitive growth and development can be seen to take place in four more or less distinct phases. However, it is obvious from his studies that these phases or stages do not indicate specific age norms. The age ranges which Piaget has given for different stages vary from culture to culture but the sequence of these stages is fixed and invariant in the cognitive development of the child. He identified four broad stages. A brief description of the characteristics of these stages is given before we can specifically examine the child's growth of logical thinking during pre- adolescent period. These four stages are:-

1. Sensory motor stage
2. Pre-operational stage
3. Concrete operational stage
4. Formal operational stage.

Sensory motor Stage (Birth to two years approximately)

At this stage, the infant's learning is mainly directed towards coordinating his actions and perceptions into organized schemata of action. The

child starts getting aware of the permanence of objects. Several themes dominate this and every succession of sub-stages in Piaget's theory. Beginning with schemes which organize perception and action, each stage involves repetition, variation and coordination.

The main achievement of this stage is object performance which is logical pre-requisite to any kind of cognitive growth of the child. A child of four months old, for example, will not try to search a toy when the same is hidden under a cloth or removed from the scene. But a child of 8 months old may scream or may feel astonished if the toy is removed or hidden. The child may try to reach the object or search for it, and may be seen expressing a frustration type of behaviour when the desired object is taken away from the child's perceptual field. It means the child expects the object to be somewhere though it is out of sight.

Another characteristic of this stage worth mentioning is that child repeats his activities with the objects and observes the consequences of his actions as if the child is trying to know the cause effect relationship between his actions and events. Piaget calls such a child 'a miniature scientist'. Implicitly, the child is cognizing that for every action, there is a consequence.

Preoperational Stage (2 to 7 years)

This stage is characterized by development of representation processes such as language, play, dreams, limitations etc. But such representations are in very primitive stage. At this stage, egocentricity is one of the important outcomes of child's activities i.e. to the pre-operational child everything revolves round him. He sees or thinks in terms of his point of view. He lacks decentrations and reversibility *i.e.*, he can focus his attention only one aspect of situation at a time and cannot reverse the direction of his thought.

The stage is transition from a system of sensory motor symbols to a new system of mental symbols. These symbols take the form of pre-conceptual schemes of classes and relationships. During the intuitive sub-stage (4 to 7) the child constructs more stable and less private classes and relations. Despite the rapid growth in the power and flexibility of mental symbols, children in the intuitive sub-stage of pre-operation do not achieve the mental coordination of classes and relations necessary for development of operational intelligence. If some task of classifying objects into categories is given to the child, the child uses trial and error approach and sometimes may be successful in placing objects into conceptual categories. But this happens in the late intuitive period (6 to 7). Secondly, he or she cannot reverse the processes and, hence, cannot master a class, hierarchy conceptually, even though can construct it in these classification behaviour. As with "classification" so is with "serration" problems which is equally important for the development of logic. One major difference classification and serration is that class as such is not perceived (we do not see the class 'tables' only the individual instances are perceptible) while an ordered relation does have perceptual characteristic even though serration as such is perceptible, yet, both class and serration develop at the same time and in the same sequence (Cowan 1978 p. 149-150).

The failure of classification, serration and number to emerge as mental constructs during intuitive sub-stage supports Piaget's claim that they are inseparably inter-related. However, there is some evidence that they do not all finally develop at the same time. Number conservation tends to occur slightly before class inclusion and multiple classifications.

Regarding the late intuitive period (6 to 7) we can say that this period can be seen in what happens when the child discovers an error. Late intuitive children discover a contradiction in their answers and begin to consider the general principle behind the specific fact.

By the end of this stage, the child develops the capacity to construct pre-conceptual classes,

relations and general strategies for "trans-deductive" reasoning with the help of private mental symbols i.e. If A is like B in one respect, it is like B in all respects. Second, the child confuses particular and general cases in the process of reasoning without regard for precise meaning of "all" and "same". In fact, the child makes inferences from one particular experiment to another but states the conclusions in general terms. Third, this reasoning is frequently "backward" from effects to causes: A implies B, if not B then not A.

Fourth, such reasoning is one dimensions, like pre-concepts which only focus on one attribute at a time, reasoning also operates on one conceptual dimension at a time. Pre-conceptual children expect taller people to be older and empirically this is often the case for growing individuals. However, the pre-conceptual child is unable to conceive of two independent dimensions - age and height- which could change at different rates.

The Concrete Operational Period

According to Piaget, children enter concrete operational stage around the age of 7 years, on the average. The entry into this stage is the most decisive turning point in the entire course of cognitive development. The children's thinking who have attained the concrete operational level bears a marked resemblance to the thinking adults but the mental operations of this stage work only when they are being applied to information that the child has directly perceived. They do not work when they are being applied to information that is abstract and purely hypothetical. Since children belonging to this stage could deal only with concrete and tangible information, it has been named as the concrete operational period. Piaget believes that certain logico-mathematical structures make very good models of the actual organization and process of cognition during concrete operational period. Thus, if Piaget says that the classificatory behaviour of the 8 year old indicates that he possesses the grouping of logical class addition, he means that the child's thought organization in the classificatory area has the properties of a group, i.e., reversibility, identity, associability composition etc. which define this logico-algebraic structure.

Similarly, if someone is given a picture or a map in order to ask a particular object one would probably describe it in two dimensional systems. "It is in the top right corner" one might say specifying a position in both vertical (bottom, top) horizontal (left, right) dimensions at right angle to each other. To adults it is obvious that the world is organized in Euclidean spatial coordinates. Piaget shows that despite the intuitive child's use of dimensional words (up, down), a two dimensional coordinate system does not emerge until mid-concrete operations (at about age 9 to 10).

At this stage, such logical operations as classifications, serrations, one to one correspondence, conservation of substance, weight and volume etc. develop but the use of these operations are limited to concrete objects . The child can operate logically with respect to actual objects. No doubt the child uses correct logic and reasoning in actual operations with objects but he cannot verbalize his reasoning or logic in the form of general principles. Abstract reasoning is beyond the reach of concrete operational child.

One of the child's most surprising achievements during the period of concrete operations is the mastery of conservation problems. Piaget and Inhelder conclude on the basis of their experiments that initially children's concepts of quantity are undifferentiated. Conservation is the ability to be aware of the invariant aspects or properties of objects in the face of transformations. For example, the same amount of clay exists even when its form is changed from that of ball to rod or doughnut. The value of money is not changed whether it is in one piece or in several smaller denominations. Thus, the value is not altered as function of the transformation of shape or form or mode of representation. For Piaget, conservation is an essential pre-requisite for the acquisition of

subsequent stages of logical thought.

How should we regard the young child's "none conserving" performance? Might it simply be due to inadequate experience which could perhaps be overcome through intensive training? Or is the deficiency more general perhaps due to inadequate maturation?

Concept of Conservation

Conservation plays a role in the theorization and experimentation in the developmental psychology of Jean Piaget. This concept is also one of the most explored areas in the field of cognitive growth. Bruner considers conservation as "a powerful idea not only in science but also in the conduct of everyday life. We need not to pause over its generality in mathematics, in which it plays such a crucial rule in the idea of function, or in physics, in which the conservation theorems are so powerful an extension of common sense version. Indeed, much of the common sense and all of science would be impossible without conservation", (Bruner, 1966, p. 183).In Piaget's words "conservation is a necessary condition for all rational activity" (Piaget, 1952, p. 3).

According to Flavell "conservation may be defined as the cognition that certain properties (quantity, number, length etc.) remain invariant (are conserved) in the face of certain transformations (displacing objects, and parts in space, sectioning an object into pieces-changing shape etc.)" (Flavell, 1963, p.245).

The same idea has been conveyed by Vernon and Kingsley. According to this "conservation is a term used to describe the situation when an attribute (e.g. weight) of an object remains invariant through certain changes in other attributes of that object" (Vernon & Kingsley, 1968, p.195-196).

Piaget assumes that conservation has a natural development in all mankind provided they live in the environment in which they have the opportunity to interact with such physical objects and materials such as water, mud, sand, sticks etc.

Development of conservation is not all or none phenomena. It is gradually mastered. The development of conservation of different concepts according to Piaget follows a certain order of appearance. First conservation of mass, then conservation of weight and then conservation of volume occur. Researchers in this area have found different age groups conserving the concept of mass, weight and volume. According to Piaget conservation of mass develops at the age of 7 to 8 years, conservation of weight develops at the age of 9 to 10 years and conservation of volume appears at the age of 11 to 12 years. Regarding exact age range for development of different kind of conservation, there is no agreement amongst the researchers. Also it has been found that there may be cultural differences. There are other aspects of conservation such as number, distance, length and area. Conservation of number develops simultaneously or just after the development of the conservation of mass. According to Piaget, conservation of area appears at the same time as that of distance and length (Piaget, 1960, p.285).The conservation of these aspects develop after development of conservation of weight (Piaget,1960). Thus, conservation of different aspects does not appear at the same time. The reason behind this is that conservation of different aspects requires some different pre-requisite of operations. With the development of conservation of one concept, the child acquires some operations which help him in the acquisition of conservation of other concepts. According to Piaget (1952) the most general pre-requisite operations for development of conservation are multiple classifications, multiple relationality, reversibility, serration etc.

Stages of the Development of Conservation

According to Piaget development of the idea of conservation, whatever may be the concept (length, area, number, mass, volume etc.) takes

place in three stages.

1. Stage of non-conservation- At this stage, the child gives justification by perceptually centring on a single irrelevant dimension of the object. The child lacks co-ordination between the quantitative relations involved in the perceptual relationship. According to non-conserver every one of the initial attributes of an object is lost in the face of transformation. Non-conservation occurs due to the child's inability to decanter. Information is not brought into conceptualization. He simply focuses his attention upon successive stages or configurations of a display rather than the transformation by which one configuration is changed into another.
2. Transitional Stage- The child of this stage attempts to coordinate the perceptual relations involved. But he is not fully successful. He gives slightly correct answer when the variation is not much but changes his idea of conservation when more variations are added through transformation.
3. Stage of Conservation- This is the stage when the child is gradually able to conserve a quantity irrespective of the number and nature of the changes made. The perceptual relationships have now become operational.

The Formal-Operational Period

The approximate age range for the onset of this stage, what we usually call adolescence, is roughly from 11 to 15 years. In most of the psychological theories of adolescence the major emphasis has always been on the emotional and social upheavals that occur during this period of life. Adolescence is usually portrayed as a period of trouble and turmoil (Erikson, 1968). Adolescents are pictured as being in a state of constant and unrelieved conflict. They are said to be emotionally unstable and subject to depression. They are described to be torn between the desire to remain children and the need to assume the responsibilities of adulthood. Thus, the traditional view of adolescence is somewhat gloomy.

Piaget, in sharp contrast to the trouble and turmoil view, regards adolescence as the most exhilarating and productive time of life. According to him it is the time when one plans one's future and fixes the goals for life. Adolescence is a time of great hopes and a time when simple answers to the burning questions are just not good enough. Piaget finds the thinking and reasoning of adolescents praiseworthy. He believes that intelligence reaches its peak between the age of 11 and 15 years. The thinking and reasoning during this period is clearly superior to that of childhood and it may even be superior to that of adulthood.

The reasoning at this stage is said to be hypothetical-deductive. Unlike the concrete operational thinking which operates on hard tangible facts, formal thought, extends beyond the confines of everyday experience and it is not tied up with perception and memory. The formal-operational thinking involves deducing conclusions from propositions which are hypotheses rather than facts actually verified by the adolescents. Piaget has drawn an important conclusion from the features of the hypothetical-deductive reasoning, i.e., the mental operations at the formal-operational stage may be executed from start to finish at purely symbolic level. This suggests that intelligence has moved away from 'things' towards 'ideas'. Thus, formal-operational intelligence transcends reality.

Flavell (1963) has described formal thought as "a generalized orientation, sometimes explicit and sometimes implicit, towards problem solving: an orientation towards organizing data (combinatorial analysis), towards isolation and control of variables, towards hypothetical and towards logical justification and proof". Brainerd (1978) has described the features of formal operational thought as (a) hypothetical-deductive (b) scientific and reflective-abstractive.

This stage is characterized by giving

explanation phenomena and suggesting hypotheses as probable causes of events. During this stage, the child uses formal logic and abstract reasoning without taking help from concrete situations. The adolescents, at this stage, can vary the values of variable to see the effect on another variable. Reasoning begins with propositions and hypotheses; a system of what is hypothetically possible is structured and followed by empirical verification. This stage is the completion of child's cognitive growth in all aspects of combinatorial system. Reversibility is advanced by inter-relationships of negation and reciprocity resulting in the ability to maintain the dynamic equilibrium in a system involving many factors. Variables can be controlled systematically. Because of complete combinatorial system, experimental contradiction can now be isolated and solved. Conservation is no longer limited to immediate testable environment. According to Gruber et al (1977) "The Geneva School" considers the following five characteristics as the sine- qua-none of the formal operational stage:-

1. The adolescent pupil should be in a position to state as well as test hypothesis. This type of reasoning is called the hypothetical-deductive one.
2. The adolescent pupil should be able to make the effective use of propositional logic.
3. The adolescent pupil should be in a position to separate form from content and possibility rather than reality should become the chief distinguishing characteristic of his thought.
4. The adolescent pupil should deal effectively with the entire combinatorial nature of operations i.e. from the 16 binary combinations to 256 tertiary operations. It is a form of closely-knit system in which passing from one element of structure to another is always possible.
5. The adolescent pupil should be in a position to generate all the possible cases which are derivable from one single identifiable mental structure i.e. the INRC group, where the scripts have their usual meanings: I (Identity), N (Negation), R (Reciprocity) and C (Correlative or dual operation).

Findings

During the course of development, child passes through four stages, which Piaget calls the stages of cognitive development. These stages are (1) Sensorimotor stage (From birth to two years), (2) Pre-operational stage (from two to seven years), (3) Concrete operational stage (from seven to twelve years) and (4) formal operational stage (from twelve, to eighteen years). The time durations in parentheses are only approximate.

Thinking, according to Piaget develops as a result of mental operations by the child through his interaction with physical and social environment. Mental operation is defined by Piaget as an "internalised action that is reversible and part of an ensemble".

These mental operations are not abrupt but gradually developed during child's growth from infancy to adolescence. The most significant stage for such mental operations to take place is the concrete operational stage during which the child shifts from a trans-deductive logic to "reversibility" and "equilibration", and thus marks the beginning of real logic as used by adults in day-to day life. The concrete operational stage coincides approximately with what we normally call the childhood stage.

Conclusion

The present investigation enlisted Piaget Stages of cognitive development of the child; is an effort to empirically verify Piaget's Genetic Epistemology .Genetic epistemology of Piaget, as we know conceives that the cognitive development of the child is a logico-psychological process that takes place as the child interacts with physical and social environment around him. In this theory, child is considered to be a "generator-transformer" of

knowledge. In formatting this theory, Piaget has drawn much upon Kant, according to whom Knowledge is both "Synthetic" and "apriori". It is synthetic in the sense that all our experiences of the world are based upon sensations; and it is apriori, because we are born with certain innate ideas or "categories of thought" which are prior to, and at the base of any experience or perception. In fact these" categories of thought make the experience possible. The "categories" are like cause and effect, space and time etc.

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