* ***Introduction***

 *Human learning is a complex activity, and memory is just one of many phenomena that demonstrate the brain’s complexity . The study of human memory stretches back at least 2,000 years to Aristotle’s early attempts to understand memory in his treatise “On the Soul”. In this, he compared the human mind to a blank slate and theorized that all humans are born free of any knowledge and are merely the sum of their experiences. In antiquity, it was generally assumed that there were two sorts of memory: the “natural memory” (the inborn one that everyone uses every day) and the “artificial memory” (trained through learning and practice of a variety of mnemonic techniques, resulting in feats of memory that are quite extraordinary or impossible to carry out using the natural memory alone). Although traditional studies of memory began in the realms of philosophy, the late nineteenth and early twentieth century put memory within the paradigms of cognitive psychology. In the recent decades, it has become one of the principal pillars of a new branch of science that represents a marriage between cognitive psychology and neuroscience, called cognitive neuroscience.*

* ***Definition of memory***

*Memory is the capacity for storing and retrieving information, but memories are not simply recorded and neatly stored. Our memories are selected, constructed, and edited not just by us but by the world around us.*

*There are three main stages of memory :*

***Encoding*** *(or registration): the process of receiving, processing and combining information. Encoding allows information from the outside world to reach our senses in the forms of chemical and physical stimuli.*

***Storage****: the creation of a permanent record of the encoded information.*

***Retrieval*** *(or recall, recognition): the calling back of stored information in response to some cue for use in a process or activity.*

* ***Types of memory***

*Human memory is not a unitary process. Research suggests, that, at the psychological level, various types of memory are at work in human beings. It also seems increasingly likely that these various systems bring different parts of the brain into play. Types of memory can be classified in a number of ways, depending on the criterion used.*

* ***Classification by duration***

*A basic and generally accepted classification of memory is based on the duration of memory retention, and identifies three distinct types of memory :*

1. ***Sensory memory****:*

*Sensory memory takes the information provided by the senses and retains it accurately but very briefly. Sensory memory lasts such a short time (from a few hundred milliseconds to one or two seconds) that it is often considered part of the process of perception. Nevertheless, it represents an essential step for storing information in short-term memory. Visual sensory memory is called iconic memory; auditory sensory memory is called echoic memory.*

1. ***Short-Term memory***

*Short-Term Memory temporarily records the succession of events in our lives. It may register a face that we see in the street, or a telephone number that we overhear someone giving out, but this information will quickly disappear forever unless we make a conscious effort to retain it. Short-term memory has a storage capacity of only about seven items and lasts only a few dozen seconds. Just as sensory memory is a necessary step for short-term memory, short-term memory is a necessary step toward the next stage of retention, long-term memory.*

1. ***Long-Term Memory***

*Long-Term Memory not only stores all the significant events that mark our lives, it lets us retain the meanings of words and the physical skills that we have learned. Its capacity seems unlimited, and it can last days, months, years, or even an entire lifetime! But it is far from infallible. It sometimes distorts the facts, and it tends to become less reliable as we age.*

* ***Classification by information type***

*It has been distinguished between* ***recognition*** *and* ***recall*** *memory which are completely different:*

1. ***Recognition memory*** *is concerned with whether an individual knows or has faced something before such as: a picture, a word, or a person.*
2. ***Recall memory*** *needs extracting or using information that people have seen before. For instance, they might be asked to produce actions they have learned and seen, or words that have been heard previously.*
3. ***Topographic memory:***

 *Memory for the ordering and unions of items within spatial environment.It involves the ability to recognize familiar places.Getting lost when traveling alone is an example of the failure of topographic memory.*

 ***4. Flashbulb memories:***

 *They are distinctly vivid, precise, concrete, long-lasting memories of personal circumstances surrounding a person’s discovery of shocking events.*

*People remember with almost perceptual clarity details of the context in which they first heard the news or the words as; what they were doing, with whom, where…etc.The flashbulb memories forgetting curve is far less affected by time.they are stored on one occasion and retained for a lifetime.These memories associated with important historical or autobiographical events.For example: the Algerian independence, the assassination of John Kennedy and Martin Luther King…*

*They are characterized by the emotional arousal at the moment that the event was registered to the memory.It is the emotions elicited by flashbulb memory event that increase the ability to recall the details of the event.One reason that flashbulb memories are remembered is because they tend to be retold over and over again.*

*Long-term memory can be divided into* ***declarative (explicit)*** *and* ***procedural (implicit)*** *memories.*

1. ***Declarative memory***

*It requires conscious recall, in that some conscious process must call back the information. It is sometimes called explicit memory, since it consists of information that is explicitly stored and retrieved.*

*Declarative memory can be further sub-divided into* ***semantic memory****, which concerns facts taken independent of context; and* ***episodic memory****, which concerns information specific to a particular context, such as a time and place.*

***Semantic memory*** *allows the encoding of abstract knowledge about the world, information of factual nature,i.e,facts independent of a context “common knowledge”.For example;recalling how to use a phone, understanding the difference between a cat and a dog, meanings of several words…etc.Thus,it involves the conscious recollection of memories like events, facts, figures, and locations.*

***Episodic memory****, on the other hand, is used for more personal memories, such as the sensations, emotions, and personal associations of a particular place or time.* ***Autobiographical memory*** *- memory for particular events within one's own life - is generally viewed as either equivalent to, or a subset of, episodic memory.* ***Visual memory*** *is part of memory preserving some characteristics of our senses pertaining to visual experience. We are able to place in memory information that resembles objects, places, animals or people in sort of a mental image.*

1. ***Procedural memory (or implicit memory)***

*Procedural memory is not based on the conscious recall of information, but on implicit learning. Procedural memory is primarily employed in learning motor skills and should be considered a subset of implicit memory. It is revealed when we do better in a given task due only to repetition - no new explicit memories have been formed, but we are unconsciously accessing aspects of those previous experiences.*

***Classification by temporal direction***

*A further major way to distinguish different memory functions is whether the content to be remembered is in the past,* ***retrospective memory****, or whether the content is to be remembered in the future,* ***prospective memory****.*

1. ***Retrospective memory***

*Retrospective memory as a category includes* ***semantic*** *memory and* ***episodic/ autobiographical*** *memory. In contrast,* ***prospective*** *memory is memory for future intentions, or remembering to remember (Winograd, 1988).*

1. ***Prospective memory***

*Prospective memory can be further broken down into* ***event-*** *and* ***time-based prospective*** *remembering. Time-based prospective memories are triggered by a time-cue, such as going to the doctor (action) at 4pm (cue). Event-based prospective memories are intentions triggered by cues, such as remembering to post a letter (action) after seeing a mailbox (cue). Cues do not need to be related to the action (as the mailbox example is), and lists, sticky-notes, knotted hankerchiefs, or string around the finger (see box) are all examples of cues that are produced by people as a strategy to enhance prospective memory.*

* ***Techniques of memorizations***
1. ***The peg system***

*The Peg memory systems are ideal for remembering information that must be recalled in a particular order. They work by associating information you already know well (the numbers 1 through 20, and the letters A through Z) with the new facts you want to remember.*

*A "peg" is just a mental hook on which you hang the information. This hook acts as a reminder to help you mentally retrieve information. Let's look at the number from 1 to 10 first. If you could associate a piece of information with the number "5", then simply thinking of "5" would give you back that fact.*

***types of the peg systems****:*

* ***Number-Rhyme Pegs***

*1. One-Sun 2. Two-Shoe 3. Three-Tree 4. Four-Door 5. Five-Hive 6. Six-Sticks 7. Seven-Heaven 8. Eight-Gate 9. Nine-Vine 10. Ten-Hen*

* ***Number-Shape Pegs***

*1 ( Pencil form) 2 (Swan form) 3 ( heart top form) …………*

* ***Alphabet Pegs ( sounds alike )***

* A – Hay  B – Bee  C – See  D – Deed  E – Eve …………..*

* ***Concrete Alphas***

* A – Ape  B – Boy  C – Cat  D – Dog  E – Egg ……………*

 ***Example :*** *Let’s say that you were asked to memorize a list of retronyms you have studied in pragmatics :*

*Oven (conventional ; microwave)*

*War (conventional ; nuclear)*

*Typewriter (manual ; electric)*

*Soap ( bar ; liquid ; gel )*

*Television ( HD ; 3D ..)*

*Conference ( face-to-face ; video ..)*

*Chocolate (bar ; hot )*

*Parents ( adaptive ; biological)*

*You decide to use the Number-Rhyme Peg Method to remember these words*

*1- Begin by associating the first word (oven) with the first rhyming peg word (sun). For example, picture clearly in your mind a small, baked sun coming out from the oven .*

*2- Associate the second word (war) with the second rhyming peg word (shoe). For example, imagine a shoe war ,where people are fighting using their shoes.*

*3- Associate the third word (typewriter) with the third rhyming word (tree). For example, imagine a giant tree typwriting her story .*

*Now you try. Think of associations for the rest of words, Soap\_door ,Television\_hive , Conference\_sticks, Chocolate\_heaven , Parents\_Gate . Once you have your list of associations, then review them quickly after 1 minute, 5 minutes. This will really help lock the images and the list of items in your mind.If you really worked through this example, you be a bit amazed at how well you can recall this list of eight items. Try this now: ask yourself, what is item #7? What is item #2? What is item #5? You should be able to instantly remember and say the word.*

1. ***Phonetic Number System***

*The Phonetic Number system is a substitute alphabet for changing numbers to letters. The reason this helps in remembering numbers is due to the effectiveness of "chunking" and memory.*

*For example, if I asked you to memorize the phrase, "Four score and seven years ago", you could easily do it. You could repeat it back perfectly every time - even though that phrase consists of 30 letters and spaces in a very specific order. Now try memorizing the 30-digit number "8567 13543 887 54365 23678 369". Pretty impossible, right?*

*So an incredibly powerful trick for remembering numbers would be finding a way to convert the numbers to letters. Then you could take the random 30-digit number and turn it into a series of words or phrases. This is exactly how the Phonetic Number system works.*

***Number to Letter Conversion***

*Here is the conversion table. To be able to use the Phonetic Number system for remembering numbers, you must first memorize this table (sorry). It's actually not as hard as it looks.*

|  |  |  |
| --- | --- | --- |
| *1 = is the "t" or "d" sound* | *5 = is the "l" sound* | *9 = is the "p" or "b" sound* |
| *2 = is the "n" sound* | *6 = is the "j", "ch", or "sh" sound* |  *0 = is the "z" or "s" sound* |
| *3 = is the "m" sound* | *7 = is the "k" or hard "g" sound* |  |
| *4 = is the "r" sound* | *8 = is the "f" or "v" sound* |  |

*remember this nonsense phrase: TeN MoRe LoGiC FiBS. This will help you to memorize the*

*sounds in order from one to zero.*

*One more point. Notice that all of the letter equivalents are consonants. Vowels are not assigned to a number in this method. Nor are the consonants "w", "h", or "y" (w-h-y). This is a good thing, because it means you can use the vowels and the three unused consonants in your word equivalents however you like.*

***Example :***

*Let’s say that you have encountered this date (14/03/1879) as the natal day of the famous Albert Einstein .Now, for memorizing this date you just need to convert its digits to the associated letters you have learned ; TiReSoMe (14/03) TouGH GaP(1879). Then you would take your silly phrase and quickly think of a visual association to remember it by. For instance, you might think of Einstein in a tiresome situation where he is trying toughly to fill in a gap .*

1. ***The key word method***

*The Keyword Method is an effective system for remembering definitions, learning foreign language vocabulary, and more. The way you use the Keyword Method is by combining the creation of substitute words with visualization (a two-step process): First, convert the sound of the word into one or more concepts that can be visualized. Then, associate those concepts with an image representing the actual meaning of the word.*

***Example 1***

 *- Aglet. An "aglet" is the plastic piece at the end of a shoestring.*

*So what's an easy way to remember this strange word? Create a memorable, crazy mental image that reminds you of the sound of the word. For instance :The eggman is pulling on the end of your shoelace. As he does this, he lights up. This picture is strange and impossible, of course. That is what makes it stick in your memory!*

***Example 3***

 *- Transient. When used as an adjective, transient describes something that exists for a short period of time then is gone. Transient is pronounced "tran see ent".*

*Here's an example of "transient" used in a sentence:*

*Joe experienced transient relief when the plate he dropped didn't break on impact. On closer inspection, however, he realized the edge of the plate had chipped."*

*The word transient sounds very much like "train sees ant ;A train engine zooms quickly toward an ant crossing the train's path. The train (having eyes) sees the ant but cannot stop. The ant may not realize it, but he's about to get squashed. Thus, from the train's perspective, the ant is short-lived, a transient obstacle.*

1. ***Mnemonics***

*A mnemonic device is any learning technique that aids information retention. Mnemonics aim to translate information into a form that the brain can retain better than its original form.*

***Examples***

* *Knuckle mnemonic for the number of days in each month of the Gregorian Calendar. Each knuckle represents a 31-day month.*
* *To memorise the colours of the*[*rainbow*](http://en.wikipedia.org/wiki/Rainbow)*: the phrase "*[*Richard Of York*](http://en.wikipedia.org/wiki/Richard_III_of_England)*Gave Battle In Vain" - each of the initial letters matches the colours of the rainbow in order (Red, Orange, Yellow, Green, Blue, Indigo, Violet). Other examples are the phrase "Run over your granny because it's violent" or the imaginary name "Roy G. Biv"*
* *To memorise the North American*[*Great Lakes*](http://en.wikipedia.org/wiki/Great_Lakes)*: the acronym HOMES - matching the letters of the five lakes (Huron, Ontario, Michigan, Erie, and Superior)*[*[10]*](http://en.wikipedia.org/wiki/Mnemonic#cite_note-10)
* *To memorise the names of the planets, use the*[*planetary mnemonic*](http://en.wikipedia.org/wiki/Planetary_mnemonic)*: "My Very Eager Mother Just Served Us Nothing" - where each of the initial letters matches the name of the planets in our solar system (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune).*[*[13]*](http://en.wikipedia.org/wiki/Mnemonic#cite_note-13)
* *Bloom's Taxonomy: Keep calm at all sporting events: (Knowledge, Comprehension, Application, Analysis, Synthesis, Evaluation).*
* *The first eight U.S. presidents: Will a jolly man make a jolly visitor? (George****W****ashington, John****A****dams, Thomas****J****efferson, James****M****adison, James****M****onroe, John Quincy****A****dams, Andrew****J****ackson, Martin****V****an Buren)*
* *Adjective order in English: OSASCOMP (Opinion, Size, Age, Shape, Color, Origin, Material, Purpose).*
* *Sequence of letters :*

 ***I****before****E****, except after****C***

 *Or when sounded "****A****" as in n****ei****ghbor, w****ei****gh and w****ei****ght*

 *Or when sounded like "****eye****" as in h****ei****ght*

 *And "w****ei****rd" is just****weird***

* *When two vowels go walking the first does the talking : For words like "****oa****t" or "****ea****t", here the second letter a is silent and first letter o and e respectively are pronounced in the examples.*
1. ***The memory palace (the method of loci)***

*To use the method of loci, you associate items you wish to remember later with locations of a familiar room, building, or street. Then, to retrieve the information, you mentally "stroll down memory lane" and visualize the same locations. If the method works, the information you stored in various locations will come back with the memory of the location. To be effective, one must usually visualize an object "doing something" or interacting in some way with the objects at a particular location.*

***Example :***

*The following is a list of words that are nouns and verbs at the same time ; suppose that you are about to memorize them in the order below. All what you have to do is to create an imaginary edifice or palace where you place them in association whith what you believe will make you recall them easily.*

*The list :* ***dress ; milk ; swim ; bread ; fly ; flower ; smoke ; dance ; balloon ; emailing ;***

 *Imagine that you are about to get in the university from the large entrance where a bunch of agents are standing and each one of them is wearing a balley* ***dress*** *(visualize colors and shapes and the length as well ) as you walk along heading toward your department you notice the fountain from wich a jet of* ***milk*** *is produced and students are* ***swimming*** *as if it was a milk pool, you ignore them and you imagine yourself entering the English Departement Door that is made up of* ***bread****. Once you enter you meet the old guy responsible for keeping students disciplined, who starts* ***flying*** *around with two flower-shaped wings (imagine the colors). You walk the stairs to find Mr Haroun Melguani wearing a rockstar clothes and* ***smoking*** *cigarettes (sorry). You carry on walking up till you reach the room 19 where most of our classes are held just to find that Mr Taibi is on the desk,* ***dancing*** *along his favorite song ‘i believe i can fly’,on the other side his Mr Chaira is bouncing on a huge* ***balloon*** *up and down ,while sending you and* ***email*** *‘’ my IQ is the lowest ‘’.*

*Try to really engage your mind with the details of what you are visualizing, this is an effective way to get the information fixed in your mind. Try to recall the words now, i bet you can do that easily.*

* ***Models of memory//***

 *Many researchers proposed different models of memory which provide abstract representations of how memory is believed to work, especially in second language acquisition.*

***1-***[***Atkinson–Shiffrin memory model//***](http://en.wikipedia.org/wiki/Atkinson%E2%80%93Shiffrin_memory_model) *In 1968,* [*Atkinson–Shiffrin proposed a model*](http://en.wikipedia.org/wiki/Atkinson%E2%80%93Shiffrin_memory_model) *of memory, which is known as the multi-store model. The model shows all the memory stores as being a single unit whereas research into this shows differently. It is believed that the short-term memory can be broken up into different units such as visual information and acoustic information, and the long-term memory is made up of multiple subcomponents, such as* [*procedural memory*](http://en.wikipedia.org/wiki/Procedural_memory)*. This model has been criticized for being too simplistic.*

***2-Working memory model//*** *In 1974, Baddely and Hitch suggested a tripartite model of working memory derived from research they did on the role of the short-term/long-term memory. Then, they developed this model of working memory on the basis of deeper research. This theory proposes a central executive which has two "slave systems" responsible for short-term maintenance of information. The "central executive" is responsible for the supervision of information integration and for coordinating the slave systems. These systems are phonological loop that stores phonological information and the visuo-spatial scratchpad that stores visual and spatial information. In the year 2000, Baddeley extended the model by adding another component, the episodic buffur, which holds representations that integrate phonological, visual, and spatial information, and possibly information not covered by the slave systems (e.g., semantic information, musical information). The central executive has a particular interest in* ***the field of second language acquisition.*** *It is described as being an attentional control system which is linked to long-term memory. The phonological loop is capable of holding and manipulating language-based, as opposed to visuo-spatial (the visuo-spatial sketchpad), information. Baddeley and others (Daneman, 1991; Daneman & Carpe-nter, 1980; Daneman & Green, 1986; Gathercole, Willis, Emslie & Baddeley, 1992; Service, 1992) have not only found that the phonological loop is important to speech production, and reading and listening comprehension, but they have also demonstrated that it plays a substantial role in the acquisition of language.*

***Working Memory//Definition:*** *The term ‘working memory’ refers to the ability to hold and manipulate information in the mind for a short period of time. In other words, it refers to the mental processes responsible for the temporary storage and manipulation of information in the course of on-going processing.*

***Features****: working memory is useful, flexible, and fragile system. Its capacities are limited.*

 ***Working Memory in Second Language Acquisition and Processing****//*

***3- Model of second language acquisition (VanPatten and Cadierno, 1993)***

 *VanPatten and Cadierno (1993) and VanPatten (1996) portray the role of processing from input to output in the following schematic model.*

***I                 II                              III***

***input -------->  intake ----------> developing system ----------> output***

 *According to this model, at each stage (I, II, and III) in the process, the learner engages in linguistic processing that is mitigated by the limited capacity of the learner's L2 Working Memory. At all three stages, there is* ***a competition*** *between* ***meaning*** *and* ***form****. Thus, the facility with which new information can be integrated into the developing system is governed by the learner's ability to deal with the processing demands at the time the new information is encountered (VanPatten, 1996). The appeal of VanPatten and Cadierno's (1993) model is that it suggests that the competition of resources plays a central role in the integration of input into the developing interlanguage. Additionlly, it contributes to the dimension of the Multidimensional Model that accounts for developmental sequences in learning by suggesting that the capacity of working memory at a given time restricts the ability to acquire a linguistic form new to the interlanguage system. However, this model was criticized because it views working memory as a unified system that must devote limited resources to both meaning and a variety of forms. And it claims that there is a competition between* ***meaning*** *and* ***form****, but it does not explain how this competition happens.*

 *According to Baddeley (1992), the term "process language" means that the new language items if addressed attention activates working memory to make connections and associations to prior knowledge. If understood the new items are provisionally stored in the short-term memory until that piece of language is useful for a meaningful context, and then it is stored in a long-term-memory. That is why it is important to give enough time for students to process it. This does not mean that students will be in silent just processing it, but it means that students will listen, repeat, write, read, speak and interact with the new items. For Butters and Cermak, it is important for language teachers to recognize what kind of memory students will be using depending on the learning activity; (episodic, semantic or informational memory). A student may recall things on the wall, or color of clothes, smells, sounds without having paid conscious attention to any of these things or had the intention to remember any of them. In order to have long-term learning, students should be exposed to different facets of memory recollection. How can teachers work that? When teachers create a setting to make students imagine a real and meaningful situation where they will be using language for getting a new information among themselves, their memory will store the event, whenever that event is recalled, the students will be using their episodic memory. Whenever language is used to explain meaning, students will be using semantic memory. When students talk about the language itself (structure, spelling, and rules), about the meanings or values of specific texts or contexts, when they connect concrete to abstract things, they will be using semantic memory. Informational memory does not necessarily require consciousness. The mind stores information from what the body perceives. Sometimes a certain smell will remind a certain event and people do not even realize why they are recalling that, because they do not have a conscious connection to it. Informational memory is used to store quantities of knowledge in order to answer questions on test or to show teachers that they have learned. In class, most time teachers work with informational memory, then semantic memory but few times with episodic because they forget to expose students to experience the new knowledge. Subsequently, Skehan (1998), in his own model, retained an important role for memory, and stated that memory, although traditionally associated with the acquisition of new information, is also concerned with retrieval, and with the way elements are stored. Fast-access memory systems are what allow output to be orchestrated into fluent performance. It is not enough to know a lot of words, obviously. You have to be able to retrieve them, and at speed. Skehan also reviewed some case studies of exceptional language learners, and concluded that to be exceptionally good at second/foreign language learning seems to require possession of unusual memory abilities, particularly the retention of verbal material. Exceptional L2 ability does not seem to rest upon unusual talent with a rule-based aspects of the language, but rather on a capacity to absorb very large quantities of verbal material, in such a way that they become available for actual language use. If memorizing large quantities of ‘verbal material’ is a characteristic of exceptional learners, can less exceptional learners be trained to get similar results?*

***4)******Skehan's model*** *which describes* ***the complexity of working memory and long-term memory****, sheds some light on the connection between working memory and long-term memory and also suggests that working memory must be able to engage in a number of different tasks (Skehan, 1998). It attempts to address the external competition by employing Schmidt's (1994) noticing, but noticing alone will not guarantee that an utterance will become intake available for processing in working memory. Prior to being ready to actually process a form, a learner may notice the form in the input and yet not have a sufficiently well-developed system to maintain the form in working memory. In other words, it is quite possible that a noticed item might decay before it is actively processed in working memory.*

***S****o, previous studies indicated how memory processing tends to involve the way L2 learners assimilate, restore and retrieve information. This in turn requires educators and language teachers to consider the best ways to present information and how to increase the possibility that meaningful links are made to enable later retrieval of information. These procedures can be taken into consideration in L2 general classroom teaching and management.*