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Using the Information Processing Approach to Explain the Mysteries of the Black Box: Implications for Teaching Religious and Moral Education

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Abstract
The aim of this paper is to use the three "stage theory proposed by Atkinson and Shiffrin (1968) or the "information processing approach" to explain the cognitive processes or the mysteries of the "black box" and its implication for teaching Religious and Moral Education. The rapid creation of computers has encouraged the use of computer model to explain learning, which is termed as the information processing approach, proposed by Atkinson and Shiffrin in the late 1960's. Thus, the information processing approach is based on the apparent similarities between the operation of the human brain and that of the computer and this gives the implication that information processing approaches are concerned with the nature of the cognitive processes. The implications of the information processing approach or the stage theory for teaching Religious and Moral Education, should place emphasis on the design of the curriculum, that is experiencing what is being taught, focusing on the developmental levels of leaners and employing the appropriate teaching and learning materials to give the right information to the learners especially in the initial stages of cognitive development.
Keywords: black box, cognitive development, memory, memory system information, teaching

1.0 Introduction

One of the primary areas of cognition studied by researches is memory. There are many hypotheses and suggestions as to how this integration occurs, and many new theories have built upon established beliefs in this area. Currently, there is widespread consensus on several aspects of information processing; however, there are many dissentions in reference to specifics on how the brain actually codes or manipulates information as it is stored in memory. Schacter and Tulving (as cited in Driscoll, 2001) state that "a memory system is defined in terms of its brain mechanisms, the kind of information it processes, and the principles of its operation" (p. 283). This suggests that memory is the combined total of all mental experiences. In this light, memory is a built store that must be accessed in some way in order for effective recall or retrieval to occur. It is premised on the belief that memory is a multi-faceted, if not multi-staged, system of connections and representations that encompass a lifetime's accumulation of perceptions. Eliasmith (2001) defines memory as the "general ability, or faculty that enables us to interpret the perceptual world to help organize responses to changes that take place in the world" (p. 1). Additionally, Goldstein (2010) defines memory as the processes involved in retaining, retrieving and using information about stimuli, events, ideas and skill after the original information is no longer present.

According to Goldstein, even though psychologist have been able to make a connection with regards to how information is stored in the human memory, these processes remain a mystery. This is due to the fact that there is no direct access to the cognitive processes of the human memory. Hence, the processes involved in the encoding, storage and retrieval of information in the human memory remains a mystery of the "black box". It is important to state that the memory performs two interrelated function namely, conserving and retaining of information or experiences and recall or recognition of what is retained. The ability of the memory to perform these interrelated functions is aided by three processes which include; encoding, storage and retrieval. The aim of this paper is to use the three "stage theory proposed by Atkinson and Shiffrin (1968) or the "information processing approach" to explain the cognitive processes or the mysteries of the "black box".

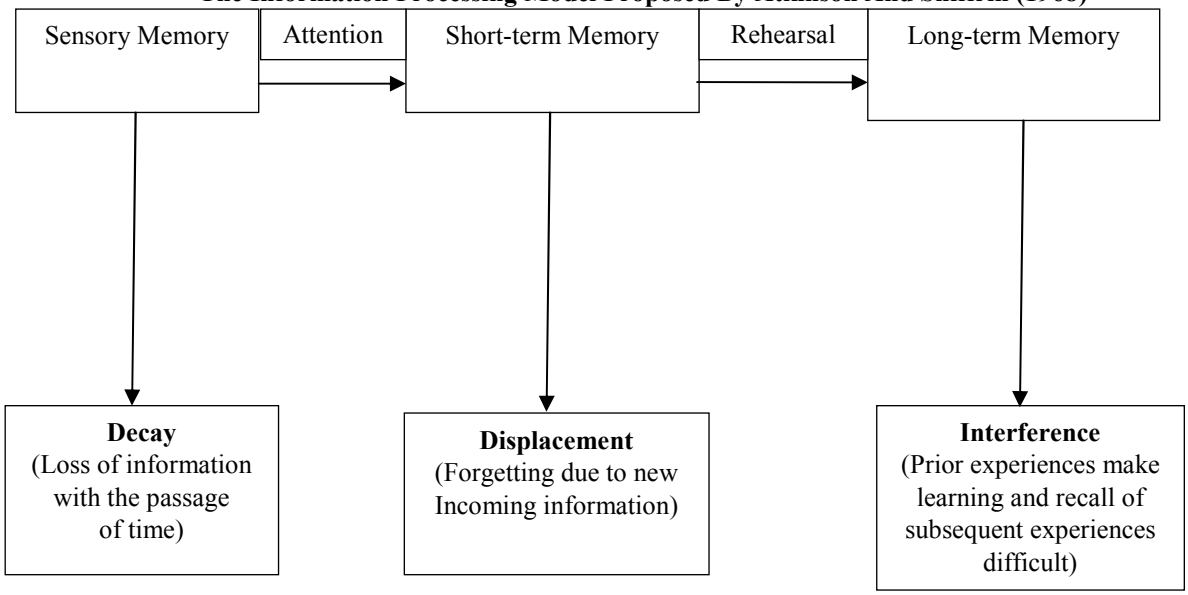
2.0 Brief Background of the Information Processing Approach/Theory

The rapid proliferation of computers has encouraged the use of computer model to explain learning, which is termed as the information processing approach. This approach has led to the study of human memory (brain) which is based on computer analogy. It was proposed by Atkinson and Shiffrin in the late 1960's. It was assumed that the information that came from the environment was processed by series of temporary sensory memory systems. These information is then fed into a limited capacity short-term store assumed as the working memory. This working memory is responsible for holding the information and transferring it to the long-term memory for storage and retrieval. Yahaya (2010) asserted that in recent years, psychologists have attempted to develop theories of memory using the computer as a model. The information processing theories are based on

the apparent similarities between the operation of the human brain and that of the computer. This does not mean that psychologist believe that the brain and the computer operate in exactly the same way. Obviously, they do not, but enough general similarity exist between the human brain and the computer to make the information processing model useful. Just as a computer takes in input, process it and produces output, the human brain takes in information (by way of sensory experience), processes it (by way of making meaning out of it and keeping it) and produces output (by way of recalling the information stored). This gives the implication that information processing theorists are concerned with the nature of the cognitive processes. Lutz and Huitt (2003) are of the view that the information processing theory is more applicable to students, in that students learn most effectively when they can relate new knowledge to what they already know. They continued that information processing theory has made its greatest contribution in explaining how human memory works. This relates to how we take information (encoding), organize it in our minds (storage) and gain access to it when needed (retrieval).

It can be deduced from the above that the human memory is known to have performed cognitive processes, which cannot be done away with as far as this discussion is concerned. Firstly, it performs the cognitive process of encoding which involves processing of information into the memory. It also means putting information in a form that can be used by the memory. It also involves forming mental codes. For example, a mental code for the chronological appearance of the colours of the rainbow could be formed as "Read Over Your Geography Books In Vacation" which implies the colours as "Red, Orange, Yellow, Green, Blue, Indigo and Violet". Secondly, the cognitive process also involve storage which entails maintaining of the encoded information overtime. Thirdly, the human memory performs the cognitive process of retrieval which has to do with the process by which one pulls out stored information from the memory. For example, one's ability to call people's names and answer questions in examinations demonstrate retrieval. Simply put, retrieval entails pulling out information stored in the brain or memory when needed for use.

The Information Processing Model Proposed By Atkinson And Shiffrin (1968)



3.0 Three Stage Theory of Information Processing Approach

Traditionally, the most widely used model of information processing is the stage theory model, based on the work of Atkinson and Shiffrin (1968). The key elements of this model are that it views learning and memory as discontinuous and multi-staged. It is hypothesized that as new information is taken in, it is in some way manipulated before it is stored. The stage theory recognizes three stages of memory: sensory memory, short-term or working memory, and long-term memory which are discussed below.

3.1 Stage One

Sensory Memory: The sensory memory is the initial stage that holds all information. In the words of Lutz and Huitt (2003), the sensory memory represents the initial stage of stimuli perception. It is associated with the senses, and there seems to be a separate section for each type of sensual perception, each with its own limitations and devices. Obviously, stimuli that are not sensed cannot be further processed and will never become part of the memory store. This is not to say that only stimuli that are consciously perceived are stored; on the contrary, everyone takes in and perceives stimuli almost continuously. It is hypothesized, though, that perceptions that are not transferred into a higher stage will not be incorporated into memory that can be recalled. The transfer of new information quickly to the next stage of processing is of critical importance, and sensory memory acts as a portal

for all information that is to become part of memory. This stage of memory is temporally limited which means that information stored here begins to decay rapidly if not transferred to the next stage. This occurs in as little as half second for visual stimuli and three seconds for auditory stimuli. This means that the sensory memory can be classifies into two namely, the iconic memory which has the visual sensory system as its source and the echoic memory which has the auditory sensory system as its source. The capacity of the sensory memory is very large but the information in it is unprocessed.

3.2 Stage Two

Short- Term Memory: The second stage of information processing is the working or short-term memory. This stage is often viewed as active or conscious memory because it is the part of memory that is being actively processed while new information is being taken in. Short-term memory has a very limited capacity and unrehearsed information will begin to be lost from it within 15-30 seconds if other action is not taken. It can store a limited number of items (about seven chunks). A chunk is a grouping of related items of information. It is susceptible to interference such that when new information enters, it pushes out the old information. The usefulness of the short-term memory is that it enables us to keep information in our minds long enough to make sense of the sequence of words and directions, to solve problems and make decisions. The short-term memory is highly susceptible to interference such that when a new information enters, it pushes out the old information. Thus, if the previous information has not been coded, rehearsed and passed on to the long-term memory, it likely to be lost. This follows logically that rehearsal of information should be encouraged.

3.3 Stage Three

Long-Term Memory: The third stage of the information processing theory is the long-term memory which houses all previous perceptions, knowledge, and information learned by an individual, but it is not a static file system that is used only for information retrieval (Lutz & Huitt, 2003). Abbot (2002) suggests that long-term memory "is that more permanent store in which information can reside in a dormant state–out of mind and unused–until you fetch it back into consciousness" (p. 1). In order to incorporate new information, long-term memory must be in communication with short-term memory. Four kinds of the long-term memory have been identified, namely; episodic long-term memory, semantic long-term memory, declarative long-term memory and procedural long-term memory. Pylyshyn (2000) defines the episodic long-term memory as the memories of specific events related to individual experiences. It means that it stores memories of events that are episodic in nature. For example, the memories of a young gentleman attending a dinner or any social gathering and finding loved one at the grounds who then becomes the wife. Huitt (2010) defines the semantic memory to mean the memory of the long-term that consist of abstract knowledge and facts about the world. For example, philosophical theories and sayings of the world. Eliasmith (2001) stated that the declarative long-term memory handles factual information. This means that it contains information such as recollection of words, names, definitions, dates and faces of people. For example, the ability of students to remember that the capital town of Ghana is Accra. Finally, the procedural long-term memory is defined as the memory that houses memories for actions, skills and operations (Paivio, 2005). For example, skills on how to ride a bicycle, skills on how to ride a car, skills on how to analyze questionnaires using Statistical Package for Social Sciences (SPSS) and skills on how to operate electronic devices.

4.0 Implications of the Information Processing Approach for the Teaching Religious and Moral Education

This section discusses the implication of the information processing approach for teaching Religious and Moral Education. Firstly, the design of the Religious and Moral Education curriculum should place emphasis on experiencing what is being taught. For example, the use of fieldtrips and experimentation. This is because leaners are able to learn best when they experience what is taught during the teaching and learning instruction. This means that the curriculum should be designed in a way that it should be related to the learning environment of the learners.

Secondly, the curriculum designers should take into consideration the developmental levels of the leaners. In this regard, the statement of instructional objectives and the selection content should take into consideration the developmental levels of the leaners. This is because certain contents of the curriculum cannot be easily understood at certain levels of cognitive development.

Thirdly, teachers should employ the appropriate teaching and learning materials to give the right information to the learners especially in the initial stages of cognitive development. It is noted here that learners at the initial stages of cognitive development see their teachers as the repository of all knowledge and once an information is given to them, it becomes difficult to change it. Finally, teachers should be able to present information in such a way that it can be incorporated into the memory systems of students easily to enhance retention and retrieval when the need arises.

5.0 Conclusion

In conclusion, the paper discusses systematically the use of the three "Stage Theory" proposed by Atkinson and Shiffrin (1968) or the "Information Processing Approach" to explain the cognitive processes or the mysteries of the "black box". The implications of the information processing theory to the teaching Religious and Moral Education have been comprehensively explained.

References

Abbot, B. (2002). *Human memory*. Fort Wayne: Indiana University-Purdue University at Fort Wayne, Psychology Department. Retrieved from http://www.users.ipfw.edu/abbot

Atkinson, R., & Shiffrin, R. (1968). Human Memory: A Proposed System and Its Control Processes. In K. Spence, & J. Spence (Eds.), *The psychology of learning and motivation*. New Jersey: Van Nostrand.

Driscoll, M. (2001). *Psychology of learning for assessment* (2nd ed.). Boston: Allyn and Bacon.

Eliasmith, C. (2001). *Memory: Dictionary of philosophy of mind.* Pullman, WA: Washington State University.

Goldstein, E. B. (2010). *Cognitive Psychology: Connecting mind, research and everyday experience* (2nd ed.). USA: Thomson Wardsworth Press.

Huitt, W. (2010). *The information processing approach*: *Educational psychology interactive*. Valdosta, GA: Valdosta State University.

Lutz, S., & Huitt, W. (2003). Information processing and memory: Theory and applications. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State.

Paivio, A. (1986). *Mental representations: A dual coding approach*. New York: Oxford University Press.

Pylyshyn, Z. (2002). *Mental imagery*: *In search of a theory behavior and brain sciences.* New York: McGraw-Hill.

Yahaya, A. (2010). *Information processing and its implications to teaching and learning.* Malaysia: University of Technology Press.