COGNITIVE PROCESS OF DEVELOPMENT IN CHILDREN

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ABSTRACT

In this article we explored the theories of Arnold Gesell, Erik Erickson and Jean Piaget about how human beings development. In this component we will analyze the cognitive processes of how children perceive and develop, in particular children from a cross-cultural background. How learning takes place, and how the influences of culture, and environment plays a role in the cognitive process of children's development. It deals with a more mathematical theory of development. This is a timely article to read for the 21st century.

INTRODUCTION

COGNITIVE PROCESS OF DEVELOPMENT

Changes in thinking and learning relate to physical changes in the brain. The repeating patterns of these changes suggest common growth cycles in behavior and in the brain-encyclical property that explains the remarkable human capacity for plasticity.

Recent research and theory in cognitive neuroscience have produced insights into how the development of the brain, especially the cerebral cortex, relates to thinking and learning. (Fishner & Rose, 1996: Thatcher, 1994), according to Fisher K. Prior conceptions typically treated development as a sequence of stages, like the steps of a ladder, but current work replaces that overly simple notion with the rich biological concept of a recurring growth cycle: Both behavior and the brain change in repeating patterns that seem to involve common growth cycles (Case, 1991; & Fishner, 1980).

These growth cycles repeat several times between birth and 30 years of age. Each recurrence produces a new capacity for thinking and learning that appears to be grounded in an expanded, reorganized neural network. Humans have a new opportunity for relearning skills and reshaping networks that they missed learning in earlier cycles. This cyclical property seems to explain the remarkable human capacity for plasticity, including recovery from damaging environments and neural

injuries, especially when later development occurs in a benevolent, nurturing environment (Diamond & Hopson, 1998 cited by Fishner).

When we look at thinking and learning, the cyclical changes in capacity are not evident in everything that children or adolescents do because most of their acting, thinking, and learning do not push the limit of their capacities. Each new round of the cycle, called a developmental level, is evident in a person's optical level, the most complex skill or understanding that he or she can produce. Usually a person produces this optimal level only with strong contextual support, like that from a teacher , a tutor, or a text. Without such support, most thinking and learning occur at lower levels, not at the optimal level. (Fisher, K. 1998, p2).

STAGES AND CYCLES OF COGNITIVE DEVELOPMENT

When we look at the classical conception of development, it treats thinking and learning as a progression through a series of stages that form steps in a developmental ladder, In a dynamic skills framework, development is much more variable and flexible and shows complex, dynamic patterns of change with many of the properties described by mathematical theories of complexity, chaos, and catastrophe (van der Maas & Molenaar, 1992; van Geert, in press).

A metaphor for some of the dynamic properties is a developmental web, with thinking and learning changing in parallel along multiple strands or domains, as reflected in such concepts as Gardner's (1993) multiple intelligences. For example a child develops a

set of spatial skills and a separate set of musical skills, strands on the left (spatial)and the strand on the right musical. When a new developmental level occurs, optimal performance along most strands will show a discontinuous change, reflected in growth spurts and reorganizations. These changes do not occur all at once, but they are distributed across a specific age period or zone. With the emergence of each level, a child can build a new more complex kind of skill or understanding in diverse domains. Fisher, K. (1997).

Each level produces a cluster of spurts in optimal skill and understanding across many domains in a particular age period, a cognitive surge analogous to the spurts in height that children periodically show. Unlike height, however, cognitive spurts are evident only under optimal support conditions, not across the entire array of children's behaviors. A good teacher will bring this out in the classroom, but they will typically not be evident when a child is working or playing alone or without support. Fishner K.p2.

According to Fishner (1980) development involves a long series of new levels, each constructed independently in parallel for each strand or domain. The first strand develops in the child shortly after birth, and they continue to emerge until they reach age 30 years. These spurts in capacity seem to be grounded in two recurring growth cycles. The shorter term cycle involves constructing successive levels of skill or understanding, moving from single units, to mappings relating to a few units, to systems relating multiple units, and finally to the formation of a new kind of unit that reorganizes and simplifies systems.

This reorganization and simplification in turn is nested in a longer-term cycle, moving through four different forms of action and thought called tiers (reflexes, actions, concrete representations, and abstractions). Both cycles seem to be based in the growth of neural networks involving a combination of changes in connections among regions of the cortex and changes in brain activity in particular region. (Case, 1991; Fischer, 1980).

Capacities for building more complex sensor motor actions emerge between 3months and 2 years and eventually create the first concrete representations (for example forming sentences, symbolizing specific people as independent agents, naming categories of emotions, counting numbers). Optimal levels for representational capacities develop during childhood, between 2 and 12 years. Eventually a child understands his or hers first abstraction (such as evolution by natural selection, reflective judgment, the golden rule). Fichner K. p3

Recent discoveries about the brain functioning have led to the first evidence of recurring cortical growth cycles. Especially exciting are the striking parallels of these cortical cycles with the cognitive developmental cycles for levels and tiers. Previously, scientists did not have access to enough data on the development of brain functioning to support any specific analysis of cortical growth cycles. The recent discoveries have provided strong sources for analyzing patterns of change in cortical activity and connection. Studies in three countries have found similar cyclical patterns of cortical change with age in

childhood and adolescence (Fisher & Rose, 1996; Matousek & Petersen,1973).

The amount of energy in the electroencephalogram (EEG), indicates electrical activity in the cortex that shows systematic spurts that closely parallel the spurts observed in optimal levels for cognitive development, In addition, connections among cortical regions, which are measured by EEG coherence (the correlations of wave patterns between regions), demonstrate qualitative shifts at the same age periods. The ages for these two kinds of brain changes are remarkably similar to those of the cognitive levels.p3.

Both types of measures—energy and connection—show not only spurts but also specific growth cycles that parallel the two cognitive cycles. One cycle for development of new forms of action and thought, the second cycle for the development of a specific skill levels. (Fischer & Bidell, 1997).

Spurts in cortical connections move systematically around the cortex in a similar pattern for each skill level, presumably reflecting changes in neural networks.

Spurts in the growth of connections begin with front to back connections in both hemispheres and shift to involve mostly fight hemisphere connections. Within the right hemisphere, they gradually move from long distance connections to more local connections. When the spurts reach front to back in the left hemisphere and then

simultaneously in the right, the process starts over again for the next level.p3.

Children and adults do not develop in stages, although optimal levels of skill do show relatively sudden spurts and reorganizations. The variation in skill levels is enormous and they only occasionally function at an optimal level, as teachers see their student. Full development of each level emerges gradually over a long period. Even under optimal conditions in a single domain, such as spatial reasoning, the concurrent zone spans time. There is no sudden transformation, no instant change at, ten years of age to understand abstract concepts about space. Instead, children show cluster of changes over several years, such as 10 to 12 years for optimal level with spatial concepts. P4.

In everyday functioning students vary in their skill levels. They typically perform at lower levels because the support for optimal skills seldom exists. Educators need to teach to ordinary functioning, and not only to optimal levels, because students need to use what they learn in the many situations where there is no optimal support. To sustain a high skill level without support, a student requires extensive practice and experience. Even intelligent adults have to work for long periods to master new abstract concepts in unfamiliar domains. Capturing the educational implications of growth cycles requires analyzing the full range of variation in levels of skill and understanding, not focusing primarily on optimal levels or growth spurts (Bidell & Fischer, 1992). These concepts and findings have an important implication for the development of thinking and learning, and especially for educators.

ENVIORNMENT AND DEVELOPMENT

Most researchers agree that a combination of biology and environment contribute to behavioral traits. This is in agreement with Erickson's theory of psychological development results from the interaction between biological needs and social demands. What portion of each is still a debate, especially in the area of intelligence? (Azar, B.1995).

According to Detterman, PH.D, an intelligence researcher at Case Western Reserve University, it is difficult to say which factor and how big of an effect they have. Few environmental variables have been found that account for substantial portion of the variation in intelligence. He states "understanding how environment affects intelligence is the most difficult of all to study." though it is important, said Detterman. He thinks the effect of environment is multifaceted, and it will be extremely complex to find out how all the variables relate.p93.

Socioeconomic status is the one factor or variable that has been strongly linked to IQ. Poverty predicts low IQ in studies, but it is difficult to determine causation. Most researchers presume that poverty-associated with risks such as poor environment, schools and lack of access to special programs-causes a drop in intellectual attainment. Others feel that the purpose for low IQ is low socioeconomic status. (Azar 1995, p93).

Edward Zigler, PH.D, director of the Bush Center for Child Development and Social policy at Yale University believes that IQ

measures the level of intelligence that the environment has allowed a person to reach. His research on intelligence and learning shows that IQ measures three things: cognitive ability, achievement and motivational factors. The more traditional view of IQ tests posit that they measure cognitive ability alone. Cognitive ability, he admits is least open to change. He estimates that approximately 50% of cognitive ability is influenced by genetics and the other 50% by the environment. Achievement is somewhat related to cognitive ability, said Zigler, but it is even more affected by environment. (Zigler cited by Azar p93).

According to Zigler, motivation is mostly influenced by one's environment, Children learn to be unmotivated; children growing up in poor environments have little incentive to answer test questions, let alone to perform well. Therefore, he claims that environment plays a greater role than genetics, unlike the theory of Arnold Gesell suggested. Zigler also states that getting children to use their genetically determined intelligence optimally is the way to improve achievement.

Zigler's research points out what he calls reaction range. Any one person has a maximum and a minimum IQ score that he or she can reach. Environment predicts how optimally one reaches that maximum or how close to the minimum one scores. Environment can count for as many as 25 IQ points. Zigler cited by Azar (1995).

If environments play such an important role, then children of cross-cultural background should be tested in their own environment to measure their levels of IQ, and achievement.

Let’s examine cross-cultural cognitive abilities in children from different backgrounds.

CROSS CULTURAL STUDIES OF COGNITIVE DEVELOPMENT

Many cross-cultural studies have been undertaken to investigate the universality of Piaget’s theory of cognitive development. One of these researches was done by Berry’s model of functional ecology, which posits that the sequence of the stages proposed by Piaget may be universal, but the rate of development is determined, in part, by ecological and cultural factors. (Berg 1994) p1. cited by Mwanwende 1992).

Following three preliminary studies carried out by (Berry, 1976; & Dasen 1977) on cognitive developmental comparison of three subsistence- economy cultures, two of which were (Canadian Eskimos and Australian Aborigines) low-food accumulating, nomadic, and hunting societies, and the third (Ebri Africans) was a high food accumulating, sedentary, and agricultural society. These groups are viewed as functioning near opposite ends of the eco-cultural scale suggested by Berry’s model of functional ecology. The results supported the hypotheses that the younger children of the two groups would attain the spatial concepts of order, rotation, and horizontality at an earlier age than would those of the third group (Ebri Africans from the Ivory Coast). It was hypothesized that the third group would

develop concepts of conservation of quantity, weight, and volume more rapidly than would the two nomadic, low-food accumulating groups. Berg, Y. (1994).Support for this hypothesis was obtained only for the children within the age range of 12 and 14.

Piagetian studies carried out in North, West, East and South Africa, involving the concepts of conservation of quantity, weight, volume and number, transitive inference, and class inclusion have confirmed that Piaget's theory can be validated cross-culturally. A general developmental trend has shown that the older the child, the better the performance. It has also shown that the overall performance of African children is comparable with Western children, both qualitatively and quantitatively. In a number of cases, talking to the subjects is disadvantageous to African subjects whose cultures do not facilitate or encourage discussion between an adult and a child. However, subjects who are provided with familiar materials from their environment, and are encouraged to reflect on their answers when given a question, are more likely to give a more reflective response. Irvine (1978) & Bovet (1974).

According to Mwamwenda (1992) Piagetian task by Africans in the role of education, shows cognitive development susceptible to environmental effects. It is logical to expect educated Africans to perform better than those who have no formal education. But, if cognitive development is purely a matter of biological maturation and general environmental experience, there should be no significant difference between performance and the two groups that Berry's model

used. Both sides of the argument have been supported empirically, although not to an equal degree.

Research in cross cultural application of general learning principles was arguably shaped by the acceptance of “Ferguson’s Law.” or the law of cultural differentiation (Ferguson, 1996 cited in Irvine & Berry, 1998). Ferguson’s law states that cultural factors prescribe what shall be learned and at what age; consequently different cultural environments lead to the development of different patterns of ability” (Ferguson, 1956, p.121). As seen in the result of Berry’s study.

It is often said that African children find it difficult to engage in abstract thinking, because their orientation is concrete. Price-Williams (1962) examined this assertion on abstract and concrete modes of classification in 80 educated and 60 uneducated Tiv children in Central Nigeria. Their ages range from 6 ½ 8, 9 ½ years He conducted the study in their local language and used test material with which subjects were familiar. When properly probed, Tiv children were able to use abstraction in their classification, and there was no significant difference in performance between educated and uneducated subjects. In both groups, the older subjects’ classification was more abstract (less concrete): “In all groups the abstract reasons were the most frequent” and “there is little difference between these African children tested and European children” (p.59). With regards to attaining Piaget’s concrete operational stage, the two groups were not different, although both groups were behind similar groups of European children. (Price-Williams cited by Mamwende 1968).

It is suggested by Hale-Benson, 1986, that an African world view is fundamentally different from a European world view. These fundamental differences give rise to cultural differences between European, or American ethnic groups whose ancestry can be traced to Africa or Europe. These cultural differences lead to different socialization practices, which in turn lead to ethnically based differences in how children communicate, learn, and process information.

Cognitive/learning styles

Its' only a decade ago that psychological research linked personality constructs with cognitive processes. This has created the concept of cognitive style. Although there is no concrete definition of learning style, Messick (1976) try to give us a definition. According to Messick an individual's cognitive style reflects "stable attitudes, preferences, or habitual strategies determining a person's typical modes of perceiving, remembering, thinking, and problem solving." (p5). In other words cognitive styles reflect individual differences in how information and experiences is organized and processed. According to cognitive style theory, these characteristics modes of processing information are manifestations of deeper personality characteristics that develop slowly and are not easily modified by training. Cognitive styles transcend specific abilities like those determined by psychometric factor analyses, and have broad applications beyond school settings. Cognitive styles are usually conceptualized as "bipolar," with each opposite pole having more or

less adaptive features depending upon situation contexts. Messick (1976, 1987).

When we examine cognition according to Piaget theory on concrete operational stage, we can assume that biological, environmental, and cultural factors plays an important role to how thought processes and information is received and then processed. African children in their own language, (according to the Berry's test) were able to give abstract answers to questions using their own learning style. Why? Because the questions was given to them in their own language which they can correlate with something that is familiar from their own environment.

From my teaching in Africa for 8 years, I can attest to the fact that having used the native language to teach a subject matter is more effect than using my own native language, English. Although English is the primary language that the education system uses for instruction, sometimes it is hard for the native speaker to translate the meanings into their own language, process it, and then answer effectively. When the native language is used for instruction, the response was remarkable different. The answers where given with abstract thoughts and reasoning. A familiar setting in their own learning style and environment, makes the native more comfortable to respond and there is no translation. When the English language was used for instruction, more elaborate explanation and definition had to be used to create an understanding of the subject matter. In this case, environment and

different learning styles, a familiar language makes a difference in the way cognitive processes operate.

COGNITION AND SCHOOLING TODAY

Contemporary cognitive researchers are refining Piaget's theories. They are discovering that children acquire some abilities earlier than Piaget postulated. Computer simulations of intelligence and if-in formation processing are comparing computer neural networks to human neurophysiology and human neuroanatomy. New cognitive theorists are speculating about how the human brains receives attend to, selects, rehearses, encodes, organizes, stores, and finally retrieves memories. (Bojorklund D. F. & Bojorklund B. 1992).p84.

According to Bojorklund some learning can be accelerated, however the price of stress is known to impair memory. He suggest a slower physical maturation maybe more adaptive for humans.

Language development continues as children begin to read, write, and use their memory stores efficiently. School-age children like to play with language. They use dialects, coded languages, slang, curse words and words of other languages. Bilingual or multicultural children may have a more limited use of English in primary school than monolingual children. However, there are cognitive and psycholinguistic advantages to knowing more than one language. Bilingual, bidialectal, and multilingual children usually have greater long-term flexibility with grammar and syntactical structures.p84

In today's school the questions that are being asked are ---

Are Public schools able to meet the cognitive needs of today's children?

Would tracking children with different cognitive learning styles be more effective or efficient? Should cognitive development and schooling be inclusive or exclusive?

Today's public schools tend to have overcrowded classrooms, underpaid teachers, and more problems with truancy and delinquency than other schools in the past. Parents who can afford it opt to send their children to private schools. Cognitive needs of children in public schools suffer the consequence.p85.

School administrators and teachers often have biased feelings about the educational needs of boys versus girls, or about the needs and motivations of children from different ethnic groups. The quality of life for all people will be enhanced by providing each child with the cognitive and educational stimulation necessary to help them reach a maximum level of potential fulfillment. Bojorklund p85.

Today's ethnically diverse classrooms emphasize the necessity of intercultural sensitivity in education. Yet, indications remain inadequate about cross-cultural awareness and cognitive approaches in teaching children, especially from a diverse background. Educators as well as learners continue to have cross cultural misconceptions. Frisby stated that "an increasingly homogenous teaching force and an increasingly culturally and linguistically diverse group of learners causes friction" (1990, p. 487). As a solution, Cheng urges, according to Frisby, that teachers be reeducated in

how to relate to these new breed of learners." (1990, p.263). Culturally sensitive individuals, however, respect cross-cultural differences as well as similarities. Slayer, M. (1992).

CONCLUSION

The article examines the cognitive developmental process. It probes into how the brain and mind process, retrieve, and use information; the brain and its' functioning according to the ability and capacity to perceive intellectually. It looks at changes in how thinking and learning relate to physical changes in the brain. We also examined the stages and cycles of cognitive development. It looks at growth cycles, of the human brain, and its capacity for plasticity, including recovery from damaging environment and injuries.

The debate about the influences of environment or genetics that shapes us as an individual person is discussed. Like Erickson's theory most of the result points to a balance between biological and environmental factors. Some even argues that it is a fifty- fifty balance between the two factors. Zigler suggest that recent studies prove that the environment has a greater influence on how we develop.

We also examine cognition and studies of diverse children, comparing them with Western children on Piagetian task theory. It shows that children from multicultural background when tested in their own language perform just as well as Western children. If tested in

their own language abstract thoughts emerge through answer given to them.

It also looks at today's schools and asks if educators attend to cognitive development in children. The answer was no, administrators and teachers are overworked with other disciplinary problem to emphasize cognitive development in their curriculum.

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