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Investigating Different Memory Pathways L2 Learners use: A Practical Application to the Brain Compatible Learning

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Abstract. Memory is not a single entity. It is a gift of Mother Nature, the ability of living organisms to retain and to utilize acquired knowledge. Memory is precisely related to learning, in that memory in biological systems entails learning and that learning implies retention of such information. Memory can be divided into multifaceted systems. The renaissance of encephalon compatible learning applies the new brain research to teaching and learning. This revolution will change school start times and discipline, continuous assessment, teaching strategies, budget priorities, classroom ambience, use of hi-tech, and even the way we think of physical education. But before considering the practical applications of this research, it is necessary to have a useful model for deciphering it. This study investigates the memory pathways that a group of EFL learners in Iran were inclined to use, the factors affecting this, and conscious recollection/retrieval in learning second language. The researcher studied the individuals' memory/learning readiness before going to school, investigated their memory self-efficacy, and determined which memory pathway(s) was/were preferred by L2 learners. The researcher gathered data using three instruments, researcher made Self-report Measure of Memory (SRMM), Bandura's Memory Self-Efficacy Questionnaire (MSEQ) followed by the researcher-made Self-report Memory/learning Readiness Interview (SMRI). Both descriptive statistics (mean scores, variances, standard deviations, and frequencies) and inferential statistics were run on the data. The results of the first instrument (SRMM), the interview (SMRI), and MSEQ were in agreement with theories, experiments, and hypotheses mentioned.

Keywords: Memory pathways, encephalon compatible learning, declarative memory, non-declarative memory, semantic memory, episodic memory, priming

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1. Introduction

The intricate topic on memory has engaged linguists, psychologists, and neuroscientists for as long as they have been interested in the relationship among brain, mind, behavior, and language. Among the vast literature on memories, the theoretical aspects of applied linguistics, focusing on LLSs and declarative, procedural memory, and working memory, will be reviewed followed by theoretical and empirical aspects of memory pathways put forward by neuropsychologists and neuroscientists who amass considerable evidence for the hypothesis that hippocampal, temporal, cortical, and cerebellar regions contribute to memory. Later on, encephalic-minded discipline works out a compromise agreement reviewed from each camp.

1.1 Linguists' explanations on memories

L2 acquisition besides learning strategies is described to be a complex cognitive skill within cognitive-theoretical framework. Linguists who belong to processing school of thought claim that LLSs begin with declarative knowledge, that can be proceduralized with rehearsal and proceed through the cognitive, associative and autonomous stages. Declarative knowledge that consists of consciously known facts requires processing in short-term memory (STM) to be stored in long-term memory (LTM). The propositions in LTM are organized and differentiated from schemata which present a set of statements, rules, or facts. At the very moment, the strategy which is being applied could be scrutinized through any form of data collection by interrupting ongoing mental processes. Rabinowitz and Chi (1987) stated whether or not automatic use of learning techniques qualifies as being strategic; similar mental processes are being used when the strategy is still of declarative knowledge. Ericsson and Simon (1987) discovered that strategies that have become proceduralized may be operating automatically through connections in LTM and the process does not enter STM and it may be inaccessible for introspective report.

Cognitivists fall into two main groups. The first one, entitled "Processing approaches", investigates the work of psycholinguists who have analyzed the L2 acquisition of "procedural skills" from a range of perspectives. The second school investigates approaches that study the acquisition of language from emergentists' point of view. In this school, the second language is acquired through usage, by extracting pattern and regularities from the input, and building ever-stronger association in the brain (Mitchell & Myles, 2004). McLaughlin (1990) believes that learning involves a shift from controlled towards automatic processing. Learners first resort to "controlled processing" in the second language. This controlled processing involves the temporary activation of a selection of information nodes in the memory, in a new configuration. Such processing requires a lot of attentional control on the part of subject, and is constrained by the limitations of the STM. McLaughlin (1990) believes that words have to be put together in a piecemeal fashion, one at a time and they have not been memorized as an unanalyzed chunk. Through repeated activation, sequences first produced by controlled processing become automatic. Automatized sequences are stored as units in the LTM, which means that they can be made available very rapidly whenever the situation requires it. Another processing model from cognitive psychology is Anderson's (1985) ACT model. This model is not dissimilar from McLaughlin's. It is more widespread, and the terminology is different, but practice leading to automatization also plays a central role. It enables declarative memory to become procedural knowledge. One of the major discrepancies is that Anderson claims that there are three types of memory: a working memory, similar to McLaughlin's STM and therefore tightly capacity-limited, and two kinds of LTM-a declarative long-term memory and a procedural long-term memory. Anderson (1985) believes that declarative and procedural knowledge are different kinds of knowledge that are stored differently. According to Anderson, the move from declarative to procedural memory takes place in three stages: the cognitive stage, the associative stage, and the autonomous stage. It was the ACT model that has been applied to the field of language learning strategies (LLSs) by researchers such as O'Malley and Chamot (1990). On the other hand, connectionism likens the brain to a computer that would consist of neural networks complex clusters of links between information (Mitchell & Myles, 2004).

O'Malley and Chamot's remedy (1990) to procure the existing strategy was to administer two portions of task; while the person is processing the less demanding portion automatically, the conscious mind will set free to use learning strategies for more demanding portion and the latter becomes available for introspective analysis. They had a hard evidence of dictation to keep tabs on learning strategies because of its deliberate processing. In terms of memory before the advent of executive control in lower stages of genetic epistemology, heuristic process casts the footings of declarative knowledge and requires processing in STM, the theory has raised but not resolved to the bottom; whether the processed knowledge is stored separately in two languages or as a single system. Also the diffuse boundaries between cognitive strategy and metacognitive strategy have been a contentious issue among analysts. Furthermore, the correspondence between mental process and stages in acquiring a complex cognitive skill, strategic rules and communicative competence is still tenable. Declarative memory is often easy to form and is easily forgotten, whereas procedural memories tend to require repetition and practice from time to time but less likely to be forgotten. As for planning, monitoring and checking the outcome of learning, O'Malley and Chamot (1990) and Brown (1994) found indication of metacognitive knowledge under the name "problem identification". It was experienced that direct attention to the task while it was ongoing became somehow obscure to elucidate the boundary between using executive thinking skill and using it as an integral aspect of task performance. Also, selective attention to overall aspect rather than executive function was conveyed. O'Malley and Chamot (1990) believe that declarative information is used in language comprehension and production. He also pointed out that strategic processing as well as production system is affiliated to the SLA. Rumellhart and Norman (1978) postulated that memory system has no reference to procedural knowledge; much might not be gained in precision by a number of other investigators. Declarative memories can be accessed for conscious recollection; however, the procedures we learn can be performed without conscious recollection.

1.2 Neuropsychologists' explanations on memories

It is typical of us to be good at one type of recall, like faces and places, but not others, like addresses and dates. Students who are thought of as "lazy learners" may indeed recall only what they can. Retrieval is specific. The success of that retrieval is highly dependent upon state, time, and context. Facing different contexts we usually ask ourselves "which kind of memory can be retrieved and how it can be retrieved" (Jensen, 1998).

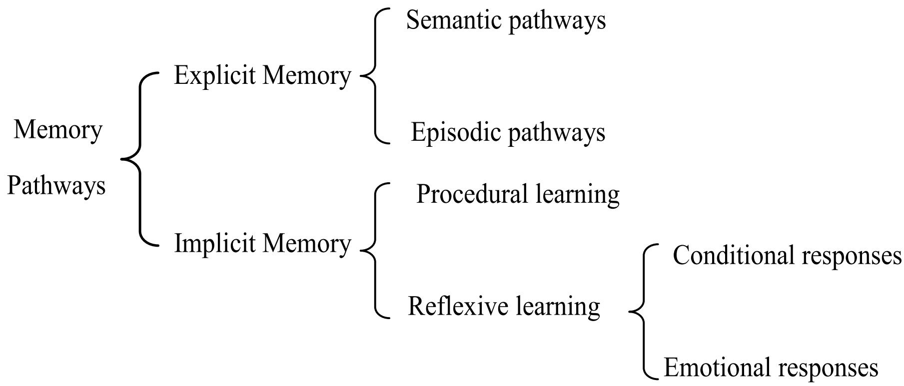

Figure1: Model of Memory Pathways, adopted from Jensen (1998)

By using the right system, in the right way, students can consistently experience better recall of their learning. "Explicit Memory" Includes both "STM" (5-20 seconds) and "working memory" (seven +/- chunks). It comes in several forms including the more word-based semantic memory and the event-type episodic memory. "Semantic memory" is an explicit memory as well as factual or linguistic memory. It's a part of declarative memory and includes the names, facts, figures, and textbook information. In fact, only explicit memory pathways have a STM or a working memory. Jensen (1998) states that "semantic memory" requires the use of language which triggers through association. This may be a relatively new need; humans have had little use for semantic recall until recent history when books, schools, literacy, and social mobility became common. It is the weakest of our retrieval systems. The storage of semantic memories seems to be distributed throughout the cerebrum. It is not that we are incapable of retrieving. The brain is not well-equipped to routinely retrieve this type of information. It requires the use of language triggers through association. Jensen (1998) continues that semantic learning will be inaccessible if the original learning is trivial, too complex, and too "contaminated" with other learning. It may also lack relevance or sufficient sensory stimulation.

"Working memory", a general term for multiple temporary storage area, allows several types of information to be held at the same time. This implies that there may be multiple sides in the brain where temporary storage occurs, rather than a single short memory. It means that we cannot be aware of the entire information repository simultaneously. Within working memory, representations can be consciously manipulated, contrasted, clustered, and re-assembled (Kaplan & Sadock, 2007). Therefore, consciousness may be related to this aspect of mental functioning. Working memory span constraints are: (1) controlled attention, (2) task switching ability, and (3) inhibition of irrelevant information (Marton et al., 2007). It seems that man has a constricted ability transacting executive functions and processing with its all concomitants. Cognitive information including filtering mechanism and working memory decides on sensory information whether to achieve their goals or to hamper the irrelevant information. Marton et al. (2007) postulate that children with specific language impairment (SLI) have significant constraints on information processing involve limitation in general cognitive capacity and in working memory, particularly in executive functions. Working memory functions well when one has greater ability to control attention, block irrelevant information, and avoid distraction. When one is to achieve his/her goals and hold it in active memory to be monitored and fully achieved he/she uses executive functions. Sustaining one's goal among myriad of distractions, attentional capacity of working memory is responsible for any executive functions (Marton et al., 2007). Marton et al. (2007) observed where processing and storage are simultaneously required children with specific language impairment (SLI) show a poor performance on working memory tasks comparing their normal age group. Their performance indicated processing deficiency in syntax and sentence length (Montgomery, 2000). Marton continues that their accuracy in the complex sentence, information storage, and word length are deteriorated. Children with SLI reveal a larger effect of deficiency in the syntactic complexity than sentence length which is examined in the listening span task (ML). The listening task is composed of sentences with syntax complexity of heterogeneous length to check their concurrent processing performance. The children with SLI cannot process simultaneously the exact words in the context and the semantic and syntactic information of the sentences. Among adults with SLI, increased complexity results in decreased accuracy; therefore, she concludes that the processing of complex sentences requires working memory capacity.

LTD (long-term depression) is considered to hold one of the poles of memory-procedural memories; furthermore, LTP (long-term potentiation) is presumed to entail declarative memories. To Squire and Zola-Morgan (1991), declarative memory entails conscious recollection of facts and events. Declarative memories are available to conscious recollection. Non-declarative memory relates to a collection of abilities wherein performance changes due to experience but without affording access to conscious memory of the original experience. Non-associative learning includes habituation and sensitization. To Bear, Connors, and Paradisco, (2007), procedural learning is divided into two facets of learning; (1) non-associative learning and (2) associative learning.

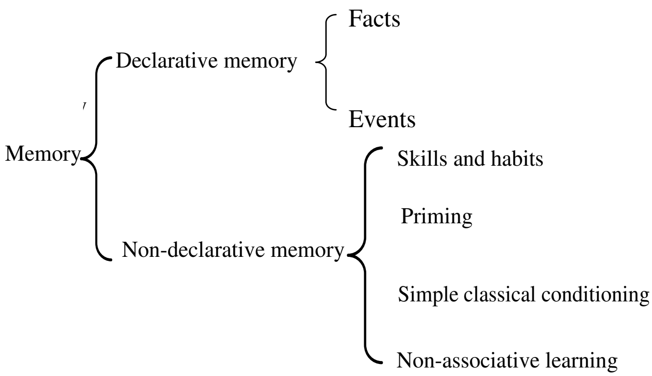

Figure 2: Memory systems (Adapted from Squire and Zola-Morgan, 1991)

To Squire (1992) and Schacter (1996), "declarative or explicit memory" resides in hippocampus in medial temporal lobes. It is the memory we can describe, elucidate, and write about. The written exam, essay or any exam-type recall used in schools and colleges are one of the types. "Semantic memory" or "linguistic memory" is a factual, explicit entity as a part of declarative memory includes: names, figures, fact, and any informative texts and contexts that challenge the brain. Declarative or explicit memory entails STM and working memory (Jensen, 1998). Biologically "episodic and semantic memory" that reside in hippocampus are distinguished by their organizations. They are constituents of declarative memory. Episodic memory acts as our record of unique personal experiences. It is the capacity to mentally call back the momentum and besides it re-experiences a particular incident. Semantic memory as our general world knowledge involves in time-independent factual information and is organized by logical and abstract dimensions. Hence, episodic memory is organized along temporal dimensions and the contents of it involve autobiographical information (Tulving, 2002). Therefore, declarative memory is to collect and bring memories up to conscious experience and manipulation. Declarative memory is featured by its excellent expression which is in turn flexible in that the contents of it are the repository of various behaviors. The integration of declarative realistic properties in hippocampal circuitry with one another has been under study since it is difficult to probe how they share the same organization footings. Eichenbaum concludes that it is not perceptible what biologically realistic mechanisms can clarify high level cognitive properties such as (1) mental time travel, (2) flexible expression, and (3) conscious recollection (as cited in Gazzaniga, 2004).

When we identify and detect a kind of stimulus based on recent experience with the same stimulus we facilitate learning by the use of priming. This form of memory, termed perceptual priming, is a kind of memory that is independent of the medial temporal loci which is damaged in amnesia. Paller and Squire state that "non-declarative memory" entails skill learning, habit learning, conditioning, and the phenomenon of "priming". The cerebellum is essential for conditioning of skeletal musculature, the amygdala for emotional learning, and the neocortex for priming. "Priming" and "declarative memory" are coupled in brain potentiality (as cited in Kaplan & Sadock, 2007).

Procedural memory is known as motor memory, body learning, or habit memory. It is expressed by student responses, actions, or behaviors. It's activated by physical movements, sports, games, theater, and role play (Jensen, 1998). Even if you have not ridden a bike for years, you can usually do it again without practice. Procedural memory appears to have unlimited storage, requires minimal review, and needs little intrinsic motivation. Memories of learned skills involve both the basal ganglia (located near the middle of the brain) and the cerebellum. In fact, the best examples of physical evidence found so far for any memory in the brain are those from skill memory. This evidence is located in the cerebellum (Thompson, 1993). To the brain, the body is not a separate isolated entity. Body and brain are part of the same contiguous organism, and what happens to the body happens to the brain. This dual stimulus creates a more detailed "map" for the brain to use for storage and retrieval (Squire, 1992). That is why learners may tell you that the most memorable classroom experiences were based on practical learning.

1.3 The renaissance of encephalon compatible learning: A follow up to "postmodernism"

The transition of SLT methods from traditional methods (ALM, Silent Way, TPR, CLL, etc.) to post method condition and selective learning which is based on cognitive processing strategies, it has been the epitome of predecessors' desire to enhance the level of proficiency required for participation among communities. English language use has taken its foothold as an auxiliary language for participation in today's global village. Serving the purpose, the need to guide English language learners or L2 learners toward efficient level of proficiency and accuracy to a certain extent has been growing out of research. Pica (2000) puts forward that L2 learners benefit from a variety of experiences; from direct instruction to conversational communication. Pica does not believe in random and eclectical experiences but rather in selective one derived from strategies of cognitive processing and features of linguistic complexity. However, Pica described the commonalities, complexities, and values he just juxtaposes methodologies and it seems that one could not approximate learners-need discipline dispensing with the irrelevant and improvident of re-conceptualization of tradition. Kumaravadivelu's postmodernism (1994) fits the bill to the extent he broaches that L2 teachers are not to seek alternative methods, but rather an alternative to methods. Hence it could not be considered a sure-fire recipe since it is based on learners' need and teachers' experience and awareness coping with classroom ambience. Kumaravadivelu's expression is untrammeled to the extent that the impossibility of its presuppositions could still be on a crusade since to him, fabricating any individual method to be effective seems to be far-fetched. However, context, setting goals, and learners' expectation play an inevitable role for a method to be implemented; probing learners' encephalon (brain and cranial nerves) will throw light upon the crux. Pica (2000) wished to aver that the integration of communication methodology with traditional methodologies that might be served effectively in instructional practices. To the researcher, skepticism is the end-product of such determination since docile and tractable acceptance of what has been mustered of methodologies and hypotheses is going to muddle our application.

All stimuli are stored at several levels; likewise, the formation of memory potential initiates to be easily activated. New synapses usually appear after learning. Genetically, some people have a better memory but not in all facets of memory pathways. Cell stimulations repeatedly excite nearby cells and if weaker stimulations apply to those nearby cells their abilities to get excited will be increased. LTD occurs when a synapse is modified in order that it may be less likely to fire. By avoiding the wrong connection quicker learning is promoted. A good example of LTD is trial-and-error learning (Siegfried, 1997). Cells change their receptivity to signals which are based on previous stimulation. Therefore, the modification of synaptic efficacy produces learned cells which can adopt new behavior as well. Learning and behavior seem to be different more often. Our behaviors are governed by emotional states and memories. The researcher likes to draw attention to whatever Arnold (1960) claimed in "appraisal theory" about the property of "emotion" as the product of "implicit evaluation" of any stimuli that could be led to "conscious (explicit) memory". Arnold (1960) stated that emotion, which is the product of implicit evaluation of a stimulus, could be either harmful or beneficial as a prerequisite for conscious (explicit) memory. However, "feeling" is the conscious reflection of what we appraise unconsciously. Arnold's appraisal theory describes the generation of emotion as follows: first, unconscious implicit evaluation of stimuli; next, action tendency; third, peripheral responses and finally conscious experience (as cited in Kandel et al., 2000).

To be inclusive, the evidence suggests that emotional intelligence develops early, and the school years might be fairly late for nurturing emotional literacy. Much of child's emotional intelligence is learned in the first year of his/her formative years. Children learn how to react in myriads of simple practiced cause-and-effect situations with parents (Wilson, Willner, Kurz, & Nadel, 1986). Most educators know the value of crawling and tottering time, in developing learning readiness. Gradually emotional intelligence stage will be developed into emotional literacy stage in which declarative memory thrives. Declarative memory supports the capacity to recollect facts and events, and it supports the encoding of memories in terms of relationships among the elements being learned. The stored representations are flexible and led to successful performance. Non-declarative memory abilities are skills and habits, simple form of conditioning, priming, and other ways that change our reaction with the world. What is learned in non-declarative memory will be expressed through performance and what is learned in declarative memory will be expressed in recollection (Eichenbaum & Cohen, 2001). Anthony et al. state that priming is a form of non-declarative memory that is reflected as non-conscious effects of previous experience on future behavior (as cited in Gazzaniga, 2004).

Troubled early relationships make a child use glucose in dealing with "stress" instead of cognitive processing. Kotulak (1996) states that infants' stress and violence cause the brain to increase alertness chemicals. As a result, they will have blood pressure, play truant, and be aggressive during his/her emotional literacy stage. "Attunement processes" help children to be monitored by situations exposed like the state of being pleased, fearful, disappointed, ashamed, etc. in modeling them. Likewise, the exact monitoring of memory pathways seems to be molded at a prior state during the first critical 48 months which provides dissimilarity and idiosyncrasy among many different possible futures. To what extent do children need to alter their brain? Vygotsky's "sign and tool" theory (1978) could cover both motor brain and language development; furthermore, Jensen (1998) claims that motor brain, early thinking skills, visual brain and language development are to be shaped and customized. He continued that early motor stimulation (such as crawling) is needed for school success. Research on motor skills shows that it has a great influence on reading, writing, vision, hearing, attention, sensory motor development, rapid response via lower-level adaptive reaction, intention, limbic system, and simple conditioning. Visual brain development thrives much earlier than that of motor brain development. Infants get visual stimulating input by handling different objects to explore the world. Therefore, TV, play station, and computer games are two-dimensional but the real world is three-dimensional. Also, TV does not provide interaction, feedback, reflection, and comparison. Auditory brain recognizes the early survival sounds in the receptor sites as well as auditory phones. Therefore, brain develops specific neural cells to be capable of receiving phones. Thus, exposure to the words articulated by parents and folks, physical phonetics and environmental sounds shape the brain. Weinberger believes that children are very receptive to music. Since mathematics and music are homorganic they have related circuitry; consequently, one may influence the other in future (as cited in Jensen, 1998). Since early sounds mold the brain, music is also considered to assist learning as well. Parents who talk to their children frequently and use bigger adult lexicons will make a huge vocabulary which will lead to a desirable reading skill later on. We must not forget that knack of reading occurs at different ages, some can read at age five, others at six, and the rest at ten (Greenberg, 1991).

Among four-part sleep cycle, the dream state (rapid eye movement-REM) is a crucial step to inculcate memories and long-term memory processing. It is the first and the last few minutes of our sleep cycle emits theta rhythms (4-7 Hz). It activates amygdala and Entorhinal cortex (Ackerman, 1996). Therefore, waking up too early affects REM sleep (the last few hours of sleep) which could not enhance and consolidate rehearsing of hippocampus function as well as memory.

According to Jenson (1998) teachers must also pay attention what stimulates better thinking, learning, and recall among children. To him, some three levels such as: student, school principals, and community can influence children. It means that beside the nature, nurture can be influential. Enrichment process of the brain reacts to certain impacts of the environment such as threat, embarrassment, humiliation, sarcasm, etc.

Why are some L2 learners better at speaking? Are they able to use a specific type of memory for a certain type of skill better? While explicit learning involves neocortical structures as well as the hippocampal formation, implicit memory involves the cerebellum and amygdala and the specific sensory and motor systems recruited for the task being learned. Implicit procedural learning is essential to the development of any motor skill as well as cognitive activity. Spoken languages require the use of action verbs, helping words, or suffixes which are the realm of procedural memory, rather than word order to explain subject-object relationships. Word-order dependent languages rely on short-term memory for simpler structures and working memory for more complicated syntactic functions (Wiltgen, Wood, & Levy, 2011).

Kandel et al. (2000) elucidates that not only are reading and listening processed separately, but the act of thinking about a word's meaning (in the absence of sensory inputs) activates a still different area in the left frontal cortex. He concludes that observations illustrate three points: (1) the cognitive processing for language occurs in the left hemisphere and is independent of pathways that process the sensory or motor modalities used in language, (2) speech and hearing are not necessary conditions for the emergence of language capabilities in the left hemisphere, and (3) spoken language represents only one of a family of cognitive skills mediated by the left hemisphere.

1.4 Objectives of the study

The objectives of the study are:

1. Investigating individuals' types of memory which are quite specific to language learners.
2. Investigating whether getting necessary stimulation for school

readiness develops memory/brain before puberty (1 to 6 years in age).

3. Investigating the extent to which individuals differ and use either explicit memory or procedural associative memory.

4. Investigating whether individuals use episodic memory, semantic memory, procedural or non-declarative memory as their main retrievals in order to set and apply an encephalic-minded discipline.

5. Investigating whether L2 learners use different types of memory the moment they use different language skills.

1.5 Research questions

Based on the objectives of the study, the present study aims at answering the following research questions:

1. Are there any differences/relationships between and among individuals in types of memory they use?
2. Does getting necessary stimulation for school readiness before puberty (1 to 6 years in age) influence memory/brain development?
3. Is there any significant difference/relationship between individuals in using specific types of memories?
4. Is there any significant difference among individuals regarding episodic memory, semantic memory, or non-declarative memory as their main memory pathways?
5. Do L2 learners use different types of memory the moment they use different language skills?

1.6 Theoretical framework of the study

Models of memory pathways (Jensen, 1998) (see Figure 1); memory systems (Squire & Zola-Morgan, 1991) (see Figure 2), hippocampal information processing and relational memory networks which is inspired by Gazzaniga (2004), Bandura's Self-efficacy Methodology (1977, 1980) and information processing pathway in hippocampus which is inspired by Squire and Knowlton (2000) depict the main theoretical framework of the study.

2. Method

2.1 Participants

The participants of the study comprised 65 (33 males and 32 females) EFL intermediate learners studying at "Management and Technology Institute". The reason for selecting these students was that they would be mature enough to perform on questionnaire and interview. All students were native speakers of Persian and ranged between 20 to 27 years in age. The participants were not chosen on the account of their academic scores, intelligence, sex, racial segregation, etc. Instead, they were selected on the basis of their maturity to understand and explain their retrospective view and background on memory pathways. Therefore, they were randomly selected from five intact classes and all the participants in each class received questionnaires (SRMM).

For the second phase, from these five intact classes, ten top students (high-achievers) as well as seven low-achievers on the score-sheet (comprised 17 male/female intermediate learners) were selected. The selection was based on their marks listed on their Master Cards in three successive terms in 2012. By observing the normal probability curve of the marks, the researcher skipped the cases that were piled up in the middle and selected those who were piled up at the two sides. Later on, they were announced to collect some information about their childhood from their parents in advance. They were both interviewed (SMRI) and required to answer a 10-item questionnaire (MSEQ).

2.2 Instruments

The researcher gathered data using three instruments: researcher made Self-report Measure of Memory (SRMM), Bandura's Memory Self-Efficacy Questionnaire (MSEQ) followed by the researcher made Self-report Memory/learning Readiness Interview (SMRI). The SRMM questionnaire consists of 38 items identifying different memory questions: explicit/semantic memory questions, episodic memory types, implicit/procedural memory questions, brain potentials associated with priming and declarative questions, and working memory questions. The reliability index for the questionnaire obtained through Cronbach's Alpha was 0.77 which was an acceptable reliability index.

The MSEQ is unique in that it is derived from Bandura's Self-efficacy Methodology including 50 items identifying 10 memory tasks for which subjects assess their memory abilities (Bandura, Adams, & Beyer, 1977; Bandura, Adams, Hardy, & Howells, 1980). Out of 50 items, 10 were selected to be used to compare the efficacy level of the high and low achievers of the study. Individuals were asked to consider how well they believed they can perform on a given task. The reliability index for the questionnaire obtained through Cronbach's Alpha was 0.90 which was quite a high index and approximately similar to that of MSEQ measured by Berry, West, & Dennehey (1989).

The researcher made a Self-report Memory/learning Readiness Interview (SMRI) comprising 11 items identifying different school readiness questions indicative of timing of motor development, visual brain deficiency, auditory brain development, language development (through vocabulary acquirement), maintenance of memory, malnutrition and dehydration leading to memory loss.

2.3 Procedures for data collection and analyses

The data were collected in two consecutive weeks in the late winter 2012. All participants were given a brief overview of the study including the objectives of the questionnaire, the time required for completion and the directions for answering the items of the questionnaire. The participants were assured of the confidentiality of the results and the advantages of the study. The descriptive statistics were calculated for the data to determine the types of memory pathways the participants are tilted to utilize. Later, inferential statistical procedures were run on the data which will be reported in the next section.

3. Results and Discussion

3.1 Results of self-report measure of memory (SRMM)

The mean scores of memory pathways in SRMM fell at high, medium, and low level which showed a great discrepancy among L2 learners tilting toward a certain type of memory pathway. Table 1 shows the means and standard deviations of memory pathways used by the participants of the study. The result of the descriptive statistic analysis showed that the mean for participants who tilted towards either semantic or episodic memory was 3.51 (SD= 0.37). They assigned some 61.5% of the participants using either semantic or episodic memory. Besides, some 15.4% of the participants were good at both. Collectively, 77% of the participants were the high users of declarative memory (users of either episodic/semantic memory, or even both) and the rest were moderate users (see Table 6). With regard to non-declarative memory, the mean of non-declarative memory was running at about 3.73 (SD= 0.60) and 74% of the participants inclined towards this type of memory and some 21.5% of the participants were considered as moderate users of non-declarative memory as well.

Table 1: Mean and SD of the whole memory pathways used by the participants

Memory pathways	N	Minimum	Maximum	Mean	Std. Deviation
Episodic memory	65	2.17	4.42	3.5372	.49235
Semantic memory	65	2.17	4.33	3.4038	.50972
Working memory	65	1.00	4.00	2.5169	.74153
Using different types of memory when learners use different skills	65	1.75	4.75	3.8308	.65417
Choosing MT/TF in preference to written exam	65	1.00	5.00	3.9462	.99264
Non-declarative memory	65	2.00	4.80	3.7385	.60820
Association of Priming and declarative memory	65	1.00	4.50	3.2231	.69754
Priming with shallow recollection	65	1.00	4.67	3.4103	.76096
Valid N (list wise)	65				

As it is evident in Table 1, the highly frequently used declarative/explicit memory was episodic memory which showed a high mean of 3.53 with regard to semantic memory with a moderate mean of 3.40.

Seemingly, the highest frequently memory used in Table 1 was "non-declarative memory" with a high mean of 3.73 (SD= .60). The next highly frequently used memory was "episodic memory" with a mean of 3.53 (SD=.49). Then came "semantic memory" with a moderate mean of

3.40 (SD=.50), followed by "association of priming and declarative" and "working memory" with means of 3.22 (SD=.69) and 2.51 (SD=.74).

As it is evident in Table 2 and as mentioned earlier, all of the memory pathways of this study fell within either moderate or high range of use. The highest frequently memory pathway was non-declarative memory with a mean of 3.73. The next highly frequently used memory was episodic memory with a mean of 3.53. The next highly frequently used memory was declarative with a mean of 3.47 followed by the least memory used, semantic memory, with a mean of 3.40 which was also considered moderate memory using this pathway among the participants. The reason the researcher missed out working memory in Table 2 is that information acquired by declarative memory can ordinarily be supported by non-declarative memory, the nature of recognition memory, and memory for single items versus memory for conjunctions or associations which are the realm of working memory. Therefore, in Table 2 for the time being, it is to be preferred to concentrate on hippocampal dominate declarative memory as well as non-declarative memory abilities.

Table 2: Mean and SD of the declarative, non-declarative, and sum of both declarative and non-declarative memory as an overall memory pathway

	Episodic memory	**Semantic memory**	**Declarative memory**	**Non-declarative memory**	**Sum of Declarative & Non-declarative**
Valid N	65	65	65	65	65
Mean	3.5372	3.4038	3.4705	3.7385	3.5167
Std. Deviation	.49235	.50972	.40616	.60820	.37850
Minimum	2.17	2.17	2.38	2.00	2.59
Maximum	4.42	4.33	4.17	4.80	4.24

To top it all, the results of the analysis in Table 2 were subjected to ANOVA (Table 3). The difference between the means of four dependent variables, as indicated in Table 2, clarified that the differences between semantic, episodic, and declarative means were significant at $p < 0.05$ (Table 3), except for non-declarative memory.

Table 3: ANOVA results on episodic, semantic, declarative, non-declarative mean, and the mean of overall memory pathways

		Sum of Squares	df	Mean Square	F	Sig.
Episodic mean	Between Groups	13.134	35	.375	4.572	.000
	Within Groups	2.380	29	.082		
	Total	15.514	64			
Semantic mean	Between Groups	12.780	35	.365	2.752	.003
	Within Groups	3.848	29	.133		
	Total	16.628	64			
Declarative mean	Between Groups	10.200	35	.291	23.583	.000
	Within Groups	.358	29	.012		
	Total	10.558	64			
Non-declarative mean	Between Groups	15.417	35	.440	1.547	.116
	Within Groups	8.257	29	.285		
	Total	23.674	64			

In order to see the frequency and percentage of non-declarative memory pathway, frequency distribution and percentage in SPSS were run. The results presented in Table 4 are indicative of the fact that the highest frequency belongs to the participants who were good at non-declarative memory which is running at about 74%. Seemingly, 95% of the participants were good and moderate users.

Table 4: The frequency and percentage of non-declarative memory

	Frequency	Percent	Valid Percent	Cumulative Percent
Good at non-declarative memory	48	73.8	73.8	73.8
Moderate at non-declarative memory	14	21.5	21.5	95.4
Weak at non-declarative memory	3	4.6	4.6	100.0
Total	65	100.0	100.0	

As illustrated in Table 5, frequency distribution and percentage present the data in order to indicate that 68% of the participants in this study were inclined to take MC/TF exam rather than the written one. 26% of the participants were neutral and 6% of the participants preferred to take written exam.

Table 5: The percentage and frequency of MC/TF preference

	Frequency	Percent	Valid Percent	Cumulative Percent
MC/TF are chosen in preference to written exam	44	67.7	67.7	67.7
No difference	17	26.2	26.2	93.8
Written exam are preferred	4	6.2	6.2	100.0
Total	65	100.0	100.0	

As it is obvious in Table 6, the overall episodic memory use was reasonable in which some 41% of the participants were good and besides some 15% were good at both semantic and episodic. 41% and 15% makes 56% which shows a fairly high index for episodic knowledge of the participants. However, the results presented in Table 6 are indicative of the fact that only 20% of the participants were good at semantic memory pathway. Considering those who were desirable at both semantic and episodic, the findings indicate that 35% of the participants had the benefit of a desirable semantic knowledge.

Table 6: The percentage and frequency on explicit memory pathways

Explicit Memory Pathways	Frequency	Percent	Valid Percent	Cumulative Percent
Episodic memory use	27	41.5	41.5	41.5
Semantic memory use	13	20.0	20.0	61.5
Good at both episodic and semantic memory	10	15.4	15.4	76.9
Moderate at both episodic and semantic memory	14	21.5	21.5	98.5
Weak at both episodic and semantic memory	1	1.5	1.5	100.0
Total	65	100.0	100.0	

Table 7 illustrates the descriptive statistics/frequency of working memory. Only about 14% of the participants in this study took advantage of a desirable working memory. Some 32% of the participants were moderate and 54% of the participants were not benefited. It depicts that more than half of the participants (35 out of 65 participants) claimed the low use of working memory performance in simultaneous processing and storage of the inputs.

Table 7: The percent and frequency of working memory

	Frequency	Percent	Valid Percent	Cumulative Percent
Good at working memory	9	13.8	13.8	13.8
Moderate at working memory	21	32.3	32.3	46.2
Weak at working memory	35	53.8	53.8	100.0
Total	65	100.0	100.0	

3.2 Results of memory self-efficacy questionnaire (MSEQ)

The result of the descriptive statistic analysis showed that the overall mean MSEQ score for high achievers was 88.6 (SD=4.78) and for low achievers the overall mean MSEQ score was 59.8 (SD=1.64). Since the rank-ordering of means is approximately the same for age groups as Bandura et al. (1980) and Berry, West, & Dennehey (1989) measured, evaluations of relative task difficulty and confidence are comparable across age. Thus, the MSEQ illustrates the need to separate confidence ratings from predictions of skill level and highlights the value of self-efficacy methodology for age-related studies of memory self-assessment. To see whether there was a significant difference between high/low achievers, an independent samples *t*-test was also run. The significance was .000 which was smaller than 0.05, so the differences between high achievers and low achievers were significant (Table 8).

Table 8: Results of independent samples t-test of high/low achievers in MSEQ

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total	Equal variances assumed	4.566	.049	5.293	15	.000	28.74286	5.43020	17.16867	40.31704
	Equal variances not assumed			4.503	6.721	.003	28.74286	6.38297	13.52166	43.96405

3.3 Results of memory/learning readiness interview (SMRI)

The result of researcher made Self-report Memory/learning Readiness Interview (SMRI) shows that there were significant differences between high and low achievers in their motor brain, early thinking skills, auditory and visual brain, and language development. It answers the second research question. Since early motor stimulation (such as crawling and tottering) is needed for school success, motor skills have a great influence on reading, writing, vision, hearing, attention, sensory motor development, rapid response via lower-level adaptive reaction, intention, limbic system, and simple conditioning (Table 9).

Table 9: The result of self-report memory/learning readiness interview (SMRI)

Questions	High achievers	Low achievers
1. When did you start tottering to your feet?	9, 10 & 11 months	10, 13 &18 months
2. Did your parents give you enough "vestibular stimulation" like rocking, jumping, and walking pace during your childhood?	Most of them were greatly skipping and romping along.	They were playing and romping.
3. Did your parents entertain and calm you down by watching TV and playing computer games as a baby-sitter during your childhood?	Never! They developed real world three-dimensional visual development.	50% of them used to watch TV, etc. regularly and resorted to two-dimensional inputs.
4. To what extent did your folks play music and sing nursery rhymes during your childhood (the first six years)?	They reported that they listened to music and sang songs remarkably.	Almost 50% of them didn't use to sing nursery rhymes or even listen to music.
5. Did your parents use to tell bedtime stories? To what extent?	Some 60% of them used to be told bedtime stories.	Very rarely!
6. Did your parents talk to you and with themselves frequently using bigger and adult words during your childhood or they used motherese talk?	All parents talked to them and with themselves using adult words.	30% of the parents talked to them using motherese talk and the rest used adult words.
7. What time were you inclined to get up when you went to the elementary school? Were you an early bird or late riser?	They were late risers and inclined to get up at noon or 10 to 11 AM.	Most of them were early risers or even slept in snatches.
8. What time were you inclined to get up when you went to the high school? Were you an early or late riser?	They were late risers and inclined to get up at noon or 10 to 11 AM.	Most of them were early risers or even slept in snatches.
9. Did you use to get enough inclusive nutrients such as leafy vegetables, salmon, nuts, lean meat, fruits, and dairy products? Were you Breast-fed?	They got enough nutrients. Most of them were breast-fed.	They got enough nutrients; but they were mostly fed by condensed milk.
10. Did you get rid of your hunger by eating chips, crackers, hamburgers, and French fries?	At all or very rarely!	Some used to eat junk food but the rest didn't.
11. Did your parents and school principals persuade you to drink water throughout the day or you used to drink soft drink, juice, coffee, or tea instead?	They all just get used to drinking water.	They get used to drinking water except for two interviewees.

3.4 Discussion

As it is evident in Table 1, the difference between the means of four dependent variables (semantic, episodic, declarative and non-declarative memory) clarified that the differences between semantic, episodic, and declarative means were significant except for non-declarative memory. It meets the first and fourth research questions. Motor memory, body learning, and habit memory, which involved both basal ganglia and the cerebellum, make participants map and use them the moment they may lack enough knowledge retrieving explicit memory or even they use them to support "conscious recollection system" in declarative memory. Therefore, the individuals are different in mapping their own knowledge.

As a result, learners' episodic and semantic memories will be based on the way they make up their conscious recollection. As it is evident in Table 3, and with respect to the fourth research question, results showed that the difference between the groups using different memory pathways in learning English was significant, but at significance of .116, non-declarative memory indicated that the differences between the groups were not significant using this type memory. It means that other groups (semantic and episodic users) were inclined to use non-declarative memory as well.

The capacity for episodic recollection and synthesis of episodic memory (semantic memory) depends on the same input structures and sequences. It seems most of the learners did not benefit from frequency of occurrence, categorical relations, overlapping, and timeless routine experience. Therefore, using the same method for all learners is a far cry from what we have been used to. Learning which is acquired and adapted under a certain circumstances is recalled when we are in that same state (recall-learning matching phenomenon). Thus, there is no sure-fire discipline for all races and ethnic communities since their input structures and sequences, environment, categorical relations, experiences, symbolic group identities and cultural identities are different.

The coding connection is one-way directional and asymmetrical; besides, learners are required to retrieve the way they have completed the sequence of the initial input patterns in their representing sequential events. As a result, one can detect that the participants of the study were in need of retrieving through the sequence of the initial input patterns to give their semantic a go, or their language instructors should present and rehearse in their representing sequential events. Therefore, providing a context flavored with the sequence of the storage to recall seems to be essential for episodic learning/retrievals and flexible expression of explicit memories. Why language learners were different in retrieving materials was partly influenced by part of their previous individual experiences, ethnic communities, attitude, and symbolic group identity. Besides, their episodic learning was individually dependent. Since semantic memory is a synthesis of episodic, associatively networked, and stored in distributed network, it links conceptual representations and component of representations. The association varies between individuals in strength, their overlap in features, and their categorical relations. This association varies drastically among individuals from one culture to another.

4. Conclusions and Implications of the Study

One positive way to deal with language learning and retrieval is to diagnose the pathways L2 learners are achieving below their expected capabilities by examining individuals and dividing them into groups that seem to have the same footings in memory pathways (e.g. they are better at autobiographical information, logical dimension, knowing dependent recognition, remembering dependent recognition, automatic-minded semantic memory, controlled-minded semantic memory, etc.) followed by the application of encephalic-minded discipline in each separated group. Applying memory-treatment interactions, teachers can classify learners with their particular memory pathways or memory difficulties. Retrieval-treatment interactions work to detect the defect among individuals to retrieve through episodic knowledge, semantic knowledge, or working memory and discover whether they are inclined to utilize recollection, performance, etc. In this study, the means of working and semantic memory show that these two pathways are L2 learners' nemesis. Since the interaction between working and cognitive control considered within semantic knowledge, the process of deep learning, sequential learning, and frequent-reviewing are suggested while semantic retrieval needs association of conceptual representations, frequency of occurrence, and overlapping.

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