LONG-TERM POTENTIATION IN TEACHING VOCABULARY IN FOREIGN LANGUAGE: A CASE STUDY

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Approval of the graduate School of Sciences

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

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This is to certify that we had read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

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ABSTRACT

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This thesis mainly intends to study and reach some conclusions related to major challenges concerning vocabulary teaching or learning, how vocabulary teaching can be improved, findings obtained from the studies in order to reach that purpose and to what extend the suggested alternative vocabulary techniques are effective. It is also aimed to outline the basic insights of the mind, storage, and retrieval from the literature involving linguistics and language teaching. Based on above mentioned background knowledge, it is also intended to derive some significant conclusions to improve the effectiveness and thus the quality of vocabulary teaching in language instruction. In accordance with the principles of the human memory, how we can alter current vocabulary instruction techniques and

activities and what scholars offer language teachers and learners are dealt with in detail. So as to validate and prove the efficiency of suggested techniques and activities, a case study is carried out and findings are discussed at large. Additionally, interviews about vocabulary teaching have been carried out with the involved students and instructors and the obtained data has been evaluated. In the final part of the research, some implications and suggestion related to vocabulary teaching are provided along with the underlying rationale behind them aiming to increase the quality of teaching of lexical items and as a result to increase overall quality of language instruction.

Keywords: vocabulary, learning, brain, memory, storage, recall, retrieval,

ÖZ

YABANCI DİL KELİME ÖĞRETİMİNDE UZUN-DÖNEM HAFIZA: BİR UYGULAMA ÇALIŞMASI

Bilgin, Zikri

Yüksek Lisans, İngiliz Dili ve Eğitimi

Tez Danışmanı: Dr. Feyza Doyran

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Bu tez, temel olarak kelime öğretimi ya da öğreniminde karşılaşılan temel güçlüklerin belirlenmesi, kelime öğretiminin nasıl geliştirilebileceği, bu amaçla yapılan çalışmalarla elde edilen bulgular ve kelime öğretimi için önerilen alternatif öğretim tekniklerinin ne kadar etkili olduğu ile ilgili araştırma yapmayı ve sonuçlara ulaşmayı amaçlamaktadır. Ayrıca beyin, belleğe kaydetme ve hatırlama ile ilgili temel özelliklerin anlatılması da amaçlanmaktadır. Yukarıda bahsedilen temel bilgilere dayanarak, dil eğitiminde kelime öğretiminin etkinliğini ve böylece kalitesini artıracak bazı önemli sonuçlar çıkarılması amaçlanmaktadır. İnsan hafızasının çalışma ilkelerine uygun olarak, mevcut kelime öğretim teknik ve etkinlikleri nasıl değiştirebileceğimiz ve bu konuda bilim insanlarının dil öğrenci ve öğretmenlerine neler önerdiği detaylı bir şekilde incelenmektedir. Önerilen teknik ve etkinliklerin geçerliliğini belirlemek amacıyla bir örnek uygulama yapılmış ve sonuçları detaylı bir şekilde anlatılmıştır. Ayrıca kelime öğrenimi konusunda ilgili

öğrenciler ve okutmanlarla görüşmeler yapılarak veriler toplanıp değerledirilmiştir. Araştırmanın sonuç bölümünde kelime öğretilmesinde ve dolayısyla dil öğretiminde kalitenin artırılmasını amaçlayan kelime öğretimi için bazı tesbitler ve öneriler gerekçeleriyle birlikte anlatılmaktadır.

Anahtar Kelimeler: kelime, öğrenme, beyin, bellek, kaydetme, hatırlama, sözcüğe erişme

To my wife and my daughter,

Neslihan and Nisa BİLGİN

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Definition of Terms

Some technical terms which are frequently used throughout the study reoccuringly need to be explained and clarified at the beginning so as to avoid any confusion.

Recall: It is usually used along with *retrieve*. Recall is the act of remembering something, an idea, experience, feeling or information stored in the mind.

Retrieve: It is the process of searching for and finding a pre-coded information by tracing certain channels.

Potentiation: Although it is rather similar to memory or storage in terms of meaning, potentiation covers the changes in the structure of nerve cells or chemical levels. It has to be noted that potentiation involves storing information in different parts of the body.

Memory Pathways: The brain builds particular channels or links to store any relevant information to be used later on. Any newly experienced knowledge is linked to the existing schemata of the individual if it is considered relevant or meaningful by the person. Therefore, while coding information, the brain establishes special track lines consisting of connected neural cells in order to store messages. These linked neural cells for any specific info are called memory pathways and are used for remembering.

Dendrites: Human brain is formed of billions of nerve cells. Most cells have a cell body and a network of branches. These branches are called dendrites (see Figure 1). They receive input from other neurons.

Dendritic Branching: The living antenna receiving electrical signals grows and splits into two, and once more another two. The more we learn, experience a new thing, emotion, or experience, the more dendritic development occur. As the branching increase cortex become thicker (Diamond, 2001, p107).

Axons: Some neurons have long, longer than branches relatively, and thin extensions and they are called axons. They are less in number and weak branches. They collect any input from various cells and transmit signals around.

Myelin: It is sheets of a white fatty material that wraps around the axon transmission wires. They strengthen the axons, the core linking channels as they cover it, and after that axons can transmit electrical impulses faster and better (Diamond, 2001, p.48). The implication is that the stronger axons myelination is, the faster and healthier communication between neural cells is achieved. Then, it becomes easy to link the cells, ideas, or recall any information when needed.

Synaptic Development: At the very end of dendrites, there are synapses which send electrical and chemical signals to other cells (see Figure 2). Each time new information is coded, a new synapse forms and this is called synaptic development. If there is more dendritic branching or synaptic development, there will be more neural networks established and if the myelination is also included, it will be very-well organized and coded information. Therefore, recall will be easier and more accurate and that is the basis of memory.

CHAPTER I

INTRODUCTION

1. 0 Presentation

In this chapter, there are five sections. First, some background information for the study is presented. Following this, the research questions are explained. After that, some of the terms which are frequently used throughout the study are explained very briefly. Then, the scope and purpose of the study are clarified. Finally, an overview of the thesis is presented.

1. 1 Background for the Study

Starting from behaviouristic approach to teaching and proceeding with recent humanistic, eclectic approaches including Gardner's Multiple Intelligences Theory, and many other theories have all enlarged the horizons of people concerned. Along with tremendous developments and amazing discoveries concerning the structure and functioning systems of the human brain, some basic traditional theories, particularly those involved in education are being shattered. As a consequence, alternative curricula, teaching approaches and methods, activities, materials and testing mechanisms are being developed. Various and more effective learning or teaching principles are proposed by the scholars and these principles apply to development of all human beings and so any specific disciplinary area.

One of the areas influenced by brain-based research is language and language teaching. The more linguists and language teachers discover about brain systems, the more they tend to modify, adapt or change their approaches, techniques, types of activities and materials, goals and objectives, and assessment types. That very topic has so many different aspects and involves various factors concerning the language process and neural development. As these changes are strategic ones, it is most natural to see the revolutionary impact on language teaching at schools not much ahead of time.

It is certain that selection of materials and tasks for language teaching require a thorough consideration of some principles of neural functioning and related systems of the brain involved in language acquisition and production. First of all, after reactionary theories against Chomsky's (cited in Lieberman, 2000) universal and innate grammar, language is thought to be observed not in a hard-wired, specific part of the brain but rather in various neural network systems involving the activation of different areas for performing different language functions. As researchers find out more about the process of seeing, hearing, speech production, inner thought, retrieval, recalling and memory systems, planning and conduction strategies of the language courses change accordingly. These changes focus on and are influenced by some strategic principles of learning and some other aspects of neural growth and functioning such as experiential, associative, sensory learning, memory pathways, motivation, stress, nutrition and finally social learning. Naturally, this will lead to ground modifications or changes in curricula, materials, task types, activities, time, duration, feedback, assessment and some administrative rules and regulations in

language schools. It is obvious that there are many dimensions of the language learning processes and brain relationship but these are the key points that need to be taken into account so as to make language teaching much more efficient.

People got relatively more concerned with brain based teaching particularly after astounding results showing the effectiveness and efficiency of the teaching and presenting the learning potential of the students were achieved from Jensen's Super Cam Project (The International Association of Supervision and Curriculum Development [CASCD], 1997) and Gardner's Project Zero (Project Zero). It is obvious that our brain is capable of doing more than what most people suppose so. "The social behavioral sciences didn't know much about students' brains, but they did know how to herd thirty of them into an enclosed setting" (Slywester, 2000). Teaching approaches and methodology have shown tremendous changes especially in recent years. However, sometimes innovators may have to face strong resistance to change. Kovalik also talks about resistance to change or reactions to the improvements and changes brought by scientific research to education and also language teaching. She intends to show how difficult it is to put all these theoretical findings into practice by changing the methods or techniques which have been used for many years saying "Tradition dies hard" (Kovalik, 1996:viii: viii). Similarly, Baddeley also talks about the same aspect of education and he says "Knowledge and skills do not guarantee habitual performances of people conceiving that smoking is bad for their health, for example, is not enough to change their behaviour; entrenched habits die hard." (Baddeley, p.104). Although it is a complex task to initiate change, language teachers, like all others, need to change their approaches to teaching and

start using new methods and techniques presented in the literature in that specific area. Certainly, change, as it is in any area, requires knowledge based on research, time, effort, strategic planning and patience. Therefore, a study is expected to shed more light into the area of language teaching, specifically vocabulary teaching in relation with the working principles of the brain although the findings of this study might be limited to a research group in a particular context.

1.2 The Scope of the Study

This study is limited to the teaching of vocabulary in language education and it doesn't deal with other language skills directly. Yet, it has to be stated that all language skills and contents are interdependent and many aspects are subject to overlapping. Also, brain-compatible teaching of any language skill, such as reading, speaking, writing, etc. may involve using or practicing some vocabulary items as well. Still, the scope of the study is limited to teaching of only lexical items in English for Academic Purposes (EAP) context at university level.

1.3 The Purpose of the Study

One of the most significant and problematic areas of language is learning or teaching vocabulary and chunks. It cannot be disputed that many students and teachers face major problems related with vocabulary and this inevitably affects the competence and performance level of learners with the other language skills. Learning, storing or recalling of the words in language learning is really a challenging and complex task for learners to achieve. "There is nothing more

frustrating than having a name or a word on the tip of one's tongue, something that you know, but simply cannot produce at the crucial moment. Having good, flexible, efficient retrieval is as important as having good information storage" (Baddeley, 1997). Obviously language learners, teachers and even sometimes native speakers have the problems of storing and recalling of information. There should be no doubt that an in depth study of language, memory, recall and strategies and methods of fostering and improving memory and finding practical and realistic applications these methods and strategies to real life in language teaching will supposedly increase the effectiveness and efficiency of language teaching and so the quality of the education offered. This is the core purpose of this study.

1.4 The Research Questions

This study mainly aims to find the answers for the following questions.

1. What are the possible factors that cause students' failure in learning vocabulary?
2. To what extend do the types of activities used for teaching affect the storage of the target words in the brain?
3. What sort of changes, adaptations, improvements, techniques and activities in teaching vocabulary in language classrooms can be used to enhance memory?
4. How can long-term storage of words in language teaching be increased?

Vocabulary is an indispensable part of foreign language learning and it still remains a challenging part of language to learn for many students all over the world especially in EFL contexts. Although there have been great developments in

language and psychology, particularly educational psychology, and numerous approaches, methods and techniques to language learning and teaching and so vocabulary teaching have been put forward by professionals in the field, these theories are either neglected by the teachers or administrators or they simply do not function effectively and efficiently for the purpose. Moreover, many teachers seem to be informed of modern and effective techniques but they do not know the underlying rationale for the use of alternative teaching techniques and they are not fully aware of the cognitive, psychological and neurological processes of learning that specific method or technique proposes. In other words, they simply do not know what happens in the learners' brain and what sort of neural processes each technique or activity they use involves. They use these new techniques just for the sake of variety underestimating or ignoring the true value or application. Therefore, it is argued in this study that knowledge of various vocabulary learning and teaching techniques and activities, awareness of the underlying principles dominated by basic functioning systems of the human brain, knowledge of the process of memory formation, and finally designing and teaching the lexical items according to those brain-compatible principles will all supposedly increase long-term potentiation of the words and so the effectiveness and efficiency of language education.

CHAPTER II

REVIEW OF LITERATURE

2.0 Presentation

This part of the study aims to provide a general definition of 'memory' and present some information about types of memory. Additionally, the relationship between memory and the brain is closely examined and parts of the brain involved in memory are discussed. The end of the chapter deals with current approaches to teaching vocabulary, memory and the learning process and provides some useful guidelines concerning enhancement of memory pathways, particularly the storage of vocabulary items that have been proposed by different scholars in the field of ELT or neurolinguistics.

2.1 What is memory?

People have always been concerned with memory for hundreds of years and numerous definitions or explanation of the term has come out at different times. To begin with, Baddeley (1997) defines memory, although it is very basic and partially oversimplified, as "…a system for storing and retrieving information, information that is, of course, acquired through our senses. Whether we see something, hear it or smell, it will obviously influence what we recall, since in one sense our memories are records of percepts. One way of obtaining an overview of human memory is to trace the way in which visual and auditory stimuli are processed and remembered" (p. 9). Certainly, there are some other types of information, experiences, or feelings to be

stored in the brain. “Experience arouses emotion which fixes attention and leads to understanding and insight, which results in memory. People can vividly remember experiences involving shock, fright, anger or pleasure” (Howard, 2000). Similarly Pycha (2000) intends to underline the importance of attention in memory formation process by quoting from psychologist and philosopher William James “Millions of items of the outward order are present to my senses which never properly enter into my experience. Why? Because they have no interest for me. My experience is what I agree to attend to. Only those items which I notice shape my mind-without selective interest, experience is an utter chaos” (p.2). Definitely, she is pointing out that interest is the key point for attention and memory formation.

Another description of memory is proposed by Jensen (1998) and he claims that if there is sufficient firing of neurons in the right way stimulated, the learner can remember enough of the related memory. This can be achieved only if the learner is exposed to different type of stimuli and experiences requiring the use of different sensory networks with conscious attention within enough time given for processing and organizing. A different explanation of memory process is provided by Hannaford (1995) stating “As the limbic system gears up, nerve networks connect the sensory and motor base patterns to emotion and memory is established” (p.61). On the other hand, Scovel (2001), focuses on a different aspect of memory and emphasizes the role of forgetting, saying memory is selective forgetting. Figure 1 shows the basic process of memory formation according to Stevick’s model (cited in Scovel, 2001:101). In his model, during teaching or interaction with an individual student, the teacher provides different stimuli appealing different senses of the learner and

some of them are perceived by the learner if he sends the signals to working memory. And again only the some of the information transmitted to working memory may come out as output, which means that some of the information is not valued by the person to be remembered. It is also shown that the output goes to teacher and the cycle starts again and the information is distributed multi-dimensionally.

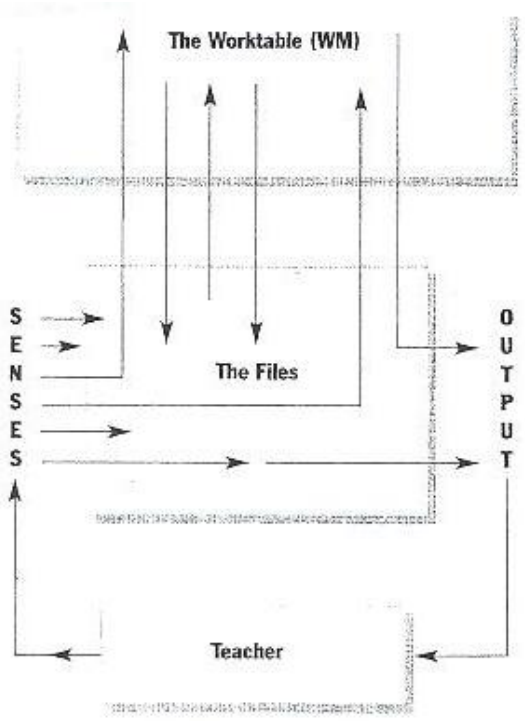

Figure 1: Process of Memory

(Adapted from Scovel, 2001.)

It is not denied that most of the stimuli or information sensed by the individual is forgotten and only what the person finds important, useful and pays

attention is stored for longer time and this information is usually linked to already existing knowledge in an organized way.

> "Superior memory results from the use of resistatable procedures acquired during training, retention can be aided by prior familiarity with related information. Memory for spatial information of course schedules was improved when the information could be related to previous experience.... learning is facilitated by distinctiveness of individual items of information"
>
> (Healy and Bourne, 1995:26).

Obviously, memory is too complex to define and it certainly involves different aspects which make it a necessity do deal with the types of memory. Baddeley (1997) states "They (storage and retrieval) are not separate functions; they go hand-in-hand" (p.5), indicating that memory and learning are directly connected to each other as memory can be accepted as competence and retrieval as performance. Awareness of the memory types to be used for any learning or teaching situation will undoubtedly improve the quality of learning and thus, advance education. This can also be applied in teaching vocabulary in foreign language learning.

2.2 Types of Memory

There are various classifications of memory and Figure 2 shows a very basic structure of memory. It presents very basic stages of memory formation. First of signals are received through senses if there is enough attention towards the stimuli and this phase is called immediate memory. Then, the perceived signals are sent to working memory for consolidation. After assessment of the information, only the

information that is considered helpful or significant is stored in the long-term memory. The very basic classification of memory is perhaps done according to the time information is held in the mind. The shortest is the working memory which can hold information even less than a second. Short-term memory is capable of storing information, although a limited number, for only a few seconds. On the other hand long-term memory is the type of memory which forms the basis of learning and can hold an incredible amount of information for an indefinite period of time which can vary according to the nature, significance of information and context and type of storing.

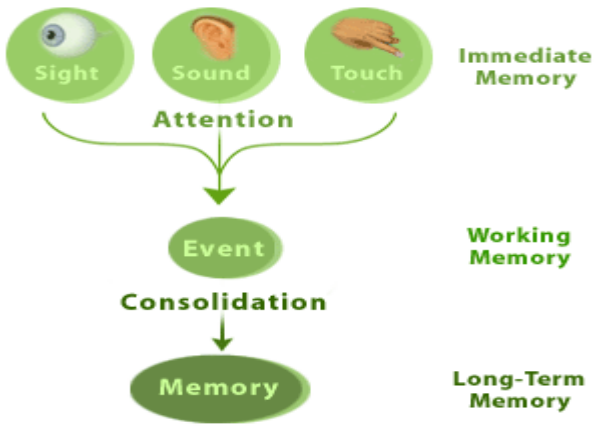

Figure 2: Process of Memory

(From Ranpura, 2000.)

Crosson (1992) talks about two different approaches to memory formation. First one is Atkinson and Shriffin's multiple- stores approach (see figure 3) and the other is Crosson's three stage memory; a) sensory register (all perception of stimuli from auditory, visual, tactile senses), b) short-term store (it can hold information only a very brief period of time), c) long-term memory (p. 292). According to multiple stores approach to memory, "the probability of long-term storage is increased if

items can be held in short-term storage longer" (Crosson, 1992:294). As Figure 3 shows, for long-term storage, working memory or short-term memory has a crucial role as it is the centre to evaluate the incoming information and then send to long-term memory. It is obvious that again working memory makes the response output possible by resorting to the already stored data in the long-term memory to be activated later. This process is the recall process.

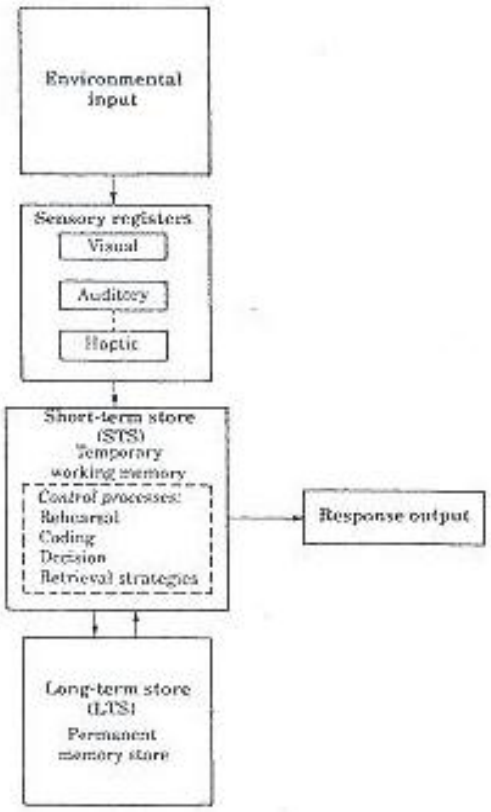

Figure 3: Atkinson and Shriffin's Memory Model

(From Baddeley, 1997:44)

We can classify memory according to the type of information stored. Declarative memory or explicit memory is involved in the process of storing mostly facts and events whereas nondeclarative memory, implicit memory, is responsible for coding of hidden, in other words unconsciously or casually received information or

experiences. Emotions, particularly pleasant experiences, pre-defined priorities and uniquely created meaning can be stored in the brain for a longer period of time and they all boost implicit memory (Jensen, 1998).

Declarative memory can also be classified into two: a) semantic memory and b) episodic memory. Scovel basically classifies memory into two as Declarative Memory controlling definitions, dates, names, phone numbers, and e-mail addresses etc. and Procedural Memory involving remembering how we do something. Apart from this classification, McClelland (cited in Scovel, 2001) proposes another sort of memory which he calls Parallel Distributed Processing (PDP). It covers procedural memories involving integration and coordination to complete different tasks at the same time and this type of memory involves Episodic Memory which requires the sequential organization of a series of events, experiences or information.

There is evidence for distinction between these three types of memories. The damage to parietal lobe, just above and behind the right ear, affects procedural memory negatively, but both the other two types mentioned above (Scovel, 2001:99). Damage to the other parts of the brain proves that there is a separate and individual memory storage (Scovel, 2001:99).

Making use of different memory types such as procedural, episodic, reflexive, and semantic memories might be effective in improving memory. That is possible as the gnostic area, an area integrating and conducting thinking in the brain, is activated and it connects to somesthetic, auditory, and visual areas that receive information from different parts of the brain (Hannaford, 1995). It is also stated that emotionally enhanced memory pathways, controlled by amygdala, are capable of storing

information for a long time (Caine & Caine, 1991). Keeping that in mind as teachers, it is essential that we aim to incorporate emotionally involving tasks and activities to foster long-term memory.

Semantic memory is associated with storage of basically names, figures, facts etc. And it is mostly used in especially second language acquisition. Use of graphics, graphic organizers, mind-maps, rhymes, visualizations, mnemonics, peg words, music and discussion will all contribute to enhancement of that semantic memory (Jensen, 1998).

Episodic memory is linked to coding experiences, events, locations and contextual memories. It is also involved in storing of information or experiences including sights, sounds, smell and movement. Episodic memory can be boosted by making use of similar sensory stimuli by practicing story writing, creating stories or talking about designing activities to link to past experiences. Tulving talks about two types of memory, episodic memory which covers memories of specific experiences from our past linked to specific times and locations. On the other hand semantic memory involves knowledge based, generalized information (cited in Baddeley, p.151).

Procedural memory mainly deals with organizational or sequential information. It is mainly based on the procedural information and linked or depends on a chain of information. That sort of memory covers a series of tasks and activities following each other according to a meaningful order.

Reflexive memory is the automatization, or sort of habituation of the material or behaviour through rote practice. That might be effective to a certain extent but some learners cannot learn without making meaning associations and context.

On the other hand, implicit memories, nondeclarative memories are procedural, reflexive, sensory conditioning and spatial (Jensen, 1998). Procedural memory is based on bodily movements or motor learning, a kind of hands-on experience type of learning, which is the base for an ELT method, namely Total Physical Response (TPR). So as to make use of implicit memory, it is a lot beneficial to apply movement, role-playing, dancing, team formation activities to teaching to improve memory and so learning quality as stated by Hannaford (1995) emphasizing the role of body and movements in learning.

Sensory conditioning relies on the use of different senses to establish various neural memory pathways by building sensory-specific cues (Math & Matters, 1998). Therefore, it is a good idea to provide the learning materials and atmosphere with different sensory evoking stimuli, like posters, music, movement, guest speaker, smells or food etc. to ease the formation of neural network in the minds of learners. On the other hand, spatial memory involves the type of learning based on surroundings and context, which can also be called *peripheral learning*. That sort of learning is most effective with field trips, or actual practices in real life or simulations.

Jensen (1998) says “Memory is a process, not a single spot in the brain” (p.156). So it is not a given memory, but a skill that can be improved like any other skill like driving, playing tennis, etc. It can be concluded that different scholars

interested either in memory formation or learning talk about various types of memory. Certainly knowledge and awareness of all these types will provide great advantage not only to teachers, designers or neurolinguists but also to every individual to improve the efficiency of their memory. There is another classification of memory done according to the length of the period information is retained in the mind.

2.2.1 Short-term Memory

Short-term Memory is vast, which indicates that it can perceive many different stimuli or information at the same time and it can last maximum for 20 seconds. The hippocampus is the centre of short-term memory which can hold information for about 5 to 20 seconds (Jensen, 1998). Hippocampus is considered to be short-term memory centre because it actually functions as the index, a sort of information or signal distributor, part of the brain. Hippocampus ties up the relationships or different aspects of an event (covering name, face, context, time, etc.). Short-term memory can be improved by using some memory enhancing techniques such as mnemonincs, visualization, association, concentration and personalization and following practice makes the neural connections and thus memory pathways which is also called the process of myelination.

Short-term memory is vital for survival and is activated very frequently. Yet, its capacity is limited and cannot code information for any longer time than only a few seconds. For example, when somebody tells us a telephone number to learn, we need to write it down or ask again for repetition and we can remember it for only a

few seconds of course if it is not too long and our attention is not disturbed by any other input. Therefore, it is not good for learning and we need long-lasting information to be coded in the brain and remembered when needed easily.

Short-term memory is the first place that elicits information and it is a process affected by the personal values, feelings, opinions and expectations of the person. “Information starts as a short-term memory in the limbic system where sensory images are combined with emotional components that add to important survival information. Figure 4 depicts the overall process of STM. The figure displays that if the stimulus is above the sufficient threshold level and the items are being paid attention, the information is received firstly by the short-term memory. Short-term memory gets lots of information but actual decision making part of the brain is working memory which elicits the signals and makes some critical decisions concerning the information, such whether to store, where to store or not to store at all.

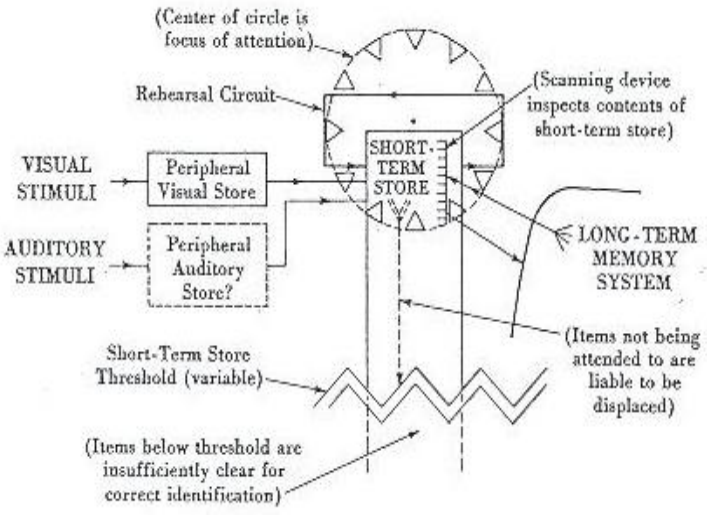

Figure 4: Short-term Memory

(From Howe, 1970:45)

If the information is valued and practiced, it becomes the template for reorganization of previous patterning. This reorganization of base patterns becomes long-term memory in the free-form information system throughout the brain" (Hannaford, 1995).

In learning, the capacity of the short-term memory is not adequate for learning as learning requires recall of the necessary information in the long term. On the topic, Bowen and Marks, (1994) argues that "The short-term memory appears to be notoriously inefficient" (p.102). It is certainly true that short-term memory doesn't need to be large since its main function is to receive any kind of information without any kind of selection or elicitation. In many language teaching contexts, we expect learners to memorize the meaning or translation of the word, like learning a telephone number. The capacity of short-term memory (STM) is limited so we need to provide further repetition and practice for long-term retention. Therefore, it is crucial to store information for longer time for later usage. We can help our students to learn and store vocabulary in a way that fits to their unique memory and learning style (Bowen and Marks, 1994, p.103).

2.2.2 Working Memory

Another type of memory is working memory which is supposed to reside in the prefrontal lobe and when information is forwarded from immediate memory to working memory, some parts of the information or experience will get lost. Prefrontal cortex is the centre of working memory which can hold around 7+/- bits of information for two seconds which is really a very limited capacity. Working

memory is the part in which value, the type of information, coding and linking strategies are determined. It is the gateway that controls incoming signals and gives important decision about what to do with that information and how to do that.

2.2.3 Long-term Memory

The last and most essential memory type, long-term memory, has got a larger potential to store information and experiences covering casual, functional, temporal, episodic and semantic representations and it is a really dynamic, flexible and selective process (Restak, 2000). Long-term memory formation is initiated by neural growth and myelination in which neurons began to fire more rapidly and strongly. Cerebral cortex is the part of the brain that is associated with particularly long-term memory storage and retrieval (Howard, 2000).

Long term memory involves different sorts of memory types. The brain receives various types of stimuli and information through various senses and processes that information or stimuli in a tremendous speed and time (see figure 5). Actually, the figure obviously shows the complex structure of long-term memory. As it can be seen in Figure 5, long-term coding lies with short-term memory. That means that what the learner does with the information in the working memory after the signals are sensed affects coding information for longer time usage.

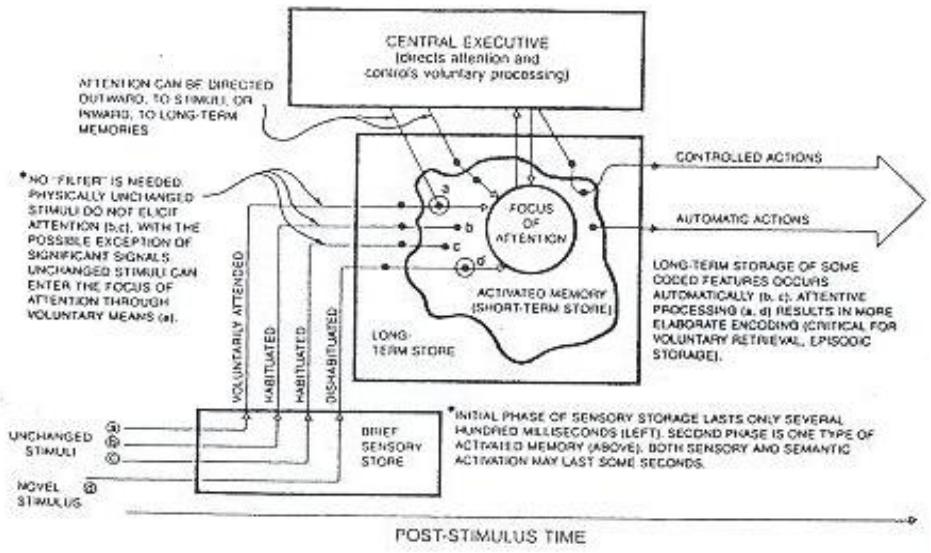

Figure 5: Long-term Memory Formation

(Crosson, 1992:297)

We can, for instance, talk about the existence of long-term auditory, tactile, olfactory, and visual memory. In a study carried out by Nickerson, (cited in Baddeley, 1997), his subjects were shown 600 hundred different pictures and they were asked to recall the pictures after one day and one year to compare the results. The accuracy rate for the one day recall test was 92 per cent whereas accuracy falls down to 63 per cent in the test given one year. Yet, it is obvious that it is still a high percentage to remember after one year.

In everyday learning, most of the learning is based on semantic meaning and stored accordingly in the brain. "Much long-term memory for material is presented auditorily, it involves language, and is probably stored more in terms of its meaning than its sound (Baddeley, 1997, p.23). However, Baddeley focuses on the role of process of coding rather than the type of information percepted. He makes his point clear indicating "not memory as categorized on the basis of the modality of input,

memory categorized in terms of the memory process involved and the functions that serve" (Baddeley, 1997, p.27).

Long-term memory is essential for learning and integration of past experiences and ideas with present and imagination or creativity for the future. Although it is rather challenging to enrich memory, especially long-term memory, some principles and techniques are suggested by experts concerned with the memory and memory pathways, all of which can be considered and applied in ELT. In addition to knowledge of memory types, knowing the parts of the brain involved in the process of long-term coding is thought to provide some essential benefits for teachers and learners.

2.3 Brain and Memory

2.3.1 Parts of the Brain

Even though it is admitted that human brain still remains a complex organ to understand fully, scientists particularly interested in memory discovered amazing aspects and different sections, structures, working and function(s) of brain, including synaptic development and even plasticity features. Even it is enough to realize the significance of it and although the brain makes only two per cent of the body, it consumes nearly 20 per cent of the body's total energy (Jensen, 1998). This is the evidence for what sort of time and energy consuming business the brain is involved in. Despite the fact that there might be some integrative or unitary, cooperative functions, different parts of the brain is claimed to have different functions or responsibilities and findings of the brain research will supposedly provide us better

understanding of memory and long-term potentiation of words in language acquisition.

Brain is formed of two hemispheres. The right hemisphere is involved in spatial and artistic intelligence whereas left hemisphere dominates functions such as analytical and verbal skills, reading, writing, mathematics etc. It has to be noted here that mental or physical functions all require communication and coordination of both hemispheres, and that is carried out by corpus callosum (Van da Graaf, 1998). Gazzaniga proposes that left hemisphere has a control over consciousness basing his theory on the argument that since language and consciousness, that is attention being paid to stimuli, are directly related and language is controlled mainly by the left hemisphere, it can be concluded that consciousness lies within the left hemisphere (Gazzaniga, 1995). However, split-brain research revealed that 2 hemispheres of the brain have different consciousnesses.

The very basic structure of the brain is composed of cerebrum and four lobes (see figure 6). Cerebrum is the thick outer layer of the brain, consisting of four lobes in two hemispheres. The Cerebrum is involved in reasoning, sensory perception, initiation of voluntary movement, memory storage, thinking, limbic functions which are related with emotions (Van da Graaf, 1998).

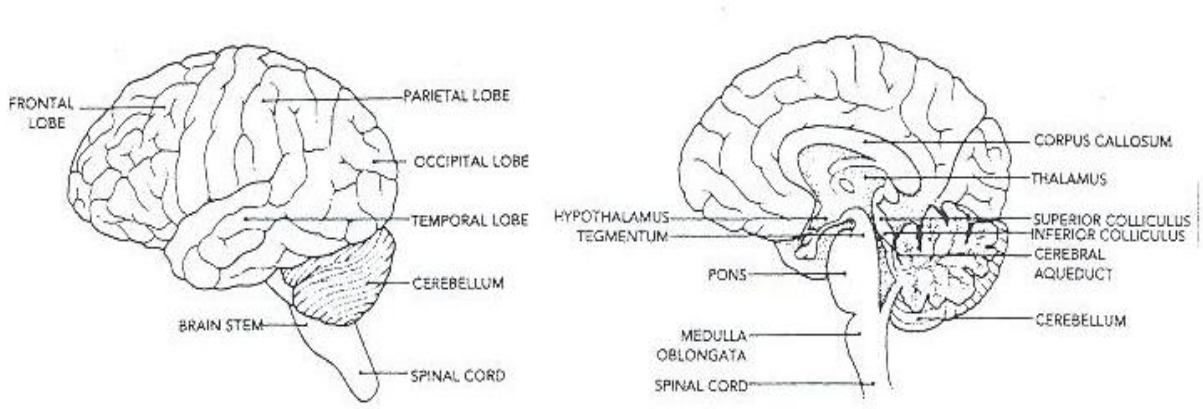

Figure 6: Sections of the Brain

(From Diamond, 1998)

Frontal lobe is responsible for reasoning ability, making judgments, memory functions, planning, emotions and verbal communication (Van da Graaf, 1998). The parietal lobe takes active role in the functions such as understanding talks, word formation to express emotions and ideas, understanding written texts and shapes (Van de Graaf, 1998). The temporal lobe covers the auditory areas, vestibular and olfactory areas and is involved in hearing and controls language comprehension and storage of visual and auditory information in the brain. (Van da Graaf, 1998). Sounds in auditory cortex, emotions in the amygdala and contextual memories are stored in the temporal lobes (Jensen, 1998).

The occipital lobe of the brain is the part of the brain associated with visual areas mainly and it is related with interpretation of visual stimuli and associations (Van da Graaf, 1998).

Along with cerebrum, the underlying parts of the brain, the amygdala, hippocampus, basal ganglia and septum are all directly involved in emotions, movement and memory (Bloom and Lazerson, 1988). Jensen claims that cerebellum

takes part in various mental functions including memory, spatial perception, language, attention, emotion and nonverbal cues (1998). Emotional memory can be stored in any part of the body because there are peptide receptors all over the body including hippocampus, the organs, tissues, muscles, skin and endocrine glands (Pert, 1997).

The Limbic system converts information to appropriate modes for processing and comparing them with past experiences. The limbic system is involved in the tasks such as directing information to appropriate memory storage, transferring information to long-term memory from short term-memory, and also controlling eating, drinking, sleeping, body temperature, waking, chemical balances (heart rate, blood, sugar level), feelings (Kovalik, 1996:18).

The brain stem is the part of the brain responsible for controlling basic life skills for survival, defending territory, hunting, greeting, nesting, sexual courtship, etc. It is believed that the brain stem has no language (Kovalik, 1996:20). "Words (symbols for something for which there is no prior experience) rarely evoke an accurate understanding of their concept and therefore their application is impossible" (Kovalik, 1996:39).

Brain stem and the limbic system are the parts that receive and send the stimuli to these parts of the brain and they are organized and interpreted with sensory-motor memory firstly in close collaboration of neocortex. That makes it possible to integrate new information with the past experiences. (Hannaford, 1995).
The cerebral cortex processes information per minute received from different senses and transmitted from the limbic system. The cerebral cortex performs functions such

as reasoning, problem-solving, analyzing, creating, synthesizing, handling very complex tasks (Kovalik, 1995:19). Van da Graaf states that language is primarily controlled by cerebral cortex in the left hemisphere for most of the normal people. It is argued that right hemisphere stores stress patterns, prosody, intonation of words, rhythm and ortagraphy of the language (Ergenç. 1999). Wernicke's area, an area responsible for mainly language functions, is particularly involved in the production of words, namely speech. Impairment in the angular gyrus, another part of the brain, results in difficulty in finding a specific word, or name of a person or an object which is an explicit evidence for the role of it in memory (Bloom and Lazerson, 1988).

"Fundamentally, memory represents a change in who we are. Our habits, our ideologies, our hopes and fears are all influenced by what we remember of our past. At the most basic level, we remember because the connections among our brain's neurons change; each experience primes the brain for the next experience, so that the physical stuff we are made of reflects our history like mountains reflect geological areas. Memory also represents a change in who we are because it is predictive of who we will become. We remember things more easily if we have been exposed to similar things before, so what we remember from the past has a lot to do with what we can learn in the future" (Ranpura, 2000).

Attention is one of the key points that has great influence on memory as it shapes the perception of the information by the short-term memory first and then working memory. Anything not being paid attention cannot be stored. The amount of active brain waves determines the level of attention. There are different levels of brain waves and knowing the significance of each state may provide useful guideline

for achieving better memory formation. Attention is observed as neural activity as brain waves and there are 4 basic types of brain waves.

1. Beta waves are observed in frontal lobes which are active while the brain is involved in functions such as debate, exercise, complex project and competition. That level is the maximum, peak level of attention.
2. Alpha waves are seen in the parietal and occipital lobes and related to reading, writing, watching, and problem-solving tasks.
3. Theta waves are active especially in temporal and occipital lobes and this sort of waves are observable during the drowsy state for processing information (Van da Graaf, 1998).
4. Delta waves are produced in the cerebral cortex and they are active while in sleep which means there is no consciousness (Van da Graaf, 1998; Jensen 1998).

There are some neurotransmitters in the brain directly related with learning such as acetylcholine, dopamine, seratonin, noradrenaline, endorphin, calphin, and GABA. Acetylcholine is associated with arousal, attention, motivation, movement and so memory (Howard, 2000; Jensen, 1998). Cortisol, a kind of hormone produced within the cortex as a result of stress, destroys the production of connective circles and kills the neurons leading impaired memory (Van da Graaf, 1998; Jensen, 1988). High level of cortisol is believed to result in the destruction of the brain cells in the hippocampus, which is the area related with formation of explicit memory and initial coding of new information which is obviously crucial for memory and so for learning (Jensen, 1998). Noradrenaline is also associated with the reticular activation system

and so memory (Jensen, 1998). Certainly, there are some unclear points about the connections and functions of some brain sections and hormones produced within the brain, which is the focus of many neurologists.

2.4 Memory and Learning

We cannot talk about learning unless there is exact and accurate recall of any information when it is needed at a certain time and situation. “Learning involves remembering a personal incident, acquiring new information, mastering a new skill or developing new habits.” (Baddeley, p.104). It has to be noted here that only conscious attempts and various trials and experiences will lead to well-organized memory storage. “Learning is not attained by chance, it must be sought for with ardour and attended to diligence.” (Abigail Adams, in a letter to his son-cited in Diamond, 1998:264). Scovel also emphasizes the role of attention on memory saying that memory is considerably affected by attention (Scovel, 2001:102).

Hannaford (1995) mentions that bodily sensation such as sight, sound, smell, taste, emotions and movements enrich memory and strengthen the memory pathways. Memory is not stored in a single place or pattern in the brain but it consists of various cycles or neural pathways involving different parts of the brain and these networks are subject to any kind of development or modification as the person interacts with environment.

Why we forget is another crucial question to be studied to understand memory more thoroughly. The basic argument is that the earlier messages are overlaid by the incoming new ones. There is certainly the role of sleep involving

hypothalamus to categorize the experiences and information deciding whether to store or get rid of the unnecessary ones. During sleep, hypothalamus sorts out the data to be stored or thrown out and it is claimed that in REM sleep our memories tend to keep meaningful or important information and we tend to recall that type of information more easily. Talking about the factors influencing memory, the role of interference is also worth dealing. On the topic, Baddeley states "...the number of the items lost does not depend on level of initial learning" (Baddeley, p.185).

It is certain that selection of materials and tasks for language teaching require a thorough consideration of some principles of neural functioning and related systems of the brain involved in language acquisition and production. Awareness and knowledge of brain and principles of the memory will certainly allow language teachers produce materials and design lesson plans under the light of this data. It is obvious that there are other dimensions of the relationship between language learning process and brain but these are the key points that must be taken into account so as to make language teaching much more efficient.

2.4.1 Enhancing Memory Pathways

One of the major problems language learners has always been retrieval and recall of the learned information. Traditional systems have not been so successful so far. Therefore, not only neurolinguists but also many language teachers, scholars and learners are interested in memory and means of enriching memory pathways. The more we learn about the structure and functioning of the brain, the better and more effective ways of coding information in human neural systems we develop. And it is

most likely that the amazing discoveries concerning the human brain will lead language researchers and teachers to use various strategies to empower memory systems.

Researchers claim that language functioning of the brain can be explained with Functional Language Systems (FLS) or neural network (circuitry) systems that involve different areas of the brain for different functions. So, for effective teaching and better memory, activation of various neural networks is necessary. Still, cerebellum, hippocampus, amygdala and cerebral cortex are the parts mostly associated with memory. Similar to any other neural part, each has different functions and connections to other areas for some specific functions. That directs us towards the use of different techniques to increase the capacity of our memory, particularly long-term memory.

First of all, our teaching needs to be compatible with brain based teaching principles such as visualization, contextualizing, personalization, associative and sensory learning, involving movement and some similar ones which will be mentioned in the next chapter. Activation of different sensory neural networks will be beneficial for different types of learners and building upon different intelligences. Instead of solely two-dimensional teaching using traditional methods and materials, it will foster the associative learning and so create stronger memory pathways to use task and materials that activate different neural systems such as vestibular system or limbic system. Thus, the interest of visual, auditory or kinesthetic learner will be taken into consideration and once they get involved, learners will start to associate the new input to their own experiences or background information coded in their

existing memory networks. One important point here is that most of the learning should be implicit rather than explicit since natural exposure to language and meaningful social interaction will facilitate coding of new information and adding up new synapses to existing ones. If information is added up to past experiences or information systematically, that is long term potentiation and myelination is required to make axons stronger for long lasting retrieval and easier recalling. That necessitates practice and not monotonous but purposeful and enjoyable activities so as to learn and code any knowledge in the long term memory.

In accordance with the principles mentioned above, some practical tasks or activities or material types are recommended for language teaching. Use of sounds, music, colors, shapes, signs, pictures or posters, objects, symbols (literature), the idea of contrast, purposeful movements are some of the commonly used ones. They will help individual mind to create various inner contexts to store input in the brain by producing new synapses and adding them to the present neural circuitry systems. Additionally, experiential learning tasks are highly advised by scholars such as field trips, calling guest speakers, interviews, peer or group projects that require social interaction. Certainly, these types of language tasks will not only increase interest and decrease stress of learners and monotony, but also activate different areas of the brain for different learner types. Thus, information will not be stored in a single, two dimensional memory pathways but in rather enriched neural storage, which will potentially last longer, and be easier to recall.

Rote learning is not recommended much since it is not meaningful learning but some researchers such as Durkin suggest that it is a good idea to teach some

expressions in chunks (segmentation) in rote memorization format. On the topic, he says “Repetition of elements can increase their salience enough to overcome natural loss of accessibility owing to memory overload” (Durkin, 250). Of course, if repetition is practiced within meaningful sentences or contexts, myelination and axon development will take place and learners will have an easy access to those segments when needed, which will in turn boost language comprehension and production.

For better memory in vocabulary learning, some linguists talk about the use of mapping. It again refers to the use of associative mechanisms of the brain since suggestion is based on the idea that some words will have links to others coded in the brain if learned in a certain pattern or sequence. Some activities making use of synonyms or antonyms or word groups such as words about sports, food, science etc. are examples of increasing developing efficient memory networks.

Personalization, which involves the affective domain of language such as motivation, interest, feelings and attentiveness, is another way of boosting memory pathways. Making use of teacher’s own experiences, pictures, ideas, belongings etc. may boost memory formation. And students’ sharing their own experiences and feelings in the classroom for studying any planned language structure or skill will enhance memory pathways since amygdala will be involved. Role-plays, interviews, interactive tasks, discussions and games can be used for that purpose and it is argued that emotions help a lot to develop healthier memory pathways. Creating positive attitudes and feelings and learning in a joyful atmosphere will activate different areas of the brain and will create more enriched neural paths to store new information received during that time. Use of music and linking input with some meaningful

bodily movements are some other highly suggested tasks for building stronger memory systems in the brain.

It is probable that there are numerous other means to foster memory and in the core of many lies the significance of variety of tasks for activating many different neural networks for creating more meaningful contexts and increasing myelination through meaningful and natural practice for long term memory and efficient recall. Shortly, tasks and activities to improve memory neural systems can be enlarged by language teachers after considering the features of their unique learners and designing such a task will force us to do more research on the brain and memory relationship, learn more and come up with our own suggestions which will possibly be inspired by previously suggested ones.

Howard talks about three basic aspects of memory: intend, file and rehearse; in other words, first it is utmost necessary to find a reason or rationale to store information to make it a meaningful and conscious experience. Secondly, the information needs to be organized and connected to already existing schemata and it is well-known that every individual creates his or her own, unique organization. And the final stage is to practice the coded information with a variety of meaningful activities such as using flashcards, recording audio tapes and reviewing while jogging, role plays, projects, debates, field trips if possible etc... (Howard, 2000; Buzan, 1998).

It is also suggested by Jensen to practice at certain frequency and intervals. For instance, rehearsal within ten minutes of learning, then after 48 hours, and 7 days

later will be beneficial for enhancing better memory pathways to make retrieval and recall considerably easier and effective (Jensen, 1998).

Another suggestion for memory enhancement is proposed by many neurosciences (Howard, 2000, Jensen, 1998, Hannaford, 1995, Baddeley, 1978) claiming the need for systematic break for revision according the working principle of lobes and the brain in 90-minute cycles and the argument that the maximum time duration a person can pay to a continuous stimuli is limited to approximately 20 minutes. Some stretching activities such as Denison's brain gym (1983), walking, climbing, similar bodily exercises, or games, revision or other enjoyable activities could all be effective to refresh the brain and memory to make it ready for new information. Additionally, revision or activation of the already learned knowledge provides the learner with the activation of neural networks makes it easier for the learner to build connections and organize new information easily. Besides, revision or rehearsal of the existing knowledge makes memory pathways stronger for later usage or recall and projects, writing tasks, dramatization and personal progress report type of tasks assigned to the learners may attain the need of revision and practice. The application of information to different tasks in various formats and contexts at certain intervals makes it possible to repeat the newly acquired and desired behaviour and this helps learners to see the whole to make learning a real-life experience within a holistic perspective (Howard, 2000).

Another crucial dimension of language learning, similar to mastery of many others subjects, is that it requires different ways of storing and recalling and recall of that information when necessary. Integration of the previous knowledge and

acquisition of new ones within meaningful and authentic context is vital for creating new memory pathways for storing information in the brain. Materials and activities that are closest to real life cases and meaningful and interesting for learners will certainly facilitate synaptic development for new information and long-term potentiation of the stored information makes myelination necessary. That can be done by including repetitive practice of the language structures, lexicon and skills but a variety of content materials, (use of contrast, interesting, extraordinary topics, sounds, music and movements) and tasks even for the same language point are important so as to avoid the risk of losing joyful fluency of language learning and face boredom or monotony. By doing that, axon development and myelination will be boosted to create better memory systems.

One of the most significant ways of increasing language learning efficiency is related with motivation. Many researchers and educators have emphasized the value of motivation but especially recent studies focus more on fostering intrinsic motivation rather than extrinsic. Of course, that can be achieved applying some carefully planned strategies, teaching techniques and supportive and exploitable materials serving that specific purpose. Learning types mentioned above and interesting, new content materials prepared for the appeal of different learner types with various types of activities will definitely contribute to curricular objectives. Thus, instead of directing learner working for some kind of award (grades, certificates etc.), learners will be assisted in gaining a notion that learning is meaningful and they can distinguish between what is useful and meaningful for them and what is not. So, that means classical conditioning theories and teaching that

depend on reinforcement and punishment systems need to be avoided to create an efficient learning atmosphere. Additionally, considering such an approach will automatically make some ground changes in assessment inevitable. Since current assessment types and our labeling models at schools lead to great considerable amount of stress in our learners and many neurologists and educators agree upon the claim that stress is one of the most significant deadener of learning as it only activates our survival neural systems in the brain shutting down other sensory learning systems, particularly our planning and higher order thinking part, neocortex. Motivation is directly linked to joyful fluency and that can be achieved through the use of a variety of curricular and extra-curricular activities and materials such as games, music, movements, role-plays and some other meaningful interactive tasks. To sum up, motivation plays a key role in optimizing language learning and it is closely connected with other learning strategies. Therefore, it should be considered as one chain of the language learning system and language materials and tasks need to be planned with the consideration of motivation factor for each language classroom.

It may not be so much directly related with language learning strategies but along with motivation and stress, leading learners and educating them on the importance of adequate and balanced nutrition, water and oxygen need of the brain is crucial. They should be encouraged and guidance be given on the topic in order to increase the capacity of their neural functioning. Like in any type of teaching and learning process, it is essential to keep motivation, attention and nutrition factors mind while teaching since they are all related with memory.

2.4.1.1 Sensory Learning

Like the functioning of the brain, learning strategies and techniques also have some cross sectional areas. Experiential learning makes use of sensory learning. Sensory learning is based on learning through our senses. Of course, it involves different learner types; such as visual, audio and kinesthetic and learner differences; therefore, it is crucial to organize teaching according to our particular learner groups. Teachers need to think of hemisphere dominance factors and their detailed and holistic approaches to content. That will automatically bring some kind of changes for material selection and use in the language classroom. Language involves almost all of the senses in real life but for teaching, some of them such as touching, visual or auditory aspects are ignored by many language teachers. Language is a combination of nerve functions involving the vocal-auditory system for speech production, visual-motor system for reading and writing, tactile nerve system and psychomotor system for body language and gestures. Many language researchers and teachers tend to apply more integrated teaching of language rather than teaching each skill in complete isolation. A variety of contextual materials for different learner types will not only get the appeal of majority of the students for learning but also will help each individual brain to form new and different neural networks for recording information and recall by activating different parts of the brain such as visual, audio, motor etc…use of movement, like brain gym and music which is highly recommended to language teachers by many scholars. Certainly, all of these cover the cognitive domain of language learning and we cannot simply ignore the affective domain of learning. Feelings and attitudes should be linked and included in any learning process

for better retrieval and recall, especially for long-term memory. The important point here is that our materials should present language patterns making use of different sensory parts of the brain to develop different nerve circuits in the brain for coding information.

2.4.1.2 Associative Learning

In some functional language theories, such as Lieberman (2000), it is proposed that language is performed within some integrated networks (circuitry systems) each of which functions for a specific behaviour and so teaching techniques need to be changed. Since language is not situated in one single area of the brain and different parts are activated for performing any language function, teachers need to conduct tasks and materials that facilitate neural development of various Functional Language Systems. Efficient functioning of different language systems is crucial for retrieval and recalling of language structures, words, speech production systems as well as inner thought.

Associative learning aims to add up to existing knowledge that is stored in our implicit memory coded in different memory systems and as we get conscious and unconscious stimuli (Peripheral learning), new information is stored in newly formed neurons which are linked to those already existing systems, of course if incoming information is meaningful for the thalamus. Morin and Goebel found that learners using the semantic mapping "... ranked their familiarity with L2 vocabulary more highly and were able to group more L2 vocabulary by thematic reading than learners

in the vocabulary activities group" (Morin & Goebel, 2001:15). Contextually coded, interrelated vocabulary and syntax knowledge are the bases of language acquisition.

Practically, our materials and teaching should be dominated by these findings. We can help learners to associate new information with some other sensory materials by making use of some purposefully chosen realia, visuals like content related posters (they can be posted on walls and changed at some intervals), pictures, video, audio, guest speakers, field trips and some real life type practice. That is particularly needed for the preferences of different learner types as visual, audio and kinesthetic as well. In addition, language teachers should aim to help learners to associate incoming knowledge with their personal experiences and expectations, which will naturally require involvement of some affective learner characteristics besides cognitive learner aspects. Activities and materials should be addressing to both left and right hemisphere dominant learners. That means both questions about details and questions about the whole and further relations should be asked. In other words, more than true or false or yes and no type of questions should be asked for improving language neural networks or higher order skills such as synthesizing and analyzing etc.

Another crucial dimension of language learning, similar to the mastery of many other subjects, requires different ways of storing and recalling of that information when necessary. Hohn (1995) mentions two types of memory which are very important for language acquisition: explicit memory: that is surface or stylistic information observed at that very moment. Implicit memory: integration of incoming knowledge with the previous information and experiences that already exist in our

mind. That will lead to more meaningful learning with stronger synaptic nerve development, which is best for retrieval and recall.

Materials and activities that are closest to real life cases and meaningful and interesting for learners will certainly facilitate synaptic development for new information and long-term potentiation of the stored information makes myelination necessary. That can be done by including repetitive practice of the language structures, lexicon and skills but a variety of content materials, (use of contrast, interesting, extraordinary topics, sounds, music and movements) and tasks even for the same language point are all important so as to avoid the risk of losing joyful fluency of language learning and face boredom or monotony. By doing that so, axon development and myelination will be boosted for creating better memory systems. That means more organized, meaningfully linked and stronger networks, connections will be established among the newly formed brain cells holding any specific information.

2.4.1.3 Experiential Learning

Teaching methods and components should be conducted in a way that use of language in real life situations with authentic content materials is encouraged. Only then learning will be meaningful and this will add up to neural networks. One way of achieving that is to include materials that provide learners to use the target language like acquisition of the first language. As children are exposed to natural language in real contexts, they discover the rules of language along with the meaning of expressions and they build on their synaptic development and that is easier to

recall for myelination is practiced in everyday usage and repetition of the language patterns in meaningful contexts. In other words, we should provide materials and tasks to learners so that they can discover the language structure and meaning of the words in accurate and authentic contexts rather than artificial, complicated grammatical rules. On the topic, Hohn says "reinforcement, modeling and expansion are the most important components of natural language." He also adds that when a mother asks a question "Does Billy want milk?" to her son and he responds "no milk", which is inaccurate, mother models the correct form by saying "Billy doesn't want any milk." Modeling the correct without an explicit explanation is the natural recognition of language structure and when it is repeated in some other natural contexts, which is useful for myelination in the brain (Hohn, 1989, p.72). Learning the grammar and meaning of words should have the same nature of first language acquisition. Yet, for Chomsky and other linguists, learning a language through modeling and imitating cannot explain the whole language functions or skills. Our materials and activities should aim beyond this, focusing on deep or intended meaning rather than surface meaning and that requires involvement of higher order analysis skills of the brain. Briefly, our teaching should aim actual use of language in realistic contexts with authentic and interesting contextual materials.

2.4.1.4 Social Learning

Language teaching requires a lot of social interaction as it is used in our daily lives. Language teachers need to consider that each individual learner comes to classroom with different background knowledge, experience, expectations, feelings

and personality and each has different understanding of life and social interaction. Although it is difficult to construct lessons and materials that satisfy all, mostly universal content materials and some other potentially exploitable ones can be used in language classrooms. The important point here is that we use real, authentic topics in meaningful contexts with the help of target language structures and we present language samples as learners are exposed to their first language although it is very challenging to do this in the classroom atmosphere. However, rather than two-dimensional, direct teaching, we can make use of the social dynamics in the classroom and conduct a lot of peer or group work activities, different types of interaction, discussions, games, role plays and peer correction and feedback. "Groups are able to process more information collectively than individuals." (Robert L. Hohn, 1989: 358). One important point that must not be ignored is the importance of avoiding creating competition that causes stress but encouraging coordination and cooperative learning instead. Teaching activities, methods and materials should be regulated by these principles so that learners have less stress, which means their neural systems involving sensory mechanism and especially language are ready to function effectively in the process of learning. Of course, it is easy to give assignments and send students home to prepare their posters, but as Allen (1999) explained, when students talk together about words, they activate prior knowledge and use a variety of processing skills, including listing, interpreting, categorizing, generalizing, and labeling. (Arter & Nilsen, 2009: 236). What makes it more important is that coordination and cooperation will create some kind of humor, fun and enjoyment and learners will have more positive attitudes towards learning and

language. Therefore, a realistic goal for foreign language instructors is to build these learners' communicative skills and vocabularies and to provide them with the ways to recall and organize the L2 vocabulary they are exposed to. (Morin & Goebel, 2001:16). Consequently, if appropriate techniques, materials and tasks are used, social learning will contribute a lot to the neural growth process, which leads to the language learning process.

Attention and need for information is obviously vital for memory and so learning. Kovalik (1996) also states the importance of making students aware of their needs and she even argues that "building awareness of need to learn is as important as teaching style and content" (p. 7). She also emphasizes the significance of creating sense of reality or providing real life tasks to students when teaching any information so that learners will have intrinsic motivation and find meaning, in learning. Otherwise, boredom and frustration will take place and they will "shut down the brain" whereas "curiosity and enthusiasm open the doors" (Kovalik, p.19).

Assessment should not be in the traditional exam format for it will affect intrinsic motivation negatively and create a kind of competition and labeling game as some grades are assigned and that will result in stress rather than cooperative learning. Therefore, some alternative assessment techniques are needed for brain compatible teaching. Since brain principles defend the idea that every learner has different type of neural structural characteristics and so learning styles, learning pace of every individual will supposedly be different than the others in the group. For that very reason, rather than giving the same type of standard tests in a limited time and leading learners into a kind of competition and inevitably into stress and panic, it

would be a better idea to let each learner show how much progress s/he has made in that content area or skill. The best way of evaluation is asking project works, papers, assigning research papers, homework, presentation, interview, role-plays, discussions and some other port-folio type works given more frequently according to the needs and learner styles of each student in the classroom. It is important to provide constant and encouraging feedback for each pair, which can be done in group or peer feedback instead of teacher feedback all the time.

It is commonly agreed that language learning involves different neural systems and therefore has various dimensions to be taken into account to increase teaching quality. Many new principles and theories about language acquisition are put forward by many neurolinguists and under the light of these findings, approaches, methods, techniques, goals, curriculum design, tasks and activities, material types, assessment types and some other aspects of language instruction are being reshaped, modified or changed completely. Most striking principles that involve language learning are suggested by many scholars and among these are experiential, sensory, associative learning, enhancing memory pathways, social learning and some additional factors as motivation, stress, nutrition, oxygen and water. Each of these has a rationale behind concerning the circuitry of neural structures and functioning systems of human brain. Human memory requires the use of different senses to store information in different networks established in various sections of the brain. And it is clear that the more knowledgeable we become about structure of the brain and mechanisms, the more sophisticated and efficient our teaching will be at language schools.

2.4.2 Long-term Storage of Words

Memory and increasing its capacity have always interested people for along time and in the past even people with better memories were thought to have superior intelligence or special talents. Memory involves coding of different types of information, experiences and emotions. Storing of words does not much differ from the brain-compatible learning principles in root. However, there are some slight variations in designing and applying tasks for lexical items or even chunks. A great number of techniques, methods and approaches have been proposed by scholars concerned and some of them have been used in language teaching.

Of all, perhaps the oldest one is the Galton cuing technique which was developed by Sir Frances Galton in 1883. The subject is given a cue word for recollection of a personally experienced event associated with that word, like *river*, and storing is done in that format for many other ones. (Baddeley, p. 211). Another technique is Tip of the Tongue Effect proposed by Reason and Lucas in 1984 (Cited in Baddeley). It is the state that when the person cannot exactly remember a single item and attempts to find it trying all related or close associated words or pictures in the period of search. That is supposed to boost memory. However, it is argued that sometimes in trying to retrieve a specific word, people are likely to come up with a false but associated word and store it falsely, which Baddely calls "the ugly sister effect" (p.214).

In another study carried out by Bugelski (cited in Baddeley), he proved the importance of slower presentation of information and he argued "...subjects given rapid presentation would probably be relying on rote rehearsal, whereas the slower

subjects would be basing their learning on visual imagery" (Baddeley, p.109). This clearly indicated the great need for providing learners with sufficient process time to build up more neural networks rather than establishing a single memory pathway, which has been the dominant teaching technique in most courses, as well as in language. On the topic, Melton (cited in Baddeley, p.112) says "... a wide range of studies has shown that an individual item will be better learned and recalled if successive presentations of that item are relatively widely separated, even though the interval between presentations is filled with other items".

Categorizations and organizations, hierarchical or any meaningful links between the words affect the accuracy of recall (Tulving and Pearlstone cited in Baddeley, p.131). Additionally, Lesgold and Winzenz, (1969), observed that if there is a hierarchical order, subjects could remember a mean of 70 words out of 112 words whereas only 21 words are remembered when there is not any hierarchical order (Baddeley, p.131). Figure 7 shows an example of hierarchical organization.

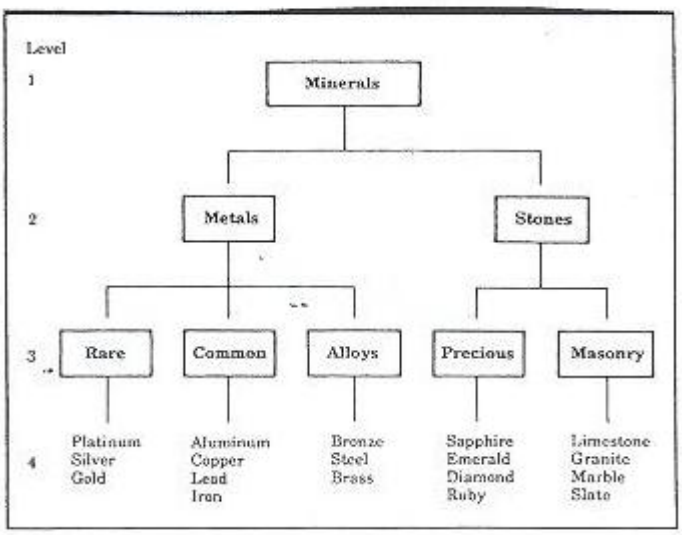

Figure 7:Hierarchical Ordering in Memory Formation

(Baddeley, 1992, p.131)

According to theory, in order to recall a single word, the learner has to go through systematic files to reach the desired one. For instance, so as to recall the word *lead*, the learner has to start with the general category *minerals* and then a subgroup of mineral is *metals* and another subgroup is common metals and *lead* is one of them. Remembering the item is achieved by following a meaningfully established link.

In 1967, Mandler (cited in Baddeley, 1997) studied on some subjects to test recall performance of some participants giving them a list of words. Only semantic organization made the difference and subjects who made grouping classifications according to some meaningful criteria could remember more items accurately. "The idea that organization might be important for learning was supported by evidence of three kinds: (1) demonstrations that organized material was easier to remember than disorganized; (2) evidence that given random material, subjects spontaneously attempt to organize it; (3) demonstrations that instructions to organize enhanced memory" (Baddeley, 1997, p.130). Jenkins, Russell, Deese have all emphasized the significance of organization in memory. Subjects were able to recognize words (high associate words such as *knife-fork*, *woman-man*, etc.) more easily than unrelated words. Also Bousfield in 1953 (cited in Baddeley, 1997, p.131) gave his subjects 60 words to memorize (15 animals, 15 boy's names, 15 professions, and 15 vegetables) and observed that recall was considerably higher than the recall of unrelated words. Similarly, Tulving and Pearlstone found out that subjects who were given the names of the categories could remember the intended words more than the others who were not given the names of the categories. This is evidence for the argument that hierarchical order is important for long term memory (Baddeley, 1997, p.107).

In a study, Ryan reached to conclusion “Recall is usually improved if the numbers are grouped” (cited in Baddeley, 1997). That apparently makes it obvious that the brain needs to make some logical and meaningful organizations for long-term storage.

Talking on the role of organization, Baddeley states that if the subjects learn even numbers according to a principle, they can remember it even after weeks or months (Baddeley, 130). Similarly, Jenkins and Russell argued that it is easier and subjects tended to remember words in associate pairs such as *man-woman*, *fork-knife* etc. In a later study, Deese found out that subjects recalled “a mean of 7.35 words from the high associated words but 5.50 from the unassociated list of words” (Baddeley, p.130). Figure 8 and 9 also put the emphasis on the role of meaningful and hierarchical organization and establishing some kind of linking between the lexical items and their properties.

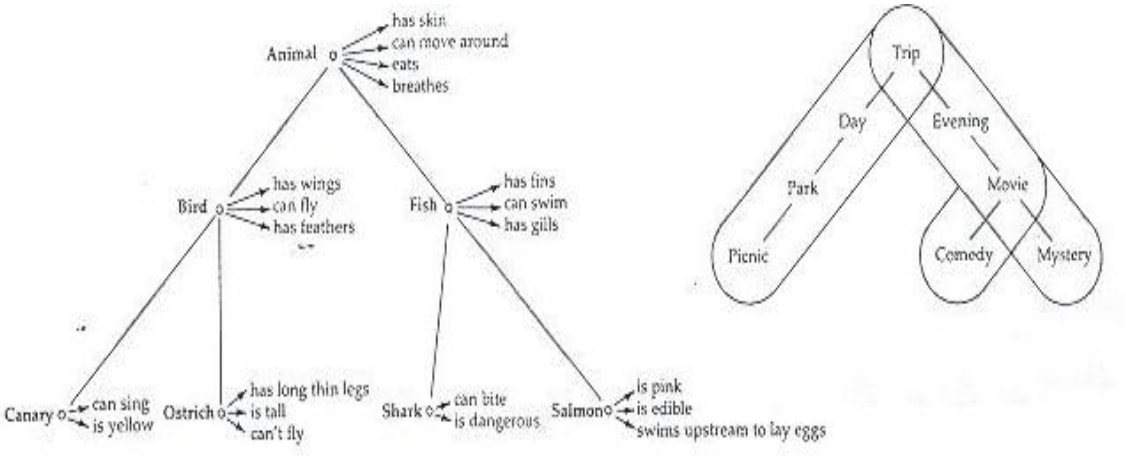

Figure 8 & 9: Hierarchical Ordering

(From Baddeley, 1997, p.250-251)

Stevick also studied vocabulary learning and storage and he states "A learner of Turkish, for example, who hears the word *heyecan*, may have to go through the round trips from working memory to the files and back: (1) Have I heard this word? Yes. (2) Ehen, and in what context? Last week, in a discussion of popular music. This may lead to identification: (3) What did it mean in that context? It meant something like "*excitement*" (cited in Scovel, 2001:102).

Whether short-term and long-term memory items are in one unitary system or are they two different systems is the question still being questioned and discussed by many scholars concerned with brain studies.

2.4.3 Current Approaches to Vocabulary Teaching

The fundamental aim of all language teaching methods or techniques is to improve some pre-defined skills of language such as speaking, reading, etc. But all of them intend to "enable learners to acquire a sufficient amount of language to function at some level in the target language" (Bowen & Marks, 1994:90). An adequate and effective memory is the basis for this and lexical syllabuses have begun to gain their role in the field of language teaching particularly in the recent years.

Wilkins (cited in Bowen and Marks, 1994) states "... there is not much value. ... in being able to produce grammatical sentences if one has not got the vocabulary that is needed to convey what one wishes to say". Unfortunately, not many students and teachers, or course book writers fully realize the significance of vocabulary in language teaching. Most people fall into the false belief that along with grammar and other language skills, the learners will automatically acquire sufficient words. As

Fowler (cited in Bowen and Marks, 1994) argues, most teachers tend to underestimate the value of vocabulary relatively as they put a lot of emphasis on accuracy, grammar, authenticity and communication. He concludes "... the source of many students' being unable to express themselves is quite simply because they do not know the right words." However, particularly in the recent years, many people concerned have begun to see the need for special care and design for teaching vocabulary in language classrooms.

Marzano also proposes a six-step approach to vocabulary teaching (Marzano, 2004:83). It involves the following steps:

1. Provide a description, explanation, or example of the new term.

2. Ask students to restate the description, explanation, or example in their own words.

3. Ask students to construct a picture, pictograph, or symbolic representation of the term.

4. Engage students periodically in activities that help them add to their knowledge of the terms in their vocabulary notebooks.

5. Periodically ask students to discuss the terms with one another.

6. Involve students periodically in games that enable them to play with terms. (83)

If you follow and use all of the steps, the results will be much more satisfactory. "In one middle school study, teachers found that the *whole* process enhanced students' achievement much more than the parts of the process in isolation did" (Marzano, 2009.84). The third step is the most significant as it helps students " ... represent their understanding of a new term by drawing a picture, pictograph, or symbolic

representation. When students do this step well, achievement increases" (Marzano, 2009:84).

Bowen and Marks make some practical suggestions such as use of hyponyms (a general and some other related word around it), collocations, family groups, antonyms, synonyms, compound words, affixical clues, charts, homographs, homophones and any other activity that will activate different senses to build better and stronger memory pathways.

Bowen and Mark emphasize some crucial aspects of learning or teaching vocabulary as the following:

- association with a mental image or a picture
- association with a situation, topic, story
- association with a need of some kind, personal significance/values
- association with another word (some positive and negative)
- association with feeling(s) (positive and negative)
- association with smell, sound, movement
- being highly memorable in itself for various reasons

In the list, we can see that some suggestions used for teaching vocabulary in ELT are based on the working principles of the human brain. Still, it has to be noted here that many teachers and educators are not informed of these underlying principles or reason for the use of such techniques in their classroom and for that very reason, the success of the teaching is likely to decline in many teaching situations and classical methods may easily replace them.

Thornbury (cited in Sert, 2007, 5) also lists some of the vocabulary teaching techniques, such as using mnemonics, word cards, guessing from context, using translation, keeping records etc. It is possible that you can add more techniques to this list, like using videos, online chat, morphological analysis, using authentic texts and visual aids, etc. Yet, whatever technique you use, cognition and information processing ability of each learner determine the success in learning new vocabulary. Similarly, Peet (cited in Sert, 2007, 5) gives some guidelines for teaching and learning vocabulary:

- A maximum of seven lexical items should be introduced to learners in a single sitting
- Up to 80% of what is taught is lost within 24 hours if not revised within this time
- A minimum of five separate exposures to a given item is advised at increased intervals
- The mind is highly organized and appears to store lexical items in semantic fields
- The deeper the level of processing the better the chances of retention
- The more personalized and student relevant the vocabulary the better

Rubin &Thompson proposes two basic approaches to teaching vocabulary in language education.

a) Direct Approach: It involves learning words in lists by doing vocabulary exercises. This approach is time-and effort-consuming as it requires a lot of practice and repetition for long-term storage.

b) Indirect Approach: Direct learning is not so much effective or efficient way of vocabulary learning compared to direct approach because there are too many lexical items to be acquired in any language.

Focusing more on other skills such as reading, writing, speaking, or listening and particularly grammar is the general tendency among the teachers. There are various techniques, direct or indirect, suggested by Rubin and Thompson (1994) that will supposedly assist teaching and learning of vocabulary.

Direct Approach Techniques

- strive for mastery at certain intervals
- put the words and their definitions on individual cards (It may be better to add a sample sentence using the word)
- say the word aloud or write them over and over again as you study
- compose (personal/unique sentences that involve your life, ideas, thoughts, fears, happiness, expectations, feelings etc.)
- tape record the words and their definitions, if you prefer to learn through your ears. Listen to it at certain intervals until you reach 100 % mastery with these words
- colour-code words by parts of speech, paint the cards including different sets of words in different colours

Use of mnemonics is another commonly used and one of the most effective means of teaching/learning vocabulary. Here are some practical guidelines for teaching vocabulary:

1. Use rhyming sounds

2. Use alliteration items –words starting with the same letters or sounds
3. Associate words with the physical world (color, size, shape, smell, feeling, action)
4. Associate words with their functions- knife: cutting, fork: eating, etc.
5. Use natural word association such as opposites
6. Learn classes of word; that is grouping them by colour, months, food, education, occupations, etc.
7. Learn related words: find the root and other forms of the same single lexical item. e.g. *communicate-communication, communicative, communicable*, etc.
8. Group words by grammatical class: nouns, verbs, adjectives, adverbs. Nouns are easier to store than adjectives and adjectives are easier to memorize than verbs relatively
9. Associate words with context: where, when, who with, what time, how, and any other linking contextual information (Rubins & Thompson, 1994:83).

Indirect Approach

a) Read a series of texts on a related topic. Thus, different structural usage, various meanings of the same word can be observed and acquired and this can be done with the use of projects, papers, reflection papers, presentations, reading, watching or doing some research. Moreover, organizing related field trips, if possible, will undoubtedly contribute to long-term storage process of the intended information.

b) Guess the meaning from the context. For instance, *I had to **hail** a taxi because I was late for the exam*. In the sentence, the word 'hail' can easily be guessed from the linguistic clues (semantic and grammatical/syntactic clues). However, Sökmen (cited in Ünal, 2006:14) puts forward some shortcomings of and possible problems associated with guessing from the context. He argues that many EFL learners have limited time and learning words mainly through guessing is a very slow process thus it may not necessarily lead to long-term retention. Sökmen says "Moreover, this is an error-prone process. Guessing the meaning of the unknown vocabulary does not mean that the word has been inferred correctly (cited in Ünal, 2006:14). Yet, guessing is still practical and beneficial as it provides learners with words in meaningful context rather than in complete isolation.

c) Break up the word into smaller components: prefixes, affixes, suffixes and they may help learners a lot to find the meaning. Rubin and Thompson (1994) states that approximately 14,000 words in Webster's Collegiate Dictionary are made up of only 20 prefixes and 14 base words.

Additionally, visiting the target language country, and learning about the target culture, researching about it, practicing speaking with natives and in conversation clubs, using the internet, attending conferences given in the target language, watching news, films or listening to foreign radio channels or music, writing and reading language materials, briefly, being actively and constantly involved in the language and practicing the intended information, words or skills will help tremendously.

2.4.4 Practical Suggestions

The limits or potential of the brain is being tested everyday and extended amazingly. Dominic O'Brien could memorize a pack of cards in 42,6 seconds, and could memorize randomly generated 100 digit binary numbers in 57 seconds. (Buzan, 1995). Based on the structure of the brain and principles concerning the structure and functioning of brain and memory process, numerous approaches, techniques or activities have been suggested by the scholars dealing with the brain, memory and learning. Knowledge of these memory enhancing guidelines will not only assist educators but also learners and educational designers such as curriculum developers, testing heads and program evaluation experts. As Buzan claims "... it is assumed that standard learning does not produce 100 % understanding or recall (Buzan, 1995). Nevertheless, it is believed that making use of these suggested guidelines will foster learning and, thus, increase the quality of education considerably.

Firstly, use of mnemonics has been recommended and even used by some language teachers for some time although it hasn't been so much well-conceptualized and associated with brain and its working system. Even the Romans made use of mnemonics to reinforce memory and ease recalling. For instance, we can associate words with sounds as *One* is a *bun*, *two* is a *shoe*, *three* is a *tree*, *four* is a *door*, *five* is a *hive*, *six* is a *sticks*, *seven* is a *heaven*, *eight* is a *gate*, *nine* is a *wine*, *ten* is a *hen* etc. (Baddeley, p.134). "The use of mnemonic principles has consequently gained respectability and popularity and they are currently being taught

at universities and schools as additional aids in the general learning process" (Buzan, p. 69).

Of all, perhaps the most crucial principle in learning is that learners should be encouraged to set their own goals and make their schemata within real-life applications. Unless they value the information or item to be learnt and unless they do not personalize the new information and link it to their existing networks of information and experiences in their schemata, we cannot talk about learning.

A different aspect of memory and retrieval process is what is called "retrieval blocks". In his study in 1979, A.S. Brown (cited in Baddeley) found out that "semantically related cues tended to slow down the rate at which subjects produced the correct response." Therefore, for better retrieval while teaching, the implication is that unrelated words or word associations or orthographically or phonologically related associations can be also an effective way of storing them in the long-term memory.

Interference theorists argue that learning of some new words will weaken or cause forgetting of others whereas some scholars do not agree with the theory. Saliency of the event, emotional state, frequency of the event are the factors that influence forgetting and recalling considerably (Baddeley, p.227). Rateliff and McKoon (1988) argued "... priming word and the target combine at retrieval to provide composite cue that facilitates recall" (Baddeley, p.239).

The contextual clues and other environmental aspects have considerable influence on memory and recall. As Baddeley points out "There is no doubt that the social environment within which we operate has a major effect on the way in which

we remember" (Baddeley, p.248). Besides, the type of experience and information shapes the coding process in the brain. Wladfogel (cited in Baddeley, p.274) found out that 50 % of memories were pleasant memories, 30 % unpleasant and 20 % neutral memories.

Test scores show that "memory and understanding don't work in the same way as the time progresses- all the words were understood- but only some were recalled. The differences between the way in which memory and understanding function help explain why so many people find they don't recall very much after hours of learning and understanding" (Buzan, p.59). He also argues that the probability of accurate recall decreases as the time goes by if mind is not given sufficient time to rest and link the information to already existing schemata (Buzan, p.59).

It is now admitted that mind needs enough time to categorize information for long-term storage. "Breaks are additionally useful as relaxation points. They get rid of the muscular and mental tension which inevitably builds up during periods of concentration" (Buzan, p.61). Buzan proposes that "within 24 hours a one-hour learning period at least 80 per cent of detailed information is lost. This enormous drop must be prevented, and can be by proper techniques of mind mapping and review" (Buzan, 64). The first review should take place about 10 minutes after a one-hour learning period and should itself take 5 minutes." Next review should take 2-4 minutes. After this, recall will probably be retained for approximately a week. Another 2 minute review can be done following a further review after about one month . Only after all this process is completed will the information be stored in the

long-term memory (Buzan, p.64). However, simply repeating does not guarantee accurate recall of the intended information. In a study focusing on the role of revision on memory, it is concluded that "Simply repeating the word did not increase their accessibility, whereas active subsequent learning did, presumably by strengthening links between the words being learned" (Baddeley, p.45) Of course, active learning involves consciousness of the mind while acquiring a new vocabulary item rather than rote memorization.

We are likely to remember from the beginning and ends and but less from the middle. However, it matters much if the item to be recalled is unique, outstanding or associated by repetition, sense, rhyming or emotions. Rhyming is another means of coding vocabulary or any other information. "The important thing in this and all other memory systems are to make sure that the rhyming word and the word to be remembered are totally and securely linked together. In order to do this, the connecting images to existing schemata must be done with one or many of the following:

1.synaesthesia/sensuality, 2. movement/motivation, 3. association-peg system: "*one-bun"*, 4. sexuality, 5. humour, 6. imagination, 7. number, 8. symbolism, 9. colour, 10. order/sequence, 11. positivity, 12. exaggeration (size, shape, colour) (Buzan, p. 75). Writing stories using the intended words and creating linked, meaningful stories will also foster memory pathways and ease recall. It is essential to try to establish different and alternative pathways so that we can easily reach that particular item when one or two other recall pathways fail.

Buzan also talks about “multi-ordinate” nature of words. Every word is the centre to which there are many links or hooks or attachment although there might be slight variations in meaning (Buzan, p.85). He also recommends learners to learn wholes rather than parts. Certainly recycling in realistic and meaningful contexts is required for strengthening memory channels for accurate recall. Jensen also agrees with the idea stating “Repetition with enough usage, they become nearly indeligible” (Jensen, p.163). This can be achieved with the use of some techniques suggested by Jensen: Use 3x5 flash cards, take most important ideas and make interesting graphic reminders/posters, audiotape/cd recording, etc. Additionally Jensen focuses on the role of using multiple memory pathways for long-term storage saying “... using multiple strategies is the most effective. It gives your brain more pathways to use when you need to recall that information later” (Jensen, p.165). “As long as you switch the way you learned it, your chances increase for new understanding and meaning” (Jensen, p.156). Again on the topic, Hohn (1995) argues “Since we are interested in knowing how the brain stores information, it is important to discover what aspects of information are retained. When a person remembers a word, does the brain store a coded version of the visual characteristics of the word, a version of the sound of the word, or some complex representation based on what the word means to the individual? The evidence suggests that the cortex makes use of all three possibilities” (Howe, 1970:20-21).

Jensen emphasizes the role of accuracy in learning since it is quite frequent to see that a learner can easily get lost with the meaning in the ambiguity of the word. That is the case particularly in classrooms where a foreign language is used as a

medium of instruction. He says “Either from television, or in person make sure you get a name right, or a new address right; or a new vocabulary word right and then practice and double check for reinforcement and confirmation” (Jensen, p.154).

Using a single memory pathway, such as translation does not provide satisfactory results in learning vocabulary. Our brain can more easily recall what is unusual or extraordinary than what is normal. (Jensen, p. 156). Jensen provides some useful and practical guidelines for making associations between the words such as:

- imagine some kind of action taking place
- form an image that is out of proportion
- create in your mind an exaggerated version of the subject
- substitute and reverse a normal mode

Some researchers say that all of our recall is simply association. The important point is to learn how to establish well-organized memory pathways and evoke these associations in the right time and right way (Jensen, p.159). Every learner generates his or her own uniquely established neural networks in the process of storing the information.

Forgetting is another dimension of memory and recall process in learning. “Loss of items from long term memory may involve their becoming misplaced in the complex associative structure of the memory, rather than their being dropped out. This loss is rather like losing a tennis ball; the ball still exists, the owner cannot find it” (Howe, 1970, p.48). Therefore, it is apparent that the problem is not related with the storing system but rather with the retrieval process which necessitates developing new memory pathways that will facilitate retrieval. Categorization is one way of

organizing words in the memory for long-term storage. Mendler in 1968 (cited in Howe, 1970) stated "recall declines when the number of items per category exceeds about 5" which means that it will be necessary to divide the categories into subcategories. If the items to be learned in one session are too many, there is less chance of storing them in the long term memory. For that reason, learners and teachers need to be selective about the words to be acquired. "Good language learners are not vacuum cleaners, sweeping up every detail that carpets their classroom" (Scovel, 2001:98). They should aim and try to store and remember only the useful and relevant information and forget the others.

In 1956, Miller (cited in Howe, 1970) claimed that we store events in our brain in our own words. On the topic Ausabel (cited in Howe, 1970) claimed that information can be retained in the memory when they are incorporated to a person's existing cognitive schemata.

"Memory scientists say you have three ways to remember things; you can use your mind for the words, use your body to trigger the memory, and use space (different locations and circumstances to trigger the learning (Jensen, p.150). "In order to remember something, ... it is necessary to retrieve, or bring back to mind, the total situation in which the events to be remembered originally occurred" (Howe, 1970:87). In other words, creating additional environmental information for the use of the learner so that s/he can make use of is an efficient way of helping learners to remember the original context or circumstance to recall the desired information. Short-term memory is the first place where the new information interacts with the already existing information in the long-term memory. Therefore, it is essential as it

shapes the encoding process of the new information into the long-term (permanent) storage.

Craik and Lockhart (cited in Crosson, 1992) proposed that if the level of processing information is deep, it is quite probable for this information to be stored in the long-term memory for longer. Processing words by either sound or written forms does not facilitate memory formation in the long-term storage. Studies have shown that "words processed semantically were more likely to reach long-term storage than words processed by the more superficial means" (Crossson, p.304).

In measurement and evaluation, the type, procedure, content and also design of the testing tools will all dominate the recall performance of the learners. "Retention performance will be best when the mental procedures required at test match those employed during training" (Healy & Bourne, 1995:27). Motoric repetition can enhance recognition memory. For that reason, teaching should reflect real life tasks and be in concordance with testing tools.

Various explanations and many practical suggestions to boost memory and recall have been outlined by some scholars involved. Jensen provides learners with some beneficial tips to help them to store the needed information in the long-term memory as:

- Attach a strong emotion to the material
- Repeat and review the material within 10 minutes, 48 hours, and 7 days.
- Make a concrete reminder-a token or artifact such as a political button.
- Act out the material or do a fun role play in your own room.
- Put it on a picture or poster-use intense colours.

- Summarize on paper and words in your notes.
- Review in different senses, using aromas, for example.
- Implement and really use the material in your own personal life.
- Make simple video or audiotape.
- Transfer the tape to your computer and use it.
- Use mnemonics/acronyms.
- Create or redo a song; make a rap.
- Make and tell a story about the material.
- Use real situations for practice in learning if possible.
- Hold an unguided discussion with a peer on the material
- Follow up the learning with your journal writing.
- Build a working model of what you learned.
- Find a buddy-support group.
- Put the material into smaller groups of three, four or seven.

Certainly the ideas listed above intend to provide some guidelines for the use of learners, teachers or any other parts involved and they will be subject to any kind of modification and variations. Moreover, more creative and applicable brain-compatible activities or tasks for long-term storage of lexical items can be included in the list.

2.5 Conclusions

In this chapter, fundamental aspects of the brain, memory, and vocabulary learning have been studied. It cannot be denied that language learning, and also

vocabulary learning, which is the focus of this study, is really complex as it involves so many aspects of language, brain and memory. It is a challenging task to unite them to reach a really effective and efficient teaching or learning method because practice or application of any theory, method, and principle particularly in cognitive sciences is quite difficult indeed. Though there may be some drawbacks and limitations, it is worth investing time and effort to test and see how these memory and vocabulary learning theories, strategies and suggestions dealt with above can contribute to teaching, vocabulary teaching especially in the long range and to what extend it affects learners' success related with vocabulary. The following chapters will deal with the actualization of these strategies and techniques listed above being practiced in real life teaching situations in a case study.

CHAPTER III

METHODS OF DATA COLLECTION

3.0 Presentation

In this chapter, the details of a case study conducted to collect data for the purpose of the research are presented in detail. First, background information about the subjects and setting is provided. Then, the methodology used for teaching the planned lexical items, including activities and techniques to be used, measurement tools, design of teaching, a sample lesson plan with materials, objectives, teaching activities and revision exercises are all explained in detail. Finally, some limitations concerning the study are clarified.

3. 1 The Design of the Study

A practical application of the theories, techniques, and activities claiming to lead to enchanted vocabulary teaching is carried out with a real classroom atmosphere. It is aimed to see whether the proposed techniques and activities mentioned in the previous chapter result in more effective and efficient vocabulary learning by boosting long-term potentiation of the words or they fail to make a significant difference in language and vocabulary teaching. For that purpose, an eight week actual in-classroom teaching is planned for the subject groups mentioned above. Additionally, interviews with five language teachers and five students in the

experimental group in this study are done, and recordings are transcribed and translated to find some answers to the research questions.

3.1.1 The subjects and Setting

This study is carried out at Çankaya University English Preparatory School and it is the spring semester of 2008-and 2009 academic year. The students taking part are all B level students who are supposed to have some English from the high school classes and this is their second term in the preparatory year. The number of the students taking part in this study was 51 and there were 16 students in the experimental group. It was ensured that the number of male and female students were nearly equal as it is an institutionally accepted policy in the school. They have progressed up to upper -intermediate to advanced level and it can be stated that their academic performance is quite satisfying with an average grade of 65 for the whole class if the first 4 mid-terms and other assessment grades are taken into consideration.

3.1.2 Teaching Materials

The course book used in the institution is a combination of a variety of book series supported with some extra compulsory and optional materials including a few-hour video and computer-based teaching. The actual teaching for this study starts on the 14th of April and finishes on the 5th of June, lasting for 8 weeks. The words covered during the teaching are chosen basically from the target vocabulary list which is included in the school's official syllabus for the spring term. This active

vocabulary list (see appendix A) is prepared for the use of all teachers within the school aiming to have a standardized amount of vocabulary items consisting of the most frequently used words in academic contexts. The books included in the official program are Lecture Ready which targets at developing basically listening and reading skills at upper intermediate or advanced level, Longman TOEFL CBT, TOEFL iBT used for developing all four basic skills as well as integrated skills so as to meet the requirements of the academic instruction, and Read Ahead 3 which is intended for reading and speaking skills. At the beginning of the semester, students who take part in this research are informed about the study and they are assured that they are not be graded according to the tests or their performance in this study and they will not face any loss or disadvantage because of the study and even this experimental study is to their advantage so long as they actively participate and contribute.

3.2 Methodology

The teaching practice for this research has two major components, one employing variety of teaching techniques that are based on the principles human brain and memory and second one systematic revision, recycling of the target lexical items for each lesson or each week. What is different from the regular classrooms is bringing new techniques to class in addition to others and creating awareness of these techniques and also awareness of the significance of revision, particularly systematic revision, not only among the students but also among the instructors. This is essential as many language teachers either totally leave vocabulary revision totally to the

responsibility of the learners or try to do some revision now and then which is obviously not so effective in boosting vocabulary learning. Moreover, many students seem to be reluctant to revise the words they have been presented and are expected know these words for their language competency and performance. For that purpose, as suggested by Jensen (Jensen 1998), students are provided revision activities 24 hours, 48 hours and 1 week and 2-3 weeks after they come across with the word supposedly for the first time for the target words each week. Meanwhile students are asked to be part of the study and do revision exercises and even bring their materials to class to share with others. These materials are addition to the regular systematic revision materials prepared for this research.

3.2.1 Activities and Techniques to Be Used

Based on the language learning theories and principles of brain and memory studied in Chapter II, a list of activities for vocabulary teaching and revising techniques have been prepared. Certainly, teacher takes initiative to select the best technique or activity or change and adapt them according to the profile that involves the needs and interest and learning types of subjects. Additionally, teacher's creativity and the nature of the word group to be taught for a particular week may also have a significant effect in the design and selection of the vocabulary teaching techniques, tasks or activities. Here are some of the techniques and activities to be used in this case study:

Peripheral learning (asking students to collect posters, films, newspaper or magazine cuttings, or any other related materials about the topic of the that week a week before the actual teaching)

- Personalization/creating reality sense/linking to students' existing neural schemata by providing or encouraging them provide personal examples
- Conducting discussion activities so that learners can practice the intended vocabulary in accurate contexts
- Exaggerating and making fun with the words
- Movements/coding with movements & practice for myelination through miming, acting, etc.
- Using visuals (pictures, posters, films, charts, etc.)
- Using real materials or objects to teach certain lexical items
- Using music (for teaching purpose or just increasing attention, motivation and relaxation)
- Using smell and taste to store vocabulary so that students can associate words with these particular sensations)
- Drawing, making, painting pictures, posters
- Contextualizing (creating stories, completing or changing stories in which intended lexical items are practiced)
- Role-plays on the related topic(s)
- Writing/translating/changing songs/writing poems etc.
- Revision exercises after 48 hours/3 weeks
- Games (bingo/opposites/odd-one-out/classification/acting out/matching

- Creating personal sentences or texts using the desired words and recording and listening to it for revision
- Making cards/pictures/signs to associate word meaning
- Integrating technology to teaching as it is a necessity to include variety for different learning types
- Writing reflection on the activities to practice recall what has been done that particular day

It has to be noted down at this point that it is impossible to make use of all the activities for the teaching of a group of vocabulary items. Therefore, teaching techniques or activities are carefully chosen from the list above and planned and used in the classroom according to so other variables in the setting such as learner characteristics, time, teaching tools, etc. Moreover, a second crucial aspect of the teaching covers systematic cycling of words to enhance long-term potentiation of words and accuracy in their retrieval.

3.2.2 Measurement Tools

In this study, a vocabulary pre-test (see appendix B) designed to measure the background knowledge or familiarity of the learners with the target vocabulary items before starting the actual teaching is administered and the obtained results for each student are recorded. A different post-teaching vocabulary test (see appendix C) intended to test the same lexical items in the pre-teaching test is administered to the students two weeks after the teaching sessions are over. The reason for this is that it provides adequate time to test long-term potentiation of the items since the beginning

and the ending of the teaching cover around 60 days. After both test scores have been obtained, the results of the two test scores for each learner and also for the whole class are compared and analyzed in order to see whether there is a meaningful link between the obtained scores. It is expected that the memory enhancing activities and revision activities aligned according to the principles of memory used while teaching will make a considerable difference and the results of the post-test will be significantly higher than the previous test. Certainly, in the analysis of the statistical information, comparative and normative analysis is done to reach some concrete conclusions.

3.2.2.1 Pilot Study

The measurement tests which are used for assessing the level of learning supposedly are not official tests and they are prepared by the researcher only for that purpose. In order to increase the reliability and validity of both pre and post-teaching tests, a piloting application is carried out for the study. To ensure that, the same tests are given at the same time to a similar group of students in the same setting. The pilot classrooms are chosen according to language level, and academic level of the students as a whole class by taking their mid-term grade averages into consideration. That is to say, the subject learners and pilot group of the study is ensured to have same or at least similar academic achievement level in their language learning. The main purpose of the pilot study is to compare the pre-test scores of the two groups to see if there is a significant difference between them. Additionally, it is intended to have data to compare if the above mentioned, brain-based vocabulary teaching

techniques and activities used in the subject classroom lead to an observable and significant difference with the post-test scores of the pilot group learners.

3.3 Design of Teaching

The actual teaching lasts for 8 weeks in classroom teaching including outside or extra practice and revision tasks and exercises for the students. A week before the teaching of the words related with the main topic of the unit, students are asked for each unit to look for any pictures, posters, newspaper or magazine articles, Internet material or any realia to bring to the classroom. At the beginning of the week, teacher writes the title of the week, e.g. "Technology Week" on cartoon and along with other material brought by both learners and students are posted on the walls and different corners of the classroom which is supposed to change the atmosphere and boost peripheral learning. According to nature of the topic of the unit, type(s) of the vocabulary items to be thought and learning styles of the students, the design and application of the tasks and activities may vary.

The teaching of the lexical items planned for each week is held in three different hours in a week, Monday for first-time teaching, Tuesday for first revision and Wednesday for second practice and revision. Thus, the 24 and 48-hour later revision suggested by Jensen can be put into practice in teaching. After a week, and then three week later, the same words are revisited for reinforcement. For revision, practice materials such as matching words with photos, antonyms and synonyms, matching words with definitions, games, pantomiming, role-plays or creative writing activities requiring the use of words to be taught are used in the classroom. Hence the

regular teaching of the language skills and regular syllabus including exams are followed, the content and pace of the topics and unit are not changed but teaching exercises, tasks, techniques or activities are either completely renewed or adapted partially according to brain-based language teaching principles and working system of the memory. Apart from that, since content- based instruction (CBI) is used in the institution, the vocabulary items could also be linked to other language skills such as reading, speaking, listening, and writing for both teaching and revision. A sample lesson plan with objectives, materials and tasks is explained here to present the type and nature of teaching applied in the classroom. It has to be mentioned at this point that these activities and tasks are designed according to the needs and interests of these particular students and they may vary according to the features of the learners and setting as well as the experience, knowledge and creativity of the language teacher.

The content and vocabulary lists are different for each week in various materials used to improve the intended language skills but the nature of design and teaching has many commonalities. In order to fully understand how brain-compatible teaching principles and memory boosting principles can be applied to language teaching in a real setting under present circumstances, it will be helpful to study on a sample vocabulary teaching lesson. The actual teaching of targeted words for week 3 in the syllabus, based on the principles of brain and memory and how the vocabulary part of the unit is studied in the classroom 102 will be dealt in this part.

3.3.1 A Sample Lesson

3.3.1.1 Objectives

By the end of the lesson, learners will be able to

- to know form and meaning of the words
- to be aware of various meanings of words and be able to differentiate in context
- understand and use the words accurately in appropriate contexts when necessary

The target vocabulary for week three are *offend, offensive, relevant, relevance, peer, slang, switch barrier, policy, smooth, smoothly, headquarter, gather, gathering, balance (v/n), spread, host, syllabus, branch, legislate, legislation, legislative, sprain, capture, hemisphere, phase, rotate, rotation, occupy, occupation, occupant, scheme, reverse(v), initial/lly, bequest, amenable, nominate, nomination, halt, implement, implementation, depict, depiction, bare, barely, abrupt/ly, glamour, peril*.

3.3.1.2 Materials to Be Used

A week before the actual teaching, students are asked to find and bring posters, articles or software materials such as photos or videos to classroom and this week is named as “Week Language” as the content for the week is based on the theme linguistics though not completely. This is intended to provide some language input including relevant or the target words which are on the walls of the classroom in order to facilitate peripheral learning. It is also aimed to make a setting change by

putting different materials on the walls as any change in the environment will boost memory. Target words are mostly taken from reading and listening materials and teaching of the vocabulary may be possible at pre, during or post stage of the activity or activities.

3.3.1.3 Teaching

Teaching of the vocabulary takes place at any stage of the reading or listening activity in each unit mostly. Whenever the target word is used, the instructor writes the word or words and their word forms as verb, noun, adjective, adverb, phrasal verb, etc. and students already know that the words written on the board are included in the target vocabulary list and they are responsible for these vocabulary items and will be tested on them in the official exams. Still, for those particular lessons, pre-obtained photos from the Internet (see appendix D) are shown via a projection device connected to a computer. The words and their forms are written on the board and photos associated with the words are discussed so that learners spend more time dealing with the words and it is essential to increase the amount of time to help improve the long-term storage of the words. Similarly, a considerable amount of the students in class are visual learners. Therefore, this activity is supposed to contribute to long-term potentiation and better retrieval of the intended words for this type of students.

At the end of the day, students are asked to write exaggerated sentences using the words in the lessons the next day. This is aimed for revision 24 hours after actual teaching. For the 48 hours later recycling of the words, simplified dictionary

definitions of the words are given and students are asked to find the right word (see appendix E). The following week, students are shown the photos used in the class for the first teaching and they try to remember the words associated with the photo being shown at the time. For the last revision during the second week, students are assigned to write a creative paragraph using minimum six words from the target list and read it aloud and record their own voice on a flash disk. The rationale behind this activity is to force students to use their imagination by personalizing their stories which cover at least 6 target words in their own voice. Later students are encouraged to exchange their recordings and listen to each other's stories. Personalization, using imagination and above all digressing from the routine and making any change in the format of vocabulary learning or teaching is expected to enhance learning and long-term storage of the words.

In order to enhance long-term memory storage, different neural network systems and activities appealing different sensations are selected for the teaching of the target words for the week. The techniques and activities used for first presentation and revision and practice of these words are as fallows: 1) whole-class discussion, 2) visual and auditory practice, 3) word matching with definitions, 4) creative writing, 5) personalization, 6) contextualizing, 7) exaggerating, 8) associating words with photos

Hence individuals learn in different styles and different pace, it is better to give them chance to choose the way they learn best. Therefore, students should be given a list of these activities and be informed and encouraged to make use of the ones they learn best for their unique learning pace and style if they are willing to do

any further vocabulary study. Thus they can draw pictures, write definition, make groups, prepare cads or charts, make recordings, write definitions, write sentences find bodily movements or gestures to associate that word with that movement or any find other means of storing and retrieving that word in the memory and a range of techniques are presented above and learners should be guided and encouraged by the language teachers to learn about them and choose the most effective ones for his or her unique learning style.

3.4 Limitations

Like many other social and cognitive sciences, applications or practice of any theory or theories may have some drawbacks and limitations. One of the main limitations in this study is that teaching can be applied to only one class group and there is not another experimental group to compare the scores although scores are compared to the scores of the control groups. Another limitation is that nearly 20 students participate in this study and apparently a larger-scale research will undoubtedly provide more dependable and accurate results. A second drawback is that the classroom was shared by two instructors one being the researcher and as a result it was necessary to do some 24 hour and some 48 hour revisions outside the class just as assignments. Therefore, the effectiveness or efficiency of these revision activities may not be as much as the ones studied in the classroom. Another drawback of the study is that about one and a half month long practice teaching with the suggested techniques takes place in the class with a certain number of vocabulary items given in a list (see appendix A). There is no doubt that a longer period of

teaching with a larger vocabulary list will present healthier statistical informational and so results for the actual purpose of the study. Still, it is believed that although there might be some concerns involving the limitations mentioned about, the planned period of time and participant group makes a good sample and provides some generalizable and realistic data about the techniques and activities used while teaching.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF THE RESULTS

4.0 Data Analysis

After the experimental teaching of the target words designed according to principles of brain and memory, a vocabulary post-test is prepared and administered to three classrooms of the same level following the same syllabus, and so have studied the same words. A pre-test had already been given eight weeks ago just before the start of the last period of the semester. The scores of the pre-test (see appendix F) and the scores obtained from the post-test (see appendix G) are compared and analyzed to reach some conclusions. It has to be noted at this point that the number of the students taking the pre-test and post-test from the same class may not be equal due to absenteeism. Besides, as some students have forgotten to write their names, the obtained scores and names of the students may not match completely, so some scores appear without names, to obtain class average for each test. An in-depth study of the data got from the test shows significant results in terms of the research question of this study. Additionally, the data obtained from the interviews from both five colleagues and five students in the experimental group is evaluated and used as a basis for finding answers to research questions.

4.1 Findings

This chapter aims to analyze the findings of the research and it also aims to relate the findings to research questions. As stated in chapter 1, the research questions of this study are as follows:

1. What are the possible factors that cause students' failure in learning vocabulary?
2. To what extend do the types of activities used for teaching affect the storage of the target words in the brain?
3. What sort of changes, adaptations, improvements, techniques and activities in teaching vocabulary in language classrooms can be used to enhance memory?
4. How can long-term storage of words in language teaching be increased?

Research question1

The first research question is about the challenges or probable difficulties for vocabulary learning. Actually, there are many variables involved in vocabulary teaching or learning process and these factors can be attributed to teachers, program, learners and features of the target lexical items. First challenge is related to instructors and language programs. As stated by some scholars "We see teacher instruction in vocabulary across the grades range from almost nothing to systematic, elaborated, and scripted models and everything in between" (Blachowicz,1987; Durkin, 1978/1979; Watts, 1995). Perhaps one of the most crucial barriers for vocabulary instruction is teachers not having enough knowledge or having some

inaccurate or inconsistent information or opinions about vocabulary teaching. Folse defines these false beliefs as myths and lists them as:

Myth 1: In learning another language, vocabulary is not as important as grammar or other areas.

Myth 8: Teachers, textbooks, and curricula cover second language vocabulary adequately.

Myth 1 and myth 8 are the most crucial ones; therefore, they are presented together at the beginning. The other six myths are more specific:

Myth 2: Using word lists to learn second language vocabulary is unproductive.

Myth 3: Presenting new vocabulary in semantic sets facilitates learning.

Myth 4: The use of translations to learn new vocabulary should be discouraged.

Myth 5: Guessing words from context is an excellent strategy for learning second language vocabulary.

Myth 6: The best vocabulary learners make use of one or two really good specific vocabulary learning strategies.

Myth 7: The best dictionary for second language learners is a monolingual dictionary. (Folse, 2004:458). It is intended in this study to clarify some vague points or misconceptions related to vocabulary teaching outlined in these myths.

Furthermore, some teachers are not informed of current and alternative vocabulary instruction strategies and techniques as colleague 3 expressed ""Actually I feel myself very weak about that (vocabulary teaching)." Similarly, Berne & Blachowicz say that teachers "...aren't confident about best practice in vocabulary instruction, and at times they don't know where to begin to form an instructional

emphasis on word learning or to change one that they feel is ineffective" (Berne & Blachowicz, 2008: 315).

Briefly, not having enough knowledge or having false opinions about vocabulary teaching could be one of the challenges for higher quality in teaching vocabulary. Another important barrier for teaching vocabulary effectively is learners' tendency to demand equivalents of the target words in L1 as mentioned by all of the instructors interviewed. Students do not see much use of various activities used in classroom for teaching words and they focus on only getting an equivalent of the target word. As colleague 1 said "They just try to translate from English to Turkish and they want to hear the Turkish equivalents of words directly from the teacher. This is the biggest challenge for me. They don't focus what I am doing in English but focus just the Turkish definition of the word." Similarly, it is difficult to get their attention as colleague 5 stated "Students see extra studies involving contextual materials unnecessary and waste of time and they want to have Turkish equivalents in a list." However, when they get the Turkish equivalents, they cannot get the exact meaning of the words and cannot use the target word(s) in appropriate context. On vocabulary word lists, Ünal says "Simply state, this teaching methodology of new vocabulary; i.e. teaching new items in isolation or with word lists, prevents students from using the new word for communicative purposes, which really is a serious pitfall" (Ünal, 2006: 21). Three of the five instructors mentioned this factor, students' tendency to focus on Turkish version of the word and ignoring the value of other vocabulary teaching activities, as a real challenge for their teaching.

Another problem related to vocabulary is its being underestimated by language teachers. As Laufer claims "... researchers and teachers continue to give less importance to it than to syntax and phonology (cited in Zimmerman, 1997: 21). Similarly colleague 4 stated "I do not think I spare enough time for vocabulary in class" since there are many responsibilities and tasks for teachers to be completed in a given time."

Not having a systematic revision and not having variety to appeal different learner types are the other factors that two of the instructors pointed out. What is more, textbooks do not give importance to variety in vocabulary instruction although providing various opportunities for language learners to acquire new words has a crucial role in language teaching. "The three top-selling content area textbooks gave little attention to multiple exposures, although the need for repeated exposure to key terms is an established need (McKeown, 1985; Stahl, 1998; Stanley & Ginther, 1991)." (Cited in Wood, 2009: 331). Similarly, 3 students interviewed said revision was not enough and so forgetting was the reason for failing to acquire words. As research suggests, forgetting factor has a detrimental role in vocabulary learning. "The mean difference (7,88) between the immediate posttest and delayed posttest for the control group, and the mean difference (6,92) between the immediate posttest and the delayed posttest for the experimental group showed the significance of forgetting within-group as well. (Kıvrak, 2007: 48). Shortly, vocabulary needs to gain its importance and be given importance as much as other language skills. That is essential because as Wilkins says (Cited in Kıvrak, 2007:1) "Without grammar very little can be conveyed; without vocabulary nothing can be conveyed."

Another difficulty in vocabulary teaching is related to words themselves. On the topic, Arter and Nilsen say that "... while some words can be defined with quick answers, other words are more complicated and need multiple illustrations" (Arter & Nilsen, 2009: 235). As two of the teachers and student 2 stated, some words do not have equivalents in the mother tongue, so this makes it harder for students to figure out an exact meaning of the word. Moreover, as put forward by student 1, 4, and 5, collocations, multiple meaning of the words, spelling and pronunciation are all other factors that affect language competence and performance in relation to vocabulary use. Additionally, as colleague 3 mentioned, target vocabulary lists may also create some problems because of the teaching load. To sum up, the difficulties concerning vocabulary teaching are about the instructors' attitude and knowledge, characteristics of target words and learners' performance and study habits which are likely to hinder acquisition of the new words.

Research Question 2

This section aims to discuss the obtained results for the application of alternative vocabulary teaching strategies to actualize more effective learning and to what extend it is achievable in case of a unique teaching context. In order to have a clearer and a better understanding of the obtained result, it is necessary to go into the details of the data analysis.

The findings of the pre and post-tests of each individual class are studied for comparison in order to find out whether there is an essential change in terms of vocabulary learning and recalling. As it has been mentioned before, the experimental

group is class 102 and classes 101 and 103 are the control groups in this study. When the data is analyzed, we can see that the average of the pre-test is 4,80 for the class 101, and 1,90 for the class103. The mean of the two classrooms is 3,38 which indicates that before the beginning of the teaching, the students in the control groups already know 3 to 4 vocabulary items, including the chance factor. Similarly, the experimental group, 102 has the average of 3,88 in the pre-test given prior to teaching. This data is essential as it shows that background vocabulary level of the students concerning the target words are somehow similar or equal both for experimental and control groups.

In order to make a more consistent statistical analysis, a T-test is applied to evaluate the scores (see appendix H). According to the findings of the T-test analysis, there is a significant difference between the pre-test scores and the post-test scores of the students in 102 ($t(15)= -11,97, p<.01$), and the same result is true for the pre-test and the post-test scores of the students in 103 ($t(15)= -4,10, p<.01$). However, there is no significant difference between the pre-test scores and the post-test scores of the students in 101. Although the difference between the pre and post-test scores of the students in 103 is also significant, $t(15)= -4,10, p<.01$, which is far limited when compared to the difference between the pre and post-test scores of the students in the experimental group 102, $t(15)= -11,97, p<.01$. It is apparent that the teaching and revision techniques practiced in the latter class have proven to be far more effective for vocabulary storage and retrieval.

If we compare the pre-test and post-test scores for each individual class, the results are quite interestingly surprising as there isn't much change at all in the

average scores of the pre-test and post-test of the control groups. Students' attendance problem and not all students' being present at the time of the administration of the tests may partly affect the results, but these two factors don't have a dramatic impact on the overall achievements of the students or on the overall class average. Besides, these factors are not much different for the other two classrooms. When the scores of the other groups are evaluated, the class 103 has an average of 1,95 in the pre-test as mentioned above and after the regular teaching, and the average of the post-test of that class is 6, 38 indicating that there is little progress in terms of vocabulary learning and it also indicates that forgetting factor is quite effective, meaning that transfer of the words from the short term memory to long term memory is not achieved for most of the measured words. For the experimental group, however, as it has been proposed in the research question, the results of the experimental group are considerably different from the other two classrooms in the post-test although they are similar in the pre-test. The average of the class 102 in the pre-test- is 3,88 and it is nearly equal to the average of the other two classes, 3,38. However, the average of the post-test results for 102, is 14,62; this is nearly three times more than the average of the other two classes together. In other words, the learners in the experimental group are able to recall nearly 75 per cent of 20 words whereas the students in the other classrooms are able to recall 10 to maximum 30 percent of the words. From this finding, it can be concluded that the brain-based techniques which are practised to boost the long-term potentiation of the words in vocabulary teaching in an EFL classroom have been quite effective and successful.

Research Question 3

This questions aims to find out the sort of change, adaptations, techniques and activities used to enhance long-term memory for improved vocabulary teaching. In chapter 2 and chapter 3 of this study, numerous techniques and activities have been presented to improve vocabulary teaching and to improve long-term potentiation. It is the instructor or the student that need to choose the most suitable and effective one for their own unique needs and requirements. Yet, there are some research findings and students' or teachers' ideas that can help us to rely in order to make sound plans and decision in our instructional design. In one study done in Turkey, the question "Are there any methods that you find useful in learning new words?" was asked to 12 language students. In the pre-questionnaire, the students thought that the best ways to learn new vocabulary are memorizing from vocabulary lists (4/12), watching foreign TV channels and films (3/12), reading magazines (2/12), playing vocabulary games (3/12). As it is seen, in the pre-questionnaire, the students favored the traditional type of vocabulary learning methods, memorizing from lists, mostly. (Ünal, 2006:32-33). This supports the idea that students only want translation, which is still a way of acquiring words. Besides, this is quite commonly used by many students.

Another way commonly used and suggested to improve vocabulary teaching is to increase interactive activities to teach new words based on the social learning principle explained in Chapter 2. This will provide learners good context to understand meaning and pronunciation and also opportunity to practice the target words to communicate in real life. Research supports this idea. "In other words,

interactive vocabulary instruction appeared to have a great impact on learners' vocabulary (Ünal, 2006:35). Consequently, the students who learn vocabulary items through cooperative learning score significantly higher on the post-test than the students who learn vocabulary items through traditional method. (Ercan, 2009: 52).

In addition to interactive learning, it is recommended to teach words in context. Nagy Herman, Anderson and Krashen propose that "Vocabulary should be presented in context rather than in complete isolation (cited in Ünal, 2006: 8). However, some researchers doubt whether this claim is so effective. Özer argues that he has found negative results for the efficiency of vocabulary teaching in context and even students who learned words in isolation scored better in his study (Özer, 2006, 74). Similarly, Nation indicated that "...there is no research that shows that learning from context provides better results than learning from word cards. (cited in Taboada, 2009:317). Although there are controversial findings from studies, still most of the students and teachers interviewed stated that they find teaching or learning words in context really effective.

Another very useful vocabulary teaching technique is the use of photos and drawing. As colleague 2 expressed "They (learners) want to see it" and she uses drawing technique. Colleague 3 said "Using visuals and pictures is a very enjoyable and beneficial technique for long-term storage of words." Student 1 said " Using visuals and revising the words were really effective for vocabulary learning and thus we had the chance to learn the words in the revision activities if we had missed the first presentation hours." Drawings and photos are used and referred as effective for vocabulary learning by 4 of the 5 students interviewed. Research also supports the

advantage of using visuals in vocabulary teaching. Merter found out that "Some of the students who joined the presentation gave feedback after two months. First, they expressed their pleasure and then said that the words taught in the presentation were on their minds. They required learning new words in the same way; via presentations by photographs" (Merter, 2006: 149). Akça also makes a similar conclusion "But, there is not a dramatic loss of knowledge, which can be concluded as visual learning can be seen as an effective learning" (Akça, 2009: 77). Still, there are some opposing ideas to the effectiveness of visuals for teaching words. Hazar studied the effectiveness of visuals to teach words and he found that there wasn't a significant relationship between the post-test scores of experiential group and control group in his study (p>0,05) (Hazar, 2007: 51). The results may change in different teaching context; however, the value of visuals is repetitively emphasized both by students and instructors interviewed as well as the scholars in language teaching. In addition to these, writing, creative or story writing using the target words was another significant technique for teaching words.

Some other techniques and alternatives suggested can be writing sample sentences using the word, making associations (with an image, name or object), synonyms and antonyms, practising in context such as debate, games, using movements and body language and revising words regularly in different and meaningful context. Meanwhile, peripheral learning can be also useful for teaching vocabulary although it has a limited use. Incident vocabulary learning can be effective as proposed by some scholars such as Ellis and Laufer (Cited in Ünal, 9: 2006). Because all students need to learn far more words than could ever be taught

explicitly, we believe that vocabulary instruction for all students should be multifaceted in nature, involving not only the teaching of specific words but also strategies for inferring word meanings and the development of word consciousness (i.e., a heightened awareness of and appreciation for words)" (Manyak and Bauer, 2009: 175).

There are certainly more techniques and activities but these are the ones that are suggested by interviewed teachers and students and that have proven to be effective with the students in the experimental group in this study. Yet, it is necessary to select the most suitable ones for the needs and interest of each unique teaching setting and ensure that there are more pathways to teach vocabulary and to boost long term-potentiation.

Research Question 4

This question aims to find some overall suggestions for enhancing long-term storage of the words based on the principles presented mainly in Chapter 2 and findings of the experimental studyin this study. In this section, it is aimed to find answers to the question how long-term potentiation of words can be improved and thus how vocabulary instruction could be made much more efficient. There have been several studies on the topic. According to a survey carried out by Berne and Blachowicz which had questions to 72 language teachers or professionals involved vocabulary teaching, following results have been obtained:

> How can we develop a consistent approach to vocabulary learning in my building/ district? 27

> What is the best way to encourage vocabulary development in English Language Learners? 18
> What are the best strategies/activities for vocabulary teaching? 18
> How can I foster transfer and retention of taught vocabulary? 17
> What are the best materials available to support vocabulary learning? 17
> How do I know what words to focus upon? 14
>
> (Berne & Blachowicz, 2008: 315)

This indicates that a great majority of the teachers want to develop a general approach to make their teaching standard but according to the needs of their district, which means they search for some overall teaching principles to satisfy their unique needs. On the topic, Berne and Blachowicz argue that "Teachers may be concerned about what strategies to use, what materials are available to aid in vocabulary instruction, and how to foster and measure transfer, but they are most concerned about collaborating on shared practice. They are concerned about ways to implement a systematic program rather than a set of practices inside a single teacher's classroom" (Berne & Blachowicz, 2008:319). Of course, teachers do have their own approaches, techniques and activities to teach words but although teachers have particular strategies and practices they believe to be effective, "they wish to weave together isolated practices into a systematic program of vocabulary instruction" (Berne & Blachowicz, 2008: 320). In their study, teachers' responses to use of vocabulary teaching activities were as the following:

Focusing on word relationships/word parts 13

Using read-alouds and songs 11

Using games/play 9

Using talk/discussion/think-alouds 6

Using word walls/ word banks 6

Integration with units and content across the content areas 6

Exposing students to difficult words 5

Systematic, explicit instruction 4

Making connections to background knowledge 4

Engagement/collaboration/drama 4

Using context 3

Preteaching vocabulary prior to reading 3

These findings reflect that unique teaching setting, and the results may and probably will vary in others. Therefore, as colleague 5 stated "Particularly for the first time presentation, the technique or activity depends on the word and the theme the target word(s) are related to, whether it is concrete or abstract." For concrete meaning words, she uses visuals but for abstract meaning, she provides context and uses guessing meaning from context. It is evident that using one single method does not work and it is a necessity to provide learners with a mosaic of various techniques and activities designed parallel to the principles of memory and learning. Then, students can be guided and encouraged to choose the most effective techniques for them and begin to practise and revise words as autonomous learners. As evidenced in the study, use of activities appealing various senses, multiple intelligence theory, works for better vocabulary teaching. "In other words, the activities that stimulated MIT positively influenced the recall of the vocabulary items by the pupils in the experimental group (Pekderin, 2006, 89-90). One crucial point to be noted here is that both teaching and recycling steps of teaching words need to be systematic and

well planned. This of course creates an extra but a necessary load on the instructors as well as students. As a colleague honestly stated ““they require lot of time to be prepared and I must be honest that I cannot spend so much time preparing vocabulary exercises or materials.” For that reason, in order to achieve better results in vocabulary teaching, teachers, program designers, administrators and other parties involved need to give priority and sufficient value to vocabulary in their teaching. Moreover, it is of vital importance that the teachers and classrooms have the required technology such as Internet, projection and other audio-visual devices to bring variety to classroom and appeal different learner types. Only along with the use of proposed techniques successfully with technology integrated teaching, improved vocabulary teaching can be achieved in language teaching programs.

4.2 Implications for Teaching

The data presented above cannot be generalized to all EFL contexts; nevertheless, it provides valuable information to derive some conclusions concerning vocabulary teaching and enhancing long-term memory. First of all, the instructor’s awareness of the techniques, selection of the potentially most effective vocabulary teaching technique and careful selection of teaching and revision materials play a crucial role in the success of the teaching. Secondly, it is possible that some students may be partially reactive as the activities require active involvement and participation as well as their contribution. Therefore, they may see these extra studies an extra burden put on them; however, this has not caused any serious problem in our study group. On the contrary, most of the exercises, activities and materials bring

variety into classroom and as a result increase students' motivation. Students are eager since they are informed that the words are the ones in their actual syllabus and they will be tested on them anyway. Moreover, students are also informed that they are quite likely to encounter these words frequently in their departmental courses. It is crucial to maintain that learners find the target words important and pay attention to them since they are well aware of the need to acquire these words and improve their lexical range. Kovalik (1996) and Scovel also emphasize the role of attention on memory saying that attention and awareness have significant influence on memory and storage (Scovel, 2001:102). For that reason, it is vital in terms of long-term storage and better retrieval to make students aware of the importance of the target words, to pay great attention and contribution to learning process of the new words during teaching. Kovalik (1996) also states the importance of making students aware of their needs and she even argues that "building awareness of need to learn is as important as teaching style and content" (p.7). Students need to be convinced about the necessity of the words and should believe that they will benefit from the planned tasks or activities for teaching.

In terms of vocabulary teaching or learning, it is very apparent in this research that the conventional methods or techniques of teaching vocabulary are not effective and satisfying neither for instructor, nor for learners if we take the pre and post-test scores of the control groups into account which shows a little or almost no improvement in acquisition of the new words especially in the long run. Although students study the words in class, the teacher writes them on the board, explains them or gives examples and even some students revise them on their own in the traditional

way of vocabulary teaching, this is just putting the words from their working memory to short-term memory. The problem is that most of the words are forgotten and lost after a while in the short-term memory and cannot be transferred to long-term storage in most cases with traditional teaching as this can be clearly seen in the scores of the students in classes 101 and 103. However, the success in language learning, particularly at academic level, totally depends on an adequate level vocabulary and being able to use it efficiently. In other words, it is of utmost necessity for a language learner to be able to quickly recall or retrieve the words that he or she needs when needed for both cognitive and productive language skills. Otherwise, students are blocked if they cannot recall a word or words and their comprehension, fluency, or accuracy and so overall language performance is negatively affected. For these reasons, it is a must for language teachers and learners to alter the existing ways of instruction and strive for alternative means of teaching or learning. At this point, the findings of this research may provide us some ideas to explore and spend some time and energy for the suggested language teaching techniques mentioned in the previous chapter so as to increase the quality of the teaching. The techniques used in the study have shown a dramatic difference in a positive way stating that it is worth giving a try to new techniques or activities designed according to the principles of brain and principles of memory, especially for long-term storage of words.

CHAPTER V

CONCLUSION

5.0 Concluding Remarks

After evaluating the research findings in this study, we can reach some conclusions related to language teaching, vocabulary teaching in particular. Yet, it has to be stated here that this study is designed and carried in a unique context and with a specific and limited groups of language learners of a certain age. Therefore, it will be irrational to make overgeneralizations about the teaching or learning methodology. However, this research may well constitute a basis for language teachers and learners to get some ideas, hints and inspiration to make changes in the way of their instruction or learning.

As it has been evident in chapter 4, traditional instruction fails to make desired progress in language teaching, especially vocabulary development of the learners because of the forgetting factor, or because not being able to retrieve the existing words in our brain is a natural phenomenon. Besides as stated "The intention to learn, however laudable, does not in itself ensure that effective learning will take place. That subjects are more likely to retain verbal input (i.e. commit new items to long term memory) if they are actively engaged in a meaningful task which involves some kind of semantic processing, and provides a unifying theme to facilitate organization in the memory" (Gairns and Redman, 1998, 91). Bearing this very basic human characteristic in mind, it becomes an obligation, as well as a necessity to

search for alternative and much more effective ways to teach vocabulary. This is essential because words are the bricks of the language and without acquiring adequate number of words, language learners will not be able to build up and improve language skills and will not be able to improve their language competence and performance. Wilkins (cited in Bowen and Marks, 1994) argues that "... there is not much value. ... in being able to produce grammatical sentences if one has not got the vocabulary that is needed to convey what one wishes to say".

Unfortunately, the significance of vocabulary in language teaching is not fully perceived by many students and teachers, or course book writers. A considerable number of people have the misconception that along with grammar and other language skills, the learners will automatically acquire sufficient words. Fowler proposes that it is quite common to observe teachers who tend to underestimate the value of vocabulary relatively as they put a lot of emphasis on accuracy, grammar, authenticity and communication (cited in Bowen and Marks, 1994). He concludes "... the source of many students' being unable to express themselves is quite simply because they do not know the right words." Fortunately, many people involved in language teaching have realized the need for special care and design for teaching vocabulary in language classrooms particularly in recent years. This is of utmost important if students are studying English for academic purposes, as it is in our case for university education in English. In conclusion, it can be stated that the suggested vocabulary teaching techniques have been effective and language teachers and learners, course or program designers and course book or skills book writers should take them into consideration and aim to incorporate a variety of these techniques and

design their materials according to the principles of memory and brain-compatible teaching. The results of the research are rather satisfactory and they encourage us as language teachers to give more emphasis and more importance to alternative vocabulary teaching proposed in this study which makes it more worthwhile to put more time and effort on it in order to achieve higher quality in language instruction.

5.1 Suggestions for the Language Teaching

It is certain that this study is limited and a larger-scale one may be necessary to obtain more accurate results related to vocabulary teaching and long-term potentiation of words. Folse says "However, by now considerable research has not always filtered down to teaching practice (Folse, 2004:457). Nevertheless, the need to incorporate alternative vocabulary teaching techniques is obvious. Blachowicz & Fisher say that "Vocabulary instruction is often a product of a variety of opportunities to learn " (cited in Tate, 2005: 39). Along with the new trends in language teaching field, multiple intelligence theory (MI) addressing various learning types and computer-aided instruction using technology in teaching which undoubtedly boosts motivation by bringing variety to classroom, applying the alternative vocabulary teaching techniques will also contribute to overall quality of language teaching. Using visuals, for instance, to teach vocabulary is quite beneficial as it "… is extremely reliable and there is little doubt that objects and pictures can facilitate memory." Moreover, it is claimed that it is easier and more effective to perceive a concrete item than an abstract item. (Gairns and Redman, 1998: 92). Therefore, lots of visuals are used as teaching materials together with creative

writing, personalization, making associations, finding the synonyms and antonyms, contextualizing, completing the sentences and recoding sentences or paragraphs covering the target vocabulary in order to boost long-term storage of the target words. Another crucial aspect of the suggested vocabulary teaching in this study is recycling of the lexical items. Nation (2001: 74-75) also informs that "Repetition is essential for vocabulary learning because there is so much to know about each word that meeting with it is not sufficient to gain this information and because vocabulary items must not only be known, they must also be known so well that they can be fluently accessed. Repetition, thus, adds to the quality of knowledge and also the quantity or strength of this knowledge" (Kıvrak, 2007: 48).

Still, it must be mentioned that this sort of vocabulary teaching and revision require dedication, commitment, spending a lot of time, effort, creativity, careful planning and design of the lessons, teaching and revision materials. Thus, it may create an extra burden on instructors' workload. Furthermore, because both teaching and revision of the target words will definitely take longer time than regular teaching, the curriculum and program designers need to allocate certain time for vocabulary teaching and revision in the official program. The supplementary materials should include target words for revision which has been done regularly in our experimental class. The vocabulary items taught weekly are regularly revised as weekend homework assignments either as cloze tests or sentence level fill-in the blanks exercises. As for revision, Gairns and Redman propose an alternative way of recycling new word entries. For them, a five-minute revision should be done five to ten minutes after the actual learning. Then, a quick review is necessary twenty four

hours later. Following that, another revision should be carried out one week later. Finally, revision can be done one month and six months after the initial teaching (Gairns and Redman, 1998, 95). Similarly, Jensen suggested practice at certain frequency and intervals. He suggested that revision within ten minutes of learning, then after 48 hours, and 7 days later is essential for enhancing better memory pathways to make retrieval and recall considerably easier and effective (Jensen, 1998). One can possibly argue that this much revision may not be possible considering the limitations related to syllabus, teaching hours, workload of instructors and some similar limitations. Even though this argument has some grounds, it is a must to find some adaptations or varieties of this revision procedure to achieve better result in long term storage. After all, it cannot be disputed that "students will find it easier to retain and retrieve an item from long term memory if they have been exposed to it through a number of different contexts" (Gairns and Redman, 1998, 95). Of course it might not be so easy or convenient for any language program or teacher to follow the suggested revision pattern; however, both teaching materials and revision materials for 24, 48, one week and two or three-week revision should be prepared and provided for all classrooms following the same syllabus. If that is not feasible, then some adaptations might be considered ensuring the systematic revision of the target lexical items.

Of course, these revision activities and exercises should be designed by selecting the best and most suitable technique(s) according to the nature of words and characteristics of the students in that unique context. Variety in teaching will undoubtedly contribute to long-term storage of the words. The practice of words with

different tasks in various formats and contexts at certain intervals makes it possible to repeat the newly acquired and desired behaviour and this helps learners to see the whole to make learning a real-life experience within a holistic perspective (Howard, 2000). The key point at this stage is designing revision materials in more real life tasks rather than rote memorization. Although it is proposed that "repetition with enough usage, they become nearly indeligible" (Jensen, p.163), "simply repeating the word did not increase their accessibility" says Baddeley (Baddeley, p.45) and adds that meaningful follow up activities fosters long-term storage and easier retrieval. Similarly it is indicated by research that "words processed semantically were more likely to reach long-term storage than words processed by the more superficial means" (Crossson, p.304). For that particular reason, we have used various visuals, made word associations, practised words in contexts and used personalization such as writing exaggerated or real life sentences using the intended words. Thus, students are directed to make use of their background knowledge, experiences and emotions while learning new words. Students will acquire words more easily if they are exposed to similar things before (Ranpura, 2000).

Additionally, vocabulary teaching should also address the feelings of the learners as emotions, particularly pleasant experiences, pre-defined priorities and uniquely created meaning can be stored in the brain for a longer period of time and they all boost implicit memory (Jensen, 1998). It is also stated that emotionally enhanced memory pathways, controlled by amygdala, are capable of storing information for a long time (Caine & Caine, 1991). Keeping that feature of the human brain in mind, we need to design our teaching to involve students' feelings

and imagination and link the intended words with their feelings and imagination. This can be achieved by making associations, writing sentences using the target words from real life, creative writing and exaggerating. Moreover, if learners value and practise the new vocabulary item(s), it becomes the template for reorganization of previous patterning. This reorganization of base patterns will lead to long-term memory (Hannaford, 1995). These meaningful activities also include techniques such as using flashcards, recording audio tapes and reviewing while jogging, role plays, projects, debates, and field trips if possible etc... (Howard, 2000; Buzan, 1998). Apparently, the techniques applied have proven to be effective in boosting storage or recall of the target words in our research and the students' feedback about the new ways of learning the words was positive and satisfying.

Another essential information obtained from the research for teaching vocabulary is the infinite capacity of human memory to store words but human memory is rather complex and therefore, doesn't fit clear cut measurement and generalizations. Related to the topic, Gairns and Redman argue that "Unlike short-term memory which is limited in capacity, long-term memory is seemingly inexhaustible and can accommodate any amount of new information" (Gairns & Redman, 1998: 87). Of course, it has to be noted here that this unlimited capacity is not so easy to achieve and it certainly demands a lot of energy, a variety of techniques and activities for teaching. Still, awareness of such a reality will and should provide both learners and teachers of a language the credence, energy and motivation to search for more effective and efficient alternative ways of long-term potentiation words.

Finally, this study is carried in a preparatory school with upper-intermediate / advanced-level group of students and the result of the experimental groups are quite satisfying. Yet, it is not clear whether similar scores will be obtained with lower level students such as beginner, elementary, pre-intermediate or intermediate level student groups. Moreover, it may be another research question if the results will be similar or completely different with children, teenagers and young learners at primary, secondary or high school level students if the same experimental research has been carried out with them.

It cannot be denied that no strategy is foolproof and no strategy is proven. "You have to see how it works in your particular setting" (Marzano, 2004:83). Still, we continuously need to search for better and more effective means of vocabulary instruction. One possible way is professional development of the language teachers particularly on vocabulary teaching. As Blachowicz and Graves argue "It is imperative that we provide teachers with continuous and systematic staff development training on vocabulary and concept knowledge. This training needs to include methods of developing vocabulary that is both *integrative*—that is, relevant to all grade levels and subject areas—and *comprehensive*, based upon a common philosophy of shared practices among teachers in a district" (C. Z. Blachowicz et al., 2006; Graves, 2006) (cited in Wood, 2009: 336). Language learning and teaching is a vast field of study and in this field, vocabulary teaching and memory is another large field that is open to further study and research to develop our teaching qualities and become real professionals in the field of language teaching in EFL contexts.

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APPENDICES

A: Target Vocabulary List

TARGET VOCABULARY LIST

undergo, tremendous, rely, reliable, reliability, feature, survey (v/n), will, willing, bet, headline, guy, take for granted, cheat, seldom, insult, insulting, chase (n/v), stress (v), expose, exposure, crucial, literacy, literate, commodity, yell, circulate, circulation, assemble, assembly line, demonstrate, competent, competency, appreciate, govern, governor, acuity, solid, encompass, elevation, vehicle, onset, entity, embark, repudiate, endure, endurance, rupture, revelation, recite, voracious, agonize, confer, blend, particle, compound, slum

barrier, policy, smooth, smoothly, headquarter, gather, gathering, balance (v/n), spread,
offend, offensive, relevant, relevance, peer, slang, switch
host, syllabus, branch, legislate, legislation, legislative, sprain, capture, hemisphere, phase, rotate, rotation, occupy, occupation, occupant, bound, transcript
scheme, reverse(v), initial/lly, bequest, amenable, nominate, nomination, halt, implement, implementation, depict, depiction, bare, barely, abrupt/ly, glamour, peril,

differentiate, unreliable, rational, rationale, target (v/n), pricing
ethics, ethical, corporate, found, bankrupt, go bankrupt, bankruptcy, shareholder, fail, failure, executive, declare, fraud, corrupt, corruption, conscience, prompt, bend, stimulus, strike (n), attorney, peninsula, jurisdiction, sophisticated, subtle, wholesaler, initiate

fundamental/ly, shift (v/n), concurrent/ly, intense, intensely, span
civilization, civilized, intellectual, property, enforce, infringement, via, violate, violation, merchandise, merchant, battle, edible, equivalent, concrete,
proponent, constrain, eliminate, elimination, invoke, conductive, rely upon, fragile,
compose, composer, deceptive, deceptively, equalize

compassion, drain, vomit, remedy, dilute, detect, detectable, undetectable, bias, biased,
simulate, simulation, distinct, distinctive, distinction, perceive, perception, common sense, interface, literal, ruin (v/n), drop out, handle (v), means (n), subdivision, pirate, crew, grave, exuberant, exuberantly, laborious, laboriously, predator, fallacy, unwary, possess, misconception, dwarf, imminent, undergo, massive, genre, alter, omit, correspond, correspondence, opt for, attribute, cluster, predecessor,
Constitute, myriad, enhance, lure, diverge, divergence, abrupt/ly, ensue, strive

trait, account for (phv), attribute to, mature, maturation maturity, skeptical, skepticism, skeptic, disparity, privilege, privileged, aspire, aspiration

abbreviate, abbreviation, calculate, calculation, calculator, resemble, capability, capable, dispute, valid, invalid, validity, underestimate, entity, call off (phv), withstand, pursuit, embark, rival, rivalry, subsequent, subsequently, conquer, scramble, apprentice (v/n), apprenticeship, devise, mock (v), endeavor, cluster, mutual, mutually, robust, resuscitate, orbit, suspend, polish, vibrate, vibration, lateral, consistent, consistency, epoch, pioneer, inferior,

garbage, vandal, vandalize, vandalism, boundary, mass (adj),
impact (v/n), scale, be in favor of, constant, constantly, substance, inhale, appliances, substitute, substitution, commercial, commercially, vigorous, bizarre, irrational

Name, Surname:
Class:

B: Pre-vocabulary Test

VOCABULARY PRE-TEST

Instruction: Following vocabulary test is designed for a research and results will **NOT** be used for grading or any other purpose. The test includes words from the target vocabulary list in Çankaya University English Preparatory Class syllabus which will be followed this semester. You are kindly asked to perform your best so as to get accurate scores related to your performance in the test. Thank you for your contribution in advance.

Read the sentences and fill in the blanks with a suitable word from the box. There are more words than you need.

hemisphere	bequests	amenable	depict	peril
corruption	consciences	jurisdiction	pioneer	attorney
subtle	infringed	fragile	constrained	vomiting
dilute	fallacy	opted to	clusters	vigorous

1. The upper classes are more likely to leave _____ to their children.
2. The court ruled that he had _____ the company's patent.
3. When her parents divorced, Mary Ann _____ live with her father.
4. In general, the American courts have no _____ to deal with crimes outside the USA.
5. His stories _____ life in Trinidad as seen through the eyes of a young boy. In this new biography she is depicted as a lonely and unhappy woman.
6. But Lugar calls nuclear terror the greatest _____ of our age.
7. One of the problems often associated with working with young children is their apparently short concentration span.
8. The administration has frequently been accused of _____ and abuse of power.
9. As adults we have active _____ which help us do the right thing.
10. Abbe David Lowell, a white _____ who has defended numerous public officials, including Democratic Rep.
11. The warning signs of the disease are so _____ that they are often ignored.
12. Women's employment opportunities are often severely _____ by family commitments.
13. If she starts _____, contact the doctor immediately.

14. Opening NATO to new members may _____ its strength making it a passive organization.
15. Be careful with that vase - it's very _____.
16. Young people are more _____ than older citizens to the idea of immigration.
17. The idea that a good night's sleep will cure everything is a complete _____.
18. Atmospheric carbon dioxide in the northern _____ is increasing measurably.
19. Most galaxies are found in _____ rather than in isolation.
20. John Whitney was a _____ of computer animation.

VOCABULARY PRE-TEST (KEY)

Instruction: Following vocabulary test is designed for a research and results will **NOT** be used for grading or any other purpose. The test includes words from the target vocabulary list in Çankaya University English Preparatory Class syllabus which will be followed this semester. You are kindly asked to perform your best so as to get accurate scores related to your performance in the test. Thank you for your contribution in advance.

Read the sentences and fill in the blanks with a suitable word from the box. There are more words than you need.

hemisphere	bequests	amenable	depict		
peril	corruption	consciences	jurisdiction	pioneer	
attorney	subtle	infringed	fragile	constrained	
vomiting	dilute	fallacy	opted to	clusters	vigorous

1. The upper classes are more likely to leave _BEQUESTS____ to their children.
2. The court ruled that he had _INFRINGED___ the company's patent.
3. When her parents divorced, Mary Ann ___OPTED TO___ live with her father.
4. In general, the American courts have no _JURISDICTION__ to deal with crimes outside the USA.
5. His stories __DEPICT___ life in Trinidad as seen through the eyes of a young boy. In this new biography she is depicted as a lonely and unhappy woman.
6. But Lugar calls nuclear terror the greatest ___PERIL__ of our age.
7. One of the problems often associated with working with young children is their apparently short concentration span.
8. The administration has frequently been accused of _CORRUPTION____ and abuse of power.
9. As adults we have active ___CONSCIENCES___ which help us do the right thing.
10. Abbe David Lowell, a white __ATTORNEY___ who has defended numerous public officials, including Democratic Rep.
11. The warning signs of the disease are so __SUBTLE___ that they are often ignored.
12. Women's employment opportunities are often severely _CONSTRAINED__ by family commitments.
13. If she starts _VOMITING__, contact the doctor immediately.

14. Opening NATO to new members may _DILUTE__ its strength making it a passive organization.
15. Be careful with that vase - it's very _FRAGILE_____.
16. Young people are more _____ than older citizens to the idea of immigration.
17. The idea that a good night's sleep will cure everything is a complete __FALLACY_____.
18. Atmospheric carbon dioxide in the northern __HEMISPHERE____ is increasing measurably.
19. Most galaxies are found in _CLUSTERS____ rather than in isolation.
20. John Whitney was a __PIONEER___ of computer animation.

C: Post-vocabulary Test

VOCABULARY POST TEST
Complete the sentences with a suitable word from the box. There are more words than you need.

concrete prey fallacy fragile constrain irrational
barrier deficiencies legislate capturing sprained
pioneer
hemisphere inferior imminent unwary branches
violated
bequest infringe rotation peril amenable
edible

1. A backup copy of a computer program does not _____ copyright, which means it is legal.
2. The government has promised to _____ against discrimination and make everyone equal in front of law.
3. Many analysts claim that a war between North Korea and South Korea is _____ if North Korea doesn't end its nuclear program.
4. Government troops have succeeded in _____ the rebel leader and have put him into prison.
5. Financial factors should not _____ doctors from prescribing the best treatment for patients.
6. I fell down the steps and _____ my ankle.
7. Three plays will be performed in _____ during the drama festival. Employers may work in different positions or duties to give staff wider experience.
8. Young people are more _____ than older citizens to the idea of immigration. Elderly people are more resistant to change.
9. He refused to accept a job of _____ status thinking it was degrading work in a lower status and he eventually resigned.
10. These mushrooms are _____, but those are poisonous.

11. The courtroom did not sentence the accused man as the police could not provide the court any _____ evidence.
12. The mountains form a natural _____ between the two countries.
13. Fish at the surface of the water are easy _____ for eagles as they are easily caught.
14. The bank has _____ all over the country and it is even trying to expand more.
15. They put their own lives in _____ to rescue their friends. Many admit that it was a really brave deed.
16. John Whitney was a _____ of computer animation being the first person to create an animation in the sector.
17. Be careful with that vase - it's very _____ and can be broken into pieces easily.
18. The _____ travelers who usually come to metropolitan cities for the first time from villages or small towns with the hope of finding job can easily be trapped in the streets.
19. North _____ has larger agricultural land to cultivate than the southern one.
20. His grandfather left him a _____ of $500 million in his will, so he has become a wealthy man.

VOCABULARY POST TEST (KEY)
Complete the sentences with a suitable word from the box. There are more words than you need.

concrete prey fallacy fragile constrain
irrational barrier deficiencies legislate capturing
sprained pioneer hemisphere inferior imminent
unwary branch violated bequest infringe
rotation peril amenable edible

1. A backup copy of a computer program does not _INFRINGE__ copyright which means it is legal.
2. The government has promised to __LEGISLATE___ against discrimination and make everyone equal in front of law.
3. Many analysts claim that a war between North Korea and South Korea is _IMMINENT__ if North Korea doesn't end its nuclear program.
4. Government troops have succeeded in _CAPTURING___ the rebel leader and have put him into prison.
5. Financial factors should not __CONSTRAIN___ doctors from prescribing the best treatment for patients.
6. I fell down the steps and _SPRAINED___ my ankle.
7. Three plays will be performed in __ROTATION___ during the drama festival. Employers may work in different positions or duties to give staff wider experience.
8. Young people are more __AMENABLE___ than older citizens to the idea of immigration. Elderly people are more resistant to change.
9. He refused to accept a job of __INFERIOR__ status thinking it was degrading work in a lower status and he eventually resigned.
10. These mushrooms are _EDIBLE__, but those are poisonous.

11. The courtroom did not sentence the accused man as the police could not provide the court any __CONCRETE__ evidence.
12. The mountains form a natural __BARRIER____ between the two countries.
13. Fish at the surface of the water are easy _PREY__ for eagles as they are easily caught.
14. The bank has _BRANCHES___ all over the country and it is even trying to expand more.
15. They put their own lives in _PERIL_ to rescue their friends. Many admit that it was a really brave deed.
16. John Whitney was a _PIONEER_ of computer animation being the first person to create an animation in the sector.
17. Be careful with that vase - it's very __FRAGILE___ and can be broken into pieces easily.
18. The _UNWARY__ travelers who usually come to metropolitan cities for the first time from villages or small towns with the hope of finding job can easily be trapped in the streets.
19. North _HEMISPHERE___ has larger agricultural land to cultivate than the southern one.
20. His grandfather left him a _BEQUEST_ of $500 million in his will, so he has become a wealthy man.

D: Sample Materials for Teaching

Target vocabulary : *barrier, policy, smooth, smoothly, headquarter, gather, gathering, balance (v/n), spread, host, syllabus, branch, legislate, legislation, legislative, sprain, capture, hemisphere, phase, rotate, rotation, occupy, occupation, occupant, scheme, reverse(v), initial/lly, bequest, amenable, nominate, nomination, halt, mplement, implementation, depict, depiction, bare, barely, abrupt/ly, glamour, peril, bound, transcript*

1. A.

Barrier (n)

2. A.

Host (n)

3. A.

GEEN 3400 **INVENTION AND INNOVATION** **Fall 2007**

Revised 9/13/07

SYLLABUS

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Meeting Times Discussions: 11:00-11:50 M
Studios: 9:00-10:50 T-Th
All classes meet in ITLL 150, accessible after hours via Buff OneCard

Course Description

The purpose of this course is to provide an **introduction to engineering and product invention and innovation** via a team-based design-build invention and innovation project. You will explore the invention/innovation process and learn, through hands-on *doing*, other valuable engineering skills, including oral and written communications skills, functioning effectively in teams, development of a break-even analysis to explore entrepreneurial aspects and market potential for your product, and a variety of computer design tools. You will also have opportunities to exploit the fabrication capabilities of the ITLL Manufacturing and Electronics Centers.

Course Format

The class will explore topics common to the engineering design and innovation process, such as elements of the design process, methods to stimulate creativity, decision analysis methods, aesthetics in engineering design, intellectual property and the patent process, forecasting the break-even point for your entrepreneurial enterprise, etc. Formal design reviews and other team exercises will occur during studio periods.

Miscellaneous

- You will contribute about $50 towards supplies and expenses for your design project.
- Each student must provide his/her own safety glasses
- Each team will be provided a **toolbox** containing many useful small hand tools, and a **lock** for your assigned **locker** in ITLL 150. You must return the toolbox with all the original tools at the end of the semester. Missing tools must be replaced prior to toolbox return in order to receive your final course grade for all team members. For details of the toolbox policy and contents see: http://itll.colorado.edu/geen1400/index.cfm?fuseaction=Toolboxes .

Course Elements

An **introduction to social styles** will increase awareness of the different ways we interact with others, and how others perceive us in the communication process.

Through a short and creative introduction to the design process, you will work with your team to create a **conceptual prototype** and act out a **commercial** for your invention.

Syllabus (n)

4.a.

Branch (n)

4. B.

5. C.

4.D

5. a.

Legislate (v) / Legislation (n)

5. B.

5. c.

"They heard about the 'Party Hearty' legislation."

5. D.

6. A.

Sprain (n)

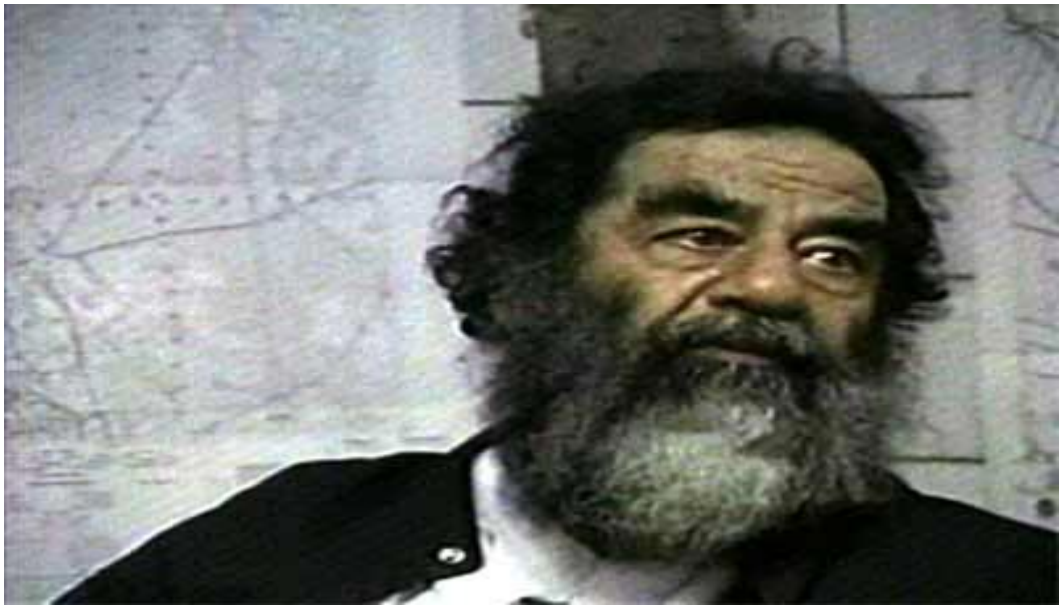
6.B.

6. C

7. A.

Prey (n) / predator (n)

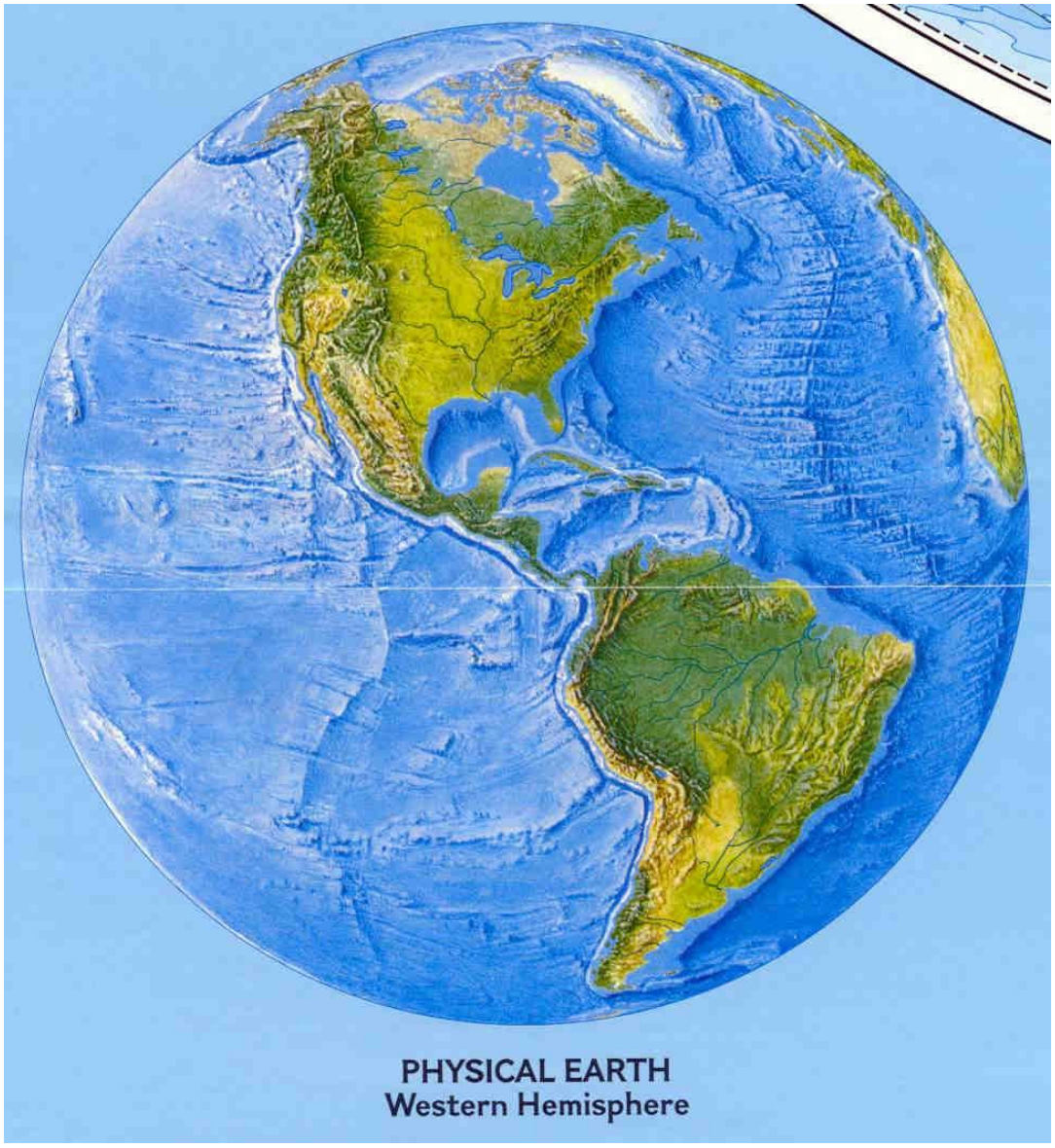
7.B



Capture (v)

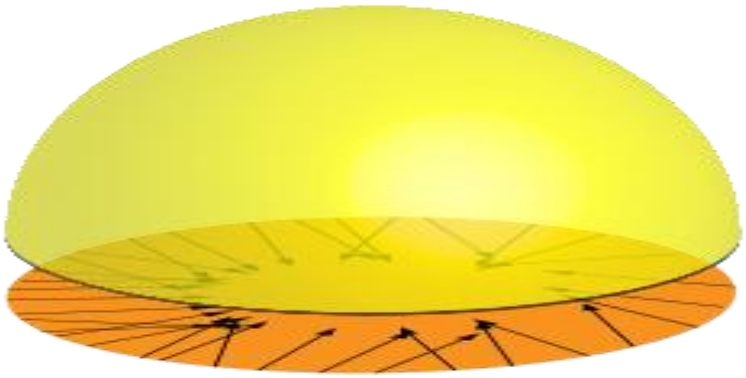
7.C

8.A

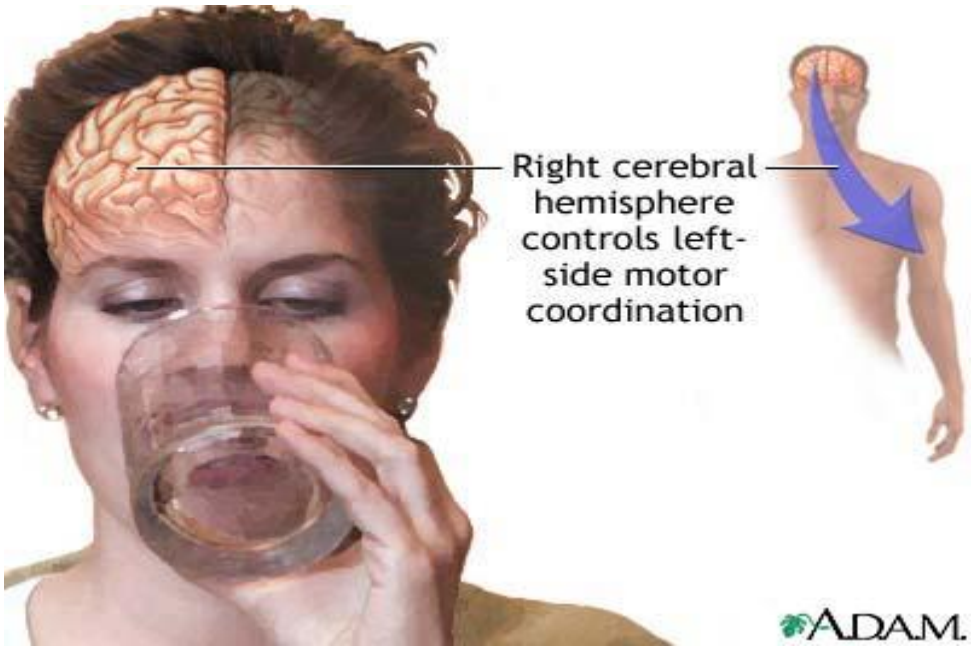


Hemisphere (n)

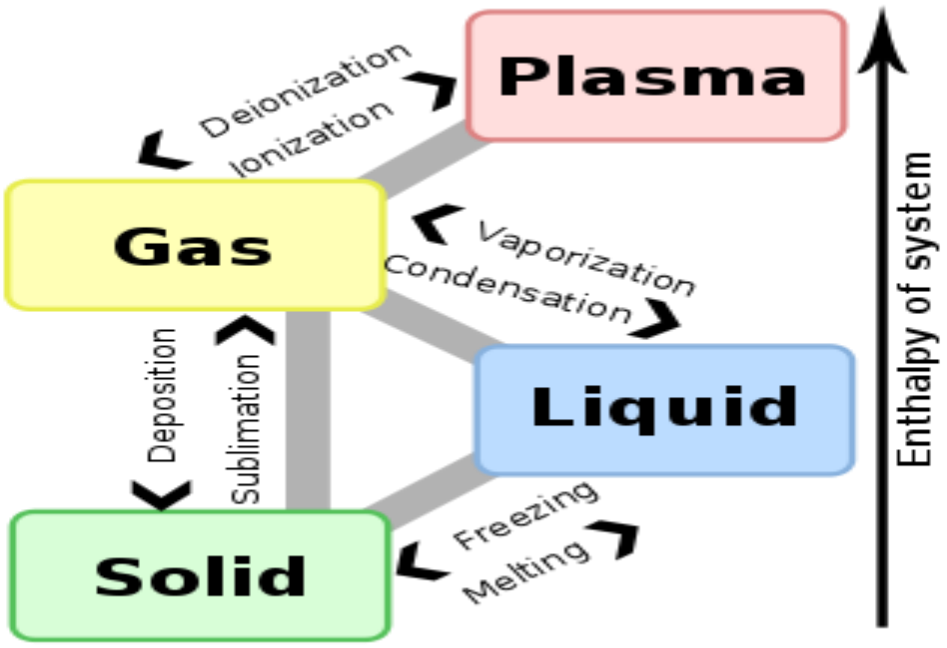
8.B



8.C

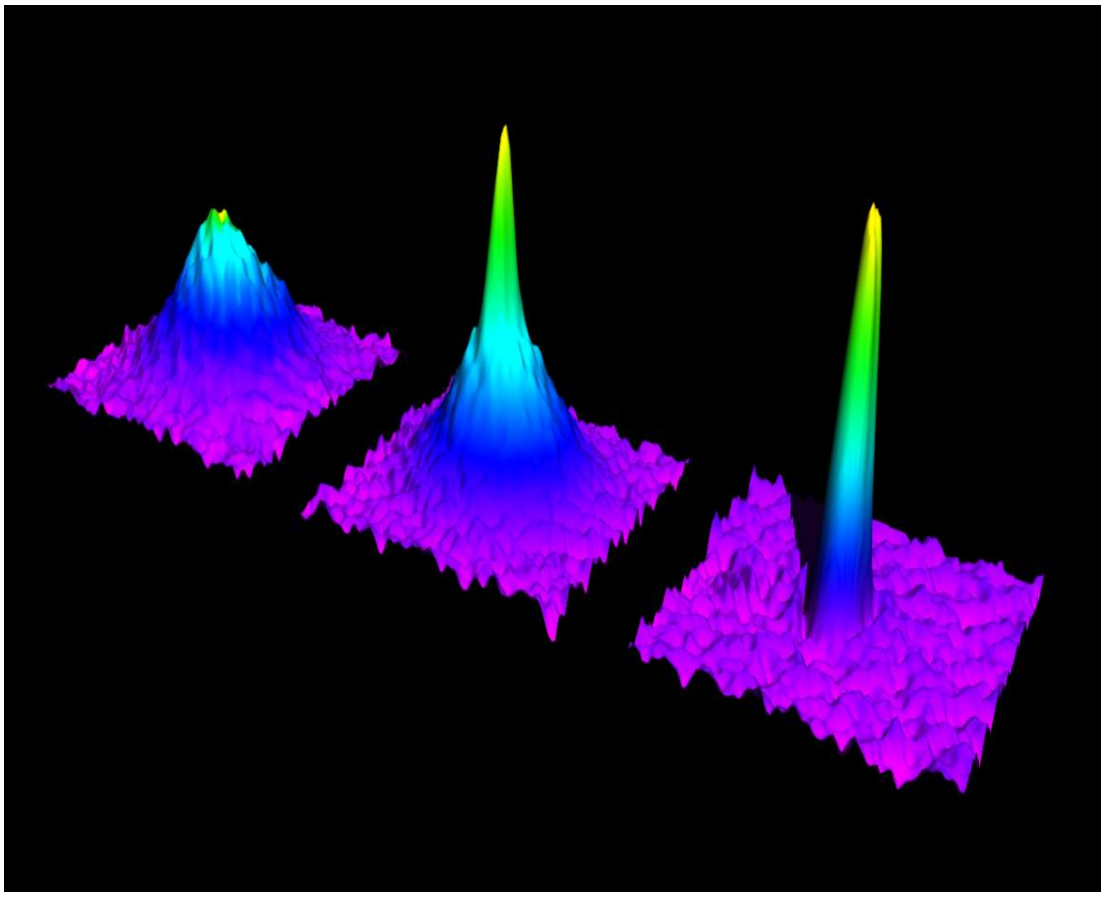

Right cerebral hemisphere controls left-side motor coordination
A.D.A.M.

9.A

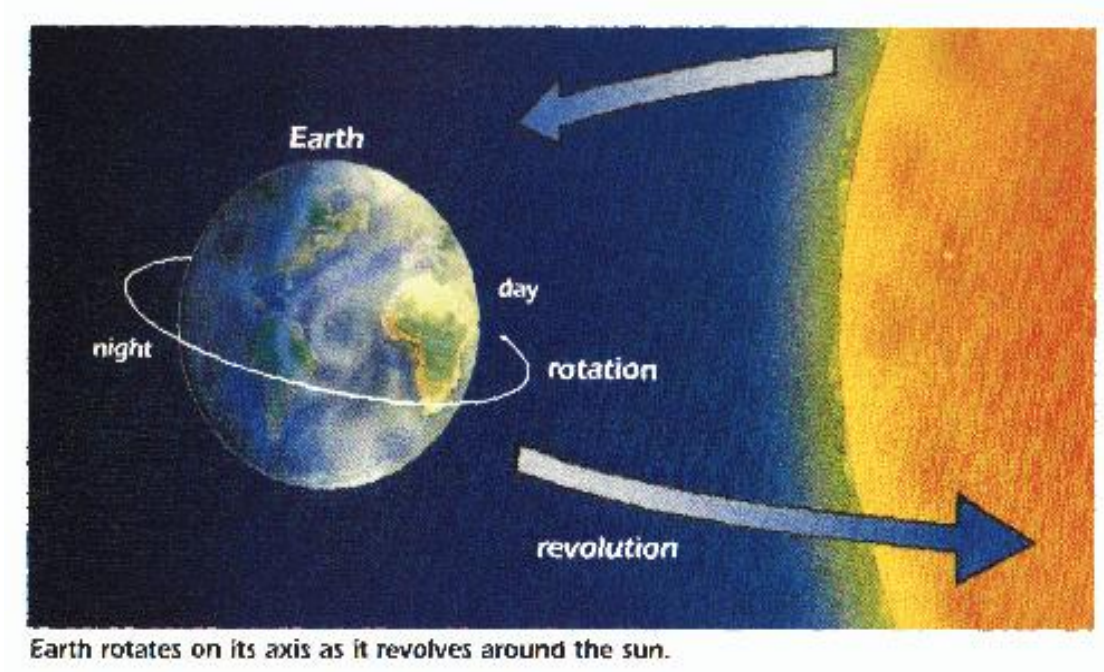

Plasma
Deionization
Ionization
Gas
Vaporization
Condensation
Liquid
Deposition
Sublimation
Solid
Freezing
Melting
Enthalpy of system

Phase (n)

9.B



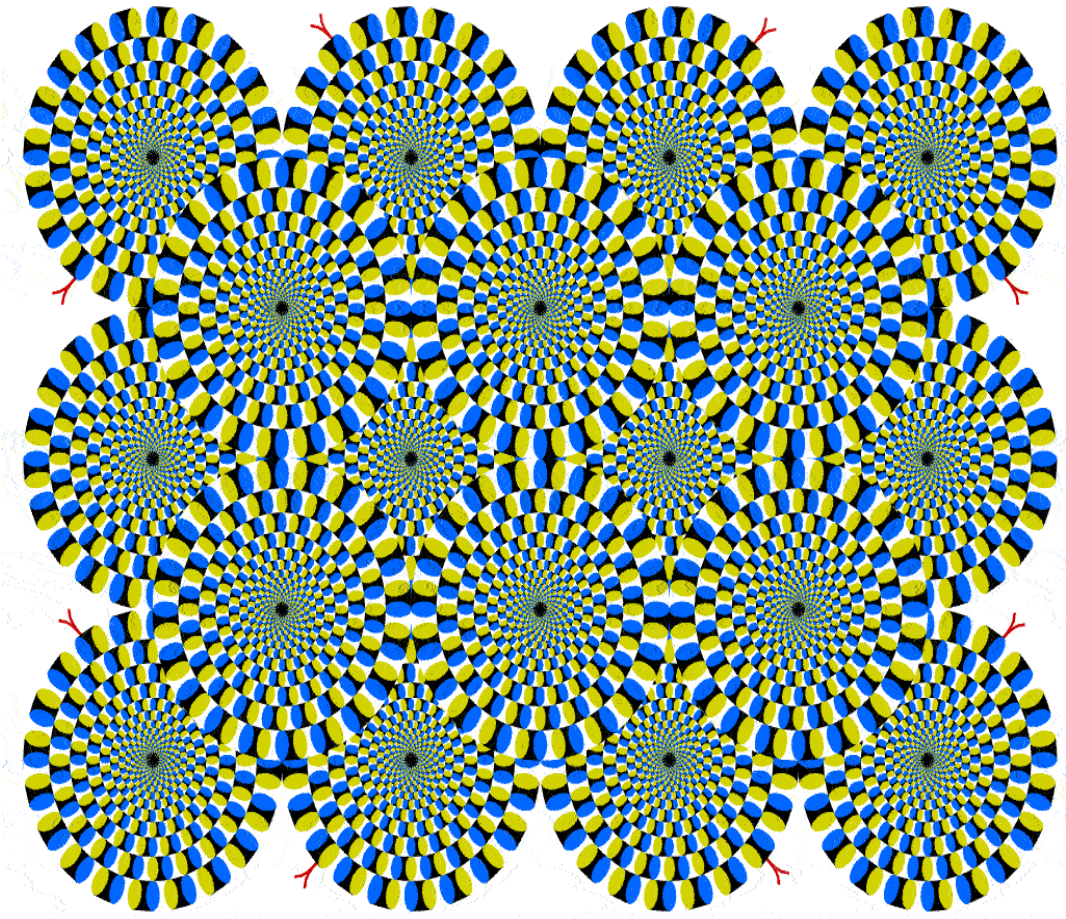
10.A



Earth rotates on its axis as it revolves around the sun.

Rotate (v) / rotation (n)

10.B



10.C

11.A

Occupy (v) / occupation (n)

11.B

11.C


the Troops
Home Now!
End
Occupation
Palestine, Afghanistan,
Iraq, Haiti...
www.InternationalANSWER.org
END
THE
OCCUPATION
www.protestwarrior.com

E: Vocabulary Revision Materials

VOCABULARY REVISION (week3)

Match the words with their definitions.

1. A person who entertains someone else as his guest, usually at home or office
2. To make new laws
3. Injury to a joint, especially in the ankle or wrist
4. A programme or list of course details including hours, objectives, materials to be covered
5. To take the control by force
6. One half of the earth
7. To turn like a wheel
8. Arm-like parts of a tree, smaller units of a business in different locations
9. Stage in the development of anything
10. To capture or to have the armed control of a city
11. To make sbd feel upset or very angry
12. Connected or related to the main theme or topic
13. A person equal in rank or age
14. Of words or sentences (utterances) to be very informal (usually unacceptable in formal context)
15. To change or to turn
16. Something put up as a defense or protection, something that stops a business
17. A planned and agreed course of action usually based on a principle or a set of principles
18. Without any difficulties or problems, not rough
19. To collect or get together
20. To make or to be equal or steady
21. To get larger or to affect a larger area
22. A plan or arrangement
23. Make go backward or in the opposite direction to the normal
24. At the beginning, first
25. Something left to somebody in a will, usually from a close relative
26. Name someone for election or for a particular job
27. To cause to stop completely, failure usually in a system
28. To put plan into practice or action
29. To describe as
30. Uncovered or naked, basic, empty,
31. Sudden, sharp, unexpected
32. Beauty or charm (often superficial) that attract people
33. Great danger or threat
34. Obliged to, have to or supposed to do something
35. An official school report that show the courses and student's grades

VOCABULARY REVISION (week3) (Key)
Match the words with their definitions.

1. A person who entertains someone else as his guest, usually at home or office **HOST**
2. To make new laws **LESGISLATE**
3. Injury to a joint, especially in the ankle or wrist **SPRAIN**
4. A programme or list of course details including hours, objectives, materials to be covered **SYLLABUS**
5. To take the control by force **CAPTURE**
6. One half of the earth **HEMISPHERE**
7. To turn like a wheel **ROTATE**
8. Arm-like parts of a tree, smaller units of a business in different locations **BRANCH**
9. Stage in the development of anything **PHASE**
10. To capture or to have the armed control of a city **OCCUPY**
11. To make sbd feel upset or very angry **OFFEND**
12. Connected or related to the main theme or topic **RELATED**
13. A person equal in rank or age **PEER**
14. Of words or sentences (utterances) to be very informal (usually unacceptable in formal context) **SLANG**
15. To change or to turn (ON/OFF) **SWITCH**
16. Something put up as a defense or protection, something that stops a business **BARRIER**
17. A planned and agreed course of action usually based on a principle or a set of principles **POLICY**
18. Without any difficulties or problems, not rough **SMOOTH**
19. To collect or get together **GATHER**
20. To make or to be equal or steady **BALANCE**
21. To get larger or to affect a larger area **SPREAD**
22. A plan or arrangement **SCHEME**
23. Make go backward or in the opposite direction to the normal **REVERSE**
24. At the beginning, first **INITIAL**
25. Something left to somebody in a will, usually from a close relative **BEQUEST**
26. Name someone for election or for a particular job **NOMINATE**
27. To cause to stop completely, failure usually in a system **HALT**
28. To put plan into practice or action **IMPLEMENT**
29. To describe as **DEPICT**
30. Uncovered or naked, basic, empty, **BARE**
31. Sudden, sharp, unexpected **ABRUPT**
32. Beauty or charm (often superficial) that attract people **GLAMOR**

33. Great danger or threat **PERIL**
34. Obliged to, have to or supposed to do something **BOUND**
35. To have the legal / official authority or responsibility **AMENABLE**

Week 6: Associating
Target vocabulary list: *literal, ruin (v/n), drop out, handle (v), means (n), subdivision, pirate, crew, grave, exuberant, exuberantly, laborious, laboriously, predator, fallacy, unwary, possess, misconception, dwarf, imminent, undergo, massive.*

1. literal ⇒ direct
2. ruin ⇒ Ani
3. Drop out ⇒ Levent /law faculty
4. Means ⇒ flying/transportation
5. Subdivision ⇒ branch
6. Pirate ⇒ Captain Hook
7. Crew ⇒ tayfa
8. Grave ⇒ George Orwell
9. Laborious/ly ⇒ atom karınca
10. Predator ⇒ cat/mouse
11. fallacy ⇒ Harun Yahya
12. unwary ⇒ Kemal Sunal
13. Possess ⇒ benimo
14. misconception ⇒ only you
15. dwarf ⇒ pamuk prenses
16. Imminent ⇒ earthquake in Istanbul
17. Undergo ⇒ old people
18. Massive ⇒ Sahara
19. Exuberantly ⇒ good harvest

F: Scores of the Pre-vocabulary Test

	101	__/20
Student 1		10
Student 2		2
Student 3		5
Student 4		5
Student 5		8
Student 6		4
Student 7		6
Student 8		4
Student 9		3
Student 10		6
Student 11		1
Student 12		9
Student 13		0
Student 14		2
Student 15		2
Student 16		5
Student 17		6
Student 18		7
Student 19		7
		4,842105
	102	__/20
Student 1		2
Student 2		2
Student 3		13
Student 4		4
Student 5		4
Student 6		3
Student 7		5
Student 8		1
Student 9		0
Student 10		1
Student 11		4
Student 12		4
Student 13		9
Student 14		7
Student 15		4
Student 16		0
Student 17		2
Student 18		5
		3,888889

	103 __/20
Student 1	2
Student 2	3
Student 3	3
Student 4	3
Student 5	4
Student 6	1
Student 7	1
Student 8	1
Student 9	2
Student 10	2
Student 11	2
Student 12	2
Student 13	1
Student 14	1
Student 15	1
Student 16	2
	1,9375

G: Scores of the Post-vocabulary Test

	101 __/20
Student 1	11
Student 2	2
Student 3	4
Student 4	5
Student 5	8
Student 6	4
Student 7	6
Student 8	4
Student 9	3
Student 10	6
Student 11	1
Student 12	11
Student 13	0
Student 14	2
Student 15	1
Student 16	2
Student 17	6
Student 18	7
Student 19	7
	4,736842

	102 __/20
Student 1	13
Student 2	14
Student 3	19
Student 4	18
Student 5	18
Student 6	14
Student 7	18
Student 8	14
Student 9	12
Student 10	18
Student 11	14
Student 12	11
Student 13	11
Student 14	17
Student 15	13
Student 16	10
	14,625

	103 __/20
Student 1	7
Student 2	12
Student 3	1
Student 4	7
Student 5	13
Student 6	10
Student 7	8
Student 8	8
Student 9	4
Student 10	4
Student 11	0
Student 12	1
Student 13	6
Student 14	7
Student 15	4
Student 16	2
Student 17	8
Student 18	13
	6,388889

Pre and Post Tests Combined

101	Test 1	Test 2
	10	11
	2	2
	5	4
	5	5
	8	8
	4	4
	6	6
	4	4
	3	3
	6	6
	1	1
	9	11
	0	0
	2	2
	2	1
	5	2
	6	6
	7	7
	7	7
	4,842105	4,736842

102	Test 1	Test 2
	2	13
	2	14
	13	19
	4	18
	4	18
	3	14
	5	18
	1	14
	0	12
	1	18
	4	14
	4	11
	9	11
	7	17
	4	13
	0	10
	2	
	5	
	3,888889	14,625

103	Test 1	Test 2
	2	7
	3	12
	3	1
	3	7
	4	13
	1	10
	1	8
	1	8
	2	4
	2	4
	2	0
	2	1
	1	6
	1	7
	1	4
	2	2
		8
		13
	1,9375	6,388889

H. T-test Scores

Paired-Samples T-Test Statistics:

		Mean	N	Std. Deviation
Pair 1	PRE_101	4,8421	19	2,73380
	POST_101	4,7368	19	3,17704
Pair 2	PRE_102	3,9375	16	3,41504
	POST_102	14,6250	16	2,96367
Pair 3	PRE_103	1,9375	16	,92871
	POST_103	5,8750	16	3,87943

Paired-Samples T-Test Results

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	PRE_101 - POST_101	,10526	,93659	,21487	-,34616	,55668	,490	18	,630
Pair 2	PRE_102 - POST_102	-10,68750	3,57246	,89312	-12,59113	-8,78387	-11,967	15	,000
Pair 3	PRE_103 - POST_103	-3,93750	3,83786	,95946	-5,98255	-1,89245	-4,104	15	,001

E. Interview Questions

Interview Questions (Students in the Experimental Group)

1. What are the barriers for learning vocabulary in English for you? What kind of difficulties do you face while learning vocabulary?
2. What kind of techniques do you use for learning vocabulary in English? Which of them do you find the most effective?
3. What do you think of the vocabulary learning and revision activities we used for learning vocabulary in preparatory school?

1. Sizce kelime öğreniminde engeller nelerdir? Kelime öğrenirken ne tür zorluklarla karşılaşıyorsunuz?
2. İngilizce kelimelerin öğrenilmesinde ne tür teknikler kullanıyorsunuz? Bunlardan en etkin bulduklarınız hangileridir?
3. Hazırlık Okulunda kelime öğretimi için kullandığımız kelime öğretimi ve tekar aktiviteleri ile ilgili ne düşünüyorsunuz?

Interview Questions (Colleagues)

1. What are the barriers for teaching vocabulary in English for you? What kind of difficulties do your students face while learning vocabulary?
2. What kind of techniques do you usually use for teaching vocabulary in English?
3. How can we improve vocabulary teaching? What can be done to improve long-term storage of words?