ADAPTIVE CONTROL OF THOUGHT OF HUMAN BEING

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Abstract

This study aims to explain the students' achievement in the neuroscience perspective. The important human organs in this case the brain is evidence to motivate human character. This article is a literature study with a qualitative approach. This study is adapted a variety of literature books and journals that related to neuroscience and character education. Human brain has function to controlled by the nervous system in the brain it means that all the activities of human being is resource the functioning of the brain. The brain is complex organ can controls memory, thought, touch, emotion, motor, vision, skills, temperature, breathing, hunger and every process that depend in our body. Neuron system is part of the thing in individual learning ability and it function in mental individually. The human brain is flexible and has the ability to change. This organ evolves throughout life and adapts to the changing environment. It is scientifically proven that human in enriched environments belong to several numbers of synaptic connections among neurons than the impoverished environment. So the implication of neuroscience to all the activities lead to neurol branching.

Key words: Cognitive theory adaptive control of thought

A. Introduction

Human beings are creatures that have brains to think compared to other creatures. One of the model methods of the human brain is to feel the sensors of the work facilities or work methods that he feels by relying on some of the senses that exist in the human being. Then the human brain will think quickly, and then will respond to body work activities, whether it is feeling lighting, smells, noise, temperature, or mechanical vibrations. In addition, the human brain consists of several parts that have their respective functions. There are differences in the function of the left and right brain which will form different traits, characteristics and abilities in a person. The *cerebrum*, which is the largest part of the human brain, is the part that process all intellectual activities, such as the ability to think,

reason, remember, imagine, and plan for the future. The cerebrum is divided into the left hemisphere and the right hemisphere, or better known as the Left Brain and Right Brain. Each hemisphere has a different function. The left brain functions in matters related to logic, ratio, the ability to write and read, and is the center of mathematics. Some experts say that the left brain is the center of *Intelligence Quotient* (IQ). Meanwhile, the right brain functions in the development of *Emotional Quotient* (EQ). In this right brain also lies the intuitive ability, the ability to feel, combine, and express the body, such as singing, dancing, painting and all kinds of other creative activities.

When the information stimulus has been accustomed to being received by someone, this can support cognitive processes. The process of translating an information stimulus that is accustomed to being received will be faster, because the brain has already translated a similar information stimulus and the translation process is stored in a person's memory. (Proctor & Zandt, 2008)

There are several ways to find out which parts of the brain are often used or dominantly used, namely by looking at their daily practices or habits, or by doing some *tests* that already exist with the sophistication of today's technology.

This is closely related to one of the functions of ergonomics. Egonomy is a systematic branch of science to utilize information about the nature, abilities and limitations of humans to design a work system so that people can live and work on the system well, namely achieving the desired goals through the work effectively, safely, and efficiently. comfortable. Ergonomics is also concerned with optimization, efficiency, health, safety and human comfort at work, at home, and in recreational areas. Specializatio ns in ergonomics include: physical ergonomics, cognitive ergonomics, social ergonomics, organizational ergonomics, environmental ergonomics and other appropriate factors. Therefore, everything related to human mental processes, including perceptions, memories, and

reactions, as a result of human interaction with the use of system elements. One of the definitions of ergonomics function is cognitive ergonomics. (Sutalaksana, 1979).

ACT-R is a theory of mechanisms that shape cognition, cognitive architecture. This theory places a fixed set of mechanisms that use task knowledge to perform tasks so as to predict and explain the cognitive steps that shape human behavior. As such, it is one example of a theory of integrated cognition (Byrne, 2012; Newell, 1990). Currently, he is also predicting the activation of brain regions used to produce behavior by using mechanisms that use procedural (how to do tasks) and declarative (facts about the world) knowledge, and working memory as activation, to perform tasks. For example, Salvucci (2006) has created a set of declarative and procedural knowledge about how to drive a car (eg, what are cars and other lanes, and when and how to turn). He then added this knowledge to the ACT-R which had a vision and motor system connected to a car simulator. ACT-R when applying this knowledge of how to drive then gives a prediction about the knowledge pool, indicating that it is sufficient to drive a car. Architecture also provides predictions about how quickly knowledge is applied, when turns and stops are made, and which part of the brain is active at each point in time. Additional knowledge can be added about how to call the phone (what and where keys, and how to retrieve a number from memory and then use the memory to press a key). The combined model can be used to predict the effect of calls on driving (Salvucci, 2009). ACT-R theory has evolved over more than four decades, and so have the acronyms used to describe the theory. ACT-R stands for Adaptive Control of Thought-Rational, although in Anderson's (1998) book ACT-R is referred to as Atomic Components of Thought. Based on the explanation above the writer tried to explain several things related to the understand and analyze the structures related to the cognitive function of the human brain, to understand the *ACT* (Adaptive Control of Thought) model or concept, and to find out the

correlation (correlation) between the dominant function of the human brain and each part of the statement or question that affects human cognitive function.

B. Discussion

1. Understanding Adaptive Control of Thought

Anderson first proposed ACT theory in 1976 in the book Language, Memory, and Thought. The ACT is the culmination of several concurrent research avenues. ACT theory applies procedural memory and thus expands the model's ability to explain more aspects of cognition. ACT expands HAM to include procedural memory (from PSG Newell), in addition to declarative memory on HAM. Procedural memory is how to perform a task. ACT also includes an increasing number of subsymbols, namely the numeric activation values for each production rule (sometimes, just "rules") and declarative memory elements. This activation value allows variation in how and when and how quickly memory elements are used (Collins & Quillian, 1969). Changes in subsymbols in knowledge are represented in smaller increments than the whole symbol (for example, changing the weight of an association between two symbols). This mechanism incorporates the deployment activation model (Collins & Quillian, 1972) for declarative memory and similar power measures for production systems. This was a precursor to work on mapping the ACT-R processes to their neurological correlations (Anderson, 1976). In the 1980s, the theory was moved to a more complete simulation that includes general cognitive processing (ACT-Embodied), and then to ACT* (pronounced Act Star), which was proposed as a general cognitive architecture. Following the initial creation of the ACT theory, Anderson, Farrell, and Sauers (1984) formulated a Limited Purpose Production System (GRAPES) to implement the latest developments of this theory. GRAPES is characterized as the first true implementation of ACT theory.

Adaptive mind control theory is an advanced computer simulation version of the "network" information processing model , called the *Adaptive Control of Thought* (ACT), or *Adaptive Character of Thought-Rational* (ACT-R), theory / model , proposed by the American-born psychologist Canada, John Robert Anderson (1947-).

The ACT model consists of two separate long-term memory stores: declarative memory (a semantic network of interconnected concepts represented by " *nodes* ") which contains "declarative knowledge" or the active part of a declarative memory system that essentially defines "working memory; " and procedural memory (consisting of "production systems") which contains "procedural knowledge" or information about how to perform a series of operations in a task. Declarative memory refers to knowing it (for example, regarding some factual information about the world), whereas procedural memory refers to knowing how (for example, regarding the correct sequence of movements to complete a particular job).

Theory / model is also referred to as the ACT-super theory which states that all behaviors Cognitive control is controlled by "production rules" that determine the steps of cognition. ACT theory is an "elaborated theory" of the previous framework by A. Newell and HA Simon (1972) which deals with problem solving skills and behavior. In another Anderson computer simulation program - developed in collaboration with American psychologist Gordon Bower (1932-) - called human associative memory (HAM), and based on "free memory in an associative net" (called FRAN), there is described a complete model of the structure and the human memory process, has as its center constructing a propositional network representation. When HAM concentrates on theory In a declarative system of knowledge , ACT uses a production system to interpret propositional networks ("a production system" is an

analogy for the condition-action pairs that theoretically underlie human cognition).

2. Declarative Knowledge and Procedural Knowledge

Declarative Knowledge: Declarative knowledge (also known as descriptive knowledge) is knowledge that we are aware of and can express verbally. This is information that we encode directly from the environment and does not require much synthesis.3 It emphasizes what one needs to do to solve a problem rather than how to solve it. Examples of declarative knowledge include facts, world history, or rules for solving mathematical equations.4 In essence, it is content that can be read or memorized.

Procedural Knowledge: Procedural knowledge (also known as imperative knowledge) is knowledge that you use while performing a task, but may not be able to express verbally. It is the encoded information of synthesizing and observing environmental (behavioral) transformations.

3. Process of Adaptive Control of Thought

The Adaptive Control of Thought theory, in all its iterations and models, rests on belief in a unitary theory of mind. This theory of mind suggests that we acquire complex skills thanks to an underlying 'human' system that differentiates us from other creatures. Instead of suggesting that we have actually evolved specialized brain faculties, the unitary theory of mind suggests we have an innate neurological component that enabled us to successfully acquire more skills as we grow and gain experience. Along these lines, becoming an 'expert' in something is not thanks to a special characteristic unique to an individual, but rather thanks to our brain's ability to effectively maneuver its underlying system. What makes humans so impressive and unique then, is the plasticity (flexibility) of this system, which we can apply to different kinds of skills. [10]

ACT therefore provides evidence for skills that humans have acquired that have little to do with evolution. For example, there are many tech-savvy individuals who are great at computer programming. Computer programming would not be a skill anticipated in the evolutionary process, as it does not ensure our survival, and therefore there is no special faculty that enables us to perform that skill. Rather, the ACT theory applies since it suggests that the brain capacity required for computer programming uses the same underlying processes that we use for other skills as well, and we simply have to learn to apply our brain to the new context. ACT theory also supports the idea that all behavior is a response to stimulus, as put forward by the behavioral perspective.

This school of thought suggests that all behavior is learned through conditioning, meaning there must be an underlying cognitive system that is able to learn how to respond to different stimuli (or cognitive units) in our environment. It seems odd that all of our cognitive processes can be reduced to a simple mathematical program or code. ACT theory suggests that all the skills we acquire are thanks to an underlying system of information processing, but it is unclear whether that system is impacted by emotions, cognitive biases, or other internal events.

There are other models of cognitive processes that suggest that our specific brain areas are in fact activated for different purposes, negating the unitary theory of mind. For example, the frontal lobe is thought to be responsible for movement, speech, and reasoning, while the temporal lobe is activated for memory, object recognition and understanding language. [13] In particular, humans' ability for language acquisition, which differentiates us from other creatures, is widely believed to be due to the existence of specific 'language' areas in the brain. This research suggests that we in fact do have special faculties responsible for different behavior. However, it could be

argued that the underlying system proposed by ACT involves all these different parts of the brain.

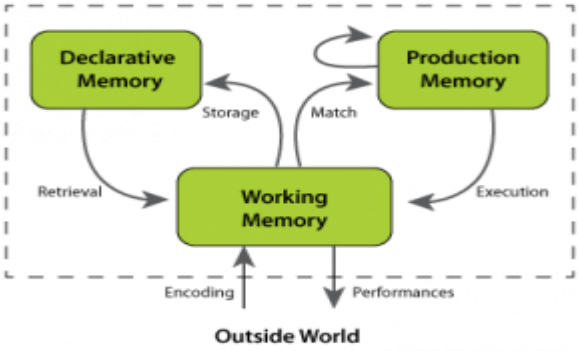
While the ACT theory explains different higher cognitive processes, it fails to explain why some people are 'experts' and others not, in particular areas. Additionally, while it informs us of the basic system that underlies memory, it does not get into detail about why some cognitive units are remembered better than others. Other theories, like the levels of processing effect, better explain how we use levels to encode information.

Lastly, ACT-R suggests that people always perform rationally. However, according to many behavioral scientists, people actually perform according to bounded rationality. Bounded rationality suggests that our ability to act rationally is impeded by our limited cognitive capacity, time, and available information, all components not factored into ACT theory.

ACT-R is a general theory of cognition developed by John Anderson and colleagues at Carnegie Mellon University that focuses on memory processes. It is an elaboration of the original ACT theory (Anderson, 1976) and builds upon HAM, a model of semantic memory proposed by Anderson & Bower (1973). Anderson (1983) provides a complete description of the ACT-R. In addition, Anderson (1990) provides his own critique of ACT-R and Anderson (1993) provides the outline for a broader development of the theory.

According to ACT-R, all knowledge begins as declarative information; procedural knowledge is learned by making inferences from already existing factual knowledge. ACT-R supports three fundamental types of learning: generalization, in which productions become broader in their range of application, discrimination, in which productions become narrow in their range of application, and strengthening, in which some productions are

applied more often. New productions are formed by the conjunction or disjunction of existing productions.



One of the strengths of ACT is that it includes both proposition and procedural representation of knowledge as well as accounting for the use of goals and plans. For example, here is a production rule that could be used to convert declarative sentences into a question:

IF the goal is to question whether the proposition (LVrelation LVagent LVobject) is true THEN set as subgoals

1. to plan the communication (LVrelation LVagent LVobject)
2. to move the first word in the description of LVrelation to the beginning of the sentence
3. to execute the plan

C. Conclusion

Humans are creatures that have brains to think compared to other creatures. One method of the performance of the human brain is to feel the sensors of the work facilities or work methods that he feels by relying on some of the senses that exist in the human being. Ergonomics is cognitive ergonomics. ACT-R is a theory of mechanisms that shape cognition, cognitive architecture. This theory places a fixed

set of mechanisms that use task knowledge to perform tasks so as to predict and explain the cognitive steps that shape human behavior. ACT theory applies procedural memory and thus expands the model's ability to explain more aspects of cognition. Adaptive mind control theory is an advanced computer simulation version of the “network” information processing model.

The ACT model consists of two separate long-term memory stores: declarative memory (a semantic network of interrelated concepts, and procedural memory (consisting of “production systems”) which contains “procedural knowledge” or information about how to perform a series of operations in a task. Declarative memory refers to knowing it (for example, regarding some factual information about the world), whereas procedural memory refers to knowing how (for example, regarding the correct sequence of movements to complete a particular job).

There are other models of cognitive processes that suggest that our specific brain areas are in fact activated for different purposes, negating the unitary theory of mind. ACT-R suggests that people always perform rationally. However, according to many behavioral scientists, people actually perform according to bounded rationality. Bounded rationality suggests that our ability to act rationally is impeded by our limited cognitive capacity, time, and available information, all components not factored into ACT theory. In other words, although we ideally act rationally.

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