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Perspectives of Human Memory Models: A Critical Review

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ABSTRACT

A number of theories and models on memory have been conducted through centuries. These models have been adopted by many researchers especially with regard to language learning. However, few authors have reviewed them critically. The main purpose of this research is to provide a critical review of the basic memory models by demonstrating their description, showing their evidences, examining their applications and their limitations if any. In addition, integrating them to serve the language teaching/learning process. The main question of the research states: Can memory models be merged in a way to result an eclectic model that provides a typical model which can be implemented in an educational setting? A critical review is put forward by manifesting the strength and short comings of these models. The research reveals; each memory model has a specific perspective of memory function in terms of processing the data that a human brain receives in daily-base life and how it holds this data otherwise it will be lost. Moreover, an eclectic model can be formulated to comprise the subdivisions that suites the teaching strategies adopted. So, in the light of this result, a researcher can design the model that fits his/her educational setting making use of them. The research is supposed to pave the way for future studies in utilizing more than one memory model and apply them to language teaching/learning process. This will be followed by a diagram demonstrating all memory taxonomies.

Keywords
Human Memory, Memory Model, Long Term Memory, Teaching, Learning.

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Introduction

Memory is the ability of the brain to encode, store, and recall data or information. It is the process of retaining information over time in order to influence future actions. Without the ability to recall prior events, language, relationships, and personal identity development would be impossible. (Tulving, E.1984). Memory is frequently conceptualized as an information processing system with explicit and implicit functions composed of a sensory processor, a short-term (or working) memory, and a long-term memory (Cowan, N. 2017). Memory under pins any learning process (Cowan, N.2014). Scholars and researchers through centuries conducted researches and presented models.

Literature Review

The study of human memory stretches back in the history for nearly 2000 years to ancient Greece and Rome at the time of Aristotle who had the early attempts to investigate memory in his treatise. Two sorts of memory were then assumed: the "natural memory" (an inborn one) and an "artificial memory" built through learning and practicing memory techniques coined as "mnemonics". They used them in teaching and learning to support information retention as methods that allow adequate storage of information in the brain. The 18th Century witnessed the theory of the English philosopher David Hartley about encoding memories through hidden motions in the nervous system. In the 1870s and 1880s William James in America and Wilhelm Wundt in Germany (the founding fathers of modern psychology) researched in the functions of human memory. Yet, investigations and researches on memory were poor and limited until the experiment of the German psychologist Herman Ebbinghaus (1885), who started revolutionary experiments being the first who developed the scientific approach to studying memory. His research findings were proved scientifically on the field of psychology carrying out several experiments on himself as a single individual using lists of nonsense syllables with association to meaningful words resulting in the concepts of the learning and forgetting curves. He

was the first who classified memory into three distinct types: sensory, short-term and long term. Later, in the 1930s Fredrick Bartlett (1932) suggested another view point on memory considering memory as an active rather than passive process. In the 1940s with the technological advances in the field of neuropsychology based on theories in biology, Karl Lashley researches in the 1950s concluded that memories were not situated in one part of the brain but are widely distributed over the cortex. During the 1950s and 1960s in the development of computer technology, an apparent parallel engagement emerged between brain processes and computers leading to more understanding of the encoding, storage and retrieval processes of memory.

Memory; Importance in Cognition and Education

A "cognitive revolution" started during 1950s and 1960s leading to a number of theories represented by George Miller's (1956) "the magical number seven, plus or minus two", Richard Atkinson and Richard Shiffrin's (1968) "the multi-store model", Fergus Craik and Robert Lockhart's (1972)" the levels-of-processing model", Alan Baddeley and Graham Hitch (1974) "Working Memory Model". These models will be discussed below.

From the 1970s onwards Endel Tulving (1972) was a pioneer in highly influential human memory researches distinguishing long-term memory, episodic and semantic, as well as devising specificity of encoding. Several formal models during the 1980s and 1990s on memory were conducted and developed in accordance with computer simulations.

Today, human memory studies are considered as part of cognitive psychology and neuroscience disciplines in addition to the cognitive neuroscience as an interdisciplinary link between the two. In 1997, Baddeley described Human Memory as a complicated system whose function is to store and retrieve vast amounts of different types of information. Baddeley (1999:17) views memory not as a single unitary system, but rather an arrangement of interacting subsystems, each of which is able to encode, register and store information then make it available by retrieval. Without this ability of storing information, we would not be able to perceive adequately, learn from the past, understand the present, or plan for the future. Klimesch (2013) emphasizes that memory has different functions with equal importance. The representations of these functions are formed when sensory information, in a certain action in the brain, is transformed and encoded. These functions are accomplished in three types of memory (sensory, short and long term memory) each of which has specific ability of information processing by which memory is created. However, most experts agreed on the distinction among sensory memory, short term memory (STM) and long term memory (LTM). For over 100 years, researchers who had intended to improve education, attempted to empirically evaluate the degree to which various memory learning techniques and instructional interventions impact student learning outcome. May and Einstein (2013) emphasized the role of memory as one of the most applicable units which students find helpful to the academic and personal spheres in their daily life. For Izawa and Ohta (2014), memory is considered as the centre of all cognitive and psychological processes. In fact, when learning phenomena are approached, memory processes are supreme at both the theoretical and application levels especially in education Radvansky (2017:136) referred to the relation between memory and learning considering it as the property of the central nervous system where learning is centered. It offers competence to an organism to learn from previous experiences as well as constructs relationships. Randall (2007:12) referred to the importance of human memory in learning as it allows human beings to engage in conceptual and reasoning processes. Thus, humans are remarkably successful in the capability of altering their environment through the ability to think, reason and learn. In her article "The Role of Memory in Learning: How Important Is It?", Savage (2018) highlighted the importance of memory in terms of the superior intellectual process that explains the temporal dimension of our mental and cognitive organization. Fahle (2019:195-198) clarified how memory constitutes the ground for learning by its integrating functions stating that the brain comprises a number of

adaptive, recurrent networks which are associative and dependent on electric activities which enable humans to store various types of information on different time scales in the brain at which learning takes place.

To conclude, Memory and educational achievement are integrated and interrelated in a way that each one of them depends on the other. Memory is a vital factor for all types of academic activities, educational processes and even educational problems. The process of learning begins with sensory signals being transcribed in the cortex. They are then transmitted to the hippocampus where new memories are believed to form. If a signal is strong, or repeated, a LTM is established and wired back to the cortex in order to be stored. Furthermore, the importance of memory lies on the powerful and dynamic capacity it possesses for all educational areas (learning and teaching) that are directly associated to learning outcome. Memory is considered as one the crucial factors used to predict the level of students' performance. It is also believed that the importance of memory stems from the ability of conceptualizing and reasoning with different dimensions in our mental cognitive organization.

Memory Theories and Models

That Memory can be divided into subcomponents is not something new; it was adopted in 1890 by William James the prominent American psychologist, then by Donald Hebb in 1949. Evidence by experiments for the fractionation of human memory have mainly been developed over the period of the last 30 years. Until the 1960s many psychologists realized that it is unnecessary to propose more than one kind of memory. In the 1950's, psychologists reached to a more general agreement on which people relied to two distinct kinds of memory: ST and LTM. However, during the 1960s and early 1970s intense controversy resulted in a range of memory models and there were some dominant theories and models which tried to explain how memory as storage system works and how retrieval works. The following are theories and models which have been developed since the early 1950's of the past century.

Miller's (1956) "Magic Number Theory"

Magic Number Theory was proposed by the American cognitive psychologist George A. Miller as "The magic number 7" theory in which he maintained that Short- Term memory (STM) could keep 7 plus minus 2 items. He pointed out that a memory has only a number of "slots" in which items are stored in the brain which has the ability to 'chunk' items of highlighted information together. These chunks counted towards the 7-chunk limit of the STM.As an example, most people are able to remember a 7- digit phone number while they would find difficulty to remember a10-digitnumber. This has led Miller for the description of number 7 ± 2 as a "magic number in understanding memory".

Miller maintained that the brain is able to 'chunk' items of information together and that these chunks counted towards the 7-chunk limit of the STM. For example, a long word consisting of many letters form, in turn, numerous phonemes. Instead of the ability to remember a seven-letter word, the mind "recodes" it, by chunking the individual items of data together. This process allows us to enhance the limits of recollection to a list of seven separate words. Information to be kept, encoding has to be achieved through specific strategies like rehearsal or visualization then it transfers to LTM where it is organized according to associations with meaning and can always be retrieved. Miller's theory was supported by previous studies like Jacobs's (1987) in which he used a digit span test with all letters of alphabet and numbers except for "w" and "7" as they have two syllabuses among letters and numbers.

Although "The magic number 7" theory has been supported by the psychologists, it has been followed by more advanced models which have added more to the investigation of human Memory.

Peterson and Peterson (1959) "Duration of Short-Term Memory Model"

Miller's 'Magic Number' was followed by a paper concerning the capacity of the STM. Peterson and Peterson (1959) have focused on the measurement of memories' longevity in order to investigate the duration of STM. That is to say, information will be lost quickly from STM if not rehearsed. The

results of their study show that STM is different from Long-Term Memory (LTM) as far as duration is concerned which means that the duration of STM is about 18 to 30 seconds without rehearsal. This model is supported then by Multi-Store Model of Memory proposed by Atkinson and Shiffrin (1968) which will be discussed thoroughly in the next section. If someone is unable to rehearse information, it will not move to their LTM store. Peterson and Peterson (1959) have not provided information on the various types of stimuli that enhance retrieval such as pictures and melodies. The examination needs unremarkable authenticity and external validity as they utilize extremely fake stimuli. They additionally just view as momentary memory span for one sort of improvements. They haven't given data about different kinds of stimuli, for example, pictures and melodies.

It is obvious from the discussion above that "Memory Decay Model" is limited in that it is not a test of how we typically use our memory in everyday situation. In addition, the study used psychology students who may change their behavior to help experimenter (Atkinson & Shiffrin, 1968 and Baddeley & Hitch, 1974).

Atkinson and Shiffrin's (1968) "Multi-Store Model"

Atkinson and Shiffrin (1968) suggested a Multi-Store Model which is also known as the cognitive model. It postulates that information received from environment goes through three stages: Sensory register then to Short-Term Memory which is able to process information and send it to LTM. Sensory register /Memory (SM) is a kind of memory store where information is received by receptors then being processed by a complicated nervous system with unlimited capacity in filtering sensory information in a short duration for fraction of second (Atkinson and Shiffrin, 1968 :91). Sensory Register/ Memory is part of perception process (Baddeley, 1999: 20). It is concerned with the five senses of which humans are not always aware of because only relevant information passes from SM to STM. In the Sensory register, information is stored for just the time to be delivered to STM. SM permits humans to retain impressions from what is seen or heard in sensory information after ceasing the original stimulus. It includes subdivisions: Iconic Memory, Echoic Memory and Haptic Memory respectively (Atkinson and Shiffrin,1968:105), one is visual whereas the others are responsible for shape recognition (Turvey, 1973:163). Iconic Memory: or Visual sensory memory is limited only to the vision field in which items decay after only 0.5–1.0 seconds. Its function is similar to sensory registers which does not allow access for further processing of information. Iconic memory keeps information for only visual stimuli such as size, shape, color and location. Echoic Memory: refers to the auditory SM (Atkinson and Shiffrin ,1968). Auditory SM is more durable than Visual Memory (Crowder and Morton,1969). SM is not only sensitive to speech sounds but also detecting rhythmic fluctuation. (Cuttman and Julesz, 1963). Haptic Memory is responsible for recollecting information resembled from by touch after exposing to a stimulus. Traces of such information are very short and prone to vanish through a duration of about 1-2 seconds. But Susan Millar (1999) suggested that haptic Memory is not firmly organized to act independently but to rely on other external cues like vision or movement.

Atkinson & Shiffrin (1968) considered Short-Term Memory (STM) as a temporary storage of information which is necessary for manipulating a range of complex tasks like comprehending, reasoning, as well as long-term learning. Baddeley and Hitch (1974) argued that STM represents not only one but also a set of complexes interacting subsystems referred to as WM. It grasps the seven most relevant chunk of information (Miller,1956) at any level in time and last anywhere 10 seconds. After that level, the information will be vanished unless it is rehearsed.

According to Atkinson & Shiffrin (1968), Long-Term Memory LTM has a virtually unlimited capacity and a virtually unlimited duration. This explains the reason for remembering things from a very long time ago and virtually unlimited capacity explains why encoding something new to LTM doesn't require getting rid of something else. It is primarily concerned with storing information.

Figure (1) bellow demonstrates stages of information processing as it starts from the input of stimuli ending either to LTM or forgotten.

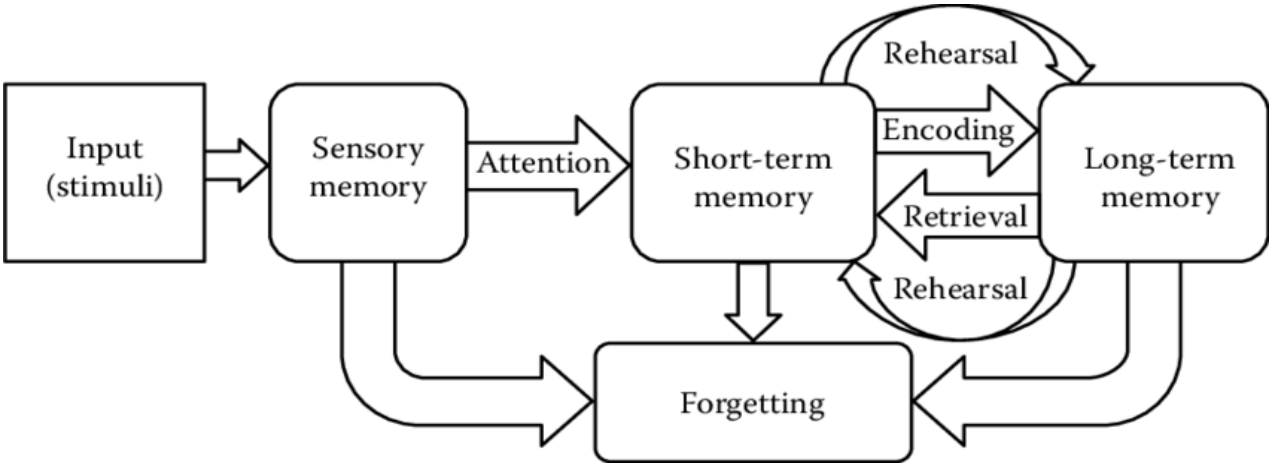

Figure 1. The Multi-Store Model of Memory by (Atkinson and Shiffrin, 1968)

It demonstrates a description of the cognitive process in "Multi-Store Model" as a Language Processor. The flow of information is directed from the stimuli in the environment, through a short-lived sensory register where information is extracted from the mass of stimuli received by the brain with attention, into the WM where the material which has been selected as important is further processed by encoding or rehearsal. Then the filtered message is passed on to a long-term permanent store. The permanent / LTM contains information about the world (Atkinson and Shiffrin, 1968). Parallel to these three stages of processing is the concept of restricted capacity. Incoming information is selected and filtered by the Sensory Register and the WM. The system, comprising the STM/WM has a limited capacity, and this is a crucial concept for our understanding of second language processing. That is to say, to remember something, information has to be transferred from a STM, where will be forgotten to the LTM where will be remembered by retrieval as in figure (2) shows.

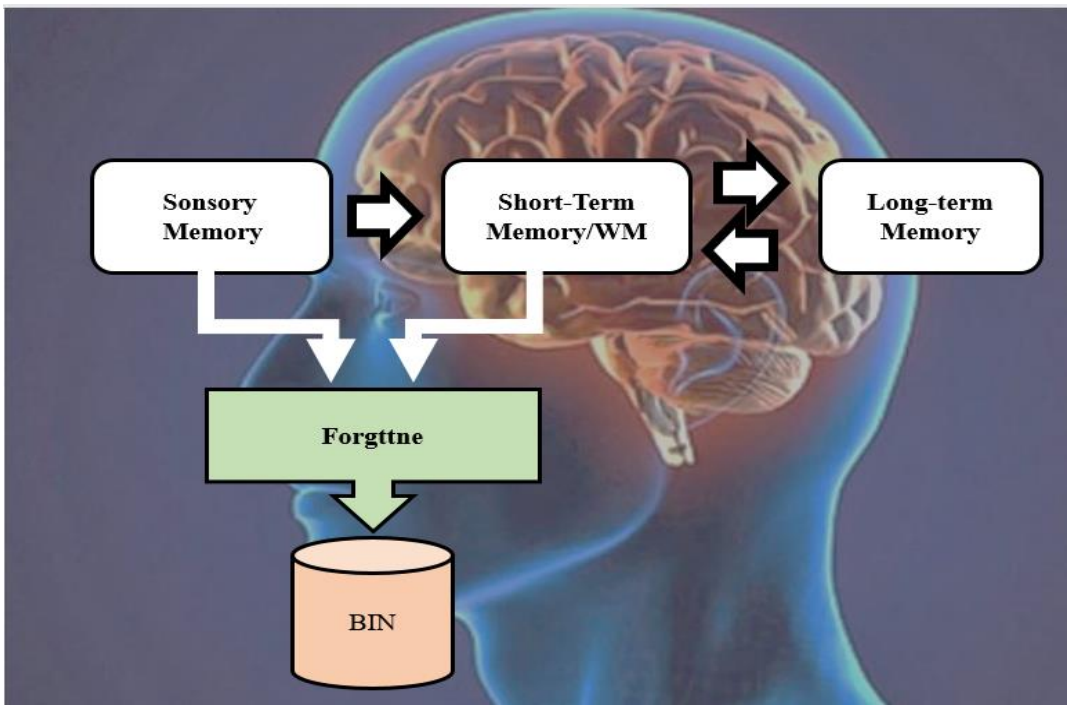

Figure 2. Forgetting information in Sensory and STM/WM by Atkinson and Shiffrin's model (1968)

This model seems to be simplistic in several ways; in that STM and LTM rely on each other. The only way that information goes from STM to LTM through verbal rehearsal and this, in these days, is considered to be oversimplified.

Tulving's (1972) semantic memory model introduced the concept of semantic memory making a distinction between two types of Atkinson & Shiffrin's LTM: The Episodic and Semantic. Tulving (1972) identified separate systems of episodic and semantic memory conceptualization in his book. He maintained that semantic and episodic memory are different in the way of their operation and information processing. Episodic Memory is the capacity to recollect experiences which includes remembering particular incidents to refer to the distinction between knowing and remembering where knowing indicates the factual recollection i.e. the semantic. By contrast, remembering indicates the feeling that is located in the past i.e. the episodic. Semantic Memory, on the other hand, primarily concerns knowledge about the. Some of the most significant experiments of semantic memory were implemented by J.F. Kihlstrom in the 1980s testing hypnosis on Semantic and Episodic Memory.

Craik and Lockhart (1972) "Levels of Processing Model" (LOP)

Fergus Craik and Robert Lockhart 1972 criticized memory description presented by the Multi-Store Models as stages. They viewed memory as processes and proposed an alternative explanation known as the *Levels of Processing* effect in 1972. Their basic idea was that the way of remembering information depended largely on the way of *encoding* or deeply processing information. They differentiated between two forms of processing; shallow and deep processing that occurs when an observation is made. "Shallow" here involves visual and auditory data for encoding. It also requires maintenance rehearsal (repetition that helps us maintain everything in the STM and contributes to information retention in a reasonably short term). It is expressed in two forms: structural and phonemic processing. Craik and Lockhart (1972) maintained that the strength of a memory trace depends upon the quality of processing, or rehearsal of a stimulus. In other words, the more we think about something, the more long-lasting the memory we have of it. This hypothesis focuses on the procedures engaged with memory. Three years later, in 1975 Craik had another experience with the psychologist Endel Tulving. They worked together in an experiment and published the findings which sought to test the levels of processing effect. Their aim was to investigate the process of affecting memory recall by deep and shallow processing (Craik and Tulving, 1975).

The model of Craik and Tulving (1975) is considered as an improvement of Atkinson and Shiffrin's (1974) model. It accounts for transferring information from STM to LTM, for instance, just only maintenance rehearsal doesn't lead to recall of information as in elaboration rehearsal. Craik and Lockhart (1972) argued that deep *processing* leads to better long-term Memory than shallow processing. Nevertheless, Eysenck (1978:1250) argued that they failed to provide a detailed account of why deep processing is so successful. The ideas of "depth" and "elaboration" are vague and ill defined.

Baddeley and Hitch's (1974,1999) "Working Memory Model"

This model is considered as an alternative to Atkinson and Shiffrin's (1968) three Multi Store Model by proposing working memory so that short term memory is no longer be conceived as a single system. Baddeley (1999) maintains that WM is part of STM which refers to the system or systems that are assumed to be necessary in order to keep things in mind while performing complex tasks such as reasoning, comprehension and learning. This model has been proposed to be as a more accurate alternative to Short-Term store (Primary Memory) considering it as "simplistic" model of Atkinson and Shiffrin (1968). Baddeley and Hitch (1974), have presented a cognitive theory which is more comprehensive that accounted for the standard operations of STM in addition to how memory is enjoined and directed, and how it is related to LTM.

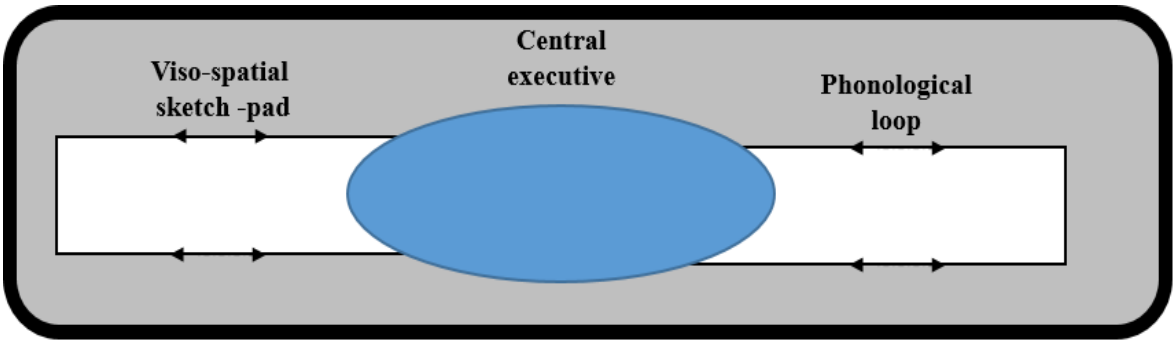

Figure 3. A simple representation of WM model proposed by Baddeley and Hitch (adopted from Baddeley, 1999:46)

They kept developing their WM model though twenty-five years, from 1974 to 2000, depending on continuous experiments resulting in what is referred to as the "Multicomponent Model".

Through several modifications on the WM model extended through the years from 1974 to 2000, Baddeley reached to the WM Model. The first version memory model of Baddeley and Hitch's (1974) had three components; (Visuo-Spatial Sketchpad, Central Executive and Articulatory-Phonological Loop (see figure 3 above). After conducting experiments and modifications, another modified version of WM model was presented by Baddeley adding a third slave system namely; the Episodic Buffer in addition to the fourth component as a complement; the Central Executive system. Visuo-Spatial Sketchpad: is represented by the 'inner eye' which is sensitive to visual data. It is assumed to be a maintaining system for the manipulation of visual images and for this reason it functions in making advantages of imagery in learning. Articulatory-*Phonological Loop*: is represented by the 'inner ear' at which the verbal content is stored but both are regulated by the *Central Executive*. This component is the most complex and ambiguous component of the span pad of WM which is highly related to an attentional and span modal controller as it collects and processes information from the other components. WM span task is one way of measuring central executive capacity which is connected with the comprehension capacity that tends to highly correlate with general intelligence measurement based on reasoning tasks (Baddeley, 1999: 55, 64). It appears to be engaged in second language learning as well as the phonological loop system that has been developed for the crucial task of language acquisition (Gathercole & Baddeley, 1989:207). By 2000, Baddeley in his article "The Episodic Buffer-New Component of WM", expanded the functions of Central Executive by adding the Episodic Buffer. The *Episodic Buffer:* serves as the memory component of the central executive. It temporarily integrates and stores information from the other two subsystems as in figure (4).

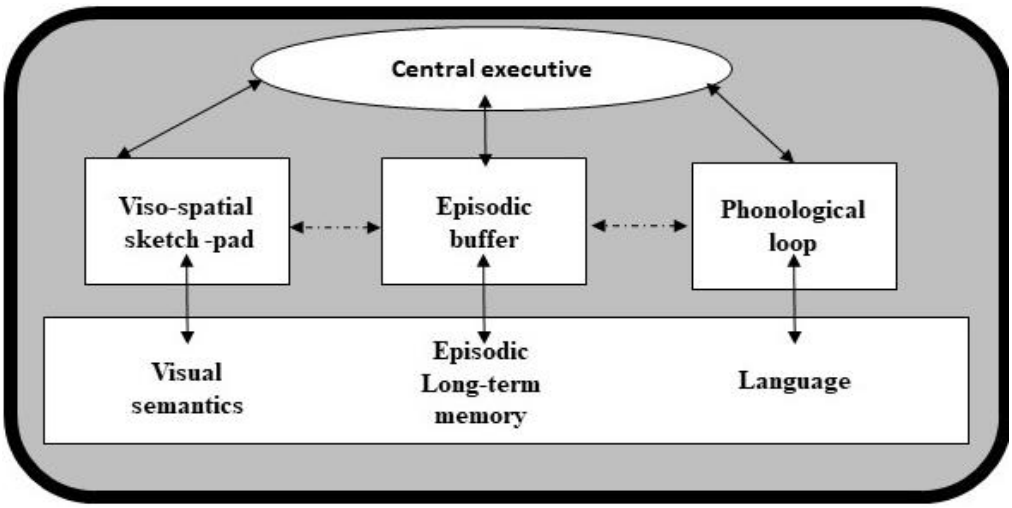

Figure 4. Second WM Model (adopted from Baddeley, 2000:421)

Conceptualized in this way, WM embraces what is called Supervisory Attentional System which is supposed to perform a variety of functions as controlling and determining attentional sources during cognitive processes engaged in higher level of cognition. For information to be held up strategies should be used to help encode it and retain it. In vocabulary memorization, rehearsal mechanism is allowed to transform spoken words into a phonological code, preventing them from decay. Written vocabulary is phonologically processed in memorization in the same store of spoken words not in a separate visual store as we imagine.

Michael T. Ullman's (2001) "Declarative / Procedural Model of Lexicon and Grammar"

In 2001, the American neuroscientist Michael T. Ulman put forward his Declarative Procedural (DP) model of language which highlights two "Memory" systems; the declarative and the procedural system which are part of LTM: Declarative Memory /Explicit Memory: is the counter part of procedural memory. It refers to the conscious and intentional recollection of factual information and previous experiences of concept. Explicit memory comprises things we can consciously tell that we know. Implicit memory alludes to information that we cannot consciously access although that explicit memory increasingly important to human as it has immediate effect on the behaviour. Through experiments, Haist Shimamura and Squire (1992) found that explicit memory is measured by a test of recall memory. There are three types of Explicit Memory: Semantic, episodic and special Memory was first introduced by Endel Tulving and Wayne Donaldson in 1972. It is part of LTM whose function is processing ideas and concepts rather than personal experience. It includes facts and common knowledge acquired like names of thing, colours, names of countries and similar basic facts accumulated through life time. Episodic Memory is specific events of personal memories. It is vivid, detailed, context specific and possibly motionless. It is about events in our life in the past such as the events of the last birthday parties or first day at school, etc. Spatial Memory refers to where things are boosts retrieval of objects' locations and places of the environment. It is a fundamental aspect of human's behavior and other animals. Searching for food, returning to locations of storage or safety, and avoiding danger places in a changing and complex environment which presents a daily challenge to many species (C.M. Bird, N. Burgess, 2009: 200–213).

Procedural or Implicit Memory is one of two main types of LTM. It is used unconsciously and can affect thoughts and behaviors. It helps people perform certain tasks without conscious awareness of these previous experiences i.e. skills and cognitive tasks we use to learn which become non conscious or automatic such as typing, riding a bicycle or videogame play.

There are three general types of implicit memory: Procedural memory, Classical conditioning effects and Priming. Procedural Memory alludes to our frequently unexplainable information on the best way things are done. like for example telling someone how to ride a bicycle; a person has to try to learn. Cohen and Bacdayan (1994:557) emphasizes that Procedural memory is linked to the idea of individual skill and habit. It refers to how things are achieved that is relatively automatic and inarticulate, and it encompasses both cognitive and motor activities. Classical Conditioning Effects: allows us to learn unconsciously without awareness or paying efforts in order to combine neutral stimuli. This stimulus is what we receive, like sounds and lights, mixed with another stimulus like food. They formulate a response which is naturally occurring like salivation or enjoyment. When an association occurs, the Memory is demonstrated, as the conditioned stimulus (sound) starts creating identical response like the unconditioned stimulus (food) did before the learning. Priming: is the final type of implicit memory see figure (5). Schacter (1987) defined it as an effect of implicit memory in which a subsequently influenced response of a stimulus comes from an exposure to another stimulus.

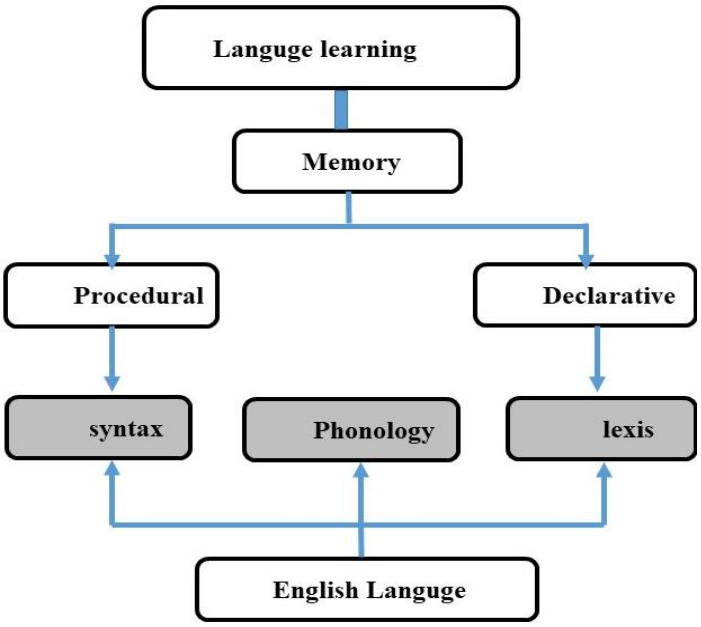

Figure 5. Ullmans' DP Model (2001)

Two functions are included in priming: the knowledge activation (e.g. the concept of "management" can be primed by addressing people with words of "instructions"); and to the influence of knowledge activation on people's behavior (e.g. people who received the priming of "management" concept may behave more committed to instructions). As for Declarative Memory, it is what we use to learn and use knowledge about facts and events such as the fact that Baghdad is the capital of or that you sent an e-mail to your dean yesterday. While procedural memory is what we use to learn those cognitive skills, which become non conscious or automatic such as typing, riding a bicycle or videogame play.

In this system, learning is about sequences and rules (syntax) and it needs extended practice but seems to result in more rapid and automatic process of skills and knowledge than learning in Declarative Memory (lexis) as demonstrated in figure (5) above).

Critical Review

The fact that memory can be divided into subcomponents is not something new; it was adopted since 1890 by William James the prominent American psychologist, then by the Canadian Donald Hebb in 1949. Evidences from experiments for the fractionation of human memory have mainly been developed over the period of the last 90 years.

In the 1950's, psychologists reached to a more general agreement on dividing memory into two distinct kinds: ST and LTM as Miller's theory proposed them with limited duration of STM. With the "Memory Decay Model" of Peterson and Peterson (1969) who agreed on these two distinctions of memory with the limit of capacity of STM. However, during the 1960s and early 1970s intense controversy resulted in a range of memory models when (1968) set out three stages of memory adding the sensory register which includes iconic, echoic and haptic memory. Baddeley and Hitch (1974) agreed on those subsystems of sensory register but they recognized the limitation and the "simplicity" of STM capacity and function postulating more sophisticated model of short-term or working memory which constitutes a set of complexes interacting subsystems (Visuo-Spatial Sketchpad, Central Executive and Articulatory-Phonological Loop and then by the end of the 1980s, the Episodic Buffer, as a subdivision between Short- and Long-Term Memory systems). As a complement of the previous two-component memory model of Atkinson and Shiffrin (1968).

Tulving (1972) conceptualized two separate systems of LTM: Episodic and Semantic memory. Whereas Ullman (2001) subdivides LTM into implicit and explicit memory which is in turn

divided into three divisions, namely (Episodic, Semantic memory Tulving (1972) and the 3rd type; the Spatial memory being different in the function and information processing.
Early 20th century has witnessed various schools in psychology (like the behaviorists and cognitivists) which aimed at developing learning theories. Each school made a development of different theories which worked on apparent perspectives regarding human mind.

Discussion

Memory has been tackled and classified differently through the history of psychological and cognitive studies of memory. Some scholars classified memory by types others by stages or by processes. From the of models above, it can be deduced that:

1. Each model above has characterized memory in terms of processing the data that a human brain receives in daily-base life and how it holds this data otherwise it will be lost. When considering them thoroughly, it can be noticed that they are interrelated and sometimes have exchangeable function. Figure (6) bellow demonstrates an eclectic presentation of these systems as seen by Atkinson and Shiffrin (1968) as stages, Craik and Lockhart (1972) as processes, Baddeley and Hitch (1974-2000) as types with the introduction of WM and finally by Michael T. Ullman (2001) as Declarative and Procedural Memory processes.
2. Even before Baddeley's introduction of the term WM, psychologists have postulated the existence of such dynamic part in spite of the difference in terminology. But it is only since the work of Baddeley (1974) that the study of memory has gained momentum. What we are concerned about in this study is the extent to which WM is concerned with processing information and what most psychologists agreed upon with regard to language processing and language learning.

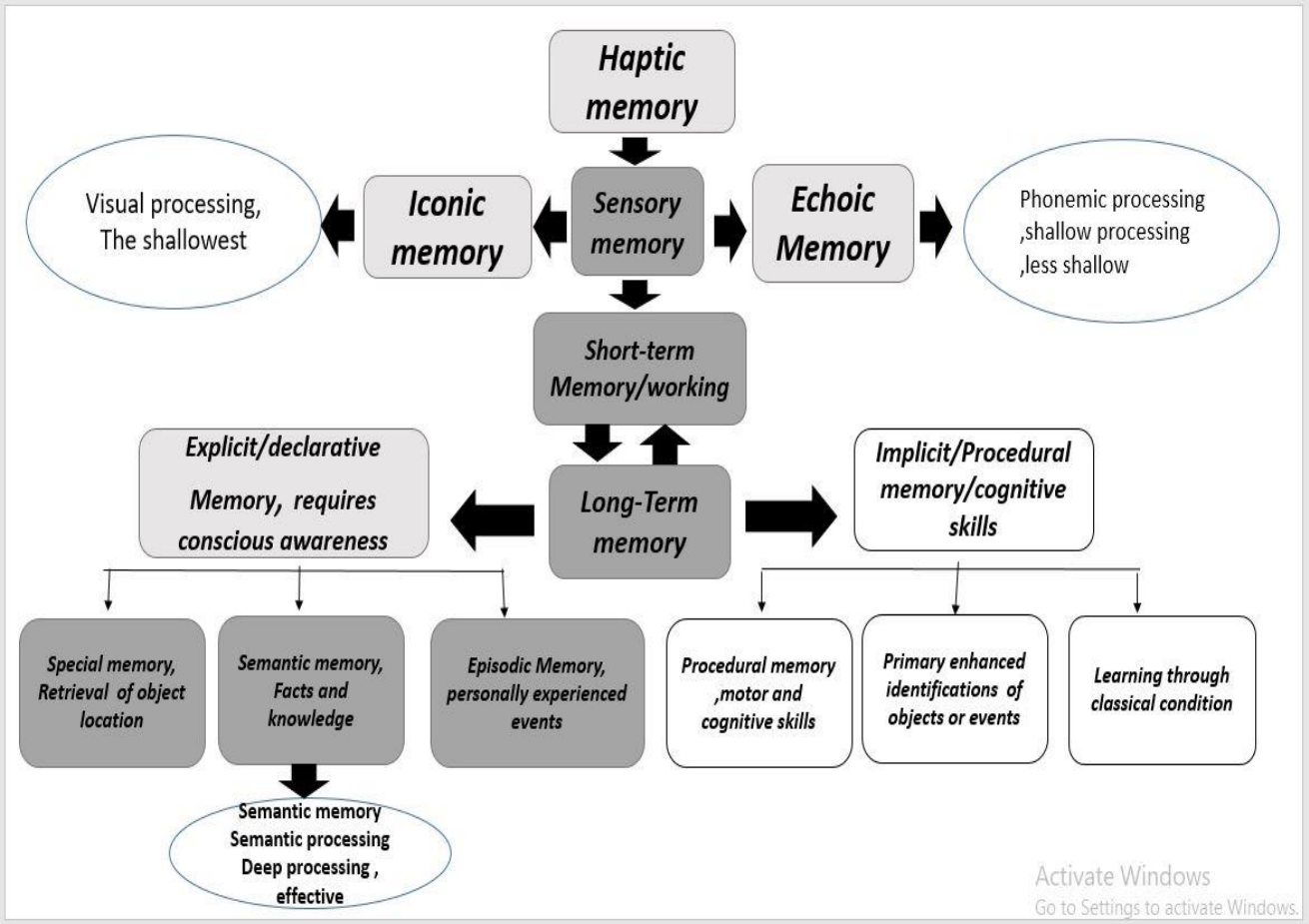

Figure 6. Memory types, stages and processes. An eclectic paradigm by the researcher

3. From information processing perspective, three main *stages* in the information comprehension and retrieval of memory can be detected. The first is encoding and combing of information received. The second, storage or creation of permanent record of the information encoded in STM or LTM. The third is the recollection or retrieval, calling back the information which is stored in response to some cue for use in activity or process like those used in learning and testing. Hence, memory is fundamental to adults but it is especially important to children and young in the educational setting.
4. Ullman's (2001) model seems to emphasize the function of the procedural memory which describes learning process.

Conclusion

In the light of has been reviewed, the main concern in this study is dealing with two different memory systems as far as learning is concerned; the STM and the LTM. It provides the reader with the perspectives of the psychological bases of how a human receives and processes information through main stages SM, STM and LTM of the magnificent structure "memory" from different perspectives. Language Learning is one of the most important activities accomplished by memory through implementing relevant learning strategies. Yet, it seems that human memory is highly intricate and complex. It needs more time and efforts to understand and learn how it works as well as it is essential to recognize its role in learning and how it can be utilized in language classrooms.

Therefore, the academic implication of this study is opening access to future researches in integrating more than one memory model for various academic purposes. Consequently, a generated model can be employed to serve the educational process, in specific, in terms of the need analysis of the targeted community or sample.

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