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A Review on the Neo-Piagetian Theory of Cognitive Development

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Gülşah Sevinç [1]
Ankara University

Abstract

The main objective of this study is to provide a review on the postulates of Neo-Piagetian theorists who provided answers to the criticism aimed at the theoretical perspective of Piaget in terms of cognitive development as they worked to eliminate the weaknesses associated with that theory. This study includes the perspectives of Neo-Piagetian theorists such as Robbie Case, Juan Pascual-Leone and Andreas Demetriou as they came up with their ways of making up for the criticism aimed at the basic elements of Piaget's theory of cognitive development. The perspectives of Neo-Piagetians such as Kurt Fischer, Michael Lamport Commons, Kurt W. Fischer and Michael Lamport Commons are also provided. This review discusses the contribution of these theorists to developmental and educational psychology. The studies conducted by Neo-Piagetian theorists not only offers favourable solutions for the educators while preparing training programs for children, but also provides valuable data for the development of assessment tools for students. They are also of high importance in that they provide information about the way a more effective learning is performed and elucidate the learning process in cases where special education is necessary.

Keywords: Neo-Piagetian, cognitive development, stages, Case, Pascual-Leone, Demetriou.

[1]*Corresponding Author*: Phd student, Educational Sciences Institute, Educational Psychology Doctorate Program, E-mail: gulsahkara85@yahoo.com, https://orcid.org/0000-0003-3623-8830

As Piaget had foreseen, his theory of cognitive development went through modification by the subsequent theorists. Neo-Piagetians like Robbie Case, Juan Pascual-Leone, Andreas Demetriou, Kurt Fischer, Michael Lamport Commons and Graeme S. Halford extended the work of Piaget to meet the harsh criticism against some basic concepts of his theory such as the universality of stages, etc. and improved our understanding of mental development. Neo-Piagetian theories offer a great deal of precious information on the psychological development of the mind as the neo-Piagetians revised the original theory of Piaget and offered a coherent body of information regarding the route brain goes from birth through adulthood.

Each neo-Piagetian theorist tried to come up with a formula for eliminating the weaknesses of the original theory while trying to preserve the strong parts of it. Their goal was to provide the best solution for the parts which faced the harshest criticism and support it with the relevant findings of research they conducted in the field. One of these points is about the Piagetian concept structures d'ensemble (Piaget, 1970) which refers to the notion of a general structure or system of cognitive operations. Although Piaget suggested the standard development of an individual comprises passing from one stage to another- four stages in total- due to the general system that operates in the deep, subsequently there were some attempts to replace that concept with new ones as it is hard to prove that such a structure exists with empricial studies. As a closely related term, horizontal décalage refers to the inability to apply a certain characteristic of a certain stage to similar tasks which are supposed to be attained at that stage. This kind of lag in timely application of a general conceptualization made it hard for a number of developmental theorists to rationalize Piaget's suggestion of a general framework operating underneath.

There are other problematic areas in Piaget's theory which led the way to a more detailed and comprehensive analysis by the neo-Piagetians. Based on such a conceptualization the main purpose of this paper is to provide a general picture on the similarities and differences between Piaget and Neo-Piagetians, to reflect the key features of the perspectives of Case, Pascual-Leone, Demetriou, Fischer and Commons as well as to discuss the implications of their studies' findings for educational environments.

Neo-Piagetian Theories: What Makes Them Different?

Piaget inspired many scholars in the cognitive development field and led to the implementation of numerous studies which deal with the way children develop an understanding of the world. Although his work has been of much respect and admiration for many years and appeared to be one of the most influential theories of all times, some of the researchers in the field came up with criticism against his theory. According to Lourenço and Machado (1996), 10 major criticisms can be listed against the Piagetian theory, some of which can be summarized as underestimating the competence of children, disconfirmed age norms related to the stages, ignoring the social factors, inability to explain development, and so on.

As for Neo-Piagetian theorists, it is possible to put forward that they arose to make up for the weaknesses of Piagetian theory of cognitive development. One of the primary objectives of Neo-Piagetians is to explain how one passes from one stage to another, and to endure criticism against Piagetian theory, which mainly depends upon the concept of equilibration for describing the passing between stages of development. Siegler and Munakata (1993) have even labelled the explanation of transition by Piaget as miraculous and indicated that believing in the way transition occurs between Piagetian stages resembles believing in Bible.

Another criticism that was frequently made against Piaget was related to his developmental stages which are supposed to be universal. Bearing in mind that a child may be classified in different stages when it comes to different domains, such as understanding mathematical concepts and spatial concepts, it may be hard to say that a child is in a specific stage at a certain moment. Neo-Piagetians also attempted to deal with such criticism and focused on dealing with the universality of the stages.

Another criticism which is directly related to the just mentioned one is that an individual may be able to pass from one stage to another faster than any other person. Piagetian theory has thus been criticized for neglecting the individual differences. Feldman (2004, p. 180) points out that "indeed it was designed to be just that", meaning that the main purpose of Piaget was to draw the general line of development with an emphasis on the shared features. Therefore, the special cases are not of great concern within that theory. Neo-Piagetian theory has also integrated different perspectives to come over such criticism.

One element of Neo-Piagetian theory differing from that of Piaget is obviously the stages. Not only Case, but also other Neo-Piagetians such as Pascual- Leone (1987) and Demetriou (Demetriou, Efklides and Platsidou, 1993) proposed his own model for the stages of cognitive development. Although Feldman (2004) retained four major domain-general stages of cognitive development and the age spans of each of these stages, he made some changes to sub-stages by adopting a similar perspective to Neo-Piagetians such as Case (1992) and Fisher (1980), who utilized recursive within-stage sequences to re-structure the sub-stages of Piaget. Feldman also used recursive sub-stages to enable his theory to be more cohesive and systematic.

As the stage of formal operations may be thought of the most controversial stage of Piaget, it is possible to witness the reflection of such controversy in Neo-Piagetian theories. Some researchers even proposed another stage after adolescence (i.e. Commons, Richards and Armon, 1984). However, most of Neo-Piagetians adhered to the original four-stages-model and structured the developmental path of cognition to reach a climax at the end of adolescence, beyond which no dramatic change in the way schemas are organized is supposed to occur in one's life in terms of cognitive development.

Structural Aspects of Neo-Piagetian Theory according to Robbie Case

In his article Neo-Piagetian Theory: Retrospect and Prospect, Case (1987) indicates points of agreement as well as points where agreement is lacking among Neo-Piagetian theories. The three postulates inherited directly from Piaget are that there are three or four levels in terms general structures, that the higher ones include those at the levels below and that to acquire these, there is a critical period of time in the lifespan (Case, 1987).

There are also some postulates which are all congruent with the ideas of Piaget but they are considered a special concern for Neo-Piagetians. Accordingly, Case (1987) refers to domain-specificity, the variation in development from one child to another and the cycle in the sublevels of cognitive developmental stages. Neo-Piagetians do not present a common ground for the stage-based framework as.

As pointed out by Case, the most prominent points where Neo-Piagetians differ from each other come the internal structure of developmental stages and main units used by the child to structure newly-acquired knowledge. As for the structural units, it is necessary to mention that whether it is schemes, symbols, control structures or skills that matter the most for the fundamental structures in cognitive development, it is apparent that all Neo-Piagetian theorists are on a similar line. In order to exemplify, it is possible to use the term M operator to refer to the key mental process from the perspective of Pascual-Leone while it is also a possibility to use the term schematic evaluation to refer to such an executive process by adopting the Case's point of view. All in all, different theorists from Neo-Piagetian movement have chosen to make use of a rich terminology to talk about the basic units or processes of development.

It can also be observed that each theorist within that movement came up with different number of stages and they do not hold the common features for distinguishing one sub-stage from another.

Key Features of Robbie Case's Work

Case has probably been the most prominent theorist following the Piagetian wave and was actually influential in the active planning of training programs based on numerous studies he conducted with his colleagues. Case's theory of executive control and central conceptual structures can be considered as the keystone of his work and are all in close relationship with the formation of his developmental stages.

Executive control structures consist of three elements: 1. a representation of environmental features 2. a representation of goals related to these features 3. a representation of a strategy to achieve these goals. Hence, they help a child to determine a problem, identify his/her goals in the process of solving this problem and come up with a strategy to attain such a goal. Such practicing is critical for an increase in the operational competency of the individual. Case (1984) associates such an increase in parallel with the age, by which a certain amount of short-term-memory storage space increases. Case (1985) describes four stages, through which these

executive control structures pass, all corresponding to Piagetian stages of development.

The first of these stages is called sensorimotor structures and includes the period from birth till 18 months, during which the baby learns to see, grasp, etc. The perceptions and actions with objects are the core components of this stage. To exemplify, the perception of a toy makes a child want to hold it (problem and goal), activating an action to go near the toy and hold it (strategy). The second stage of Case is named as inter-relational structures and covers the period between 18 months and 5 years of age. At this stage the words and cognitive images become important and there are simple relations between actions/ representations. The third stage called dimensional structures cover the years between 5 and 11 ages, during which the child gains cognitive representations that are mutually related to each other. For example, a 7-year-old child acquires a representation of a number in the row of various numbers, which implies understanding the relation between a number and other numbers. The final stage is called vectorial structures and continues from 11 year to 19 years, during which the individual grasps the relation between different dimensions of the previous stage. For example, an adolescent can understand the ratio of a number related to another number (such as, 20 kilos is two times bigger than 10 kilos). Based on prior information, the individual at this stage can make sense of complex relationships.

The sub-stages of Case are recursive in nature (Feldman, 2004). This refers to the premise that the final incident of the previous stage is considered as the first incident in the following stage. If a child has acquired a representation of quantity at the last step of the inter-relational stage, he/she starts to interpret different quantities in relation to each other and this corresponds to the first step of the next stage. It is, therefore, plausible to presuppose that once the structures reach a certain level of complexity, a new representation is formed, thus the whole process starts from the beginning again.

Case's model of developmental stages bear a specific complexity structure, defined within a range from operational consolidation, where the child works on elaborating the sensori-motor schemes, to elaborated coordination, where the child can focus on a variety of aspects at the same time (Lewis and Granic, 2010). In the middle lie the unifocal and bifocal coordination, where the child can, respectively, focus on one aspect or two aspects of a certain problem. Departing from the analogy by Case of a gradual construction of a house- vertical supports, concrete floor and then doors and windows- to explain cognitive development, it is better to conceptualize the four stages from a basic consolidation to coordination from one perspective, then two perspectives and finally a lot of perspectives. This complexity structure has also been applied to social-emotional development, turning out to be a good instrument for describing the process one goes from basic regulation to self-consciousness (Lewis and Granic, 2010). The interface between the stages of cognitive development and phases of social-emotional development, based upon

equivalent complexity, denotes to the development taking place in different domains at the same time in a parallel manner.

As mentioned before, central conceptual structures is another key term brought onto the scene by Robbie Case. Defined by Case and Okamoto (1996, p. 5) as "networks of semantic nodes and relations that represent children's core knowledge in one domain and that can be applied to the full range of tasks that the domain entails" central conceptual structures change as the stages pass by, directly as a result of maturation- as well as due to cultural practices. In the first months of life, the child can categorize the experience on a basic level. As the child grows up, the domains of knowledge become well-distinguished (Okamoto, 2010). Based on Case's example, it is best to expect a 4-year-old child to understand quantity upon seeing it. However, as the central conceptual structure to link a number word with the quantity has not appeared yet, the same child will not be able to tell you whether 4 or 5 is bigger. Though, in middle childhood, the child knows that the quantity of something is less or more upon extraction or adding, due to the emergence of the central conceptual structure of linking a number word to an idea of a set of elements with certain quantity.

What Case brought into the field of education in terms of practice is invaluable. To count just a few, his central conceptual structures inspired some scholars to create assessment devices based on coherent developmental properties. He also led to great advancements in mathematics education, with his structure approach and stages. Last but not least his profound effect on curriculum formation improved the understanding of attainments.

Key Features of Juan Pascual-Leone's Work

Another important figure who has contributed much to a better-understanding of Piagetian theory and who has worked diligently to make up for the criticism against it is Juan Pascual-Leone. Popular for the core cognitive processes called operators, Pascual-Leone, along with his friends Johnson and Agostino, (2010) stresses that the thought can be handled at two levels, one of them being mental power, and the second, being mental content. Mental content is more about the nature of the schemes and the symbols used to refer to them (such as numbers). Mental power (or mental capacity) concerns the volume a person can process and is closely related to working memory. It is important to differentiate between functional M-capacity, which refers to the ability to allocate numerous schemes for a specific performance, and structural M-capacity, which is the amount of M-capacity a person utilizes in typical tasks.

What lies beneath the stage theory of Pascual-Leone is the developmental pattern of growth a person possesses in terms of M-capacity. In an optimal learning environment the child's ability to learn is dependent upon the growth of this mental attention. Pascual-Leone (1987) comes up with a formula like that: $M = e + k$, where M stands for M-capacity, e is the constant representing mental capacity at the end of the second year in life and k grows by one unit every other year from 3 years until adolescence. It is easier to understand the logic behind this form by looking at the

following table where the M-power as well as the Piagetian stage and chronical ages it corresponds to can be visualized (see Table 1).

Table 1

M-Power at Piagetian Sub-Stages

M-Power (e + k)	**Piagetian Substage**	**Normative Chronological Age**
e+1	Low preoperations	3-4
e+2	High preoperations	5-6
e+3	Low concrete operations	7-8
e+4	High concrete operations	9-10
e+5	Substage introductory to formal operations	11-12
e+6	Low formal operations	13-14
e+7	High formal operations	15-adults

Note. M-power values, their correspondence to the Piagetian substages and related chronological ages (Pascual-Leone, 1987, p. 557)

It can be inferred from the table above that the amount of M-capacity necessary for hyperactivating one scheme (activating a scheme to its maximum) at 3-4 years corresponds to 1 and this increases by one unit every other year. Therefore, an adolescent at the age of 15 has a mental capacity of 7. This model has been tested in various domains by different scholars and has been verified by the most. In what way is this information critical? Most important of all, it is possible to predict the age range of children to benefit from a certain type of training in the most efficient way. One can also determine whether a child has an M-capacity appropriate for the age group he/she belongs to. This provides the opportunity to track the rate of development and keep an eye on the slower or faster ones. In a study by Pascual-Leone et all. (2010) regarding multiplication problems, it was revealed that M-capacity and learning is closely correlated and complements one another, showing that the cognitive development is the causal determinant.

Pascual-Leone probably has the most quantitative perspective among Neo-Piagetians and works on the number of information units that one can deal with at a certain time. Anyhow, it should also be noted that one of his principal assumptions bears the dialectical relationship between quantity and quality. Although his basic structure is quantitative, the changes which are of quantitative nature lead to qualitative changes.

Pascual-Leone, in his Theory of Constructive Operators, places schemes and hidden operators at the center of a performance, maintaining that not only the interactive processes (schemes) but also the process of resources (operators) of the psychological organism play two pivotal roles in the appearance and completion of a performance. The silent operators mainly increase or decrease the activation level of schemes, consequently leading some of them to prevail over the others and dominate. These operators can be summarized as follows:

M-operator. The capacity for Mental energy, M-Operator refers to the potential of an individual to activate cognitive structures at a certain moment. (Pascual-Leone, 1987). This operator is mainly related to the prefrontal area of the brain and includes the processes to allocate the capacity of the working memory to solving a problem.

I-operator. It is responsible for inhibiting (therefore Interrupting) unwanted or unrelated schemes (Pascual-Leone and Johnson, 2011).

F-operator. The Field Operator has been adopted from the Gestalt and mainly deals with the production of one whole performance. It brings coherence to mental representations (Pascual-Leone et all., 2010).

E-operator. It is the repertoire of Executive schemes and structures that one possesses and is in charge of following up whether M and I operators are functioning appropriately (Pascual-Leone and Johnson, 2011).

Among all Neo-Piagetians, Pascual-Leone is the theorist who supports a dialectical relationship between the organism and the environment in the process of learning. His concept of M-capacity has much to offer educators organizing their educational materials and the operators provide an insight into the functioning of a human mind.

Key Features of Andreas Demetriou's Work

Demetriou combines self-awareness, processing potentials, cognitive control and differences of thought between different domains in his theory of cognitive development. He conceptualizes brain as consisting of three levels. Two of them are general-purpose mechanisms that are oriented to the environment and the self, and one of them includes specialized thought systems and is related to the processing potentials available at a certain moment (Demetriou, Spanoudis and Mouyi, 2010). The processes at that ultimate level has a direct influence on the other two levels-knowing the self and knowing the environment. The knowing-the-self level, as the term itself suggests, is directly related to processes such as self-regulation and self-monitoring. The knowing-the-environment level is rather about the cognitive functions necessary for processing the elements in the environment. These three levels co-function to produce a performance at a specific moment. In order to interpret this information, it will be beneficial to look at Figure 1, which shows the model of Demetriou with a reference to the stages of Case.

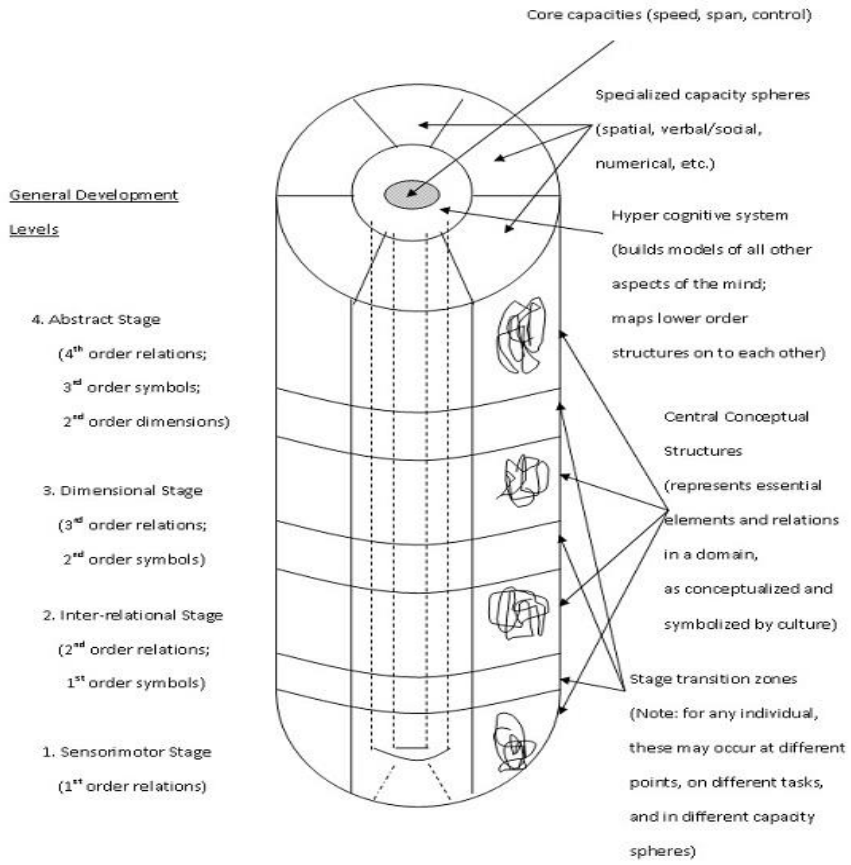

Figure 1. Model of the developing mind (Demetriou, et all., 1993)

Cognitive functioning is restricted by the processing potentials available at a certain age and these can be listed as speed of processing, control of processing and representational capacity. The tasks aimed at evaluating the speed of processing, which is the velocity necessary to carry out a cognitive task, intend to test the individual's information processor in terms of speed and reflect on the reaction time. Control of processing helps an individual to focus on the mission, ignoring the irrelevant stimulus, therefore enabling an efficient concentration. Representational capacity is akin to working memory and implies the maximum amount of information one can activate at one particular moment.

Another critical concept of Demetriou's theoretical framework is specialized domains of thought, which has been developed from the findings of six empirical studies carried out with factor analysis. Underneath this analysis lies the idea that our

cognitive system creates functional systems which correspond to different domains. That is, while we represent and process the information that we receive from our environment, we deal with it in accordance with the domain it belongs to. One of these domains is categorical reasoning, which is similar to inductive thinking. It helps us to come over the complexity of concepts by handling them based on similarities and differences. As for quantitative reasoning, it relates to any operation we conduct to deal with quantifiable reality. Spatial reasoning makes it possible to locate objects in relation to one another in one's mind. Causal reasoning enables an understanding of cause and effect. Social reasoning has to do with the comprehension of social network. Lastly, verbal reasoning makes it possible to share information and verify whether something is true or false.

Imagine a person designing and actually making a complex experiment. It is highly likely for that person to think about the possible causes of a certain effect, which means there will be more space for causal reasoning. If he/she is working on chemicals, for example, then there is also a need for quantitative reasoning to determine how much of the substance produces a certain effect. But if he/she has to place or imagine the placement of some elements on a certain panel such as an electrical circuit, spatial reasoning becomes more of an issue, requiring the orientation of the components in an orderly manner. In short, particular cognitive abilities cluster together and make it easier for an individual to process the information received from the environment in a more systematic way. The specialized domains of thought, a concept developed by Demetriou, has later been associated with Case's central conceptual structures as these two scholars worked together and concluded that executive control structures also differ across these varying domains (Case, Demetriou, Platsdiou and Kazi, 2001).

To turn back to Figure 1, it is possible to visualize the hypercognitive system which is in charge of keeping track of the cognitive experiences from the past to be able to use them in the future. An organism receives the input from all parts of the mind, such as sensations, feelings, etc. and maps them to control the processing potentials and specialized systems explained above. Therefore, it can be thought of an executive structure in command of tracking and regulating the processing potentials and specialized domains of thought. It has two central functions: working hypercognition and long-term hypercognition. Working hypercognition is responsible for setting a goal, planning the actions to attain this goal, keeping track of the progress at any step toward it, eliminating the problematic situations on the way and finally assessing the result. These are closely related to consciousness, considered as an integral element of long-term hypercognition, and Demetriou et all. (2010) points out that conscious awareness and all ensuing functions such as a self-concept (self-regulation, self-awareness, etc.) and a theory of mind are part of the hypercognitive system. That is to say, long-term hypercognition contains representations on cognitive experiences from the past which arise as a result of the functioning of working hypercognition. According to Demetriou, age is the determinant factor for all of these processes (speed of processing, specialized domains of thought, etc.) to development.

A significant common point of Case and Demetriou is about the development of mental units. According to Demetriou, as soon as these units of the cognitive system reach a certain level of complexity, it becomes urgent for the mind to reorganize them so as to be able to manage them more efficiently (Ferrari and Vuletic, 2010). Consequently, each time a more complex and functional unit is formed, the mind becomes interested in using it instead of the previous ones which are less complex and less functional. This formation of more complex structures as the stages of development proceed fits well to the changes leading to a new stage in Case's model (1985) as he describes the transition from one stage to another occurs as a result of such a process.

Key Features of Kurt W. Fischer's Work

Kurt Fischer is known for his skill theory (Fischer, 1980) in which he refers to the structures of skills appearing in cognitive development. There are certain ways in which transformation of these skills come about from birth to adulthood. In Fischer's model skills develop step by step, mainly from sensory-motor level to representation level and then to abstract level. That is to say, an infant can first control variations in behavior in sensory-motor actions, then those of representations and abstractions. Fischer (1980) stresses the critical role of the environment for passing from one level to another and this evidently separates his approach from Piaget and others who accentuate the organism more than any other factor in cognitive development. This emphasis on the environment also differentiates Fischer's concept of skill from Piaget's schemes, which mostly refers to the cognitive structures of the organism. The levels are composed of certain behaviors which a person can control as they form a cognitive structure and that process denotes to cognition in Fischer's model. As the person can assert more control in the forementioned levels cognition becomes more sophisticated.

A vital contribution of Fischer for the learning processes lies in his emphasis on the positive environment as a reference to stimulus provided to the child for a better performance and an effective cognitive development. With a supportive environment the child can reach the optimal level (Fischer, 2008), a term which is a reminder of the Vygotskian (Vygotsky, 1978) concept of proximal zone of development. The optimal level refers to the upper threshold a child can reach with parallel to his or her cognitive development through the participation of another person, with encouragement or by taking as a model. At the other end of the scale comes the functional level, which refers to the best performance of a child that can be yielded independently or with low degree of support. Such an atmosphere which lacks meaning and value leads to a decrease in the manifestation of skills one possesses. All in all, it is highly necessary that the learning environment provides support for an efficient cognitive development.

Fischer's model of cognitive development differs from those of many theorists in that it does not take a ladder-like perspective. Instead Fischer (Fischer and Hencke, 1996) adopts a web-like approach indicating that development does not take place as

a linear process and in a fixed manner for everyone. Fischer and Bidell (2006) stress that development cannot be taken as moving from one step to the upper, mostly because such a model would undervalue the variability in behaviors and developmental route. In Fischer's (Fischer and Bidell, 2006) developmental perspective, it is apparent that each web builder constructs knowledge in his or her own way and strands in the web come together in a unique way in a supportive environment to form a specific path for cognitive development. This does not necessarily mean that the individual does that alone, on the contrary the social network play a very active role in shaping and strengthening the webs. A critical output of such an approach for the learning environments is that each and every student follows different routes, strengthens different strands and coordinates varying routes in the developmental web while acquiring a certain skill, which is the result of differing environments they come from. Fischer and Bidell (2006) accentuate that there may be stagelike jumps in very supportive contexts, which is also an evidence for the necessity of positive atmosphere for a better learning process.

Key Features of Michael Lamport Commons' Work

Piaget's formulation of cognitive development consists of four stages, the last of which is formal operational stage. However, subsequent experts suggested that formal operations do not represent the final point of cognitive maturity one can reach in life. The following stage has been frequently referred to as postformal thought (Commons and Ross, 2008) within Michael Lamport Commons' approach. Commons and Ross (2008) presume that there are four post formal stages as explained below.

Systematic stage. At the systematic order, tasks require that one can discriminate the system or framework in which formal-order relationships between at least two variables are apparent (Commons, Ross and Bresette, 2011). As one considers and coordinates more relationships, comprehension will be more efficient. An analysis of the available possibilities that are multidimensional is necessary for an appropriate integration of all the resources at hand.

Metasystematic stage. At this phase at least two multivariate sytems should be coordinated. It means that systems produced in the previous stage have to be treated at a superior position and different systems have to be compared. Each system is taken into consideration in terms of similarities and differences, which leads to a thorough inference about the causal relationships. Commons et all (2011) point out that those who come up with creative solutions and innovations function at this stage.

Paradigmatic stage. The metasystems stressed in the previous stage are critical as it necessary to coordinate them at paradigmatice stage. This is possible only if one can comprehend the latent relationship between different bodies of knowledge which seem to be irrelevant. In other words, a new paradigm is created based on the analysis of a set of metasystems (Commons and Ross, 2008).

Cross-paradigmatic stage. The paradigms obtained in the previous stage have to be examined and integrated into a new field, or an old one has to be profoundly

transformed (Commons et all., 2011). An example would be Charles Darwin coordinating geology, biology and ecology to ultimately bring out the chaos theory. As very few people can function at that level, there is limited research on it.

Postformal thinking has commonly been associated with creativity and innovation as it is what causes one to be curious about anything around and to pay great attention to novelty. Apart from such emphasis on creativity, this concept fills a critical gap in terms of the weaknesses Piaget's theory represents as it takes development beyond adolescence and brings about an explanation for the evolution of thinking afterwards. In other words Commons' contribution to Neo-Piagetian perspective is opening the way to cognitive development after formal operations, in somewhat a stagelike appeareance. Despite that critical role, it has been criticized for lacking empirical basis; therefore, it needs to be confirmed with relevant studies.

A General Analysis of the Neo-Piagetian Theories

Neo-Piagetian theories appeared principally as a result of the way Piaget described the transition from one developmental stage to another. Equilibration was not the perfect explanation for many theorists and therefore each of them came up with their own theory. Whereas Pascual-Leone linked cognitive development with the increase in mental capacity, Case and Demetriou referred to development taking place as a result of increasing information processing ability. With information processing, Case (1985) implies a schematic search, where one looks for another scheme; schematic evaluation, where an assessment on the combination of two schemes is made; retagging, where one labels the schemes in another way to reach them easier next time; and schematic consolidation, which is the ultimate end at which a new unit comprising the old two schemes is formed. These four processes which help to acquire a functional mental unit from two separate units plays a key role in cognitive development.

Another point of criticism for Piaget was that he mainly described development on a biological basis, which also led neo-Piagetians to make up for such a weakness in their theories. Not only in Case's model, but also in Demetriou's and Pascual-Leone's model, environment is emphasized and cognitive development is attributed to mind and experience with the environment at the same time. Case also stresses the role of the environment in cognitive development maintaining that there have to be specific situations in the environment which trigger a certain scheme so that such a scheme can be developed. Pascual-Leone's theory (influenced by the dialectical approach) is highly contextual as well, as it takes into consideration the role of tutors in the child's development.

Neo-Piagetian approach has made a great impact on education and no matter the modifications made to the original theory, the general framework of Piaget's developmental levels have been maintained to a great extent by neo-Piagetians. However, there are important modifications in other aspects, which all contributed to

a better understanding of Piaget as well as to the development of curriculums in different fields.

What Are the Implications for Learning Environments?

Robbie Case's work has been applied in the educational field and these programs were mostly implemented in mathematics learning. Studies which have been performed by Case in this field are of great value for children with typical development processes as well as for those who are disadvantaged. The implications of his studies in terms of age ranges for handling a specific mathematical problem are of great importance for mathematics teachers. Also Pascual-Leone carried out much research based on his popular formula M = e+ k to analyse the M-capacity of students from a variety of age groups. As a result of these studies (i.e. Pascual- Leone, Johnson and Agostino, 2010) on different mathematical operations (such as multiplication), it could be put forward that the M-capacity equivalents for different ages proposed by Pascual-Leone have been confirmed. It would be beneficial for the educators to consider these while working with children. These elements are also helpful while preparing assessment devices for children.

Another crucial contribution of Case is that the findings of the studies on working memory will be of great help to tutors teaching in all domains of knowledge, providing them a framework to teach certain concepts bearing in mind the working memory capacity of the students in accordance with their age. Educators must pay full attention to the students' developmental level while organizing their teaching material. Moreover, the more studies scholars make to assess whether children have acquired specific competencies based on the findings of Neo-Piagetians' research, the more effective the assessment process will be and this will in turn help to organize educational environments more effectively. Case (1993) mentions that assessment devices based on his conceptual structures will be beneficial for a more coherent assessment. Also, as the attainments to be expected from a certain age group are more explicit due these studies, it is easier than before to sequence them, especially for the pre-school education.

Thanks to the studies by Demetriou, it was found out that even children with special needs could benefit from training programs on the condition that the training environment is structured appropriately and the learning process is rendered systematic. This leads us to conclude that children with dyscalculia or dyslexia could improve their learning in the field of mathematics or reading provided that the learning process and environment is organized in accordance with the disorder.

The research by Case, Demetriou and Pascual-Leone suggest that working memory and processing capacities have to be taken into account while the educators sequence the concepts and skills. It would be possible to obtain optimal attainments from the learning process if the developmental processing of the students are taken as a basis. As Demetriou et all. (2010) put it, once domain-general constructs are taken into consideration by educators, it will bring about improvements in learning and

increase in school performance. As the educator will understand six domains of thought and individual differences based on them, he/she will be able to design the teaching process better and may apply some intervention programs, if deemed necessary.

Discussion, Conclusion and Suggestions

Neo-Piagetian Theory offers a great deal for the educators in the field. Therefore, it is highly necessary that we comprehend the findings of the studies by Case, Demetriou, Pascal-Leone and the others who are not referred to in this paper, and conduct new studies to test the validity of the supposed structures in the Turkish samples. This will definitely help the students make use of their learning processes better and the educators to design these processes more efficiently. These studies will, without doubt, fill the gap in the Turkish literature and provide us with valuable information on cognitive development. Such a comprehensive examination will also provide a better sense of our knowledge on child development while establishing a preview on the potential problems which are likely to come up in the future. It will also be possible to produce new assessment devices using the results of relevant studies.

As Piaget mentioned in his quote in the opening part of this essay, neo-Piagetians mostly differed- and not contradicted- compared to his own theory. They mainly contribute to an understanding of the general stages of cognitive development and open the door to track true knowledge in the light of available research.

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Bilişsel Gelişime Yeni Piagetci Yaklaşıma İlişkin Bir Değerlendirme

MAKALE TÜRÜ	Başvuru Tarihi	Kabul Tarihi	Yayın Tarihi
Derleme Makalesi	10.12.2018	07.06.2019	08.06.2019

Gülşah Sevinç [1]
Ankara Üniversitesi

Öz

Bu çalışmanın temel amacı Piaget'nin bilişsel gelişime ilişkin kuramsal yaklaşımına yöneltilen eleştirilere karşılık ortaya çıkan ve kuramın zayıf yönlerini gidermeyi hedefleyen Yeni Piagetcilerin önermelerini derlemektir. Bu kapsamda Piaget'nin bilişsel gelişime ilişkin yaklaşımı ile Yeni Piagetcilerin bakış açısı arasındaki benzerlik ve farklılıkları ortaya koymak ve yeni Piagetcilerin yaptıkları araştırmaların eğitim ortamları için doğurgularını yansıtmak bu çalışmanın amaçları arasındadır. Bu çalışma dahilinde bir evre kuramcısı olan Piaget'nin doğumdan ölüme kadar bireyin geçtiği bilişsel gelişim aşamaları gibi en çok öne çıkan önermelerine gelen eleştirilere Robbie Case, Juan Pascual-Leone, Andreas Demetriou, Kurt W. Fischer ve Michael Lamport Commons gibi Yeni Piagetcilerin getirdiği yeni yaklaşım ele alınmakta ve bu kuramcıların gelişim ve eğitim psikolojisi açısından değerli katkıları tartışılmaktatır. Yeni Piagetcilerin çalışmaları çocuklarla çalışan eğitmenlerin eğitim programlarını düzenleme aşamasında değerli katkılar sağladığı kadar öğrencilerin değerlendirilmesine yönelik araçların geliştirilmesi aşamasında da önemli veriler sunmaktadır. Ayrıca öğrenmenin nasıl daha etkili bir şekilde gerçekleşebileceğine dair bilgi sağlamaları ve özel eğitim gerektiren durumlardaki öğrenmeye ilişkin açıklamalar getirmeleri açısından da oldukça önemlidir.

Anahtar sözcükler: Yeni Piagetciler, bilişsel gelişim, evreler, Case, Pascual-Leone, Demetriou.

[1]*Sorumlu Yazar*: Doktora öğrencisi, Eğitim Bilimleri Enstitüsü, Eğitim Psikolojisi Doktora Programı, E-posta: gulsahkara85@yahoo.com, https://orcid.org/0000-0003-3623-8830

Amaç ve Önem

Piaget'nin bilişsel gelişime ilişkin kuramına yöneltilen eleştirilere karşılık olarak ortaya çıkan Yeni Piagetci yaklaşımda özellikle aşamaların evrenselliği gibi temel noktalara yeni açıklamalar getirilmesi hedeflenmiştir. Doğumdan sonra bireyin bilişsel çerçevede geçtiği evrelere ve ilgili dönüm noktalarını aydınlatmaya yönelik çalışmalar yapan Yeni Piagetcilerin temel önermeleri ile Piaget'ninkiler arasında farklılıklar olduğu kadar benzerlikler de vardır. Yeni Piagetcilerin farklılaştığı noktaların başında bir bilişsel gelişim evresinden diğerine geçişin nasıl gerçekleştiğine ilişkin getirdikleri açıklamalar ve evrelerin kapsadığı yaş aralıklarının yeniden şekillendirilmesi gelmektedir.

Bu çalışmanın amacı Piaget'nin bilişsel kuramının zayıf yönlerini gidermek için ortaya çıkan Yeni Piagetcilerin önermelerini derlemek ve eğitim alanına katkılarını ortaya koymaktır. Alanyazında Yeni Piagetciler ile ilgili çalışmalara pek rastlanmamaktadır. Bu açıdan bakıldığında bu çalışmanın alanda önemli bir boşluğu dolduracağı ve benzer çalışmaların yapılması için ilham vereceği düşünülebilir. Buradan hareketle söz konusu çalışmada Yeni Piagetci akımın en önde gelen kuramcılarından Robbie Case'in önermeleri ve alana katkıları üzerinde durulmaktadır. Case'in yanı sıra niceliksel yaklaşımıyla ön plana çıkan Pascual-Leone'nin önermeleri ve bunların eğitim açısından önemi vurgulanmaktadır. Ayrıca özelleşmiş düşünce alanları kavramını vurgulayan ve bu kavramı yapılan birçok ampirik araştırma ile destekleyen Demetriou'nun bakışaçısına dair de kapsamlı bilgi sunulmaktadır. Benzer şekilde Fischer'ın sosyal bağlam vurgusu ve Commons'ın soyut işlemler sonrası düşünceye ilişkin evreleri de bu çalışma kapsamında ele alınmaktadır. Alanda Yeni Piagetciler ile ilgili sınırlı sayıda çalışma olduğu göz önünde bulundurulduğunda bu derleme çalışması sunduğu kuramsal bilgiler ile önemli bir boşluğu dolduracaktır.

Yöntem

Bu çalışma Piaget'nin bilişsel kuramının temel önermelerinin yanı sıra Yeni Piagetcilerin ortak özellikleri ve Robbie Case, Juan Pascual-Leone ve Andreas Demetriou gibi kuramcıların yaklaşımlarına ilişkin bir derleme yazısıdır.

Bulgular

Piaget sonrası oluşan akımının en öne çıkan figürlerinden biri olan Robbie Case'in yaptığı çalışmalar eğitim programlarının hazırlanmasında önemli katkılar sağlamıştır. Case'in kuramının yapıtaşlarından olan yürütücü kontrol ve merkezi kavramsal yapılar bilişsel gelişim evreleri ile çok yakından ilişkilidir. Yürütücü kontrol ile ilgili olarak kısa süreli bellekte meydana gelen değişime vurgu yapan Case yürütücü kontrol yapılarının bir bilişsel gelişim evresinden diğerine değiştiğini belirterek dört evre tanımlar: Duyu-motor, karşılıklı ilişkiler, boyutsal yapılar, vektöriyel yapılar. Case'in evreleri belirli bir karmaşıklık sırasına dayanır ve çocuğun sırasıyla duyu-motor şemaları, tek odaklı koordinasyon, çift odaklı eşgüdümleme (koordinasyon) ve gelişmiş eşgüdümleme süreçlerinden geçmesi şeklinde ele alınır.

Yeni Piagetci akımın bir başka temsilcisi olan Juan Pascual-Leone'in kuramında öne çıkan kavramların başında zihinsel kapasite (M-power) gelir ve bu, bireyin işlemleyebildiği bilgi birimini temsil eder. Bir başka deyişle Pascual-Leone bireyin zihinsel kapasitesini çalışan bellekle ilişkilendirir. Pascual-Leone bireyin zihinsel kapasitesinin yaşam boyu 3 yılda bir bir birim arttığını belirtmektedir. Bu açıdan bakıldığında Yeni Piagetci kuramcılardan en niceliksel yaklaşıma sahip olanı Pascual-Leone'dir.

Son olarak Andreas Demetriou'nun kuramının öne çıkan kavramları öz farkındalık, işlemleme yeteneği, bilişsel control ve özel düşünce alanlarıdır. Bireyin bilişsel olarak işlevselliği o yaşa ait işlemleme yeteneği ile sınırlıdır. Demetriou bilişsel sistemimizin çevreden alınan verinin kategorik, niceliksel, alansal, nedensel, sosyal ve sözel kapasite/akıl yürütme gibi farklı alanlardan hangisine aitse ona göre işlemlendiğini vurgular.

Kurt Fischer öğrenmede olumlu sosyal çevrenin önemini vurgulaması bakımından bilişsel gelişim ile sosyal bağlamın birlikteliğini vurgulayan bir kuramcıdır. Beceri kuramı kapsamında çocuğun becerilerinin olumlu uyaranların olduğu, destekleyici ortamlarda gelişeceğini öne sürmektedir. Fischer'ın bilişsel gelişim sürecine ilişkin yaklaşımı merdiven metaforu üzerinden ilerlemezken daha çok ağ benzeri bir yapı şeklinde özetlenir. Fischer olumlu bir öğrenme ortamında her öğrencinin farklı yollar izlediğini, böylece aynı anda bazı rotaların daha fazla bütünleştiğini belirtmektedir.

Lamport Commons soyut işlemler sonrasında gelen dört evreden sözeder. Bu evrelerde sırasıyla birey en az iki değişken arasındaki ilişkilerin olduğu sistemi; iki ve daha fazla sistemi; üst sistemleri ve paradigmaları ayrıştırabilir. Soyut sonrası düşünce sıklıkla yaratıcılık ve yenilikle ilişkilendirilmiştir.

Tartışma, Sonuç ve Öneriler

Yeni Piagetci kuramcılar Piaget'nin bilişsel gelişim kuramını zenginleştirmiş ve bu kurama gelen eleştirilere yönelik çalışmalar yapmıştır. Case gibi Yeni Piagetci kuramcılar Piaget'nin evreye dayalı gelişim önermesini korumuş fakat kendi evre yaklaşımlarını ortaya koymuşlardır. Pascual-Leone ise zihinsel gelişimi yaşam içerisinde bir birimden yedi birime kadar ilerleyen zihinsel kapasite ile özdeşleştirmiştir. Fischer ise bilişsel gelişim ile beceri geliştirme süreçlerini bir arada değerlendirmiştir. Bir başka deyişle Yeni Piagetciler bilişsel gelişimi zihinsel kapasite artışı, işlemleme kapasitesinde artış gibi birbirinden farklı şekillerde açıklama yoluna gitmişlerdir. Her kuramcı bilişsel gelişime kendi bakış açısından yaklaşmış, kimi ağırlıklı olarak niceliksel bir açıklama getirmiş, kimi ise daha niteliksel bir gelişimi vurgulamıştır.

Yeni Piagetciler Piaget'nin kuramının eksik olarak değerlendirilen kısımlarını geliştirirken bir yandan eğitim alanında uygulamaya dönük olarak önemli katkılarda bulunmuşlardır. Gelişimsel evrelerin eğitim ortamlarında çalışan eğitimciler için oldukça faydalı olduğu söylenebilir. Çocuğun bulunduğu gelişimsel döneme göre

eğitim ortamlarını ve koşullarını düzenlemek olumlu katkılar sağlayacaktır. Bunun yanı sıra öğrencilerin değerlendirilmesi aşamasında da evreye dayalı bir yaklaşım oldukça değerli katkılar sunmaktadır. Yeni Piagetcilerin özellikle matematik ve fen bilimleri alanında yaptıkları çalışmalar bu alandaki eğitime yönelik önemli bilgilerin elde edilmesini sağlamıştır.