REPUBLIC OF TURKEY

ÇUKUROVA UNIVERSITY

THE INSTITUTE OF SOCIAL SCIENCES

DEPARTMENT OF ENGLISH LANGUAGE TEACHING

THE INFLUENCE OF BRAIN-COMPATIBLE LEARNING ON ENGLISH LANGUAGE PROFICIENCY OF ADULT LEARNERS

Gülten KOŞAR

PhD. DISSERTATION

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To Çukurova University Institute of Social Sciences,

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APPROVAL

I certify that this thesis conforms to the formal standards of the Institute of Social Sciences.

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ÖZET

BEYİN-UYUMLU ÖĞRENMENİN YETİŞKİN ÖĞRENCİLERİN İNGİLİZCE YETERLİKLERİ ÜZERİNDEKİ ETKİSİ

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Danışman: Doç. Dr. Hasan BEDİR
Mayıs 2016, 192 sayfa

Alan yazınına şimdiye kadar kazandırılmış olan yaklaşım ve metotlar göz önünde bulundurulduğunda, İngilizce öğretiminin kalitesini arttırmak adına farklı yaklaşım ve metot arayışlarının yeni bir durum olmadığı görülmektedir. Bahsi geçen amacı gerçekleştirebilmek için son dönemlerde yapılan girişimlerden birisi beyin-uyumlu öğrenme prensiplerinin öğrenme ortamlarında uygulanmasıdır. İlgili alan yazını incelemesi, araştırmacıyı beyin-uyumlu öğrenmenin İngilizceyi yabancı dil olarak öğrenen yetişkin öğrencilerin dil yeterliği üzerindeki etkisini araştırmaya yöneltmiştir; çünkü alan yazını bu konuda az sayıda çalışmayı içerisinde barındırmaktadır.

Karma yöntemli araştırma tasarımına sahip olan bu çalışma, 53 üniversite hazırlık sınıfı öğrencisinin katılımıyla yürütülmüştür. Denek grubundaki toplam katılımcı sayısı 27 iken kontrol grubundaki katılımcı sayısı 26'dır. Denek grubundaki katılımcılara 336 saat boyunca beyin-uyumlu öğrenme prensipleri doğrultusunda İngilizce öğretilirken, kontrol grubundaki katılımcılara çalışmanın yürütüldüğü süre zarfında konu anlatımı metodu gibi metotları içerisinde bulunduran geleneksel yöntemle İngilizce öğretilmiştir. Ön muafiyet ve son muafiyet sınav sonuçları, duralama sınavı sonuçları, beyin-uyumlu öğrenme hakkındaki görüş anketi, dil öğrenme inançları envanteri, öğrenme stilleri envanteri, yaşanılmış İngilizce öğrenme tecrübeleri anketi, hemisferik durum işaretçisi, iki yarı-yapılandırılmış anket, öğrenici günlükleri ve öğretmen günlüğüyle toplanan veri SPSS 22 ve MAXQDA 11 kullanılarak analiz edilmiştir. Veri analizi neticesinde elde edilen bulgular, denek grubu katılımcılarının son muafiyetten aldıkları notlarla kontrol grubundaki katılımcılardan daha başarılı olduklarını ortaya koymaktadır ki, bu da beyin-

uyumlu öğrenmenin İngilizceyi yabancı dil olarak öğrenen yetişkin öğrenicilerin dil yeterlikleri üzerinde olumlu etkisinin olduğuna işaret etmektedir.

Anahtar Kelimeler: İngiliz dili eğitimi ve öğrenimi, beyin-uyumlu öğrenme, beyin-uyumlu öğrenme prensipleri, İngilizceyi yabancı dil olarak öğrenenler, yetişkin öğrenciler

ABSTRACT

THE INFLUENCE OF BRAIN-COMPATIBLE LEARNING ON ENGLISH LANGUAGE PROFICIENCY OF ADULT LEARNERS

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Mayıs 2016, 192 pages

The quest for finding out new methods or techniques in an effort to ameliorate the quality of English language teaching is not a new phenomenon in view of the approaches and methods having been introduced to the literature heretofore. One of the current initiatives embarked on to accomplish the mentioned objective involves the implementation of brain-compatible learning principles in learning environments. The review of the related literature has led the researcher to carry out a study in order for investigating the impact of brain-compatible learning on adult EFL learners' language proficiency as scarce number of research has been conducted on the topic of concern so far.

This study having a mixed methods research design was conducted with the participation of 53 university prep class learners. The focus group was comprised of 27 learners while the remaining participants, 26 participants, took part in the study in the control group. The participants in the focus group were subjected to the intervention in brain-compatible learning principles for 336 hours while the ones in the control group were traditionally taught such as being subjected to lecture method in the duration of the study. The data collected by pre-post proficiency exam results, retention exam results, perceptions about brain-compatible learning questionnaire, beliefs about language learning inventory, learning styles inventory, lived English language learning experiences questionnaire, hemispheric mode indicator, two semi-structured interviews, learners' diaries and teacher's diary were analysed by employing SPSS 22 and MAXQDA 11. The findings attained from the analysis of the data reported that the focus group participants outperformed the control group participants in the

post-proficiency exam, which indicates that brain-compatible learning has a positive influence on adult EFL learners' language proficiency.

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

PET: Positron imaging technology

fMRI: Functional magnetic resonance imaging

EEG: Electroencehalogram

CAT: Computerized axial tomography

BALLI: Beliefs about language learning inventory

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CHAPTER I

INTRODUCTION

1.1. Introduction

The European Commission (2007) proclaims that stimulating young learners through establishing favourable conditions may enable them to develop their skills, and this in turn could pave the way for the social and economic development of societies with the active involvement of empowered young learners. The fundamental idea expressed by the European Commission (2007) gives prominence to the crucial place occupied by education; nonetheless, the significance of education needs to be accentuated not only for young learners but also for adult ones.

What outcomes are expected from today's institutions of higher education appears to be the parameter for assessing the quality of education and determining the ways adult learners should be educated. One question raised by Dalin (2005), which is worth-stressing, investigates whether the education system is preparing learners for yesterday not for the upcoming, uncertain, and challenging future. According to Dalin (2005), educational achievements should involve attaining the competence to solve problems, and to communicate.

Promoting learners to develop the skills of effective communication and problem solving requires the parties involved in teaching process to embark on initiating and directing change. This brings forth the necessity to keep in mind the parties pursuing incompatible goals because as pointed out by Fullan (1993) how we interpret change is influenced by our past experiences, and the common beliefs and values in our professional circle. Drawing the attention to the importance of the incremental change in education and teaching style, Fullan (1993) purports "creative solutions arise out of interaction under conditions of uncertainty, diversity and instability". Teachers of English do also need to take steps in the direction of amelioration of the quality of English language teaching.

Knowledge of English language has been contemplated to be a key player in the future careers of learners at tertiary level irrespective of the

department at which they have their academic education. Given the significance of English in a plethora of arenas such as the world of technology, academia, commerce and so forth, ongoing discussions and explorations in Turkey and in several other parts of the world regarding the ways to be engaged in with the intention of subsidizing and fostering the quality of English language education gain acceptance. Since the 1990s which has been labelled as the brain era brain-compatible learning (the related literature involves another prevalently used term which is brain-based learning, yet so as to attain consistency in respect to the terminology throughout this thesis brain-compatible learning is going to be used.) has been posited to be a promising approach to augmenting the effectiveness of English language learning and teaching.

Brain-compatible learning is defined by Jensen (1995, 2000), a well-known researcher on brain-compatible learning, as "learning in accordance with the way the brain is naturally designed to learn". The definition evokes the likelihood that existing methods and approaches could be considered to have of little use for enhancing the effectiveness of teaching and learning process. The failure in accomplishing anticipated learning outcomes has been expounded by the advocates of brain-compatible learning via placing the emphasis on the incongruity between the way learners are pushed to learn and the natural trail the human brain follows whilst learning (Caine & Caine, 1994; Hart, 1983; Jensen, 2000). That is to say, traditional ways in which learners are taught are resembled to swimming against the current. Introduced to the literature as a theory and attained its practicality in the field of teaching and learning by specified principles, brain-compatible learning seems to be of interest to one targeting re/structuring her instruction for stimulating language learning process.

Brain-compatible learning is applied to classroom environment by the medium of doing instructional planning and transferring it into practice in the light of brain-compatible learning principles. Even though there appears to be a discrepancy in regards to the names attributed to the principles by different scholars (Caine & Caine, 1994; Jensen, 2000), the common point amongst them lies on the significance ascribed to igniting the human brain's natural learning. One point to mention is the fact that brain-compatible learning has been subjected to criticisms that may be situated on the belief that current findings from brain research are insufficient to get benefit from in education.

Nevertheless, taking into account the uncertainty as to the date on which almost everything respecting the human brain and its potential will be uncovered, being at a standstill without attempting to make sense of and utilize the available findings presented by brain research does sound irrational. Additionally, commencing to ground language learning and teaching on the current findings of brain research, and then, making necessary amendments in accord with the upcoming developments in neuroscience could make a significant contribution to the current language learning situation and to improvements in learners' language proficiency.

Language proficiency that can be defined as the capability of a person to perform in the learned/acquired language might be impacted by a great number of factors encapsulating learning environment, teachers, learner motivation, teaching styles, teaching methodologies, family, and expectations of the society and the state from English language lessons et cetera. The methods selected to conduct lessons do not, though, function as the sole factors exerting influence on the achievement of the predetermined objectives, the place they hold in the level of language proficiency an adult learner can attain is unignorable. One of the virtually new approaches in comparison to the long-standing ones, brain-compatible learning has been conceived to be a promising approach for innovative teachers whose efforts may yield better outcomes in relation to language learning.

1.2. Background of the Study

In search of seeking new ways to be utilized so as to boost learning, researchers have investigated the effect of a variety of methods on facilitating and improving language proficiency, none of which has been able to serve as a panacea in language learning. Prior to the advancement in imaging technology, observable and measurable behaviours were focused upon rather than the natural way the brain learns. Hart (1983) is one of the scholars drawing the attention to the incongruity between the way the brain naturally learns and the way the brain is forced to learn. Being at one with Hart, Sousa (1998) argues that teachers' instructional practices modify the way the brain learns. Advances in the fields of neuroscience, neuro-psychology, neuro-linguistics, cognitive psychology, and education have fortunately enabled researchers to delve into

the inner-workings of the brain and how the brain learns (Huang, 2006), and by so doing, educators have had a chance to eliminate the noncompatibility between the way they teach and the way the brain learns.

Wolfe (2001) gives an example of how teachers can make use of the information stemming from neuroscience in the decision-making processes they engage in when pondering upon their instructional practices:

> For example, PET scans of a reader show that much more frontal lobe activity occurs when the subject reads silently than when he or she is reading aloud to others. Activity in the frontal lobes often indicates higher-level thinking. On the other hand, the scan of the student reading aloud glows brightly in the motor area of the brain that governs speech, while showing little activity elsewhere. One way to interpret these scans is that there is more comprehension of what is being read when one reads silently. Do these scans prove that students should never read aloud? Of course they don't. Armed with this information, however, teachers are able to make more informed decisions about how to balance silent and oral reading to obtain both diagnostic information on decoding problems and how to enhance comprehension of what is being read (p. 11).

There has not been a plethora of research having explored the influence of brain-compatible learning on improving EFL learners' language proficiency. The studies conducted on brain-compatible learning have prevalently concentrated on the perceptions of teachers and learners of brain-compatible learning. Weimer (2007), one of the researchers investigating perceptions regarding brain-compatible learning, examined the perceptions of teachers and learners of the influence of brain-compatible learning on engaged learning and long-term memory enhancement. It was revealed at the end of the study that teachers and learners agreed on the positive effect of brain-compatible learning on engaged learning and long-term memory enhancement. Another study aiming at unveiling learners' perceptions and conducted by Avcı & Yağbasan (2010) sought the seventh grade learners' perceptions of the impact of brain-compatible learning on science lesson. The study was completed in 24 hours, 8 weeks. The participants noted the effectiveness of brain-compatible learning during the interview conducted at the end of the intervention.

Besides the limited number of research carried out to explore the perceptions concerning brain-compatible learning, a meagre amount of research has been carried out to investigate the impact of brain-compatible learning on academic achievement in different fields. Çengelci (2007)

conducted research, in which the participants were elementary school students, to explore the effect of brain-compatible learning on success and retention in social sciences. The findings of the study revealed that the performance of the experimental group with respect to success and retention in social sciences yielded a statistically significant difference in comparison to that of the control group. Duman (2010) conducted a study to investigate the effect of brain-compatible learning on academic achievement in measurement and evaluation course taken by prospective teachers at the department of social sciences. The study designed as pre- and post-test control group indicated that the group instructed in accord with brain-compatible learning outperformed the one taught in line with traditional teaching methods.

In Turkey and in other countries a limited number of studies have been conducted to examine the influence of brain-compatible learning on English language learning. Baş (2010) researched the influence of brain-compatible learning method on the 6th grade learners' achievement levels and attitudes towards English lesson. The study adopting a pre- and post-test control group research design revealed that the experimental group taught in compliance with brain-compatible learning had better achievement levels and a higher motivation level in contrast to the control group.

1.2.1. Theoretical Background

Considering the principles embedded in brain-compatible learning, building a linkage between brain-compatible learning and constructivism seems to be plausible. Constructivists state that knowledge is attained by adding new information to already existing knowledge frames (Brooks & Brooks, 1999; Peters, 2000). Depending on this definition of constructivism, Merrill (2008) propounds that constructivists challenge the notion that there is an objective reality to be transmitted by teachers to all learners. In line with what is purported by Merrill (2008), Tippins, Tobin, & Hook (1993) put forth "It is an active process in which learners construct knowledge in a way that makes personal sense. And it is a subjective process, as learners draw on their own background experiences to make sense" (p. 223).

A number of facets of constructivism are based on Piaget, Vygotsky and Von Glasersfeld. Amongst these scholars, Piaget, the theories of whom are

rooted in cognitive psychology, is regarded to be the foundational figure of constructivism. Constructivist view of learning conceives the learner as playing an active role in due course of construction of knowledge while the teacher undertakes the role of a guide and a mediator (Kinghorn, 1991; Peters, 2000). Likewise, learners are active in every aspect of learning process in a brain-compatible learning environment from making decisions about what is going to be presented to the assessment procedures. That is to say, the link between constructivism and brain-compatible learning is overt when the rationale underpinning constructivism and brain-compatible learning is considered.

Alongside of constructivism, brain-compatible learning can be associated with social constructivism as one of the principles espoused by the proponents of brain-compatible learning is related to the social side of the brain/mind. Vygotsky is acknowledged to be the "seminal theorist for most social constructivists" (Bentley, 1998, p. 239). Phillips (1995, p. 7) states that social constructivism "focused on the social factors that influenced learning". Because brain-compatible learning emphasizes the cruciality of ensuring the incorporation of classroom activities entailing cooperation amongst learners into instructional planning, it is unambiguous that research in brain-compatible learning can be based on social constructivism.

Besides constructivism and social constructivism, brain-compatible learning could be linked to humanistic approaches as well in that emotional involvement of learners into the learning process is considered important in both approaches. Brain-compatible learning attaches importance to learner emotions, in other words to eliciting appropriate emotions before, during and after getting learners to carry out a task. In addition, the fact that brain-compatible learning environment tries to eliminate the feeling of threat from learning settings manifests that in parallel with humanistic approach emotions are acknowledged to be fundamental in brain-compatible learning.

1.3. Statement of the Problem

A broad range of methods and techniques has been resorted to in English language teaching heretofore on the purpose of fostering learning process. The mainstream conception among researchers and practitioners in regard to employing diversified methods is that "one-size-fits-all" approach

cannot meet the demands of various parties, particularly learners with different needs, involved in learning process. Factors such as motivation, aptitude, age, learning styles, personality, prior learning experiences and so forth have been envisioned to exercise influence over success or failure in language learning. Thus, being in search of new theories, methods and techniques possessing the potential to contribute to betterment in the quality of language learning and teaching appears to be continuing incessantly.

Till the last three decades very few number of studies were conducted in an attempt to incorporate neuroscience into educational practice; nonetheless, the number of research aiming at exploring ways to bridge the gap between neuroscience and educational practice has gained momentum in past years (Ansari, Coch, & De Smedt, 2011; Edelenbosh, Kupper, Krabbendam & Broerse 2015; Hruby, 2012; Koch, Timmerman, Peiffer, & Laurienti, 2013; Samuels, 2009). It has been claimed by Edelenbosh et al. (2015) that as long as researchers carry out their investigations in collaboration with practitioners, extracting more neuroscientifically informed teaching and learning may be achievable.

According to Gura (2005) educators need to devise practical teaching practices by conceiving the brain's development. The theory which is in parallel with the proposal of Gura (2005), and has been applied by educators to achieve amelioration in learning is brain-compatible learning. Nonetheless, Hart (1983), draws the attention to the incongruity between the way the brain inherently learns and the way the brain is forced to learn. Keeping in sight the developments in imaging technology, such a discrepancy may not be acceptable any longer in that these advancements have enabled researchers to investigate brain functioning when a person is alive.

Until the 1990s, the decade of the brain, the techniques employed in language teaching were not correlated with the research on brain functioning due to technological impediments. Nevertheless, turning a blind eye to the findings originating from imaging technology in pursuit of the technological improvements may not be logical bearing in mind the significance of coming up with new theories and methods to augment the effectiveness of language teaching, and its counterpart, language learning.

Subsequent to literature review, the researcher has realized the paucity of the studies conducted to investigate the impact of brain-compatible learning on foreign language learning both in Turkey and abroad. Kaufman, Robinson , Bellah, Akers & Haase-Wittler (2008) lay stress on the fact that educators have now and then ruled out brain, to state in other words, the influence of brain over learning. However, Freeman & Wash (2013), by drawing attention to student evaluations, emphasize the significance and necessity of a brain-compatible learning environment in classrooms. Their study reveals that safe learning environments, active engagement in the learning process, and the conditions stimulating critical-thinking and reflection are appreciated by college students. With a view to elucidating the impact of brain-compatible learning principles roted in brain-research, the researcher has decided to carry out this study.

1.4.   Aims and Research Questions

A growing understanding of how the brain learns and integrating that knowledge into instructional practices has been associated with increasing the efficiency of learning process. Taking into consideration the likely contribution of brain-compatible learning to EFL contexts, the primary purpose of this study is to investigate the influence of brain-compatible learning on English language proficiency of adult learners.

Another goal to be accomplished in this study is inspiring teachers of English teaching to language learners of all ages both in Turkey and abroad to apply brain-compatibe learning in their classes. On the condition that English language teachers think it is worth trying to explore the impact of brain-compatible learning subsequent to examinig the finidings of this study, this could result in better learning outcomes on the part of learners.

The findings of the study serve the purpose of finding out answers to the following research questions.

1- What are the focus and control group participants' lived English language learning experiences?
2- Is there any statistically significant difference between pre- and post-proficiency exam results of the focus and control group?

3- Is there any statistically significant difference between pre-and post-proficiency exam results of the male and female participants in the focus and control group?

4- Is there any statistically significant difference between pre-and post-proficiency exam results of the participants in the focus and control group with regard to their learning styles?

5- Does brain-compatible learning lead to a change in focus group participants' dominant hemispheres?

6- Is there any statistically significant difference between post-proficiency exam results and retention exam grades of the focus group?

7- Is there any statistically significant difference between pre-and post-beliefs of the focus and control group about language learning?

8- What are the participants' perceptions of brain-compatible learning?

1.5. Significance of the Study

The quest to find out new approaches, methods and techniques with the intent of increasing the effectiveness of language teaching on the part of learners of all ages has been a common phenomenon in the field of English language teaching. Hase & Kenyon (2013) claim "despite the role of higher education to foster our brightest minds and to expand the frontiers of knowledge, teaching was primarily a pedagogic, teacher centric activity" (p. 19).

To convert the state of learning environments from the ones characterized as domains where all-knowing teachers dominate to the ones where learners are acknowledged as the agents of learning doing the work of learning, at least most of learning, a number of steps has been taken and several research has been conducted. One of the current initiatives in this respect has centred upon brain research findings shedding clearer light on how the human brain works. In the 1990s, which is known as the decade of the brain, and following the 1990s, a growing interest in applying the findings of brain research to education has been observed. The rationale behind the endeavours depicted to deepen the understanding of how the brain functions

has been interpreted as the goal to shape teaching practices in accord with how the brain learns, which is labelled as brain-compatible learning.

Brain-compatible learning has been defined and focalized by a number of researchers (Caine & Caine, 1990; Degen, 2014; Genesee, 2010; Freeman & Wash, 2013; Hart, 1983; Jensen, 2000; Ridley, 2012; Sousa, 2001). Jensen (2000) defines brain-compatible learning as "learning in accordance with the way the brain is naturally designed to learn" (p. 6). Caine & Caine (1991) state that "brain-based learning involves acknowledging the brain's rules for meaningful learning and organizing teaching with those rules in mind" (p. 4). Seeing brain-compatible learning at the intersection point of various disciplines, Brandt (1999) propounds that findings from neuroscience alongside educational psychology, cognitive science and professional experience have provided noteworthy insights into learning process. The findings yielded by neuroscience have been enhanced by the recent developments in imaging technology, and have sparked opportunities to establish the ground for advocating learning process via brain research.

Over the past 30 years developments in brain imaging techniques such as positron imaging technology (PET), functional magnetic resonance imaging (fMRI) and electroencehalogram (EEG) have enabled researchers to explore the areas of the brain getting involved in processing or storing information in due course of various mental activities (Aldridge, 2012; Wolfe, 2001). Before the advancement of the modern imaging techniques, neuroscientists claimed that the number of brain cells was fixed at birth (Jensen, 2000). Nevertheless, Lombardi (2008) states "the brain is a marvellous organ that can be tapped into, taught, stimulated, and grown." The findings obtained by brain research have been the centre of the rising interest since the beginning of the 21st century (Aldridge, 2012). Connell (2009) argues that brain research is expected to impinge its influence on teaching and learning around the world. Lombardi (2008), having similar opinions with Connell (2009), suggests that teachers of English language learners can make use of brain-compatible teaching on the purpose of adjusting their instructional practices to learners' learning styles.

Subsequent to literature review, it has been realized that a plethora of studies on brain-compatible learning has been related to fields other than English language teaching such as physics, mathematics, social sciences,

science and so forth. This study can be considered to be one of the pioneering works exploring the influence of brain-compatible learning on English language proficiency. Besides, a four-month-training on 12 brain-compatible learning principles, which have been proposed by Caine & Caine (2000), differentiates this study from the existent ones.

The findings to be gathered from this study following the intervention will provide the relevant parties subsuming language learners, language teachers, researchers, teacher trainers, text book writers and administrators with the evidence making evident the probable positive influence of brain-compatible learning on adult learners' English language proficiency. Therefore, this study is expected to contribute to the field of English language teaching not only in Turkey but also abroad.

1.6. Assumptions

It is assumed that all the participants in the focus group will participate in the researcher's classes regularly and can gain insights into brain-compatible learning. It is expected that the proficiency and placement tests used to designate prep-class learners' levels are valid and reliable.

1.7. Definitions of Terms

Brain-compatible learning: "Brain-compatible learning can be viewed as techniques gleaned from research in neurology and cognitive science used to enhance teacher instruction … to enhance students' ability to learn using ways in which they feel most comfortable, neurologically speaking" (Connell, 2009).

Brain-compatible learning principles: Core aspects of how the system of brain, body and mind learns (Caine & Caine, 2000).

Adult learner: In this study adult learners are considered to be the learners between the age of 18 and 20.

Neuroscience: It is the scientific study of how nervous system develops and its structure.

Educational psychology: "Educational psychology involves the study of how people learn, including topics such as student outcomes, the instructional process, individual differences in learning, gifted learners and learning disabilities."

(http://psychology.about.com/od/educationalpsychology/f/educational-psychology.htm)

Cognitive science: "Cognitive science is best conceived of as a broad interdisciplinary field that draws primarily on psychology, artificial intelligence, linguistics, philosophy and neuroscience" (Stillings, Weisler, Chase, Feinstein, Garfield & Rissland, 1995).

Language proficiency: "It is the degree of skill with which a language user can use the language" (Thornbury, 2006).

1.8. Conclusion

This chapter provided information, though not in detail, about what brain-compatible learning is, background of the study, why this study is significant and how it will contribute to the related literature and to English language teaching both in Turkey and abroad. Additionally, this chapter put forward the purposes and research questions of this study, the assumptions to be considered in this study, and the operational definitions. The following five chapters will dwell on literature review, methodology, findings, discussion, and conclusion, respectively.

CHAPTER II

REVIEW of LITERATURE

2.1. Introduction

This chapter is dedicated to bringing together the information in regards to what has been introduced to the literature about learning, adult learning, language learning, the human brain, brain-compatible learning, brain-compatible learning principles as well as providing information about the research that has been carried out till the present day in the impact of brain-compatible learning on academic achievements in various subjects and in teachers' and learners' perceptions of brain-compatible learning. In addition, this chapter will provide information about the connection between brain-compatible learning and English language teaching. The studies to be shared in this chapter will be referred to again in the discussion section of the thesis in an effort to compare the findings of this study with their findings.

2.2. Learning

Learning is perceived to be a natural process (Barkley & Bianco, 2014) and notwithstanding the fact that each one of us engages in learning, either formal or informal, in our lifetime, how to define learning is an issue on which no consensus has been reached up till today. Several definitions of learning can be found in the literature: Gordon (1989) defines learning as "a relatively permanent change in an organism's potential for responding that results from prior experience or practice" (p. 6); according to Flaharty (1985), it is "a more or less permanent change in the behaviour potentiality which occurs as a result of repeated practice" (p. 7); to Domjan (1998) it is "an enduring change in the mechanisms of behaviour involving specific stimuli and/or responses that results from prior experience with similar stimuli and responses" (p. 13); for Jarvis (1992) "learning is the essence of everyday living and of course experience; it is the process of transforming that experience into knowledge, skills, attitudes, values, and beliefs" (p. 11); looking at the matter from a constructivist perspective, Sumara & Davis postulate (1997) "… a process of organizing and reorganizing one's own subjective world of experience, involving

the simultaneous revision, reorganization and reinterpretation of past, present and projected actions and conceptions" (p. 107). Table 1 displays further definitions of learning taking part in the literature (*Pritchard, 2014).*

Table 1

Definitions of Learning

A change in behaviour as a result of experience and practice

The acquisition of knowledge

Knowledge gained through practice

To gain knowledge of, or skill in, something through study, teaching, instruction or experience

The process of gaining knowledge

A process by which behaviour is changed, shaped or controlled

The individual process of constructing understanding based on experience from a wide range of knowledge

The commonality in the definitions of learning given in the preceding paragraph and in Table 1 is the focus on the perpetual change in behaviour. Hase & Kenyon (2010) assert that prevalently cited definitions of learning have difficulty in catching up with the developments in neuroscience, which is achieved by the advances in such imaging technologies as PET, EEG and fMRI, and hence seem to be obsolete. Being informed about what happens when people learn, a distinct definition of learning is provided by neuroscience researchers who purport that learning requires establishing connections between brain cells, thus ends in physical change in the human brain (Doyle & Zakrajsek, 2013). Neuroscience researchers maintain that the more connections between brain cells are strengthened the more chances learners will have for lasting memories which is also known as long-term potentiation.

The emphasis on change is valid in the definition of learning provided by neuroscientists as well; however, the change takes place in the brain while the change mentioned in the definitions proposed by researchers and scholars not from the field of neuroscience is associated with the virtually enduring change in the observable behaviours. How learning happens appears to be more significant than an attempt to reach a consensus on defining learning as albeit its naturality, learning is a multifaceted phenomenon encapsulating a great

number of factors from 'genes' to 'neurophysiology', from 'social experience' to 'psychological factors' (Hase & Kenyon, 2013).

In an attempt to identify how learning, the complicated case, takes place, Blackwell (2012) posits a circle of learning comprised of four stages. Table 2 below provides information about the stages in the learning cycle and kinds of questions to be asked in the process of learning.

Table 2

The Stages in Learning Cycle

Stages	Sorts of Questions
Engage	Why?, Why should I pay attention to it?, Why is it important? meaningful? relevant?
Share	What? What should I know about this? What do the experts have to say? What data exists?
Practice	How? How is this useful? How will I apply it? How does it work?
Perform	If? If I apply this, what new results will be generated? If I am to be successful in applying this, what accommodations or adaptations will I have to make for my real world environment?

The steps in the learning cycle are the stages to be followed for any kind of learning to happen such as riding a bike and studying a language (Blackwell, 2012). Providing any of these steps are bypassed, it may result in unsuccessful learning. Learning theories that have been introduced to the literature so far

aim at making sense of the learning process; that is to say, they aspire to determine a framework for comprehending how learning happens. Alike the diversity in defining what learning is, theories explaining the learning process have shown variations in the course of time. There has been a substantial change as for how learning was conceived in the past and how it is considered now, and there will probably be changes regarding how it will be considered in the future to come. To clarify the perspective change concerning the approach to how learning happens, a quotation by Hase & Kanyon (2013) might be shared:

> ….. humans are hijacked very early in life by an educational system that was designed in the industrial revolution to educate workers to make the industrial wheel go around. Thus, education has become a commodity and the curriculum, chiselled in stone, is delivered by 'experts' from on high. Assessment becomes the key for opening doors and teaching is geared to providing the key. The needs and motivations of the learners and, more importantly, what is happening in their brain is of secondary importance, if it is of any importance at all (p. 20).

2.2.1. Learning Theories

Pritchard (2014) and Hase & Kenyon (2013) state that the start of interest in learning can be sheeted back to ancient Greece, yet the late nineteenth and early twentieth centuries are the starting points of the modern history of learning, in other words, the science of learning. The mounting interest in learning has led to the emergence of a number of theories attempting to explicate the process of learning.

Pritchard (2014) divides learning theories into two major branches as behaviourism and constructivism but at the same time does not ignore the existence of sub-branches of learning theories alongside subsuming them under behaviourism and constructivism. The explorations on learning underpinning behaviourism profoundly gained momentum over the early years of the twentieth century. The advocates of behaviourist view of learning centred their explorations upon observable behaviours. Mowrer & Klein (2001, p. 2) purport "behaviourism, …, is a school of psychology that focuses on the role of experience in governing behaviour".

 Pritchard (2014) states that behaviourists name the kind of learning centring upon observable behaviours as conditioning encompassing two

different types: classical conditioning, and instrumental or operant conditioning. The former is unintentional and "mechanistic" type of learning catering for an "adaptive purpose" (Mowrer & Klein, 2001). What differentiates the latter one from classical conditioning is the way the response (behaviour) is produced. Behaviour is emitted voluntarily in operant conditioning. It is considered to be more "flexible in nature", and consequently, to be more powerful than classical conditioning (Pritchard, 2014, p. 8). In operant conditioning rewarding is used in order to reinforce the behaviour; additionally, with an eye to eliminating unwanted behaviours some form of punishment may be imposed.

Constructivist learning theories fall under cognitive science which is concerned with "how people learn, remember and interact often with a strong emphasis on mental processes and with an emphasis on modern technologies" (Pritchard, 2014, p.18). Existing in the broad field of cognitive science, constructivism conceives learning as a "mental construction" (Pritchard, 2014, p.18). The word 'mental' directs attention to the processes occurring in the mind while learning, and the word 'construction' can be associated with the process of adding incoming new information to the current knowledge structure. The role of the learner as the active constructor of knowledge is highlighted in constructivism.

It is worth dedicating a few lines to social constructivism subsequent to sharing outstanding features of constructivism. Social constructivism, as the name indicates, lays emphasis on the interaction between learners and others in the process of constructing knowledge. The "others" encompass teachers, friends, more proficient learners, family members and so on. The learner constructs new knowledge by the medium of grounding it upon existing knowledge, and understanding as establishing dialogues with the "others". Since this study is concerned with investigating the influence of brain-compatible learning on adult learners' language proficiency, it may be useful to dwell on the theories associated with adult learners, which are adult learning theories.

2.2.1.1. Adult Learning Theories

Adult learning has been of interest to researchers and till the mid twentieth century the studies that were conducted in the laboratory environment

investigated the influence of advancing age, if any, on the rate at which adult learners learned (Merriam, 2011, p. 29). One of such research is the study carried out by Thorndike, Bregman, Tilton & Woodyard (1928) which yielded that adults between the ages of 25 and 45 are capable of learning at "nearly the same rate" as the participants aged 20. Merriam (2011) views that there exist three foundational adult learning theories: andragogy, self-directed learning, and transformational learning.

2.2.1.1.1. Andragogy

Andragogy, which has been proposed by Knowles (1968, p. 351) as "a new label and a new technology", contradistinguishes adult learning from child learning and pedagogy. Notwithstanding the fact that andragogy takes place in the literature amongst adult learning theories, Knowles puts emphasis on the characteristics of adult learners in place of unfolding how adults learn and illuminating the learning process undergone by adult learners. Below are the underscored traits of adult learners proposed by Knowles (1980, 1984).

- As a person matures, his or her self-concept moves from that of a dependent personality toward one of a self-directing human being.

- An adult accumulates a growing reservoir of experience, which is a rich resource for learning.

- The readiness of an adult to learn is closely related to the developmental tasks of his or her social role.

- There is a change in time perspective as people mature –from future application of knowledge to immediacy of application. Thus, an adult is more problem-centred than subject-centred in learning. (Knowles, 1980, pp. 44–45).

- The most potent motivations are internal rather than external (Knowles, 1984, p. 12).

- Adults need to know why they need to learn something (Knowles, 1984, p. 12).

The characteristics of adult learners have been kept in sight in adult learning since the 1980s when they were introduced to the literature, but this does not mean that andragogy has not come under any criticism; conversely, it has been critiqued on the grounds that the learner's history and culture, and the

institutional context in which adult learning happens are disregarded while the whole stress is laid on the self-directedness of adult learners. Another critique of andragogy is the continuing control of the teacher in the process (Hase & Kenyon, 2013) although it is decreased compared to the totally teacher-centric learning.

2.2.1.1.2. Self-Directed Learning

Being brought forward in the same years as andragogy, self-directed adult learning theory distinguishes adult learners from children. Various procedures and models to be carried out on the way towards executing self-directed learning were proposed from 1970s to 1990s (Danis, 1992; Grow, 1991; Knowles, 1975; Spear & Mocker, 1984; Tough, 1971). Table 3 demonstrates what a few of these models include.

Table 3

Self-Directed Learning Models

Scholar	The Models of Self-Determined Learning
Tough (1971)	Diagnosing needs – identify resources – instructional formats – evaluating outcomes.
Spear & Mocker (1984)	Detecting opportunities for learning in an environment, taking into consideration past or new knowledge
Danis (1992)	Context, learning strategies, the learner, the environmental factors in the learning context are the factors to be considered in this model.

In recent years not only has self-directed learning been addressed as one of the fundamental adult learning theories, but it has also been perceived to take an important place in lifelong learning and continuing professional

development, and to be crucial for success in online learning environment (Merriam, Caffarella & Baumgartner, 2007).

2.2.1.1.3. Transformational Learning

Transformational learning theory the founding father of which is Mezirow (2000) is another theory attempting to explore adult learning. Nevertheless, contrary to andragogy, transformational learning deals with the cognitive processes occurring in adult learning. To explain transformational learning in a more precise manner, Merriam (2011) puts forth "it is particularly an adult learning theory because transformational learning is dependent on adult life experiences and a more mature level of cognitive functioning than found in childhood" (p. 31). As articulated by Merriam (2011), experiences form the basis for transformational learning in that learning is regarded to take place following the meaning making process of adults' experiences. In addition to these, the proponents of transformational learning postulate that learning is to end up with altered beliefs, attitudes or the whole point of view.

Andragogy, self-determined learning and transformational learning are the theories that have been addressed on the purpose of deepening our understanding of adult learning at the present time. New and more comprehensive theories that might be equipped to eliminate the criticisms directed to the current adult learning theories could be introduced in the following years. Regardless of the name that will be given to new adult learning theories which may come up in the future, it is highly likely that they will embrace emotions, learning context and the body alongside the human brain as the primary contributing factors leading to adult learning.

2.3. The Human Brain

Prior to probing into what brain-compatible learning is and to what extent it can be associated with language learning and the extent to which it is possible to mention the positive influence of brain compatible, if any, on English language learning, it could be better to commence with the structure of our marvellous organ, the brain. Because although most of us, including language teachers, touch on the human brain not only during lessons but also in the course of everyday life by articulating utterances like "My brain is so tired that I really cannot concentrate on what is going on around here", we do not know

what is happening in the vivo brain whilst learning, which part/s of the brain is activated or how the new learning is stored in the human brain, and in addition, we do not understand the workings of the brain. This legitimizes the necessity of taking a step to comprehend what happens in the living brain by detailing its regions.

The parts the human brain incorporates are put down on paper in the books written on brain-compatible learning (Erlaur, 2003; Sousa, 2006; Wolfe, 2001), yet the typology executed by Sousa (2006) to describe the regions of the brain-interior and exterior regions of the brain seems to be more comprehensible than the others. The figure below illustrates the exterior and interior parts of the human brain.
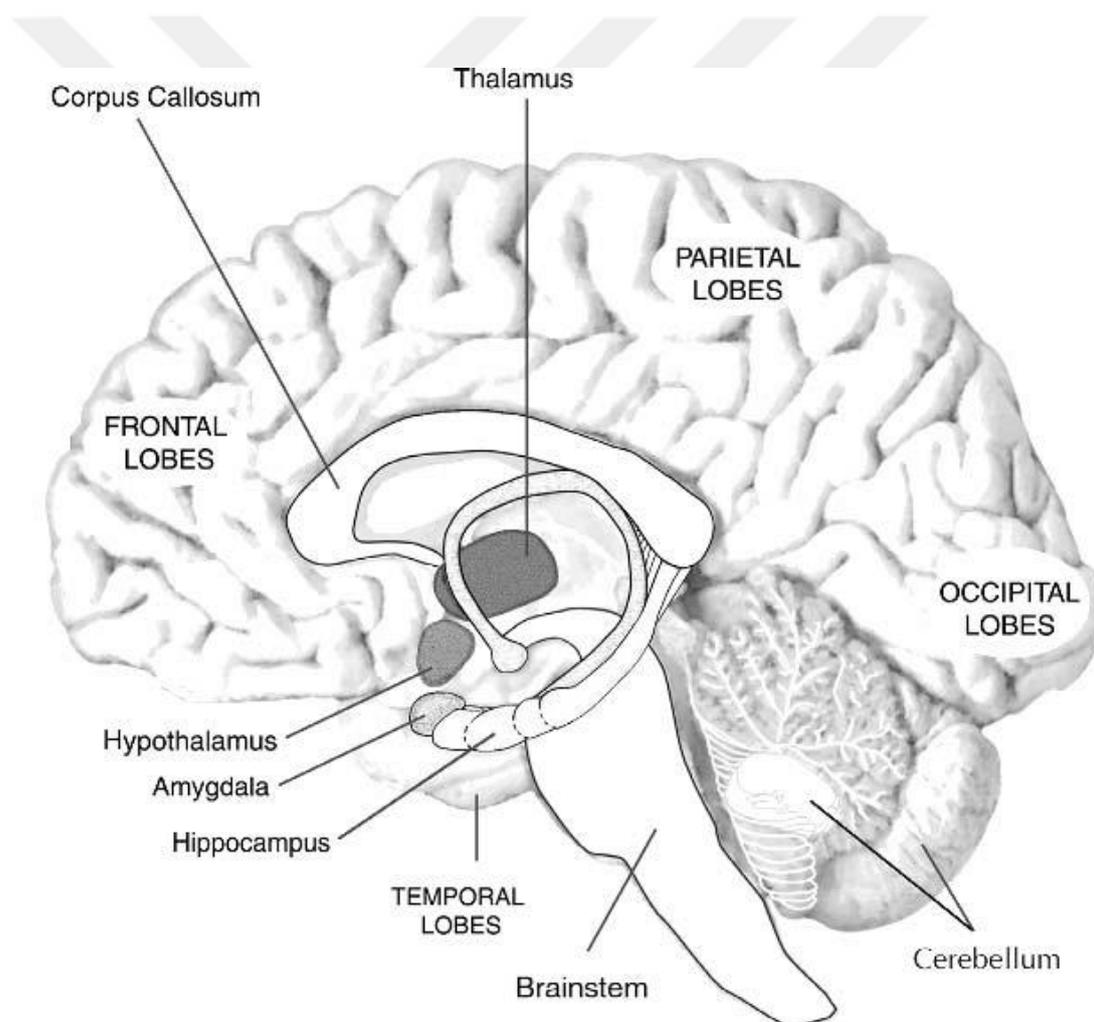
Figure 1. Exterior and interior parts of the human brain

Source: (Copyright © 2001 by Hunter Hollingsworth,

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2.3.1. Exterior Parts of the Brain

Exterior parts of the human brain consist of lobes of the brain, frontal, temporal, occipital, parietal lobes, motor cortex, and somatosensory cortex. The following paragraphs provide concise information about the exterior parts of the human brain.

2.3.1.1. Lobes of the Brain

The human brain consists of the wrinkles few of which are unique to each brain while major wrinkles are common constructs to each human brain. These wrinkles constitute the four lobes existing in each hemisphere and possess specialized functions (Sousa, 2006). The lobes are named after the bones of the skull overlying them (Burger, 2013). Following lines will provide information about the lobes of the brain comprising the exterior parts of the brain.

2.3.1.1.1. Frontal Lobes

The front part of the brain is the region holding the frontal lobes. Thinking and planning are within the scope of their authority, and besides, frontal lobes are entitled to administer higher-order thinking, execute problem solving, either for novel or familiar problems, and take the "excesses of the emotional system under control" (Sousa, 2006). Detailing the attributes of problem solving, Burger (2013) states that the solutions offered by frontal lobes are generic solutions that have been produced beforehand and stored in the long-term memory.

Malfunctions in the frontal lobes may result in such mental disorders as attention deficits, frontal lobe dementia and schizophrenia (Burger, 2013). Smith & Jonides (1999) attach importance to the frontal lobes by highlighting that the frontal lobe is the area encompassing the majority of working memory and hence, it is the place in which focus occurs.

2.3.1.1.2. Temporal Lobes

The temporal lobes which are above the ears monitor music, sound, face and object recognition and host some parts of the long-term memory and speech centres though they usually rest in the left side of the brain (Sousa, 2006).

2.3.1.1.3. Occipital Lobes

Occipital lobes resting at the back of the brain are the areas where visual processing is monitored (Burger, 2013; Sousa, 2006). Wolfe (2001) states that occipital lobes are known as visual cortex in that those areas of the brain are covered by cortical tissue.

2.3.1.1.4. Parietal Lobes

The parietal lobes that are in the upper back of the cerebral cortex behind the ears monitor body positions, calculation, touch sensations, and spatial orientations (Burger, 2013; Sousa, 2006). One of the roles of the parietal lobes is related to "maintaining focus and spatial attention" (Wolfe, 2001 p. 37); for instance, parietal lobes are activated as a person concentrates on a specific stimulus, and attention is directed from one location to another.

2.3.1.1.5. Motor cortex

Two bands exist between the parietal and frontal lobes extending from ear to ear. The band closer to the frontal lobes is motor cortex which is associated with controlling body movements. Burger (2013) explains the functions of the motor cortex as follows:

> The motor cortex works backwards and upside down: The left side regulates muscles on the right side of the body, and the right side regulates muscles on the left side of the body. The area at the top regulates our feet, and the area at the bottom, that is, closest to our ears, regulates facial expressions. Most of the volume of the motor cortex in humans is devoted to the complex precise movements of the hands and face (p. 3).

2.3.1.1.6. Somatosensory Cortex

The somatosensory cortex is behind the motor cortex and at the beginning of the parietal cortex and is dedicated to the processing of touch signals. The left side of the somatosensory cortex processes touch sensations sent from the right side of the body and the right side of the somatosensory cortex processes touch signals originating from the left side of the body. Because face and hands are considerably sensitive to touch, they necessitate more somatosensory cortex.

2.3.2. Interior Parts of the Brain

Interior parts of the human brain comprise hippocampus, thalamus, hypothalamus, amygdala, corpus callosum, cerebrum, cerebellum, gray matter, and white matter. The sub-headings below succinctly present information about the interior parts of the human brain.

2.3.2.1. Hippocampus

The hippocampus is a word used to denote Neptune's seahorse. The hippocampus comprises "a pair of curved components under the inside of temporal lobes" (Burger, 2013) and plays a fundamental role in the construction and retrieval of the long-term memories. Alzheimer's disease means the continual degeneration of hippocampal neurons, and for this reason, the degeneration of memory functions.

2.3.2.2. Thalamus

The thalamus is resembled to a relay station by Burger (2013) which executes sorting senses apart from the sense of smell and is concerned with cognitive functions. In addition, Wolfe (2001) denotes that thalamus takes in the incoming information, and for further processing to take place sends it to the "appropriate part of the cortex" (p. 87).

2.3.2.3. Hypothalamus

The hypothalamus rests below the thalamus and monitors "body regulatory functions such as body temperature, blood circulation, hunger and thirst, sleep, sexual arousal, hormonal secretion, and defensive responses" (Burger, 2013, p. 6). Hypothalamus is known to "engage the entire body and ready it to meet the demands of the situation" (p. 106).

2.3.2.4. Amygdala

The amygdala which is called as fear button is the part of the human brain dealing with activating "primal fears and other emotional responses". A stimulus such as "a loud sound or a sudden movement" will get the amygdala to trigger the hypothalamus to commence a response, for instance, to fight, to take to flight so on so forth. As well as the role played by the amygdala in the initiation of a response realized by the hypothalamus, amygdala attaches emotional content to an impression. The role undertaken by the amygdala so as

to construct and retrieve long-term memories cannot be seen as a debatable issue in that it is easier for humans to recall the details for emotional events such as wedding day (Burger, 2013).

2.3.2.5. Corpus Callosum

The corpus callosum connects the right brain with the left one, and eases the communication between the hemispheres by neural fibers (Burger, 2013). The communication between the hemispheres is realized by the corpus callosum through its large body of myelinated axons.

2.3.2.6. Cerebrum

The cerebrum which is a jellylike mass comprises %80 of the total weight of the human brain (Sousa, 2006). The cerebrum is composed of "6 layers of folded neural tissue known as the cerebral cortex" (Burger, 2013). Thinking, memory, speech and muscular movement are controlled by areas in the cerebrum (Sousa, 2006).

2.3.2.7. Cerebellum

The cerebellum, which is also known as little brain, rests behind the brainstem. It is perceived to subsidize cognitive functions including sensory input (Burger, 2013). The number of neurons in cerebellum is more than in any other part of the brain. The cerebellum plays a crucial role in the execution and timing of complex motor tasks. In addition, it is the area where automated movements such as tying a shoelace is embodied (Sousa, 2013).

2.3.2.8. Gray Matter

Gray matter is dendrites dealing with logical processing (Burger, 2013). The left hemisphere possesses more gray matter in comparison with the one the right hemisphere has. The percentage of the gray matter in males' left hemisphere is higher considering the percentage of the gray matter in females' left hemisphere for the percentage of the gray matter in females' both hemispheres is the same (Sousa, 2006).

2.3.2.9. White Matter

"White matter refers to myelinated axons which are insulated with myelin to transmit electrical impulses faster than what is possible in uninsulated

dendrites" (Burger, 2013). Sousa (2006) defines white matter as "the support tissue that lies beneath the cerebrum's gray matter" (p. 291).

2.4. Brain Cells

The human brain consists of a trillion cells which are grouped into two types: nerve cells and glial cells. Nerve cells are known as neurons the number of which is less than the number of glial cells. The glial cells, by holding the neurons together, providing support and preserving them against harmful substances, enable cellular activities to be performed well (Sousa, 2001).

The neurons are thought to be "the functioning core for the brain and for the entire nervous system" (Sousa, 2001). Neural signals follow a certain path as moving toward the respective parts of the brain. They mostly move from dendrites to soma, to axon, with many synaptic inputs at the tips of the axon (Burger, 2013, p. 11).

Contrary to other cells, neurons have tens of thousands of dendrites coming from their cores. The duty to be fulfilled by a dendrite includes receiving impulses from other neurons and sending the impulses via an axon which is insulated with myelination in order not to be affected by outlying ionic solutions and so as to transfer the impulse fast through longer axons. There is no fix number of dendrites on neurons. The occupation a person is engaged into is an influential factor in the amount of dendrites on a neuron, that is, if the occupation requires the administration of complex skills, this may increase dendrites in number, which leads to more connections between neurons and which results in more space for storing new learnings (Sousa, 2006).
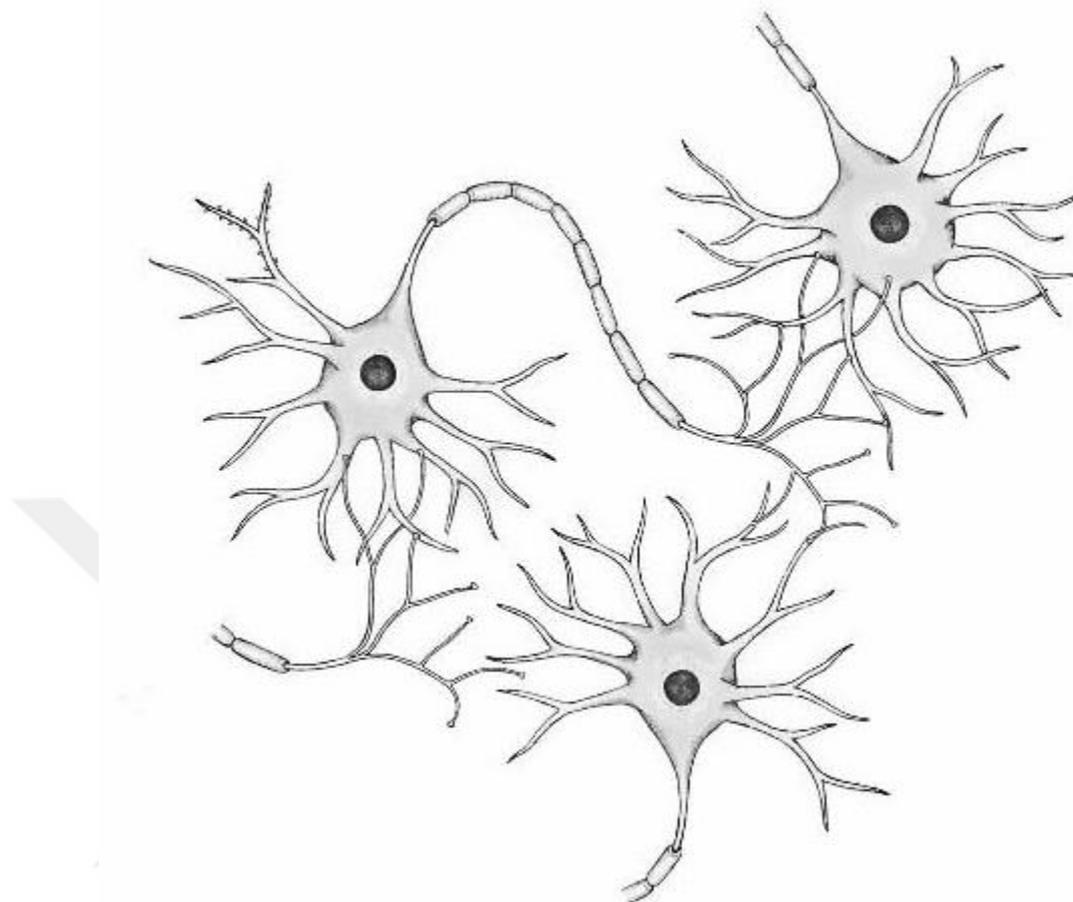
Figure 2. The neuron

Source: (Copyright © 2001 by Hunter Hollingsworth,

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A neuron does have the capacity to transmit between 205 and 2500 signals per second. Because neurons are not directly connected to each other, the connection between neurons is established by synapses which mean *join together* in Greek. Sousa (2006) expounds the process of impulse transmission by the following lines:

> A typical neuron collects signals from others thorough the dendrites, which are covered at the synapse with thousands of tiny bumps, called spines. The neuron sends out spikes of electrical activity (impulses) through the axon to the synapse where the activity releases chemicals stored in sacs (called synaptic vesicles) at the end of the axon. These chemicals, called neurotransmitters, either excite or inhibit the neighbouring neuron (p. 22).

2.4.1. Neural Communication

The human brain is comprised of billions of brain cells. Diamond (1988) states that embryonic development is characterized by the surprisingly rapid development of neurons per second, which is approximately at a rate of 50.000 to 100.000 per second. Each neuron is connected to other neurons with the help of synapses located between the end of a neuron and the beginning of another neuron. The speed at which these connections are realized is unquestionably astonishing since as it is stated by Kotulak (1996) those connections are formed at the rate of three billion a second. In order to manifest what our miraculous brain and each single neuron can achieve, another example is given by Diamond & Hopson (1998) who posit that some neurons can make 200.000 connections at any one time.

Sousa (2001) states that neurons communicate with each other via electrical and chemical signals. The question with regards to how the human brain produces electrical signals may be expounded by addressing nerve impulses. Nerve impulses are rooted in the movement of four common ions: sodium, potassium, calcium and chloride. Nerve impulses travelling along axons of neurons are bioelectrical currents (Wolfe, 2001). In addition to the bioelectrical signal, the human brain consists of chemical messengers, which are known as neurotransmitters. Neurotransmitters do possess two functions as either inhibitory or excitatory, which means that neurotransmitters may increase or decrease the likelihood that a neuron will fire (Wolfe, 2001, p. 53).

2.5. Left Brain versus Right Brain

The human brain is comprised of two hemispheres as left and right hemispheres and both do possess distinct characteristics. Lepper (2011) maintains that learning takes place more effectively on the condition that connections are made between the right and left hemispheres of the brain. Table 4 below illustrates right and left mode characteristics provided by McCarthy (1986).

Table 4

Right/Left Mode Characteristics

Right Mode	Left Mode
Intuitive	Rational
Responds to demonstrated instructions	Responds to verbal instructions
Open-ended, random experiments	Controlled, systematic experiments
Problem solves with hunches, looking for patterns and configurations	Problem solves by logically and sequentially looking at the parts of the things
Makes subjective judgements	Makes objective judgements
Looks at similarities	Looks at differences
Is fluid and spontaneous	Is planned and structured
Prefers elusive, uncertain information	Prefers established, certain info
Synthesising	Analytic reader
Primary reliance on images on thinking and remembering	Primary reliance on language on thinking and remembering
Prefers drawing and manipulating objects	Prefers talking and writing
Prefers open-ended questions	Prefers multiple choice tests
Free with feelings	Controls feelings
Essentially self-acting	Responsive to the structure of environment
Prefers collegial (participative) authority structures	Prefers hierarchical (ranked) authority structures
Simultaneous	Sequential
Is a lumper: connectedness is important	Is a splitter: distinction important
Is mute-uses pictures, not words	Talks, and talks, and talks
Is analogic, sees correspondences resemblances	Is logical, sees cause and effect

Right Mode	Left Mode
Draws on unbounded qualitative patterns that are not organized in sequences, but that cluster around images of crystallised feelings	Draws on previously accumulated, organized info

2.6. Brain-Compatible Learning

Brain-compatible learning, which has been coined by Hart (1983), is associated with empowering learners by calibrating preparations which target enabling and fostering the learning process by taking into consideration how the brain naturally learns (Caine & Caine, 1994, p. 44). Brain-compatible learning views learning as an active process in which creativity is stimulated through challenges (Lucas, 2003). Drawing the attention to the retention of information, Lucas (2003) sets forth that brain-compatible learning places emphasis on concepts which set up opportunities in order to maximize the attainment and retention of information.

The US president George H. W. Bush and the congress declared the 1990s as the decade of the brain. The name attributed to the 1990s seems to be an accurate description of what happened during that decade as what Lombardi proclaims in his paper (2008) is taken into account: "Experts recognize that we have learned more about the brain in the last decade than in all the time preceding" (p. 219). Brain-compatible learning and what is aimed at succeeding in it could be understood better by the words of Jensen (2000) about the importance of brain-compatible learning: "Nature's biological imperative is simple: No intelligence or ability will unfold until, or unless, it is given the appropriate model environment (p. 1)."

As posited by Lucas (2003) what makes brain-compatible learning as a theory worthy of grabbing attention is the chances created by brain-compatible learning that enable the encoding and retrieval of information better. By the medium of the developments in brain imaging techniques such as x-rays, computerized axial tomography (CAT) scans, PET, fMRI, and electroencephalography (EEG) the way the human brain learns has been

understood better, though there still remains a bundle of information to be uncovered about the workings of the brain. Below is the fundamental information about brain imaging technologies.

2.6.1. X-Rays

X-rays discovered in 1985 mark the beginning of the electronic age of the imaging technologies. X-rays do penetrate into non-metallic objects easily. Some of the radiation is absorbed by the atoms in the object and the remaining part of the radiation presents the images.

2.6.2. Computerized Axial Tomography (CAT) Scans

Cat scans make use of x-ray technology yet 'combines several two-dimensional images into a set of three dimensional slices' (Wolfe, 2001, p. 5). The images obtained by CAT scans provide a clearer and more detailed picture of the brain.

2.6.3. Positron Emission Tomography (PET) Scans

PET scans are used to manifest which areas of the brain are activated when a person performs various mental activities. So as to achieve this, subjects are injected radioactive glucose which is carried to the brain through blood.

2.6.4. Functional Magnetic Resonance Imaging (fMRI) Technology

fMRI is preferred so as to depict the neural activity of the brain as well as the anatomical structure of the brain. In fMRI the subject is asked to engage in a mental activity like listening to music and the areas of the brain responsible for the mental activity activate certain neurons. More blood moves to the activated parts of the brain in that more energy is required in those areas. fMRI scanner measures the changes in intensity and provides a computer image (Wolfe, 2001).

2.6.5. Electroencehalograhy (EEG)

EEG is used in the field of sleep physiology epilepsy and language processing. It is used to measure the electrical patterns resulting from oscillation of neurons. The sensors placed on the skull and scalp can detect the impulses passing from the brain through the skull and scalp (Wolfe, 2001).

Brain-compatible learning, which is designated as one of the salient topics of 21st century (Aldridge, 2012), has been favoured in an attempt to bridge the gap between educational practices and how the brain learns. What is put forth and aimed at in brain-compatible learning may be deeply enlightened by understanding brain-compatible learning principles.

2.7. Brain-Compatible Learning Principles

The literature on brain-compatible learning encompasses brain-compatible learning principles resorted to for instructional planning, yet 12 principles proposed by Caine & Caine (1994) have been widely cited by researchers interested in educational practices resided in these principles. Below is Figure 3 displaying the 12 brain-compatible learning principles proposed by Caine & Caine (2000).

Figure 3. 12 brain-compatible learning principles

Source: Caine & Caine (2000)

The sub-headings below contain information about what is entailed in each principle.

2.7.1. Principle 1: All Learning Engages the Physiology

It has been thought that comprehension solely requires the brain which is considered to be separate from the body (Caine & Caine, 2000). Nevertheless, the literature involves research the findings of which show that the mind and body are connected (Damasio, 1994; Thelen & Smith; 1994). Caine & Caine (2000) put forth that learners can comprehend better on the condition that classroom environment enables them to use their body as well as their brain.

2.7.2. Principle 2: The Brain/Mind Is Social

Caine & Caine (2000), while introducing this principle, have underscored the social nature of learning and have built linkages with situated learning (Lave & Wenger, 1991) and with communities of practice (Wenger et. al. 1999, as cited in Caine & Caine, 2000). Caine & Caine (2000) purport that teachers can achieve an increase in learner comprehension provided that they take into consideration the social nature of human beings and promote social interactions and collaboration in the learning environment.

2.7.3. Principle 3: The Search for Meaning Is Innate

Making sense of things is a requisite for human beings which could be proven by "explanatory drive" introduced by Gopnik, Meltzof & Kuhl (1999). Caine & Caine (2000) claim that every learner's thirst for meaning making could be clarified considering the phenomenon that all people react novelty. Additionally, they argue that meaning making process could be made easier for learners if their interests, perceptions, and goals are taken into account.

2.7.4. Principle 4: The Search for Meaning Occurs through Patterning

Patterning is defined by Caine & Caine (2000, p. 4) as "meaningful organization and categorization of information". The tendency to find and create patterns amongst people is more understandable once it is kept in sight that the brain is liable to realise and create patterns (Restak, 1996, as cited in Caine & Caine, 2000). Caine & Caine (2000) claim that learners do possess untapped capacities in order to perceive and create patterns and to associate them with the already existing ones.

2.7.5. Principle 5: Emotions Are Critical to Patterning

It has been known that emotions are embodied in every thought, response and decision as demonstrated by neuroscience (Damasio, 1999; Pert, 1997, as cited in Caine & Caine, 2000). Caine & Caine (2000) underline the importance of emotional experiences in lasting learning. They suggest that teachers should optimize learning via eliciting appropriate emotions before, during and after their experiences with a text.

2.7.6. Principle 6: The Brain/Mind Processes Parts and Wholes Simultaneously

Caine & Caine (2000) state that meaning making out of experiences requires both seeing the big picture and directing attention to the details. Thereby, embedding details into wholes is significant.

2.7.7. Principle 7: Learning Involves both Focused and Peripheral Attention

According to Caine & Caine (2000), we are exposed to a bundle of stimuli, yet what is attended to might be just a small portion of the available stimuli. They maintain that we can also learn from context to which we do not draw our attention consciously but we still do learn from context. For this reason, they claim that teachers can help learners learn more effectively by not only deepening their attention but also using context as a supplementary force to learn.

2.7.8. Principle 8: Learning Is both Conscious and Unconscious

Caine & Caine (2000, p. 5) state that learning involves both conscious attention to a problem in order for solving it and "unconscious incubation" following conscious processing. The need for reflecting on experiences is what is highlighted in this principle.

2.7.9. Principle 9: There Are at least Two Approaches to Memory

This principle is suggested with the intent of drawing the attention to the importance of engaging learners in different ways to remember. Caine & Caine (2000) argue that a separation of memory has been done for educators as the memory for isolated facts and skills, which may also be entitled as rote memorization, and as the dynamic memory that is related to organizing life experiences.

2.7.10. Principle 10: Learning Is Developmental

As the name of the principle indicates, this principle is introduced to lay emphasis on the fact that new learning builds on previous learning and variations in maturation. In addition, this principle sets forth that more effective learning could be ensured if individual differences in maturation, development and prior learning are considered.

2.7.11. Principle 11: Complex Learning Is Enhanced by Challenge and Inhibited by Threat Associated with Helplessness and/or Fatigue

Caine & Caine (2000) maintain that creativity theory (Deci &Ryan, 1987), stress theory (Sapolsky, 1992; Lazarus, 1999) and perceptual psychology (Combs, 1999) all show that mental and emotional functioning is hindered by fears and threats linked to helplessness. Thus, this principle places great emphasis on setting up a supportive and challenging environment so as to promote learning in place of leading to emergence of threat.

2.7.12. Principle 12: Each Brain Is Uniquely Organized

This principle manifests a parallelism with individual indifferences and their impact on learning. Caine & Caine (2000) state that every person has a unique genetic blueprint and life experiences specific to her. For this reason, unless learners' abilities and interests are taken into consideration, maximizing learning may be unlikely.

Figuring out the implications of brain-compatible learning for education is as important as apprehending brain-compatible learning principles. Caine & Caine (2000) attempt to sort out the implications of brain-compatible learning for education in addition to proposing 12 brain-compatible learning principles. Table 5 below depicts brain-compatible learning principles and their implications for education.

Table 5

12 Brain-Compatible Learning Principles and Their Implications for Education

No	Principle	Implication for education
1	All learning engages the physiology.	Use of different senses and body
2	The brain/mind is social.	Stimulating social interaction
3	The search for meaning is innate.	Enhancing comprehension by taking into account learners' interests, purposes, and ideas
4	The search for meaning occurs through patterning	Perceiving and creating patterns and associating new patters with what learners already understand.
5	Emotions are critical to patterning	Eliciting appropriate emotions before, during and after their experiences with a text.
6	The brain/mind processes parts and wholes simultaneously	Embedded details into wholes and parts.
7	Learning involves both focused attention and peripheral perception	Deepening students' attention and learning from the context unconsciously
8	Learning is both conscious and unconscious.	Giving sufficient time to reflect on and process experiences.
9	There are at least two approaches to memory.	Engaging in multiple ways to remember.
10	Learning is developmental.	Taking into account individual differences in maturation, learning and prior experiences.
11	Complex learning is enhanced by challenge and inhibited by threat associated with helplessness and/or fatigue.	Supportive, empowering and intrinsically challenging environment.
12	Each brain is uniquely organized.	Integrating individual talents into teaching

2.8. Brain-Compatible Learning Strategies

In order for practitioners to be able to apply brain-compatible learning principles to learning environment, Jensen (2000) proposed brain-compatible learning strategies. The strategies with which brain-compatible learning environment could be set up appear to carry tremendous importance for having the knowledge of what a teacher needs to know to establish and maintain brain-compatible learning environment. Literature review has shown that brain-compatible learning strategies having been proposed by Jensen (2000) seem to be a comprehensive presentation of these strategies. Below are the categories included in brain-compatible learning, and classroom strategies the categories may be put into practice with, which are provided by Jensen (2000).

2.8.1. Atmosphere

The atmosphere in which learners are expected to learn should be convenient to learning in that conducive learning atmosphere may facilitate and optimize learning while opposite situation can impede learning.

2.8.1.1. Classroom Strategies for Establishing Facilitative Atmosphere

- The colour of the classroom is a factor that exerts impacts on how the brain reacts. For instance, in classrooms where primary students have education contrast colours such as orange and red can be preferred.
- Classroom temperature should be 68-72 degrees.
- Fresh air should be allowed into the classroom to maintain indoor air quality.
- Keep the classroom neat and teachers can be role models for their students in keeping the classroom neat.

2.8.2. Brain Fitness

Brain fitness is related to doing simple activities and movements to enable whole brain learning.

2.8.2.1. Classroom Strategies for Maintaining Brain Fitness

- "Do activities that cross the left side of the body to the right side, which helps to coordinate the left and right brain."

- Have student doodle by making the number eight sideways (∞). This helps cross the midline between the two sides of your brain and helps to remember words.

2.8.3. Choice

Giving learners a chance to make a choice can enable them to engage in whatever is presented in the classroom and feel a sense of freedom and empowerment.

2.8.3.1. Classroom Strategies for Choice

- Make use of several different ways of assessment like essays, debates, paintings, songs, outlines, games, portfolios etc.
- Let students choose their seats.
- Allow students to choose their partners.

2.8.4. Differences

Jensen (2000) claims that male and female students do have diverse learning styles and this difference should be kept in sight and certain strategies need to be produced in order to meet the needs of learners with different learning styles. Both in parallel with and in contrast to what is claimed by Jensen (2000), my observations and the questionnaire I have administered in this study to detect the participants' learning styles show that not only there exists a difference as with learning styles between males and females but also there appears to be a difference as to learning styles amongst merely females or males.

2.8.4.1. Classroom Strategies to teach in Accordance with Differences

- Ensure that male and female students with different learning styles can benefit from your lessons.
- Integrate movement and concrete objects into lessons for kinaesthetic and hands-on learners respectively.

2.8.5. Emotions

Emotions and how much one learns are interconnected. Therefore, strategies on emotions should be dealt with to increase positive emotions and decrease negative emotions in order to maximize learning.

2.8.5.1. Classroom Strategies for Promoting Appropriate Emotions

- Establish classroom rituals.

- Play the same music every morning as an arrival song.

- It is okay to make mistakes.

- Learners should be supported with the confidence that the mistakes they make are a natural part of the learning process.

- Express all emotions.

- Teachers need to create such an environment and atmosphere in which learners can articulate all of their positive and negative emotions. Teachers can promote their learners to keep a journal to put their ideas into words.

2.8.6. Fun

Having fun in lessons does motivate and empower learners. It can lead to smile and laughter, which can reduce stress levels in lessons.

2.8.6.1. Classroom Strategies to Have Learners Have Fun in Lessons

- Incorporate fun into learning.

- Use humour in the classroom.

- Engage, engage, engage.

- Hands on activities can have learners engage in learning.

2.8.7. Goals

Teachers should guide their learners in setting goals, working towards goals and accomplishing them. Goals might be challenging but achievable for learners.

2.8.7.1. Classroom Strategies for Helping Learners Establish Goals

- Post a goal chart in your classroom and get learners to fill in the goal charts.

- Guide learners to set achievable, measurable and realistic goals.

- Give learners a chance to see how goals are implemented in real world.

2.8.8. High Expectations

Teachers need to have high expectations for all learners in the classroom and learners need to feel that their teachers have high expectations about them,

which could urge them to live up to the expectations their teachers have in their mind.

2.8.8.1. Classroom Strategies for Expressing High Expectations

- "Replace "Yes, but …" with "Here is how…" this way you are searching for a way to make something happen, not put it down".
- Manifest a lively mood and be energetic so that learners will be in the same mood.

2.8.9. Interests

Determining interests appealing to all learners in a class is not an easy task to achieve given the diversity among learners in regard to their interests.

2.8.9.1. Classroom Strategies for Conducting Lessons in Accordance with Learners' Interests

- Give an opportunity to male learners to write about what they want as generally, they are not keen on writing.
- Group learners according to their interests to get them to see that there are learners in the classroom with whom they can meet on a common ground.
- Try to read aloud for learners who are not good at reading and some learners learn better through hearing.

2.8.10. Just like Home

Learners can keep studying and be motivated to be successful as long as they feel that the classroom to which they come every day and in which they spend hours is not so different from their home.

2.8.10.1. Classroom Strategies to Get learners to Feel the Classroom like Their Home

- Bring plants to the classroom to create a home like environment because plants can increase the oxygen level in the classroom and this can contribute to better working of the brain.
- Ascertain comfortable seating options.
- Hang student work.
- Bring lamps to the classroom.

2.8.11. Kinaesthetic

Learning by experiencing and touching the world around is a learning style. Learners might be more involved in the learning process on the condition that teachers have learners learn by touching and experiencing.

2.8.11.1. Classroom Strategies to Ascertain Kinaesthetic

- "Be tactile. Provide creative use of hands-on manipulatives."
- "Make learning come alive." This can be achieved by setting up project work.
- Stimulate movement in the classroom.

2.8.12. Lighting

The importance of even light in the environment where learning takes place has been proven. Additionally, natural light plays a crucial role in increasing attention and endorsing positive attitude.

2.8.12.1. Classroom Strategies to Maintain Even Lighting

- "Allow as much natural light as possible into the room through windows or skylights."
- "Bring in lamps with full-spectrum light bulbs".
- "If possible, replace fluorescent bulbs with UV or full-spectrum bulbs."

2.8.13. Music

Music in the classroom can awaken the brain and increase brain waves.

2.8.13.1. Classroom Strategies for the Use of Music

- "For a more upbeat lesson with lively activities, listen to music with quick tempo and a steady beat."
- "For quiet work time, play a calming music, such as classical or instrumental."
- "Having a variety of music selections in the classroom will keep you ready whenever the music is needed."

2.8.14. Nutrition

The significant place healthy food has in brain functioning has long been known and therefore, teachers should remind their learners of the cruciality of choosing healthy food.

2.8.14.1. Classroom Strategies to Promote Quality Nutrition among Learners

- Promote your learners to eat fresh fruit and vegetables.
- Stimulate your learners to have high protein breakfast.
- Allow only healthy food in the classroom.
- Allow your learners to eat nutritious snacks like nuts during the day.

2.8.15. On-line Learning

Reaching all learners with various needs and expectations does seem to be a challenge. On-line learning may provide a way out to appeal to different learners.

2.8.15.1. Classroom Strategies for On-Line Learning

- Allow learners to keep a blog rather than a journal.
- Allow you learners to access class material on the web.
- Use new technologies to give learners an opportunity to reflect on what they have learned.

2.8.16. Patterns

The human brain needs to group and make categories to learn. Provided that the incoming information can be associated with the existing one, the new information becomes more meaningful and comprehension could be facilitated.

2.8.16.1. Classroom Strategies to Help Learners Create Patterns

- "Group ideas, names, factual information, key ideas and different subject material together."
- "Discuss the relevance of a topic by discussing the pros and cons."

2.8.17. Questioning

Brain-based questioning techniques should be developed in order for being able to reach both genders because boys have a predisposition to give answers directly, yet girls can be more timid in their answers.

2.8.17.1. Classroom Strategies to Maintain Questioning

- Provide at least 3-second wait time to learners before inviting them to verbalize their answers.
- "Be aware of unintentional gender bias when calling for answers."

- Try to use more story problems so that girls can perform better in math.

2.8.18. Rewards

Two types of rewards exist in the world of education; intrinsic and extrinsic. The latter involves money, grades and candy bars while intrinsic rewards consist of the feeling of being successful originating from accomplishing something.

2.8.18.1. Classroom Strategies to Give Rewards

- Incorporate assessments and tasks that can motivate learners perform better.
- Integrate information into activities that are linked to the real world.
- Embody discussions and debates in lessons to give them an opportunity to express what they have in their mind.

2.8.19. Seating

Traditional classroom seats might hinder learning and hence, students should have the right to choose the seats on which they want to seat.

2.8.19.1. Classroom Strategies to Provide Appropriate Seating

- Provide a variety of seating options such as desks and chairs, pillows, video game chairs et cetera.
- Prefer movable chairs to let learners choose the part of class where they can feel more comfortable.
- Change the seating plan frequently as a means of increasing learners' interests.
- Pay attention to learners sitting at the back of the class in that they receive less attention compared to learners sitting in the front rows.

2.8.20. Technology

Using technology to support learning is an effective way to facilitate learning process for learners with different learning styles. In addition, learners can be more involved in the learning process.

2.8.20.1. Classroom Strategies to Use Technology in the Classroom

- Get learners to access to computers as a part of independent learning.
- Use video clips to promote learners' sensory experiences.

- Integrate assessment tools requiring the use of technology such as power point and excel.

2.8.21. Use It or Lose It

Remembering what is learned is no less significant than learning. While some learners can recall every detail, some others can have difficulty in remembering what is learned. For this reason, creative repetition can enable learners to recall what has been learned.

2.8.21.1. Classroom Strategies for Use It Lose It

- Use songs, cooperative learning games et cetera to help learners remember.
- Use chunks in order to make information more organized in the brain and also more meaningful.
- Present the information in a variety of ways to address learners with different learning styles.

2.8.22. Video Games

Learners spend hours playing computer games and generally teachers do not believe in the effectiveness of playing video games. However, teachers can make use of the power of video games for educational purposes.

2.8.22.1. Classroom Strategies to Integrate Video Games into Lessons

- "Replace traditional activities and methods with video games that tie content to a digital environment."
- "Use simulations, video games as a way to examine alternative outcomes to historical situations."
- "Use video games for ethical dilemmas and choices."

2.8.23. Water

%80 percent of the brain is comprised of water. There is a negative correlation between rising stress hormone and lowering water level in body. These facts underline the importance of water for our body.

2.8.23.1. Classroom Strategies to Stimulate Learners to Drink Water

- Encourage learners to bring water bottles into the classroom.
- Drink water throughout the day to act as a role model for your learners.

2.8.24. Zzzz's

All teachers know the importance of sleep for learners to concentrate in class. Learners who do not get adequate sleep do have difficulty in getting involved in what is done in class.

2.8.24.1. Classroom Strategies to Ascertain Learners Sleep Well

- Present new information in the morning and focus on projects or simulations in the afternoon.
- Stimulate learners to sleep well every night.
- Consider the possibility that what you are doing in class may be boring, not engaging if learners sleep during the lesson.

2.9. Brain-Compatible Learning versus Traditional Teaching Methods

Brain-compatible learning may be comprehended better on the condition that it is compared with traditional teaching methods. The fundamental shortfall of traditional teaching is that the teacher teaches what she wants to teach without keeping in sight what the learner wants to learn (Barkley & Bianco, 2014). Brain-compatible learning, however, enables establishing a learner-centred environment through the use of materials and delivering instruction in a fun and meaningful way (Makurjea, 2003). Figure 4 below demonstrates how a brain-compatible lesson is conducted.
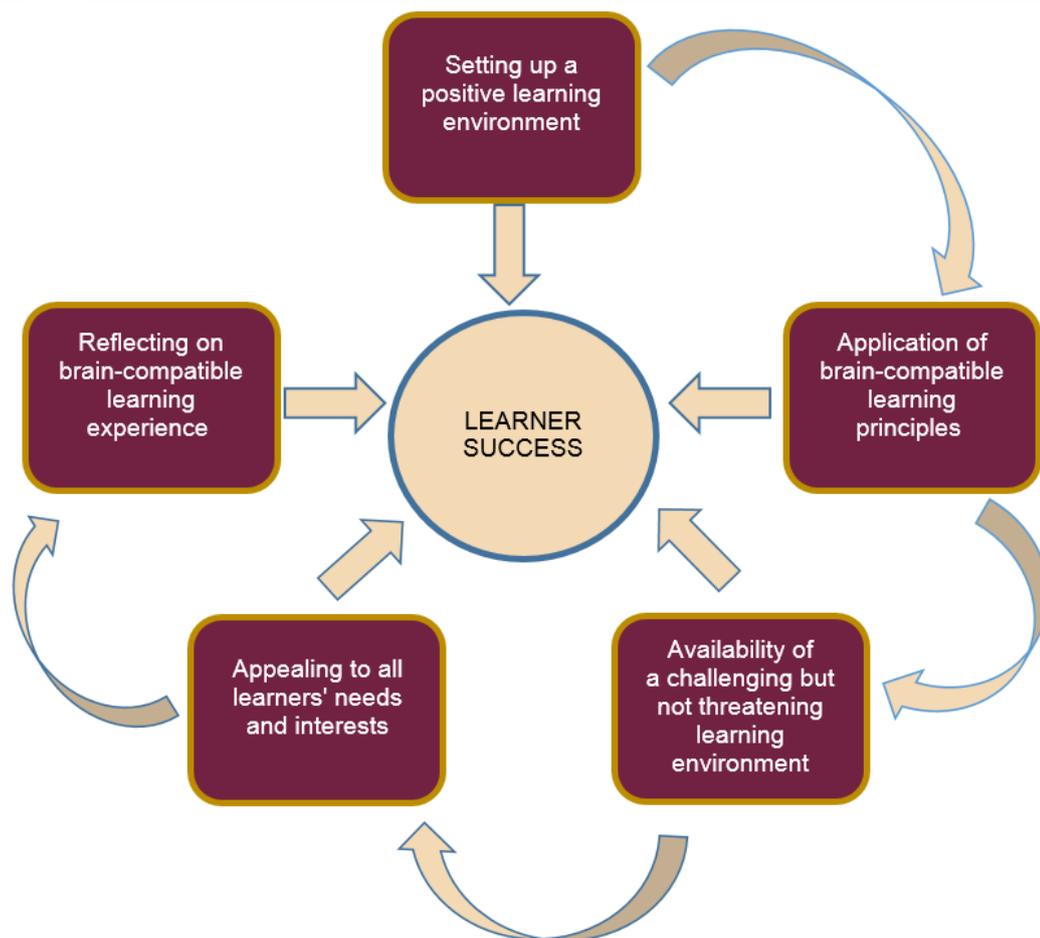
Figure 4. The way a brain-compatible lesson is structured

Caine & Caine (1991) put forth the differences between conventional teaching methods and brain-compatible learning method. Table 6 demonstrates the differences between brain-compatible learning and conventional teaching methods.

Table 6

Differences between Brain-Compatible Learning and Conventional Teaching Methods

Factors	Brain-Compatible Learning Method	Conventional Teaching Methods
Source of info	Complex source of information	Simple source of information
	Teaching content gathered from discovery, individual reflections, role playing, social interaction groups and integrated subject matter	Information directed from teacher, book or worksheet
Classroom Organization	Thematic and integrative instructions	Active role of teacher for classroom organization
	Cooperative learning	Students working individually
	Students working in small groups	or directed by the teacher.
	Assignments of individualized projects	
Classroom Management	Teacher delegates power to students	Teacher controlled
	Monitoring of responsibilities by the teacher	Teacher deciding about running teaching learning activities in classrooms
Nature of outcomes	Convergent and divergent	Convergent and focused on one dimension

The question of why conventional teaching methods have been advocated in teaching is attempted to be answered by Jeffries, Woolf & Linde

(2003) by drawing the attention to having the chance to learn directly from the teacher in conventional teaching methods. While whether learning directly from the teacher is a chance can be questioned, Jeffries (2001) sets forth negative aspects of conventional teaching methods as lack of flexibility, being devoid of maintaining consistency and not addressing to the diverse needs of learners.

Below is Table 7 that illustrates the outstanding features of conventional teaching methods and brain-compatible learning method taken from different sources and includes my views originating from my readings on brain-compatible learning.

Table 7

An Additional Comparison of Conventional Teaching Methods and Brain-Compatible Learning Method

Conventional Teaching Methods	Brain-Compatible Learning Method
Emphasis on lectures and note-taking Attending lectures Teachers determining the content of the lesson.	Emphasis on diverse means of teaching Avoiding lectures Learners have a say in determining the content of the lesson.
Teachers just following what is to be covered in the curriculum. Learners remaining at stand still position Learners are viewed to be empty vessels waiting to be filled by teachers. Assessment conducted by solely regular	Teachers adapting the lesson in accordance with the reactions of learners. Learners are active. Learners do make use of their already existing knowledge to make meaning out of the new experiences.
exams comprised of multiple choice questions	Assessing learner performance is realized through portfolio, exams, presentation, group work, project work et cetera.

Source: http://www.publicagenda.org/files/teaching_methods.pdf

2.10. The Studies That Have Been Carried Out on the Impact of Brain-Compatible Learning

Review of literature on brain-compatible learning has shown that subsequent to the advances in brain imaging technologies, the findings attained from laboratory work has been applied to the classroom environment. These applications have led to the introduction of a plethora of studies from different fields investigating the influence of brain-compatible learning on learners'

academic achievement, and teachers' and learners' perceptions of brain-compatible learning. Following paragraphs are dedicated to providing concise information about the findings of the majority of research in the interrelatedness between brain-compatible learning intervention and academic achievement, and in teachers' and learners' perceptions of brain-compatible learning.

2.10.1. The influence of Brain-Compatible Learning on Academic Achievement in Science Lesson

The study conducted by Akyürek & Afacan (2013) reveals the positive impact of brain-compatible learning on the academic achievement of 8th grade learners in science lesson. The study was grounded on a pre- and post- test control group research model. The results of the study showed that the performance of the learners in the experimental group in the achievement test surpassed the performance of the learners in the control group.

Another study investigating the impact of brain-compatible learning on science lesson was carried out by Özden & Gültekin (2008) among 5th grade learners. The findings obtained from pre/post-test control group research model showed that the experimental group exposed to brain-compatible learning instruction outperformed the control group being exposed to traditional teaching methods in post-test and retention level test.

The influence of brain-compatible learning on physics has been explored as well. Saleh (2011) carried out research on the influence of brain-compatible learning intervention on comprehending Newtonian physics. The findings attained from the quasi-experimental study showed that experimental group trained in accordance with brain-compatible learning principles had a better conceptual understanding of Newtonian physics in comparison to the control group being exposed to conventional teaching methods.

2.10.2. The influence of Brain-Compatible Learning on Academic Achievement in Mathematics

Brain-compatible learning method has been applied in a wide range of fields one of which is mathematics. Rehman (2011) conducted a study in an effort to examine the influence of brain-compatible learning on teaching mathematics at secondary level in Pakistan. This experimental study attempted to demonstrate the effectiveness of brain-compatible learning by comparing brain-compatible teaching to conventional teaching methods like lecture

method. The participants were chosen from both rural and urban schools and they were randomly assigned to either control or experimental group. The scores the participants got from the administration of pre- and post-achievement test revealed that brain-compatible learning method proved to be a more effective teaching method in comparison to conventional teaching methods.

The interconnectedness between brain-compatible learning and increasing the scores of learners in mathematics was also explored in another study carried out by Bello (2007). In this study it was found that training teachers in brain-compatible learning has a positive impact on increasing the grades of the fifth grade learners in mathematics.

2.10.3. The influence of Brain-Compatible Learning on Improvement in Reading Proficiency

Whether brain-compatible learning does exert influence on reading proficiency has been another research subject. Blackburn (2009) has carried out a study in order to investigate the effect of brain-compatible learning, if any, on reading proficiency of elementary school learners. The findings attained from the quasi-experimental study yielded that there was no statistically significant difference between the experimental group exposed to brain-compatible learning and the control group following traditional school program. This study seems to be one of those which do not yield a better performance originating from brain-compatible learning intervention.

McNamee (2011) conducted a study in order to explore the impact of brain-compatible learning on improving second grade learners' reading achievement. In the study based on experimental research design the experimental group participated in a literature unit that was taught in accordance with brain-compatible learning principles while the participants in the control group were exposed to traditional teaching practices. The findings of the study do not indicate a statistically significant difference on the part of the experimental group in regards to reading achievement gains. McNamee (2011) explains the insignificant difference between the experimental and control group by the absence of sensitive assessment measures.

Cowan (2009) did research on brain-compatible learning as a means of improving reading skills of elementary level learners struggling with improving

their reading. The purpose of doing study was to create a brain-compatible reading program with the intent of improving reading skill. The findings of the study are among those showing the positive influence of brain-compatible learning on improving learners' reading skills.

2.10.4. The influence of Brain-Compatible Learning on Improvement in Writing Skill

The effect of brain-compatible learning on improving learners' literacy skills has been investigated too. One of these studies was done by Hoge (2002). The primary aim of the study was to examine how a kindergarten/first-grade teacher applied brain-compatible learning strategies so as to advocate her learners as readers and writers. The research which was based on naturalistic design and techniques was conducted at a small suburban elementary school. The data were collected by field notes from classroom observations, interviews and questionnaires and artefacts gathered from the teacher and her learners. The findings of the study highlight the significance of brain-compatible learning in establishing a risk-free and stimulating environment and in helping learners as readers and writers.

Getz (2003) conducted a study to explore the influence of brain-compatible learning on under-prepared community college learners in their developmental English classes. This study was based on mixed methods research model and the data were collected from the scores the participants got from a writing sample, an attitude survey towards writing, and a survey of comfort with the writing situation. The findings of the study showed that there was no statistically significant difference between the two groups.

2.10.5. The influence of Brain-Compatible Learning on Improvement in Social Studies

Social studies is another area on which the influence of brain-compatible learning has been explored. Çengelci (2007) conducted a study based on pre/post-test control group research design with the purpose of examining the effect of brain-compatible learning on learners' academic achievement and retention in social studies. Findings obtained through qualitative and quantitative data collection tools showed that the participants exposed to brain-compatible learning intervention outperformed the participants in the control group with regards to academic achievement and retention. In addition, the

participants in the experimental group did have positive attitudes towards brain-compatible learning.

Another study in the field of social studies was done by Duman (2010). He carried out the study based on pre/post-test control group research design with the student-teachers from the department of social studies. Measurement and evaluation course was selected as the course on which the effect of brain-compatible learning would be researched. The extent to which brain-compatible learning intervention was effective on the participants' success was measured by comparing experimental and control group's performance in the test administered to measure the participants' acquisition of knowledge and skills in the course. The findings revealed that the experimental group taught in reference to brain-compatible learning surpassed in terms of achievement levels the control group exposed to traditional lecture model. The test included a section added in order to learn about the experimental group's perceptions of brain-compatible learning process the analysis of which shows that brain-compatible learning was considered to be effective and enjoyable.

Duman (2010) conducted another study with pre-service social studies teachers so as to ascertain the impact of brain-compatible learning on the academic achievement of learners with varied learning styles. The results attained from the academic achievement test yielded that brain-compatible learning enabled the participants in the experimental group got higher scores than the control group participants taught in accord with traditional methods. Nonetheless, the results showed that no statistically significant difference was found out between the achievement levels of the participants with different learning styles.

2.10.6. Teachers', Principals' and Learners' Perceptions of Brain-Compatible Learning and Brain-Compatible Learning Strategies Employed by Them

A number of studies have been conducted in order to shed light on perceptions of parties involved in the learning and teaching process like learners, teachers and principals of brain-compatible learning. One of the studies centred upon principals' perceptions is carried out by Martin (2006). The purpose of this study was to examine whether there was any significant difference amongst the principals' application of brain-compatible learning

strategies. The findings attained from the study based on quantitative research method showed that no statistically significant difference amongst principals at elementary, middle and high school level regarding the application of brain-compatible learning exists.

Avcı & Yağbasan (2010) carried out a study with a view to finding out the views of 7th grade learners on brain-compatible learning. The analysis of the data gathered during the interview that was conducted at the end of the training in brain-compatible learning showed that the learners had positive views about brain-compatible learning and perceived themselves as active participators in the lessons designed in accordance with brain-compatible learning.

Muscella (2014) conducted a study on examining educators' perceptions of brain-compatible learning instruction in diverse middle school inclusive classroom. The analysis of the qualitative data collected from six general education teachers, one special education teacher and two school district supervisors through nine interviews and two observations elucidated instructional experiences of middle school educators in the clarity and value of brain-compatible learning. The analysis of the data reported that the participants were willing to partake in professional development activities in order to enhance their knowledge of brain-compatible learning with a view to getting learners with disabilities within diverse middle school inclusive classroom to take advantage of brain-compatible learning.

Weimer (2007) is one of these researchers conducting a study on the perceptions of middle school teachers and learners of brain-compatible learning regarding its influence in accomplishing the objective of engaged learning and long-term memory enhancement. The findings yielded by mixed methods research design revealed the parallelism between the learners and teachers' perceptions of brain-compatible learning as a means of augmenting engaged learning and long-term memory enhancement. The author laid stress on the cruciality of the training in brain-compatible learning provided to teachers.

With the guidance of Leslie Hart, the scholar who introduced the term brain-compatible learning to the literature in 1983, Drew Elementary School in New Jersey developed a brain-compatible learning programme as an option to regular curriculum in 1985. 120 learners enrolled in the brain-compatible learning programme and an orientation focusing on presenting the literature on

brain theory was given to the team responsible for implementing the programme. The results of the project which were obtained through analysing the learners' test scores indicated that the programme was notably successful. The high degree of success achieved by the programme was, in some way, validated by the survey conducted with the learners' parents. It was inferred from parents' statements that they were satisfied with their children's progress and attitudes. Other teachers at Drew were impressed by the increased performance of the learners having enrolled in the programme and wanted to take part in the brain-compatible learning programme in the following years.

To what extent teachers implement brain-compatible learning strategies has been another research subject in several studies one of which is done by Hodges (2013). The researcher interviewed 23 teachers and administrators asking for what brain-compatible learning strategies were implemented by them and to what degree strategies influenced their achievement levels. The findings revealed that no statistically significant difference was springing from the level of implementation of brain-compatible learning strategies and years of teaching experience. Nevertheless, the participating teachers reached a consensus on the positive effect of brain-compatible learning on student learning and teachers' need to be trained in brain-compatible learning strategies.

The influence of years of teaching experience on the implementation brain-compatible learning was investigated in a study carried out by Morris (2010). The study showed that the teachers with more years of teaching experience employed more brain-compatible learning strategies than the teachers with 0-10 years of teaching experience. Another study investigating teachers' perceptions of brain compatible learning is the study done by Wachob (2012). One of the purposes of the study is to depict K-12 teachers' beliefs as to brain-compatible learning. The findings of the study showed that the participants had positive attitudes towards applying new strategies and deepening their understanding of how the brain and learners learn.

The influence of brain-compatible learning on improving 12th grade learners' success in general was explored by Odabaşı & Celkan (2010). The difference between participants' success prior to and subsequent to brain-compatible learning training was analysed and the findings revealed the positive impact of brain-compatible learning on 12th grade learners' success.

Hill (2013) conducted a study on the effect of counselling in brain-compatible learning on high school learners' academic self-efficacy and academic achievement. The analysis of the data gathered in the study based on experimental research design showed that there was a significant improvement in the academic self-efficacy and achievement of the experimental group that was taught in compliance with brain-compatible teaching strategies.

A project was conducted with the purpose of enhancing teaching practices through brain-compatible learning by Bonnema (2009). The researcher of the project reviewed the literature on brain-compatible learning and accumulated the work on brain-compatible learning strategies into a Microsoft power point presentation. Post-presentation survey results indicate that the teachers listening to the presentation benefited from the delivered information and targeted employing brain-compatible learning strategies.

Burkett (2014) carried out a study on detecting what brain-compatible learning strategies were employed by teachers to create a positive learning environment and what factors were influential in due course of determining brain-compatible learning strategies. The findings obtained from this qualitative study revealed that teachers had distinct views, concerns and attitudes regarding brain-compatible learning strategies.

Another outstanding finding is pertinent to how teachers' past experiences as teachers and learners are influential when selecting what strategies to use. The findings of the study carried out by Calella (1993) underscored the importance of teacher training activities in equipping teachers with brain-compatible learning principles and additionally, this research revealed that teachers having been a part of professional training activities on brain-compatible learning principles were more adept at applying principles to observable classroom behaviours.

2.10.7. The influence of Brain-Compatible Learning on Agricultural Education

Though there have not been studies conducted on the influence of brain-compatible learning on agricultural education, being conscious of the important role played by brain-compatible learning in teaching of various subject areas, Bellah, Robinson, Kaufman, Akers, Wittler & Martindale (2008) lay emphasis on the relevance of brain-compatible learning to agricultural education and the

probable facilitative contribution of brain-compatible learning to better learning in agricultural education.

2.10.8. The influence of Brain-Compatible Learning on English Language Proficiency

The influence of brain-compatible learning on learners' attitudes towards English lesson and on their achievement levels in English has been the focal point of few studies in the literature. One of these studies was done by Baş (2010). He investigated whether brain-compatible learning has any impact on learners' achievement levels and attitudes towards English lesson. The findings obtained from the study with pre/post- test control group research design revealed that the learners in the experimental group had higher grades in the achievement test in comparison to the control group, they were more successful, and more motivated compared to the control group.

The correlation between brain-compatible teaching strategies and English achievement test scores was investigated in research carried out by Huang (2006). The study was conducted in general English classes in schools above the secondary level in Taiwan. Some of the findings of the study revealed that there was a positive correlation between employing brain-compatible learning strategies and learners' achievement levels in English.

2.11. Second/Foreign Language Learning

A huge proportion of world population engages in learning a language other than their mother tongue due to such reasons as academic & political purposes, reading books and papers in the target language et cetera. Depending on the location where the target language is learned, a distinction has been proposed between second and foreign language learning. Providing the target language is used for communication in the local region or community, it is named as a second language; however if the target language has no local uses or speakers, it is referred to as a foreign language.

Mitchell & Myles (2004, p. 6) assert that foreign language learning can be subsumed under second language learning in that both entail similar learning processes though there still remain differences between the two as with the goals to learn the language and learning circumstances. So as to comprehend language learning, whether it is foreign or second language

learning, reviewing what language learning theories claim does appear to be important.

2.11.1. Language Learning Theories

A number of theories such as behaviourism, constructivism, and social constructivism have been referred with the purpose of explaining language learning. Mithchell & Myles (2004) point out that second language learning theories do have two aims: one is as with describing the language produced by language learners and the second one targets elucidating why language learners produce the language in the way it is. Following paragraphs encompass information about language learning theories.

2.11.1.1. Behaviourism

The proponents of behaviourism (Bloomfield, 1933; Skinner, 1957; Thorndike, 1932) resemble language learning to any other kind of learning. This theory of language learning explicates learning by the interaction between stimulus, response and reinforcement. Mithchell & Myles (2004) apply behaviourism to language learning as follows:

> Applied to language learning, a certain situation will call for some kind of greeting, and the response will be reinforced if the desired outcome is obtained, that is, if the greeting is understood. In the case of communication breakdown the particular response will not be reinforced, and the learner will abandon it in favour of a response that is hoped will be successful and therefore reinforced (p. 31).

As the words of Mitchell & Myles (2004) indicate, in the behaviourist view language learning is regarded to take place by tracking the trilogy of stimulus-response-reinforcement. Additionally, the notion of *practice makes perfect* is strongly advocated by behaviourists, which underscores the repetition of the same structures.

2.11.1.2. Universal Grammar

The Universal Grammar theory asserts that "all human beings inherit a universal set of principles and parameters that control the shape of human languages can take, and which are what make human languages similar to one another" (Mitchell & Myles, 2004, p. 54). Even though universal grammar might be conceived to be a theory aiming at explaining merely first language acquisition, it is a theory of natural languages, and since second languages are

natural languages as well, segregating it from the theories construing second languages does sound nonsensical (Mitchell & Myles, 2004).

Reference to universal grammar theory to explain second language learning relies on to what degree second languages are constrained by universal grammar. It is considered that there is either full access or partial access to universal grammar in second language learning. Full access to universal grammar means that universal grammar is completely accessible in second language learning as it is in first language acquisition. Partial access to universal grammar denotes that while some parts of universal grammar are available to second language learners, some are not.

2.11.1.3. Cognitive Approaches to Language Learning

The proponents of this theory are concerned with how the human brain processes and learns new information. Cognitive approaches to second language learning put more emphasis on the language learner and the hypotheses investigated by cognitive theorists originate from the fields of cognitive psychology and neurology (Mitchell & Myles, 2004).

Cognitive theorists fall into two groups: the theorists advocating processing approaches (Towell & Hawkins, 1994) and the ones belonging to constructionist approaches (Ellis, MacWhinney Tomasello, as cited in Mitchell & Myles, 2004). The former group of theorists examine how second language learners process new information and the latter group of cognitive theorists propound that communicative needs are the factors promoting language development.

2.11.1.4 Pragmatic Perspectives on Second Language Learning

The researchers who do embrace functional or pragmatic approach to second language learning do not centre their studies on investigating formal linguistic systems, in contrast, they take an eager interest in understanding how second language learners make meaning and accomplish their communicative goals. They claim that various learner outcomes produced by language learners cannot be clarified without probing into the speech acts language learners attempt to produce and how they address to social, physical and discourse context to make meaning.

2.11.1.5. Input and Interaction in Second Language Learning

It has been claimed that comprehensible data is a prerequisite for second language learning to take place. Krashen's input hypothesis (1982, 1985) also sets forth the significance of subjecting language learners to comprehensible input in order for setting ground for second language learning to occur. Long (1980,1981,1983a) proposed interaction hypothesis which is an extension of Krashen's input hypothesis. The study conducted by Long showed that no difference existed between native speaker-native speaker pairs and native speaker-non-native speaker pairs as to the grammatical complexity of the utterances they produced during informal conversations. Continuing communication breakdown, however, led the native speaker-non-native speaker pairs to resort to conversational tactics such as repetitions, confirmation checks or clarification requests. Thus, interaction hypothesis lays the emphasis on negotiation of meaning realized by fine-tuning the language used to appropriate it to the learner's current state of language knowledge.

2.11.1.6. Socio-Cultural Theory

Learning is postulated to be a mediated process in socio-cultural theory. The mediation may be brought about by either the learner's "developing use, and control of mental tools or "face-to-face interaction and shared processes like a joint problem solving and discussion" (Mitchell & Myles, 2004, p. 195). Scaffolding and zone of proximal development are the terms closely associated with socio-cultural theory. Scaffolding is the term that is used to entail the support provided by a skilled individual to an unskilled one in an effort to get that individual to do a task. Zone of proximal development is accepted to be the domain of knowledge and skills where an individual can reach the anticipated outcome by scaffolding.

2.12. The Link between English Language Learning and Brain-Compatible Learning

Irrespective of the fact that every learner's purpose of learning English may vary, the desired learning outcome for almost all of them is being capable of carrying successful communication without causing communication breakdown. While some learners achieve their objectives, some others fail at accomplishing their goals, therefore, it is highly significant to bear in mind that

several factors do impact learners' success or failure in learning English. Notwithstanding the generally accepted conception that learners do follow a certain developmental route, the pace at which they complete the route, and whether they will ever be able to complete the route before putting an end to showing all their efforts to improve their knowledge of English change. Differentiation among learners in terms of level of success does stem from individual learner differences.

Gardner & McIntyre (1992, 1993) divide the factors that can influence learner success into two groups as cognitive and affective factors. Cognitive factors subsume intelligence, language aptitude, and language learning strategies. Mitchell & Myles (2004) argue that second language learners who do have better general academic achievement, and do score above average in measurement of intelligence are inclined to achieve higher levels of success in language learning. Language aptitude, another cognitive factor, has been regarded to be an important indicator of learner success in second language learning. Gardner & McIntyre (1992) maintain that there is a correlation between a learner's score in language aptitude test and her overall language learning success. Regarding language learning strategies it has been claimed (Oxford & Crookall, 1989) that language learning strategies used by more proficient language learners differ from the ones employed by less proficient language learners. Besides, in the literature a large number of studies reveal that applying language learning strategies may yield better learning.

Affective factors encapsulate learner attitudes, motivation, language anxiety, and willingness to communicate. Learners' attitudes towards target language and its speakers, unsurprisingly, exert impact on language learners' achievement levels. Another affective factor, motivation is, undoubtedly, tremendously influential in doing any task including language learning. The interrelationship between motivation and achievement level has been demonstrated in several studies (Masgoret & Gardner, 2003). Like the relationship between motivation and achievement level, the interconnection between language anxiety and achievement level cannot be ignored. Anxiety may lead learners to stay silent in classes and several studies in the literature depict the negative relationship between anxiety and level of success. Last affective factor, willingness to communicate, is a construct proposed by

MacIntyre et al. (2002) and it is associated with a feeling of intentness to engage in communication by using the target language with a specific person or people.

Recalling brain-compatible learning principles advanced by Caine & Caine (1994) could help establish a link between brain-compatible learning and language learning in general and English language learning in particular. One of the brain-compatible learning principles is "learning is developmental". This principle is related to orchestrating teaching in accordance with learners' prior learning experiences and differences in maturation. The significance attached to prior learning experiences in brain-compatible learning is considerably important in English language learning as well, particularly for adult English language learners. Because adult learners may be under the impact of their prior English language learning experiences, brain-compatible learning pays special attention to learners' prior learning experiences.

Individual learner differences play a fundamental role in English language learners' achievement level and brain-compatible learning puts emphasis on individual learners' distinct interests, talents, and abilities, which is underscored in the brain-compatible learning principle, each brain is uniquely organized. As well as the importance given to individual differences, brain-compatible lessons aim at creating a supportive, empowering, and risk-free environment. English language learners, specifically adult learners, do suffer from anxiety and for this reason, provided that brain-compatible learning principles are applied to English language teaching classes, learners could eliminate the risk of being a victim of threatening classroom atmosphere.

Since language learning requires learning a huge bundle of vocabulary, providing language learners with a number of distinctive ways that can stimulate the process of learning and storing new information necessitates pondering. Considering the multiple ways presented by brain-compatible learning to language learners to help them learn and remember, probable contribution of brain-compatible learning principles to English language learning appears to be obvious.

Promoting collaboration is another highlighted component of brain-compatible learning. In English language learning collaboration realized by pair work, group work, projects, and virtual learning environments is a prerequisite.

Keeping in sight the value attached to collaboration and social nature of learning in brain-compatible learning, to what degree brain-compatible learning can foster English language learning is apparent.

Meaningful learning is of high significance for language learners to make sense of whatever is covered in language classes. Brain-compatible learning seems to be in line with the attempts to set up a meaningful learning environment as it brings learner interests, purposes and ideas into the forefront. This principle of brain-compatible learning is put into practice by joint-determination of lesson content with learners.

Brain-compatible learning reiterates the significance of patterning in that it is considered by the advocates of brain-compatible learning that meaningful categorization and organization of new information and linking it to what they have already stored in schemata might boost comprehension. Language learning is also a cumulative process and what is newly learned is built on what is previously learned.

The points raised in the preceding paragraphs manifest the link between brain-compatible learning and English language learning, and clarify why brain-compatible learning can be accepted as a paradigm in English language learning.

2.13. Criticisms Directed to Brain-Compatible Learning

Jensen (2000) has produced a paper on the criticisms directed to brain-compatible learning. The headings under which the criticisms are accumulated do present the existing criticisms of brain-compatible learning.

2.13.1. Some People Misrepresent the Findings

The findings yielded by brain research are conceived to be immature and to be neuro-myths. This has been the criticism that has been frequently put into words by the scholars having doubts about the reliability of brain-compatible research.

2.13.2. There Is Nothing New in this Approach

One of the criticisms is related to the conception that good teachers have been teaching for long in the ways recommended by brain-compatible learning. Üstünoğlu (2007) maintains that brain-compatible learning is similar to other approaches and theories. Alferink & Dougan (2010) claim that several

instructional methods having been advanced by brain-compatible learning have been known and applied in classes for long. As a counter argument to this criticism, Jensen (2000) purports that the people making such a criticism should be either "very young" or have "short-term memories" because it has not been a long time since lecture method prevailed in classes. He furthers his counter argument concerning this criticism by claiming that if teachers know why they do what they do, their actions can be more purposeful and professional.

2.13.3. Brain Research Changes Too Rapidly to Be of Value

Given the advancements in brain imaging technologies and in return in brain research, some critics of brain-compatible learning assert that current findings may be nullified with the introduction of new findings in the upcoming months and years. Jensen (2000) argues that new findings in brain research do not invalidate the existing findings.

2.13.4. Brain Research Is Confusing; One Person Says Something, and Another Says the Opposite

Jensen (2000) in order to invalidate this criticism underlines the significance of having better sharing in order for ensuring "we are reading from the same page".

2.13.5. Consultants Are Trying to Capitalize on the Brain-Compatible Learning Movement

Stretching the truth to diverse contexts and refraining from doing more research can result in misleading teachers and misinformation about brain research. Therefore, in an attempt to have a chance to address learner needs which are highly likely to show variations from learner to learner further studies are required.

2.13.6. It Is Not the Brain but the Person Who Learns

Another criticism on brain-compatible learning is verbalized by Nixon (2012). He grounds his criticism on questioning the necessity of brain-compatible learning. According to him, brain-compatible learning is unnecessary in that it is not the brain but the person who learns; additionally "learning is a dynamic and cultural activity". The point that is not taken into consideration by Nixon is the fact that brain-compatible learning does not ignore the place of the

individual and social environment in learning; contrarily, brain-compatible learning strategies and brain-compatible learning principles do permanently emphasize the importance of social nature of learning. Worden, Hinton & Fischer (2011) argue that though brain research does appear to be irrelevant to learning and does not directly dictate how to teach, unfolding learning mechanisms could be achieved by understanding the brain.

2.14. Conclusion

This chapter of the dissertation has presented what the literature encompasses as to learning, adult learning, language learning, the human brain, brain-compatible learning, and brain-compatible learning principles and strategies in addition to the existing studies in the literature exploring the influence of brain-compatible learning on learners' language proficiency and other content areas, and the existing studies aiming at unveiling teachers' and learners' perceptions of brain-compatible learning. As well as what is stated in the preceding sentence, this chapter has provided information about the criticisms directed to brain-compatible learning. The succeeding chapter will dwell on providing information about the methodology of the dissertation.

CHAPTER III

METHODOLOGY

3.1. Introduction

This chapter is devoted to providing information about the research design of the study, the participants with whom the study was conducted, the setting where the study was carried out, the procedure followed to apply brain-compatible learning principles to classroom environment, and the data collection tools employed to gather the data. Additionally, this chapter presents information about the statistical and content analysis that was conducted so as to analyse the collected data with a view to finding out answers to the research questions.

3.2. Research design

This study which was carried out in the fall semester of the academic year 2014/2015 is based on a mixed methods research design. Creswell (2003) states that mixed methods research is

> … one in which the researcher tends to base knowledge claims on pragmatic grounds (e.g., consequence-oriented, problem-centred, and pluralistic). It employs strategies of inquiry that involve collecting data either simultaneously or sequentially to best understand research problems. The data collection also involves gathering both numeric information (e.g., on instruments) as well as text information (e.g., on interviews) so that the final database represents both qualitative and quantitative information (p. 18).

Collection of quantitative and qualitative data is an indication of the use of mixed methods research design in this study. In order for gathering the quantitative data proficiency exam results, retention exam results, beliefs about language learning inventory (Horwitz, 1987), perceptions about brain-compatible learning questionnaire, hemispheric mode indicator (McCarthy, 1986), learning styles inventory (Kolb, 1999), and background information questionnaire (Oxford, 1990) were used. With a view to collecting qualitative data two semi-structured interviews, lived English language learning experiences questionnaire, learners' diaries, and teacher's diary were used.

Qualitative data collection tools were employed in an effort to support the quantitative data in this study.

3.2.1. Participants

There were two groups, focus and control group, in this study and the participants were randomly assigned to either the control or focus group. The number of the participants in the focus group was 27 while it was 26 in the control group. The participants were attending preparatory program at one of the state universities in Ankara, the capital city of Turkey.

The participants in the focus and control group were placed into B level classes at the beginning of the academic year, which also marks the outset of the study. All of the participants both in the focus and control group successfully completed the first module and started the second module to continue B+ level. All of the participants had the right to finish B+ level with their grade point average. With the purpose of gathering demographic information about the participants, *background information questionnaire* developed by Oxford (1990) was administered in both groups. Table 8 displays the participants' demographic and background information.

Table 8

Demographic and Background Information about the Participants

Characteristic	Focus Group		Control Group	
Age	x̄		x̄	
	18,26		18,58	
Sex	**N**	**%**	**N**	**%**
Male	10	37	13	50
Female	17	63	13	50
Years of language learning experience	x̄		x̄	
	9,04		9	
Overall proficiency in English	**N**	**%**	**N**	**%**
Excellent	0	0	0	0
Good	4	14,8	6	23,1
Fair	23	85,2	18	69,2
Poor	0	0	2	7,7
How important is it to become proficient in English?	**N**	**%**	**N**	**%**
Very important	24	88,9	22	84,6
Important	3	11,1	4	15,4
Not so important	0	0	0	0
Reason to learn English	**N**	**%**	**N**	**%**
Interested in English	1	3,7	0	0
Interested in British/American culture	0	0	0	0
Have friends who speak English	0	0	0	0
Required to graduate	6	22,2	1	3,8
Need it for my future career	20	74,1	24	92,3
Need it for travel	0	0	1	3,8
Do you like learning English?	**N**	**%**	**N**	**%**
Yes	22	81,5	22	84,6
No	5	18,5	4	15,4

As demonstrated in Table 8, the mean age of the participants in the focus group is 18,26 and it is 18,58 in the control group. The number of the male

participants in the focus group is 10, comprising 37% of the focus group, while 17 female participants consist of 63% of the focus group. The number of the female and male participants in the control group manifests even distribution; 13 male participants constituting 50%, and 13 female participants comprising the other 50% of the total percentage. One of the questions in the background information questionnaire was related to figuring out years of language learning experience both in the focus and control group. The mean values 9,04 for the focus group and 9 for the control group indicate that all of the participants spent almost the same amount of years learning English by the time they started their academic education.

Another important finding attained from the background information questionnaire and provided in Table 8 is about how the participants in the focus and control group perceived their overall proficiency in English before the outset of the study. None of the focus and control group participants viewed their overall proficiency in English as excellent. 14,3% of the participants in the focus group viewed their proficiency in English as good while the percentage signifying the control group participants who perceived their overall proficiency as good is 23,1%. The percentage of the focus group participants contemplating their proficiency in English as fair is 85,2%, and the percentage for the same option is 69,2% in the control group. None of the participants in the focus group viewed their overall proficiency in English as poor but there are two participants in the control group evaluating their proficiency as poor.

Table 8 also illustrates how important it was for the participants to be proficient in English. Twenty-four participants in the focus group, which composes 88,9% of the total percentage, thought that it was very important to be proficient in English. The number of the control group participants marking the importance of becoming proficient in English as very important was 22, which makes 84,6%. Three participants in the focus group and four in the control group remarked the significance of being proficient in English as important. None of the participants in both groups chose the option of not so important to indicate the importance of being proficient in English.

Another noteworthy finding presented in Table 8 is associated with the participants' reasons to learn English. One of the focus group participants remarked that he wanted to learn English because he was interested in it, yet

there is no participant in the control group stating his interest in English as the drive urging him to learn English. Two options placed under the category of reasons to learn English, interested in British/American culture and have friends who speak English, were not selected by the focus and control group participants. Six focus group participants, 22,2%, denoted that since English was required for graduation, they wanted to learn English. The same option was chosen by solely one of the control group participants comprising 3,8% of the category of reasons to learn English. 74,1% of the focus group participants and 92,3% of the control group participants noted in the background information questionnaire that they wanted to learn English for they needed it for their future careers.

Table 8 also demonstrates the participants' perceptions of whether or not they like learning English. 22 focus group participants and 22 participants in the control group marked that they liked learning English. The rest of the participants in the focus group, five participants, noted that they disliked learning English while four participants in the control group remarked their dislike of learning English.

3.3. Data Collection Tools

Below are the data collection tools and the information pertaining to them which were used in order for finding out answers to the research questions.

3.3.1. Background Information Questionnaire

Prior to commencing the training in brain-compatible learning, a background information questionnaire (See Appendix 2) developed by Oxford (1990) was administered with the intention of gathering information about all of the participants' ages, gender, how the participants rate their proficiency in English, their reasons to learn English, and the importance of English in the participants' lives. The findings obtained from the background information questionnaire are provided in Table 8 above.

3.3.2. Lived English Language Learning Experiences Questionnaire

Keeping in sight the unquestionable effect of past learning experiences on current learning experiences, lived English language learning experiences questionnaire (See Appendix 3) consisting of three open-ended questions was administered in both the focus and control group. The data attained from this

questionnaire enabled the researcher to identify whether the participants had similar or diverse English language learning experiences.

3.3.3. Learning Styles Inventory

Learners do follow different ways whilst learning and storing new information, and hence, it was thought that finding out the participants' learning styles both before and subsequent to the training would be effective in exploring whether the influence of brain-compatible learning would vary in accordance with the participants' learning styles. To do this, Kolb's learning styles inventory (Kolb, 1999) (See Appendix 4) was preferred because it is based on experiential learning. Participants' learning styles were determined with learning style analysis system. Table 9 displays the participants' learning styles before the outset of the study.

Table 9

Participants' Learning Styles prior to the Outset of the Study

Learning Style	Focus Group		Control Group	
	N	%	N	%
Diverger	1	3,7	5	19,2
Assimilator	16	59,3	12	46,2
Converger	9	33,3	7	26,9
Accommodator	1	3,7	2	7,7
Total	27	100	26	100

3.3.4. Beliefs about Language Learning Inventory

The impact of brain-compatible learning on the participants' beliefs about language learning is one of the research questions in this study. In an attempt to collect the relevant data pre- and post-beliefs about language learning inventory (BALLI) (Horwitz, 1987) (See Appendix 5) was conducted both in the focus and the control group.

3.3.5. Perceptions about Brain-Compatible Learning Questionnaire

With a view to finding out the participants' perceptions about the training in brain-compatible learning a questionnaire (See Appendix 6) was developed by the researcher. The questionnaire consisting of 36 items has a five-point

likert scale. Before administering the questionnaire amongst the focus group participants in this study, it was conducted amongst 31 learners whose ages differed between 17 and 19 in order to measure the reliability of the questionnaire. Table 10 demonstrates whether or not the questionnaire is reliable by providing the actual value of cronbach's alpha.

Table 10

Reliability Statistics of Brain-Compatible Learning Questionnaire

N	Cronbach's Alpha Based on Standardized Items	Cronbach's Alpha
36	,799	,755

The Cronbach's Alpha value ,755 indicates a high level of internal consistency in this questionnaire. In order to ensure the validity of the questionnaire, the items in the questionnaire were read by three scholars and necessary amendments in the items were made in accord with the feedback received from them. This questionnaire was conducted in the focus group following the training.

3.3.6. Two Semi-Structured Interviews

Two semi-structured interviews were conducted as a means of gathering the qualitative data. The first one (See Appendix 7) was conducted at the end of the brain-compatible learning intervention and the second one (See Appendix 8) following the retention exam conducted in May with a few changes in the questions. The first semi-structured interview was conducted in order to determine the focus group participants' perceptions of the brain-compatible learning intervention and the second interview was administered to reveal if any changes in the focus group's thoughts about brain-compatible learning occurred.

3.3.7. Hemispheric Mode Indicator

One of the research questions in this study aims to find out whether brain-compatible learning does exert impact on changing the participants' dominant hemispheres. McCarthy's hemispheric mode indicator (1986) (See Appendix 9) was administered both prior to the start and at the end of the study both in the focus and control group. Table 11 illustrates the dominant

hemispheres of the participants in the focus and control group before the outset of the study.

Table 11

Participants' Dominant Hemispheres before the Commencement of the Study

Dominant Hemisphere	Focus Group		Control Group	
	N	%	N	%
Left-brained	18	66,7	12	46,2
Right-brained	3	11,1	5	19,2
Whole-brained	6	22,2	9	34,6
Total	27	100	26	100

As shown in Table 11, the majority of the participants in the focus and control group before the commencement of the study were left-brained learners; 18 in the focus group and 12 in the control group. 11,1% of the focus group participants were right-brained while it was 19,2% in the control group. The number of the whole-brained focus group participants was 6 and it was 9 in the control group.

3.3.8. Proficiency Exam Results

The participants took two proficiency exams: one at the beginning of the academic year 2014/2015, which will be referred as pre-proficiency exam, and one at the end of the fall semester, which also marks the end of the intervention in brain-compatible learning, will be referred as post-proficiency exam in this study. The scores the participants got on the pre- and post-proficiency exam were analysed in order to see if there was any statistically significant difference between the focus and control group in terms of two groups' proficiency levels and to examine to what extent the brain-compatible learning intervention impacted the scores the focus group participants got on the proficiency exams.

3.3.9. Retention Exam Results

A retention exam was conducted amongst the participants in the focus group five months after the end of the training to examine whether there was a statistically significant difference between the grades the participants got on the post-proficiency exam and the retention exam.

3.3.10. Field Notes

An expert in brain-compatible learning observed three of the brain-compatible lessons conducted by the researcher. The expert had meetings with the researcher after the lessons to share the notes he took during the lessons (See Appendix 11). These observations were done so as to ensure that the way the lessons were conducted was compatible with the principles of brain-compatible learning. One of the reports taken by the observer is given in appendix 11.

3.3.11. Learners' Diaries

The participants in the focus group were asked to keep a diary in English to write down their thoughts and feelings about brain-compatible lessons, the things that really went well and did not go well during the lessons. Extracts will be taken from the learners' diaries with a view to supporting the quantitative data collected by the questionnaires.

3.3.12. Teacher's Diary

The instructor teaching the focus group kept a diary in which she wrote about the brain-compatible learning principles that worked well with the participants, about participants' reactions towards brain-compatible lessons, and the things that did not go well in the lessons. The extracts from the teacher's diary will be used for advocating either the qualitative or quantitative data gathered in this study.

3.4. Procedure

In this section of the methodology part of the thesis information about the preparatory program system of the university at which this study was carried out and the route that was followed whilst conducting the study will be provided.

3.4.1. The Preparatory Program System at the University Where the Study Was Carried out

The school of foreign languages where the study was conducted adopts a modular system. Each semester is comprised of two modules and in order to be able to continue with the next module learners are required to have an average of at least 59,5 over 100. The average learners have from each module is determined by the scores they get on two midterms, eight portfolio

assignments, four quizzes, and online assignments. Below is Table 12 that shows the weights of the abovementioned categories on learners' grade point average.

Table 12

Weight of Each Category in Percentages on Grade Point Average

Category	Weight of each category (%)
1ST midterm	24
2nd midterm	40
Four quizzes	20
Portfolio assignments	8
Online assignments	8
Total	100

Learners do have to attend 80% of the total class hours in a module, and so long as they meet this requirement, they have the right to take midterm 2 indicating the end of a module. Absenteeism is taken into account in the process of determining the list of learners who can take the proficiency exams at the end of fall and spring semesters. If a learner's total absenteeism from two or four modules exceeds 20% of the total class hours in the stated modules, the learner loses the right to take the proficiency exam. Nevertheless, for the proficiency exams administered at the beginning of the academic year and at the end of the summer school, absenteeism rate is not put into perspective.

Four proficiency exams are conducted during an academic year; one at the beginning of academic year, one at the end of fall semester, one at the end of the spring semester and the last one is at the end of summer school. Learners are required to get 69,5 from a proficiency exam in order to continue their academic education at their own departments.

Learners who start a department at which compulsory prep class education is required do have to take the placement exam and score 59,5 or higher so as to have the chance to take the proficiency exam. Learners' grade average does have an influence on determining their final grade from the proficiency exam. For those who score between 59,5 and 69 on the proficiency exams conducted at fall and spring semesters, grade point average is taken into

consideration in order for determining whether they have a pass or a fail from the proficiency exam. The score learners get on the proficiency exam conducted at the beginning of the academic year determines the level at which learners will start prep class education. The levels are aligned with the levels specified by CEFR. Learners who score below 59,5 or does not attend 80% of lessons in a module fail that module and are required to repeat the module again.

Language leader is the course book that was selected as the main course book in the fall semester of the academic year 2014/2015, during which the study was carried out. Total number of class hours per week for the learners at B and B+ level is 21 hours.

An English instructor is allocated to each class and the researcher of this study was randomly assigned to one of the B level classes, which is the focus group in this study. The instructor who was assigned as the main course teacher of the control group was also randomly allocated. There was no difference between the instructors of the focus and the control group as with their educational background and years of teaching experience. Both had an MA degree in the field of English language teaching and approximately 9 years of English language teaching experience. The instructor teaching the focus group arranged regular weekly meetings with the instructor of the control group to reciprocally inform each other about what was done during the week of concern and what would be done in the following week.

The control group was taught in parallel with traditional teaching methods while the focus group was exposed to the brain-compatible learning intervention. The instructor teaching the control group stated that she was using the lecture method, trying to complete the units in the course book, most of the time did not bring supplementary materials to the class, and did not ask her learners what they wanted to engage in during lessons. Though the instructor teaching the focus group had the same purpose of keeping up with the demands of the syllabus, she tried to establish a learner-centred environment, which was unthreatening, supportive, and empowering.

3.4.2. How the Brain-Compatible Learning Intervention Was Conducted

The participants in the focus group were subjected to the intervention in brain-compatible learning which lasted four months, but prior to the commencement of the intervention, the participants signed the consent form (See Appendix 1). The participants had 21 hours of lesson every week and this means that the participants in the focus group were a part of the brain-compatible learning environment for approximately 336 class hours. What necessitates clarification is how the brain-compatible learning intervention was conducted. The brain-compatible learning intervention in this study was realized by grounding the study on 12 brain-compatible learning principles proposed by Caine & Caine (1994). The principles by Caine & Caine (1994) were chosen as the ones on which the training would be based for they were considered to be more comprehensive than the other principles in the literature. In addition, the selected principles are inclusive of other principles proposed by other scholars (Jensen, 2000). Apart from these reasons, the chosen principles are the ones on which a huge bundle of studies in the literature aiming at exploring the impact of brain-compatible learning have been based.

The implications of brain-compatible learning principles for education formed the basis of the training in brain-compatible learning. The instructor of the focus group prepared lesson plans (See Appendix 10) in accordance with brain-compatible learning principles and conducted lessons under the light of these lesson plans. Three of the prepared lesson plans were emailed in an attempt to ascertain that the principles were accomplishedly integrated into lesson plans to two researchers whose interest areas encompass investigating the influence of brain-compatible learning on academic achievement and who have contributed to the literature on brain-compatible learning with outstanding papers and books.

Providing examples of how the lessons were conducted could enlighten how brain-compatible learning principles were applied to the lessons. For example, the participants were given a chance to choose the reading text they wanted to read from a bundle of alternatives and prior to delving into the questions related to checking the participants' reading comprehension, the learners' background knowledge about the content of the reading text, in other

words, their schemata were activated. Besides, the participants were expected to use their creativity in order to write a story through looking at the photos provided as prompts to guide them to complete the story.

Playing background music was an integral part of the lessons when the learners were carrying out tasks. Classical music was played particularly when the participants were reading a text and the tempo of the music was changed in accordance with the type of the activity; for instance, music with quick tempo was preferred when the learners were expected to work in small groups to write a dialogue and when competing with other groups.

The participants in the control group were traditionally taught whilst the participants in the focus group were subjected to the brain-compatible learning intervention about which details have been provided in the preceding paragraphs. The control group participants were taught traditionally since the meetings the instructor teaching the focus group had with the instructor teaching the control group participants revealed that the control group instructor generally used the selected course book and did not attempt to develop materials in accord with her learners' needs, purposes, and learning styles. As well as these points, the instructor did not spend time setting up a learning environment conducive to supporting and empowering her learners.

In order to collect the data before the outset of the study and subsequent to the random determination of classes and random allocation of instructors to classes, the participants' grades in the focus and control group on the pre-proficiency exam were compared to see whether there existed a statistically significant difference between them. The analysis of the grades revealed that there was no statistically significant difference between two groups in terms of their proficiency level prior to the start of the study. All of the participants were asked to fill in the background questionnaire and lived English language learning experiences questionnaire. Then, pre-BALLI, pre-learning styles inventory, pre-hemispheric mode indicator were administered. Following the end of the intervention, post-BALLI, post-learning styles inventory, post-hemispheric mode indicator, and perceptions about brain-compatible learning questionnaire were administered. During the intervention the focus group instructor was observed three times by an expert in brain-compatible learning in

order to ensure the intervention was congruent with what is set forth by brain-compatible learning.

During the training the participants in the focus and control group took four midterms, eight quizzes and they had to submit 16 portfolios, 2 projects, and completed online assignments. Six of the brain-compatible lessons the researcher conducted were video recorded to reflect on how well the brain-compatible lessons were conducted.

The researcher conducted the first semi-structured interview with the focus group at the end of the intervention in brain-compatible learning so as to shed light on the focus group's thoughts about brain-compatible learning. The focus group took a retention exam five months after the completion of the training and the researcher conducted the second semi-structured interview to deepen her understanding of what the focus group thought about brain-compatible learning after the retention exam.

3.5. Data Analysis

Qualitative and quantitative data collection tools were employed in order for finding out answers to the research questions in this study. The following lines provide information about how the data analysis for each research question was conducted.

3.5.1. Data Analysis for Research Question 1

Lived English language learning experiences questionnaire was employed in order for collecting data to find out answers to the first research question. For the analysis of the collected data content analysis was conducted through using MAXQDA 11.

3.5.2. Data Analysis for Research Question 2

Pre- and post-proficiency exam results of the focus and control group participants were used with the purpose of seeking answers to the research question 2. To analyse the data Mixed-ANOVA in statistical package for social sciences (SPSS 22) was used.

3.5.3. Data Analysis for Research Question 3

Pre- and post-proficiency exam results were used to find answers to the question of whether there was any statistically significant difference between

pre- and post-proficiency exam results of the female and male participants in the focus and control group. Two way ANOVA for independent samples in SPSS 22 was used to analyse the collected data.

3.5.4. Data Analysis for Research Question 4

The data gathered by the administration of learning styles inventory both prior to the start and following the end of the intervention to investigate if there was any statistically significant difference between pre- and post-proficiency exam results of the participants in regards to participants' learning styles was analysed by running two way ANOVA for independent samples in SPSS 22.

3.5.5. Data Analysis for Research Question 5

Chi-square test in SPSS 22 was used to analyse the collected data from the pre- and post-administration of hemispheric mode indicator.

3.5.6. Data Analysis for Research Question 6

Paired samples t-test was conducted for the analysis of the data gathered from the retention and post-proficiency exam results to shed light on whether brain-compatible learning could enable knowledge retention. Focus group participants' responses to the questions asked in the semi-structured interview carried out in May were used so as to support the quantitative data. For the analysis of the data collected by the interview carried out in May content analysis was conducted by using MAXQDA 11.

3.5.7. Data Analysis for Research Question 7

Whether there was any variation in the participants' beliefs about language learning was researched by conducting mixed ANOVA analysis for the data collected by administering pre- and post-BALLI amongst the focus group participants. The data provided by learners' diaries, teacher's diary, and the semi-structured interview conducted in January were used as a means of supporting the quantitative data. MAXQDA 11 was employed to analyse the data presented by the semi-structured interview carried out in January.

3.5.8. Data Analysis for Research Question 8

The focus group's perceptions about brain-compatible learning gathered by administering the perceptions about brain-compatible learning questionnaire were analysed by conducting descriptive statistics in SPSS 22. The semi-

structured interviews conducted in May and January, extracts from learners' diaries and teacher's diary were used to support the quantitative data provided by the perceptions about brain-compatible learning questionnaire.

3.6. Conclusion

In this chapter, information about the research design of the study, the participants with the contributions of whom this study could be carried out, the setting where the study was conducted, and the preparatory education system of the university preparatory school where this study was done were presented. As well as the points stated in the preceding sentence, the procedure followed as conducting the study, the data collection tools used to gather the data and how data analysis was done were presented in this chapter too. In the succeeding chapter the findings obtained from the analysis of the collected data will be presented.

CHAPTER IV

FINDINGS

4.1. Introduction

This chapter is dedicated to providing the results obtained from the analysis of the quantitative and qualitative data. SPSS 22 is used for the analysis of the quantitative data and the analysis of qualitative data is conducted by content analysis. MAXQDA 11, which is a professional software program for analysing unstructured data like interviews, was used for the content analysis of the semi-structured interviews conducted at the end of the intervention in brain-compatible learning and subsequent to the administration of the retention exam.

4.2. Participants' Lived English Language Learning Experiences

This section provides information about the focus and control group participants' lived English language learning experiences.

4.2.1. Focus Group's Lived English Language Learning Experiences

Since learners' prior English language learning experiences need to be taken into account as a factor that can exercise influence on learners' current performance in learning English, the focus group participants' prior English language learning experiences were targeted to be figured out. With the intent of unearthing the participants' prior English language learning experiences lived English language learning experiences questionnaire was administered. The following paragraphs dwell on the focus group participants' responses to the questions in the questionnaire.

4.2.1.1. The Way the Previous English Lessons the Focus Group Took Was Conducted

The first question in the lived English language learning experiences questionnaire aimed at finding out how the English lessons the participants attended to before starting English preparatory education were conducted. Table 13 demonstrates the content analysis of the responses given by the participants in the focus group to the first question.

Table 13

The Way the Previous English Lessons the Focus Group Took Was Conducted

Category	N	%
Course book-based	11	40,7
Grammar-based	6	22,2
Translation dominant	3	11,1
Checking assignments	3	11,1
Reading-based	2	7,4
Learning vocabulary	1	3,7
Speaking intensive	1	3,7
Total	27	100

As seen in Table 13, a substantial number of the focus group participants, 40,7%, stated that the English lessons they had attended prior to commencing their English preparatory education at the university where this study was conducted were course book-based lessons. The main aim of teachers was articulated by the participants giving this response as completing the units in the selected course books. One of the focus group participants stated the following in the questionnaire:

Extract 1: *The only thing I did in the English lessons I took at secondary and high school was bringing the course book to the class and doing the activities in the course book step by step.*

The semi-structured interview that was conducted in January subsequent to the end of the intervention contains valuable information about the focus group participants' evaluations of how the English lessons they had taken before had been conducted. One of the participants' response, which seems to be in line with the participant's response provided in extract 1, is as follows:

Extract 2: *Our English teacher at high school did not give any extra material to help us learn. I just used my course book like my friends and copied the passages in the course book in my notebook.*

The second most verbalized theme in regard to the way the lessons were conducted is grammar-based lessons. Six out of 27 focus group participants noted that the English lessons they had attended till the start of the English

preparatory education were structured in such a way that they solely involved memorizing grammar rules. Extract 3 below exemplifies the common view among the participants who noted that the main objective of the lessons was memorizing grammar rules:

Extract 3: *My English teachers did not teach me much. They always had me and my friends answer grammar questions and then checked our answers. Actually, most of us did not listen to the teachers in the lessons because the lessons were really boring. There were no speaking, listening and writing activities.*

Some of the participants in the focus group (11,1%) said that the English lessons they had taken before were organized around translation both from and into English. One of the focus group participants wrote down in the lived English language learning questionnaire:

Extract 4: *When I was at secondary and high school, my English teachers used to give us passages in English and ask for their translation, but I was not good at translation.*

As displayed in Table 13, %11,1 of the focus group participants verbalized that the English lessons they had taken before were based on assignments given and checked by their teachers. Two of the participants noted in the questionnaire that the lessons had been based on reading skill. They were asked to read passages aloud and then to answer the questions about them. Besides, as demonstrated in Table 13, one focus group participant stated that expanding learners' vocabulary knowledge was targeted and only one of the participants stated that improvement in speaking skill was aimed at in the past English lessons he participated in.

4.2.1.2. Focus Group Participants' Thoughts about the Efficiency of the English Lessons They Had Attended Before

In addition to detecting how the English lessons the participants had taken before were structured, it is thought that figuring out what the participants thought about the efficiency of the English lessons they had taken before would enable better comprehension of what the participants' perceptions of their prior English language learning experiences were. Table 14 demonstrates the frequency values for the focus group participants' responses to the question of

what they thought about the efficiency of the English lessons they had attended before.

Table 14

Focus Group Participants' Thoughts about the Efficiency of the English Lessons They Had Attended Before

Category	N	%
Efficient	6	22,2
Inefficient	21	77,8
Total	27	100

As displayed in Table 14, 22,2% of the focus group participants found the lessons they had taken before efficient while 77,8% of the participants remarked that the English lessons were inefficient.

4.2.1.3. Focus Group Participants' Reasons for the Efficiency and Inefficiency of their Previous English Lessons

The question of whether the focus group participants thought the English lessons they had attended before were efficient or inefficient was followed by asking for the reasons for the responses the participants gave. In so doing, the reasons the participants would set forth could enable better comprehension of the participants' thoughts about the past English lessons they took. Table 15 displays the frequency values for the reasons pointed out by the participants in the focus group for the efficiency or inefficiency of the lessons the focus group attended to.

Table 15

Reasons the Focus Group Put Forth about the Efficiency or Inefficiency of their Previous English Lessons

Category	N	%
Reasons for efficiency		
Hard working teachers	5	83,3
Value given to speaking skill	1	16,7
Total	6	100
Reasons for inefficiency		
Grammar-based lessons	5	23,8
No comprehension	4	19
Memorization	3	14,3
Devaluing English lesson	3	14,3
Inadequate class hours	2	9,5
Following merely course book	1	4,8
Demotivated learners	1	4,8
Frequent change of teachers	1	4,8
Teacher-centeredness	1	4,8
Total	21	100

Table 15 demonstrates that five of the six students noted that the teachers who taught them were hard working teachers and owing to the hard work of their teachers the past English lessons they took were efficient. One of the five participants stating that the English lessons were efficient owing to their English teachers stated in the lived English language learning experiences questionnaire:

Extract 5: *It is thanks to my English teachers that I can form basic sentences and understand what I read.*

Another focus group participant remarking the past lessons as efficient wrote down that English was a significant lesson for her and the importance she attached to the lesson made the English lessons efficient.

As can be seen in Table 15, the majority of the focus group participants, 21 participants, stated that the lessons were inefficient. The emerging themes

out of the responses 21 participants gave include following merely course books, grammar-based lessons, inadequate class hours, memorization, demotivated learners, frequent change of teachers, devaluing English lessons, no comprehension, and teacher-centeredness. 23,8% of the focus group participants explained the inefficiency of lessons by the dominance of grammar-based lessons and 19% of the participants jotted down that the lessons were not organized in such a way that would increase comprehension among learners. One of the participants putting forward grammar-based lessons as the reason for the inefficiency of the English lessons denoted in the questionnaire:

Extract 6: *The English lessons I took in the past were inefficient because teachers taught us just grammar but when I go abroad, nobody is going to ask me grammar.*

As demonstrated in Table 15, memorization was brought forward by three of the participants as they wrote down their reasons for the inefficiency of the English lessons they had taken before. Three of the participants in the focus group underlined the fact that they did not value English lessons at high school as they put all of their efforts into getting a high score on the university entrance examination to study at the university they would love to study. Inadequate class hours is another theme that emerged in the content analysis of the category of inefficiency of previous English lessons and was put forth by two of the focus group participants. Teacher centeredness, course book-based lessons, demotivated teachers, and frequent change of teachers are the other reasons remarked by one of the participants in the focus group.

4.2.1.4. Focus Group Participants' Thoughts about Their Proficiency Levels

Another question in the lived English language learning experiences questionnaire was about whether or not the learners thought they were at the level of proficiency they would like to be considering the years they had spent learning English. Table 16 below demonstrates the content analysis of the focus group participants' answers to this question.

Table 16

Focus Group Participants' Thoughts about Whether They Were at the Level They Wanted to Be

Category	N	%
Are you at the level you want to be?		
Yes	1	3,7
No	26	96,3
Total	27	100

As seen in Table 16, solely one of the participants stated that he was at the level he wanted to be bearing in mind the number of years he spent learning English. The rest, 26 participants, denoted that they were not at the level they wanted to be in spite of approximately 9 years they had spent learning English.

4.2.1.5. Focus Group Participants' Reasons for the Proficiency Level at Which They Were

The researcher contemplated that it was important to dig out the reasons the focus group participants would denote regarding the reasons for why they were not at the level they wanted to be or they were unable to achieve to be at the level they wanted to be. Table 17 displays the content analysis of the responses of the focus group participants with respect to the question raised above.

Table 17

Reasons the Focus Group Put Forth for the Level at Which They Were

Category	N	%
Reasons for being at the desired level		
Hard working teachers	1	100
Total	1	100
Reasons for not being at the desired level		
Ineffective ways of teaching English	9	34,6
Not studying enough	7	26,9
Devaluing English	5	19,2
Grammar-based lessons	3	11,5
Lazy teachers	2	7,7
Total	26	100

As seen in Table 17, the reason for the participant who noted that he was at the level he wanted to be was his teacher. He wrote down that his teacher had devoted herself to her job and learners. Thanks to his teacher's efforts he was at the level he wanted to be.

Table 17 also shows that 26 participants stated that they were not at the level they wanted to be due to a number of reasons. 34,6% of the focus group noted that ineffective ways of teaching English were the reason for not being capable of reaching the proficiency level they wanted to be at. All of the 9 participants writing down this reason pointed out that the fundamental problem causing the inefficiency was English language teaching system in Turkey. Below is extract 7 which presents one of the participants' thoughts about the inefficient ways of teaching English in Turkey.

Extract 7: *I am not at the level I want to be. This is because of the foreign language education system in our country.*

Seven of the participants noted that they were not at the level they would like to be because they did not study enough to improve their proficiency in English. Devaluing English is put forth by 19,2% of the participants as the reason for not reaching the proficiency level they wanted to be at. Three of the 26 participants underscored grammar-based lessons that did not help them be

at a higher level in English proficiency. Contrary to the participant who denoted that it was the help of his hard-working teacher that enabled him to be at the level he wanted to be, two of the focus group participants indicated their teachers as the reason for not reaching the level they anticipated to be at.

4.2.2. Control Group Participants' Lived English Language Learning Experiences

Lived English language learning experiences questionnaire was administered amongst the control group participants as well as the focus group participants in order for uncovering whether or not the participants both in the control and focus group had similar English language learning experiences. Following sub-headings involve the findings attained from the analysis of the control group participants' responses to the questions in the lived English language learning questionnaire.

4.2.2.1. The way the Previous English Lessons the Control Group Took Was Conducted

The control group participants were asked to write about how the English lessons they had taken before were structured. Table 18 demonstrates the content analysis of the control group participants' responses to this question.

Table 18

The Way the Previous English lessons the Control Group Took Was Conducted

Category	N	%
Grammar-based	11	42,3
Course book-based	10	38,5
Assignment intensive	2	7,7
Speaking intensive	1	3,8
Reading intensive	1	3,8
Vocabulary intensive	1	3,8
Total	26	100

As shown in Table 18, 42,3% of the control group participants pointed out that English lessons meant memorization of grammar rules. 38,5% of the participants in the control group noted that the English lessons they had taken till the end of high school education were based on completing the units in the

chosen course books. Extract 8 below provides one of the control group participants' thoughts about course book-based lessons:

Extract 8: *At secondary and high school our English teachers just followed course books and we did not do use anything else in the lessons.*

Two of the control group participants wrote down that the assignments given and checked by the teacher formed the basis of the English lessons they had taken before. One of the participants stated that speaking skill was aimed to be improved in the English lessons they had attended to until they started their prep-school education at university. Another theme that was articulated by one of the participants as to the way the past English lessons were conducted was reading intensive classes. 3,8% of the participants noted that teaching vocabulary was prioritized during the English lessons they had taken till the end of high-school education.

4.2.2.2. Control Group Participants' Thoughts about the Efficiency of the English Lessons They Had Attended Before

The control group participants, like the focus group participants, were asked about whether the English lessons they had taken before were efficient or inefficient. Table 19 provides statistical information about the content analysis of the control group participants' responses to this question.

Table 19

Control Group Participants' Thoughts about the Efficiency of the English Lessons They Had Attended Before

Categroy	N	%
Efficient	4	15,4
Not Efficient	22	84,6
Total	26	100

As can be understood from Table 19, four of the control group participants stated that the English lessons they had taken so far were efficient while %84,6 of the participants, which is equal to 22 participants, noted that the English lessons they had taken before were not efficient.

4.2.2.3. Control Group Participants' Reasons for the Efficiency or Inefficiency of their Previous English Lessons

The statistical analysis provided in Table 19 in section 4.2.2.2 needs to be deepened by seeking answers to the question of why the control group participants evaluated the past English lessons they had taken as either efficient or inefficient. Table 20 shows the reasons the control group participants mentioned for explaining their thoughts regarding the efficiency and inefficiency of the English lessons they had attended before.

Table 20

Control Group Participants' Reasons for the Efficiency or Inefficiency of their Previous English Lessons

Category	N	%
Reasons for inefficiency		
Grammar-based	8	39,1
Lazy teachers	7	30,4
Teacher-centeredness	2	8,7
Devaluing English lesson	4	17,4
Constant repetition	1	4,3
Total	22	100
Reasons for efficiency		
Hard working teachers	2	66,7
Use of visuals	2	33,3
Total	4	100

As seen in Table 20, eight participants noted that the lessons which did not aim at anything else apart from memorizing grammar rules caused inefficiency. One of these participants wrote down the following in the lived English language learning experiences questionnaire:

Extract 9: *The English lessons I took in the past were inefficient for we were constrained to learning English. We did not have opportunities to practise English.*

Table 20 also displays that 30,4% of the participants blamed their English teachers for not working hard enough to prepare and conduct efficient English

lessons. 8,7% of the participants stated that because of the English teachers who dominated the lessons, they were subjected to inefficient English lessons. Four of the control group participants put forth that they did not value the English lessons they had taken at high school for they were concentrated on getting high scores on the university entrance exam. Another reason written down by one of the control group participants is about perpetual repetition.

As shown in Table 20, two of the participants signalled their hard working teachers as the reasons for being able to attend to efficient lessons. Another two participants denoted that use of visuals made the English lessons they had attended to before efficient.

4.2.2.4. Control Group Participants' Thoughts about Their Proficiency Levels

The question of whether the control group participants thought they were at the level they wanted to be or not were statistically analysed and the findings are presented in Table 21.

Table 21

Control Group Participants' Thoughts about Whether They Were at the Level They Wanted to Be

Category	N	%
Are you at the level you want to be?		
Yes	1	3,8
No	25	96,2
Total	26	100

As demonstrated in Table 21, one of the control group participants believed that she was at the level she wanted to be. The rest of the participants noted that they were not at the level they wanted to be.

4.2.2.5. Focus Group Participants' Reasons for the Proficiency Level at Which They Were

Like the route that was followed in the analysis of the focus group's responses to the question of what they thought about their proficiency level, in order for the findings in Table 21 to make better sense, the control group participants' responses regarding how they supported their views as with their

current level of proficiency in English were analysed and the findings are provided in Table 22.

Table 22

Reasons the Control Group Put Forth about Whether They Were at the Level They Wanted to Be or Not

Category	N	%
Reasons for being at the desired level		
Hard working teachers	1	100
Total	1	100
Reasons for not being at the desired level		
Ineffective ways of teaching English	17	68
Not studying enough	5	20
Frequent change of teachers	1	4
Lazy teachers	1	4
Devaluing English	1	4
Total	25	100

The participant stating she was at the level she wanted to be noted that this was with the help of her hard-working teachers. The majority of the participants, 17 participants, who remarked that they were not at the level they anticipated to be, indicated ineffective ways of teaching English as the main cause. One of these 17 participants explained the ineffective ways of teaching English in the questionnaire with the following words given in extract 10:

Extract 10: *I am not at the level I want to be because everyone is aware of the inefficiency of English language teaching in state schools.*

20% of the participants made a self-criticism for not being at the level they wanted to be, and noted that they did not study English as much as needed to reach the level at which they wanted to be. The common view amongst this 20% of the participants is given in extract 11 below.

Extract 11: *I am definitely not at the level I want to be because my objective was being able to score enough to pass English exams.*

One of the participants established a connection between frequent change of English teachers and not being capable of reaching the level of

proficiency she desired. English language teachers, in other words their performance in classes, were perceived to be important both in the focus and control group. One of the participants in the control group linked the unsuccessfulness as to not being at the desired level to the teachers who did not strive sufficiently to get their learners to love and study English. Another participant associated her current level which was below what she desired with not attaching importance to English.

4.3. The Impact of Brain-compatible Learning on Improving the Participants' English Language Proficiency

With a view to depicting the likely impact of brain-compatible learning on improving the participants' English language proficiency, the scores the participants both in the focus and control group got on the pre- and post-proficiency exam need to be compared by the medium of looking at the mean and standard deviation values belonging to the exams of concern. Table 23 manifests the mean and standard deviation values of the pre- and post-proficiency exam taken by both groups.

Table 23

The Results of Pre- and Post-Proficiency Exam

Group	Pre-Proficiency			Post-Proficiency		
	N	x̄	S	N	x̄	S
Focus	27	43,23	2,342	27	77,98	7,260
Control	26	43,97	2,084	26	65,92	17,317

As demonstrated in Table 23, the average grade the focus group had in the pre-proficiency exam was 43,23 while it rose to 77,98 in the post-proficiency exam. Table 23 shows that the average grade the control group had in the post-proficiency exam depicted an increase from 43,97 to 65,92. However, as it is shown in Table 23, the mean value of the focus group 77,98 indicates that the increase is higher compared to the one of the control group 65,92, which could be explained by the brain-compatible learning environment the focus group was subjected to while the control group was conventionally taught. An increase in the standard deviation values belonging to the post-proficiency exam results of the focus and control group is demonstrated in Table 23, 7,260, 17,317,

respectively. Such a rise in the standard deviation values could be expounded by individual learner differences. Particularly, the change in the focus group's standard deviation value, which is smaller than the one in the control group, indicates that the extent to which the focus group participants benefited from the intervention in brain-compatible learning changed from participant to participant.

Besides commenting on the mean and standard deviation values obtained from the pre- and post-proficiency exam, to find out an answer to the question of whether or not there is any statistically significant difference between the two groups in terms of the variation in the language proficiency, mixed ANOVA analysis, the results of which are given in Table 24, is conducted.

Table 24

ANOVA Results of Pre- and Post-Proficiency Exams

Sources of Variance	Sum of Squares	df	Mean Square	F	P
Between-Subjects	5486,104	56			
Group	848,618	1	848,618	9,333	,004
Error	4637,486	51	90,931		
Within-Subjects	26857,022	53			
Proficiency exams	21291,674	1	21291,674	242,339	,000
Group*Pre/post proficiency	1084,539	1	1084,539	12,344	,001
Error	4480,809	51	87,859		
Total	32343,126	109			

As seen in Table 24, the p value for between-subjects group factor ,004, indicates that there is a statistically significant difference between the focus and control group as ,004 is smaller than ,05. The p value for within subjects pre- and post-proficiency exam means that a statistically significant difference exists between the pre- and post-proficiency exam results of the participants no matter in which group the participants are in that ,000 is smaller than ,05. The p value of within-subjects pre- and post-proficiency exam results by group provides information about whether there is a statistically significant difference between the change observed in the pre- and post-proficiency exam results in the focus

and control group. Because the p value is ,001, there exists a statistically significant difference in the common effect of the repeated measures of the proficiency exams and the group in which the participants are taught on the participants' proficiency exam results. This means that being taught either in the focus or the control group does have different effects on the participants' performance on the proficiency exams. The mean value the focus group had on the post-proficiency exam, which is 77,98, is higher than the mean value of the control group, 65,92 as displayed in Table 23. This shows that the focus group performed better on the post-proficiency exam in contrast with the control group.

The focus group participants articulated their perceptions of the influence of brain-compatible learning during the semi-structured interview conducted in January. All of the participants stated that the brain-compatible learning intervention helped them improve their proficiency in English. One of the participants verbalized his thoughts regarding the impact of brain-compatible learning in extract 12 below.

Extract 12: *Brain-compatible learning is so effective in language learning and because of this; I am planning to learn German by applying brain-compatible learning principles.*

4.4. The Analysis of the Pre- and Post-Proficiency Exam Results the Focus and Control Group Got in Terms of the Participants' Sexes

The third research question aims at finding out an answer to the question of whether there is any statistically significant difference between the pre- and post-proficiency exam results the focus and control group participants got with regards to their sexes. In order to attain this finding the difference score within groups and sexes needs to be analysed. Table 25 demonstrates the difference scores within groups and sexes.

Table 25

Descriptive Statistics of the Difference Scores of the Pre- and Post-Proficiency Exam Results in accordance with Group and Sex

Group	Female			Male			Total		
	N	**x̄**	**S**	**N**	**x̄**	**S**	**N**	**x̄**	**S**
Focus	17	36,92	6,551	10	31,7	7,703	27	34,99	7,319
Control	13	20,53	24,298	13	4,00	39,473	26	12,26	33,203
Total	30	29,82	18,336	23	16,04	32,730	53	23,84	26,235

As seen in Table 25, the difference score mean value for the female participants in the focus group x̄= 36,92 is higher than the one the male participants in the same group have x̄= 31,7. The same inference can be made for the control group since the mean value for the female participants x̄=20,53 is higher compared to the one for the male participants, x̄= 4,00. Total values in Table 25 indicate that the total mean value for the focus group x̄= 34,99 is higher than the total mean value for the control group x̄= 12,26. The standard deviation values in Table 25 demonstrate that the difference scores between the sexes in the focus group is less diversified S= 7,319 than the one in the control group S=33,203.

So as to find out whether the difference in terms of the difference scores between sexes does indicate a statistically significant difference two-way ANOVA for independent samples was conducted. Table 26 displays the statistical values obtained through using two-way ANOVA.

Table 26

ANOVA Results of the Pre- and Post-Proficiency Exam Results' Difference Score in accordance with Group and Sex

Sources of Variance	Sum of Squares	df	Mean Square	F	P
Group	6216,633	1	6216,6331	11,280	,002
Sex	1515,057	1	1515,057	2,749	,104
GroupxSex	409,253	1	409,253	,743	,393
Error	27004,051	49	551,103		
Total	65925,313	53			

As shown in Table 26, there is a statistically significant difference between the pre- and post-proficiency exam results' difference score of the focus and control group, .002<.05. The p value for group indicates that the scores the participants got from the pre- and post-proficiency exams are impacted by the type of the training the groups were exposed to. The question of whether sex is an influential factor in the participants' performance on the proficiency exams could be answered by the p value for sex. The p value ,104 shows that a statistically significant difference resulting from sex in the focus and control group's proficiency exam results does not exist since it is bigger than ,05. The question of whether the group in which English is taught and sex does have a common effect on the participants' performance on the pre- and post-proficiency exam can be answered by the p value for groupxsex, ,393. This p value shows that the common effect of the group and sex on the participants' performance on the proficiency exams does not produce a statistically significant difference.

4.5. Comparison of the Pre- and Post-Proficiency Exam Results of the Focus and Control Group with Regards to the Participants' Learning Styles

The question of whether there is any statistically significant difference in proficiency exam results of the focus and control group as to the participants' learning styles is another research question in this study. With a view to shedding light on this research question descriptive statistics on the difference score between the focus and control group's pre- and post-proficiency exam results with respect to the participants' learning styles are provided in Table 27.

Table 27

Descriptive Statistics of the Difference Score of the Pre- and Post-Proficiency Exam Results in accordance with the Participants' Learning Styles

Group	Diverger			Assimilator			Converger			Accommodator		
	N	x̄	S	N	x̄	S	N	x̄	S	N	x̄	S
Focus	1	37	-	16	34,17	8,13	9	37,05	6,03	1	27,66	-
Control	5	21,6	16,87	12	19,75	31,37	7	8,85	36,63	2	-44	4,24
Total	6	24,16	16,35	28	27,99	22,14	16	24,71	27,66	3	-20,16	41,38

As shown in Table 27, the mean value for assimilators in total is x̄= 27,99 and this value is higher than the one for divergers x̄= 24,16, than the one for convergers x̄= 24,71, and the one for accommodators x̄= 20,16. The mean values for different learning styles indicate that the participants who are assimilators outperformed the other participants who are divergers, convergers or accommodators in proficiency exams. Amongst the focus group participants, the ones who are convergers have a higher mean value x̄= 37,05 than the others who are divergers, assimilators or accommodators, which can be interpreted as it is the convergers who benefitted most from brain-compatible learning. Table 28 provides information about the two-way ANOVA results of the scores the participants got on the proficiency exams and the participants' learning styles that could illuminate if there is any statistically significant difference between the pre-and post-proficiency exam results of the focus and control group in regards to the participants' learning styles.

Table 28

ANOVA Results of Proficiency Exam Results with respect to Learning Styles

Sources of Variance	Sum of Squares	df	Mean Square	F	P
Group	5411,800	1	5411,800	11,421	,002
Learning style	3124,502	3	1041,501	2,198	,101
GroupxLearning style	2214,872	3	738,291	1,558	,213
Error	21323,869	45	473,864		
Total	65925,313	52			

As can be seen in Table 28, the p value ,213 which is bigger than ,05 shows that the common impact of the group in which the participants were taught and the participants' learning styles on their proficiency exam results is not statistically significant. In other words, proficiency exam results of the participants who were taught in brain-compatible lessons or traditional classes showed no variation in accord with the participants' learning styles, and the proficiency exam results of the participants with different learning styles did not vary in respect to the group in which the participants were taught.

4.6. The Connection between Brain-Compatible Learning and the Change in the Participants' Dominant Hemispheres

Another research question to which answers are looked for is whether brain-compatible learning can yield a change in the focus group participants' dominant hemispheres. So as to answer this question Table 29 depicts the frequency values of the focus group participants' hemispheric dominance before and after the training which were obtained by the administration of McCarthy's (1986) hemispheric mode indicator both prior to the start and subsequent to the end of the intervention .

Table 29

Frequency of the Focus Group Participants' Hemispheric Dominance before and after the Training

Time	Left Hemisphere		Right Hemisphere		Whole Brain	
	N	%	N	%	N	%
Before	18	66,7	3	11,1	6	22,2
After	12	44,4	4	14,8	11	40,7

As shown in Table 29, 18 of the participants in the focus group were left-brained prior to the outset of the study while the number signifying left-brained participants at the end of the study is 12. There seems to be a slight difference in the number of the right-brained participants before and after the study in that three of the focus group participants were right-brained before the start of the study while there were four right-brained participants at the end of the study. The analysis of the data gathered by the hemispheric mode indicator conducted both at the outset and end of the study revealed that six participants were whole-brained before the outset of the intervention while 11 of them were whole-brained at the end of the study. To reveal if there is any statistically significant difference between the focus group participants' hemispheric dominance considering the data collected both at the beginning and end of the study a chi-square test was conducted. Table 30 below provides chi-square test results which could depict statistically significant difference, if any.

Table 30

Distribution of the Focus Group Participants' Pre- and Post-Hemispheric Dominance

Pre-Post Hemispheric Dominance	X^2	df	P
Pearson Chi-Square	20,784	4	,000

As seen in Table 30, the p value ,000, which is less than ,001, shows that a statistically significant difference exists in the change of the hemispheric dominance of the participants in the focus group between prior to and subsequent to being subjected to the brain-compatible learning environment.

4.7. The Impact of Brain-Compatible Learning on the Retention of Knowledge

Another research question in this study aims at answering the question of whether or not brain-compatible learning can enable the retention of knowledge. In an effort to gather the data that can help answer this question, the pre- and post-proficiency exam results of the focus group participants were analysed by using paired samples t-test. Table 31 demonstrates the data belonging to this analysis.

Table 31

Comparison of Post-Proficiency and Retention Exam Results

Exam	N	x̄	S	sd	t	p
Post-Proficiency	27	77,98	7,260	26	-,447	,658
Retention	27	78,72	6,952			

Table 31 displays that there is not a big difference between the mean values for the post-proficiency and retention exam the focus group took, 77,98 and 78,72 respectively. A slight decrease in standard deviation value for the retention exam can be seen in Table 31 because it is 7,260 for the post-proficiency exam, but 6,952 for the retention exam. The p value ,658 indicates that no statistically significant difference is found between the focus group's performance on the post-proficiency and retention exam. The p value indicates that brain-compatible learning can be employed by teachers and learners as a method to enable the retention of knowledge.

The statistical data provided in Table 31 indicate that the intervention in brain-compatible learning could enable the retention of knowledge. In line with the statistical values, in the semi-structured interview carried out in May one of the focus group participants said:

Extract 16: *I will continue applying brain-compatible learning principles because I can remember what I learn better by means of these principles.*

4.8. Participants' Beliefs about Language Learning before and after the Study

One of the research questions to which answers are sought is if there is any statistically significant difference as to the participants' beliefs about language learning between the data gathered by administering BALLI before the outset of and at the end of the study both in the focus and control group. Mean and standard deviation values of pre- and post-administration of BALLI are given in Table 32.

Table 32

Mean and Standard Deviation Values for Pre-and Post-BALLI

Group	Pre-BALLI			Post-BALLI		
	N	$\bar{x}$	S	N	$\bar{x}$	S
Focus	27	120,59	5,617	27	123,96	7,350
Control	26	122,80	11,167	26	116,96	11,036

Table 32 depicts an increase in the mean value for the focus group, though not a substantial increase, from 120,59 to 123,96 between the administration of the pre- and post-BALLI. Nonetheless, there is a decrease in the mean values for the control group, because as seen in Table 32, it is 122,80 in the pre-BALLI, but 116,96 in the post-BALLI. The standard deviation values depicted in Table 32 show that the focus group participants' responses to the items in BALLI show less deviation from the mean values both in the pre- and post-BALLI, 5,617, 7,350 respectively while the standard deviation values for the control group both in the pre- and post-BALLI display a higher deviation from the mean values, 11,16788, 11,03623 respectively. In order for attaining statistical values to depict whether or not there exists any statistically significant difference between the pre- and post-administration of BALLI both in the focus

and control group the findings obtained by mixed ANOVA are presented in Table 33.

Table 33

ANOVA Results of the Pre- and Post-BALLI

Sources of Variance	Sum of Squares	df	Mean Square	F	P
Between-Subjects	4090,358	52			
Group	151,717	1	151,717	1,965	,167
Error	3938,641	51	77,228		
Within-Subjects	5052,990	53			
BALLI (pre-post)	40,594	1	40,594	,465	,498
Group*BALLI	562,556	1	562,556	6,447	,014
Error	449,840	51	87,252		
Total	9143,348	105			

Table 33 demonstrates that the p value for between-subjects group factor ,167 does not indicate a statistically significant difference as with the values obtained by the pre- and post-administration of BALLI between the focus and control group. The p value for within-subjects BALLI ,498 means that there is no statistically significant difference between the pre- and post-administration of BALLI without taking into consideration in which group the participants are taught. Another important finding that can be obtained from Table 33 is whether there has occurred a statistically significant difference between groups pertaining to the data gathered by the pre- and post-BALLI. The p value ,014 shows that the common impact of the group and the repeated measures on the participants' beliefs about language learning is statistically significant. This finding indicates that being taught in the focus or control group does have distinct effects on the participants' beliefs about language learning. As can be seen in Table 33, the mean value for the focus group in the post-administration of BALLI 123,96 is higher than the one belonging to the control group ,116,96. This shows that being exposed to the brain-compatible learning environment yields a positive change in the participants' beliefs about language learning.

The diaries kept by the participants in the focus group provide precious data about how being subjected to the brain-compatible learning environment

changed the focus group participants' thoughts about language learning. One of the participants wrote in her diary the change in her thoughts about being able to learn English. Extract 13 provides the participant's thoughts.

Extract 13: *I never thought that I would be able to speak English but I can speak English now.*

As well as the learners' diaries, the diary the researcher kept is a source of finding information about the focus group participants' thoughts about language learning. Extract 14 is taken from the researcher's diary and contains information about one of the participants' views about language learning.

Extract 14: *Today one of my learners came to talk about her prejudices about learning English. She said that she had not thought it would be possible to speak English without going abroad but had experienced that it was possible to do so even if she had not gone broad.*

Besides the learners' diaries and the researcher's diary, the semi-structured interview conducted in January provided information about the change in the participants' thoughts about English language learning. One of the participants' views concerning learning English is given in extract 15 below.

Extract 15: *I think brain-compatible learning is miraculous because I always used to think that learning English was difficult and I would never be able to achieve it but now I see that English is a learnable language.*

4.9. Focus Group Participants' Perceptions of Brain-compatible Learning

Apart from the research questions and their answers that have been covered, the last research question aims to find out what the focus group participants' perceptions of brain-compatible learning are. A brain-compatible learning questionnaire was developed with the purpose of searching for the participants' perceptions of brain-compatible learning according to which they were taught for four months. Table 34 below displays the descriptive statistics of 36 items in the questionnaire.

Table 34

Descriptive Statistics of the Items in Brain-Compatible Learning Questionnaire

No	Item	N	Min	Max	Mean	S
1	I learn better if I am allowed to engage in activities with my body as well as my brain.	27	3,00	5,00	4,5185	,64273
2	Learning becomes meaningful for me as long as I am involved in the learning process	27	3,00	5,00	4,3704	,56488
3	Engaging in collaboration with classmates is a way of stimulating learning	27	4,00	5,00	4,3333	,48038
4	I feel more motivated and learn better if my interests and purposes are taken into account.	27	4,00	5,00	4,7407	,44658
5	Learning English is easier for me if I can link new patterns to what I have already understood.	27	4,00	5,00	4,7407	,44658
6	I feel honoured if my emotions are appreciated by the teacher.	27	3,00	5,00	4,6667	,55470
7	I learn better if I engage in activities with my emotions.	27	3,00	5,00	4,3704	,56488
8	I make sense of learning experiences by paying attention to details alongside the big picture.	27	1,00	5,00	4,0000	1,07417

No	Item	N	Min	Max	Mean	S
9	I learn better if my attention is consciously directed to target linguistic elements.	27	1,00	5,00	4,0000	1,07417
10	I internalize the newly transmitted information if adequate time is allocated to reflect on it.	27	3,00	5,00	4,4815	,57981
11	I remember what I listen to and read better if multiple ways such as debates, visuals, songs etc., are utilized to help me remember.	27	3,00	5,00	4,6296	,56488
12	I learn better if my prior language learning experiences are asked and dealt with.	27	4,00	5,00	4,3704	,49210
13	I feel valued if the teacher keeps in mind that I am different from my classmates.	27	3,00	5,00	4,7407	,52569
14	I don't feel comfortable if I see that what is presented in class is threatening.	27	3,00	5,00	4,6296	,56488
15-	I learn better if I am provided with a challenging but supportive learning environment.	27	4,00	5,00	4,5556	,50637
16-	I learn better in safe learning environments.	27	4,00	5,00	4,7037	,46532
17	I feel honoured and learn better if my individual abilities are appreciated by the teacher.	27	3,00	5,00	4,5556	,57735

No	Item	N	Min	Max	Mean	S
18	I learn better when the teacher provides me with the activities, tasks or projects which are prepared by bearing in mind my individual abilities.	27	3,00	5,00	4,3333	,55470
19	I perform better if the teacher lets me choose the tasks I want to work on from a bundle of activities.	27	2,00	5,00	4,4815	,84900
20	I feel comfortable if I see that what is presented in class is threatening.	27	1,00	5,00	2,3333	1,38675
21	Listening to music during classes distracts my attention.	27	1,00	5,00	2,3333	1,17670
22	I can answer the questions asked by the teacher if I am given time to think after the teacher asks the questions.	27	3,00	5,00	4,5185	,57981
23	I feel more motivated and safer if I am given the chance to choose my seat.	27	4,00	5,00	4,5926	,50071
24	I can perform better in pair or group activities if I am allowed to choose my partners.	27	3,00	5,00	4,3333	,73380
25	I feel safer and confident if the mistakes I make in classroom are appreciated.	27	3,00	5,00	4,5556	,57735
26	I try to do my best if I take charge of my learning.	27	3,00	5,00	4,3704	,56488

No	Item	N	Min	Max	Mean	S
27	I feel honoured and relaxed in classroom environments where I am involved more in activities.	27	3,00	5,00	4,0370	,64935
28	Listening to music during classes makes me concentrate on the assigned task.	27	2,00	5,00	3,7407	,71213
29	Colourful board markers attract my attention more.	27	3,00	5,00	4,1852	,68146
30	I perform better in groups in which members have similar interests and abilities.	27	1,00	5,00	4,1111	1,12090
31	I feel valued, safer and motivated if I am given the opportunity to express my ideas and engage in debates.	27	3,00	5,00	4,3704	,62929
32	I learn better in environments where discussions and debates are promoted.	27	3,00	5,00	4,2222	,57735
33	I learn better if the teacher uses different kinds of techniques in classes such as using video clips.	27	3,00	5,00	4,2593	,59437
34	Chunks are easier for me to remember.	27	2,00	5,00	4,5185	,70002
35	I learn better if I drink water during lessons.	27	2,00	5,00	4,2593	,71213
36	I learn better if I eat snacks such as nuts, apples etc. during lessons.	27	4,00	5,00	4,5556	,50637

As can be seen in Table 34, the mean value for the first item x̄= 4,5185 shows that the majority of the focus group participants stated that they learned better if they engaged in learning with their body as well as their brain. The mean value for the second item x̄= 4,3704 shows that the participants conceived that engaging in the learning process actively was a means of making the learning process more meaningful. The participants' choices for this item varied between 3 and 5. One of the participants wrote down in his diary:

Extract 17: *I was not bored in the lesson because we talked about our best holiday in small groups. Everyone talked. I remembered good old days.*

The third item is included in the questionnaire in order to find out what the focus group participants thought about the stimulating effect of collaborating with classmates. The mean value for this item is x̄= 4,3333 and the participants' choices in the likert scale differed between 4 and 5. The standard deviation value for this item S= ,48038 is one of the lowest values amongst the standard deviation values of all the items which indicates that the participants' responses did not deviate substantially from the mean value. The teacher's diary includes data about the participants' reactions towards collaboration with classmates. Extract 18 provides the researcher's observations about the participants' reactions toward collaboration:

Extract 18: *Today I set up pair and group work activities as I usually do in lessons. The learners were expected to work in groups of four to complete a story the beginning of which was provided under the pictures giving an idea to the learners about the flow of the story. I was amazed by the enthusiasm the learners felt when they were on the task. All of them were sharing their ideas with their group mates in English and they could not be that much happy if they had completed the story individually.*

In addition to the teacher's diary, the learners' diaries entail information about the participants' thoughts of studying in collaboration. Extract 19 below is taken form one of the participants' diary.

Extract 19: *I worked in a pair work activity today to do a grammar activity to practise present simple passive. I could not comprehend it well but my friend helped me understand it.*

The fourth item in the questionnaire aims at depicting what the focus group participants thought about the importance of the value given to their interests in learning better and increased motivation level. The mean value for this item $\bar{x}$= 4,7407 shows that almost all of the participants strongly agreed on this item as this is the highest mean value that can be found in the column for mean values. The standard deviation value for this item S= ,44658 is the lowest one in Table 34 when the other standard deviation values are taken into account. The fifth item in the questionnaire provides information about the importance attached by the participants to linking the new patterns to what they already understood. The mean value $\bar{x}$= 4,7407 is the highest mean value and this indicates the common conception among the participants regarding the facilitative effect of associating the new patterns with the already stored ones. The minimum option selected by the participants is 4 and the maximum option is 5 and the standard deviation value for this item S= ,44658 indicates that there is no wide variance between the participants' responses in this item. The sixth item targets digging out the participants' perceptions of whether or not they felt honoured when their emotions were valued by the teacher. The mean value $\bar{x}$= 4,6667 depicts that the participants held strong beliefs about the significance of their emotions and the value attached to them.

The seventh item in the questionnaire was added to the questionnaire in order to gather the participants' ideas about whether they learned better so long as they engaged in learning with their emotions. The mean value for this item is 4,3704 and the standard deviation value is ,56488. The participants' choices differed between 3 and 5. The mean value $\bar{x}$=4,3704 shows that the participants are aware of the significance of integrating emotions into learning. The eight item is related to learning by paying attention to details alongside the big picture. The mean vale belonging to this item is $\bar{x}$= 4,0000 and the standard deviation value is S= 1,07417. The standard deviation value indicates that the participants' responses to this item varied greatly from each other. The ninth item is about learning better on the condition that the participants' attention is consciously directed to linguistic items. The mean value for this item is one of the lowest ones $\bar{x}$= 3,5926 and the standard deviation value is S= 1,24836. The

standard deviation value shows that the participants do have distinct opinions about learning facilitated by conscious attention to target linguistic items.

The tenth item focusses on the importance of reflection time in order to internalize what is learned. The mean value x̄= 4,4815 shows that most of the participants agreed with the item. Since the standard deviation value is S= ,57981, it can be understood that there is no huge discrepancy between the participants' thoughts about this item. The eleventh item is about the use of different ways such as visuals, songs, debates so on so forth to help the participants remember. The mean value for this item x̄= 4,6296 indicates that there was a consensus among the participants on the contribution of making use of different ways to present the new information with a view to helping the participants remember them. During the interview which was conducted in January most of the participants expressed their thoughts about the usefulness of debates. Extract 20 provides one of the participants' perceptions of debates.

Extract 20*: I like debates most. You gave us the chance to choose the topic of the debate and everyone in the class did their best in the debate.*

The twelfth item is involved in the questionnaire in order to find out what the participants thought about to what degree they could learn better whilst their prior language learning experiences were taken into account. The lowest choice selected by the participants in this item is 4 and the highest one is 5. The mean value x̄= 4,3704, and the standard deviation value S= ,49210 show that all of the participants either agreed or strongly agreed on this item. In relation to this item one of the participants said during the semi-structured interview in May:

Extract 21: *I have realized that the English lessons you taught were different from my past English lessons. You asked us about our prior language learning experiences and organized your own lessons differently.*

The thirteenth item in the questionnaire can be linked to the individual differences and the importance of keeping in sight learner differences. The mean value x̄= 4,7407 indicates that the participants thought that they learned better providing their teacher took their individual differences into consideration. The fourteenth item is about how important it is to provide a comfortable learning environment as it was integrated into the questionnaire in order to see to what degree the participants were comfortable once the content of lessons

was threatening. The mean value x̄= 4,6296 indicates the majority of the participants agreed on the conception that they did not feel comfortable once they saw that what was presented in the classroom was threatening. In the learners' diaries, it is possible to encounter sentences expressing how comfortable the participants were during lessons. Extract 21 is one of them:

Extract 21: *I am as comfortable in the class as I am at home.*

One of the questions in the interview that was carried out in January aims at finding out whether or not the classroom environment were comfortable for the focus group participants. All of the participants expressed that they were comfortable in the class and the following words are uttered by one of the participants while articulating her ideas about the comfortable learning environment.

Extract 22: *I am comfortable in the lessons because there is a friendly environment in the class and this is thanks to you.*

The fifteenth item is pertinent to seeing how the participants approached challenging but supportive learning environments. The mean value for this item x̄= 4,5556 and the minimum choice 4 and the maximum choice 5 show that the participants had similar views, though not the same, regarding better learning rooted in challenging, but supportive learning environments.

The sixteenth item concentrates on the cruciality of safe learning environments. The mean value x̄= 4,7037 and the standard deviation value S=,46532 are the indicators of the common perception amongst the participants concerning how learning can be improved in safe learning environments. One of the participants stated in the semi-structured interview in January:

Extract 23: *Safe learning environment is very important because if I do not feel safe, I cannot concentrate on anything.*

The seventeenth item in the questionnaire is about the probable importance given by the participants to the teachers paying attention to their individual abilities. The mean value x̄= 4,5556 signifies that the participants felt honoured when teachers took into account their individual abilities. The eighteenth item is associated with activities designed in accordance with learners' individual abilities. The mean value for this item x̄= 4,3333 shows that the participants had a tendency to learn better provided that the teacher took

into consideration their individual abilities whilst preparing activities, tasks and projects. The nineteenth item in the questionnaire is about allowing learners to choose the tasks they want to work on. The mean value $\bar{x}=$ 4,4815 indicates that the participants thought that they performed better as long as the teacher gave them the chance to choose from a bundle of options the tasks, activities and projects they wanted to work on. However, the standard deviation value S= ,84900 and the minimum choice 2 reveal that there were some participants who did not think in line with what is presented in the item. The teacher's diary contains information about the participants' reactions towards having a chance to choose tasks. Extract 24 is a quotation from the researcher's diary:

Extract 24: *My learners feel valued when I ask them on which task they want to work. Today the same thing happened. I asked them to select the passage they wanted to read out of 10 options, yet they offered a passage that was not on the list and the majority agreed on reading that passage.*

The twentieth item was included into the questionnaire to better show what the participants thought about threatening learning environments. The mean value $\bar{x}=$ 2,3333 shows that the participants did not feel comfortable in threatening learning environments. The 21st item aims at figuring out whether or not listening to music distracts the participants when they are on a task. The mean value $\bar{x}=$ 2,3333 indicates that the majority of the participants were not distracted due to the music played in the background; nonetheless, the maximum choice is 5, as can be seen in Table 33, demonstrates few of the participants considered that music distracted their attention. This can be explained by most of the participants' reactions at the beginning of the study that they were not used to studying and listening to music at the same time. One of the participants wrote in her diary:

Extract 25: *At the beginning I did not think I would be able to focus when music was played but now I ask the teacher to play music when we are on a task.*

Another participant remarked during the interview in May that he was continuing to listen to classical music when he was studying and would do so in the future, too.

The 22nd item sets forth the concept of wait time needed to be provided after teachers ask a question. The mean value for this item $\bar{x}=$ 4,5185 indicates

that the majority supported the idea that wait-time should be given after asking a question instead of calling for learners' names immediately to get the answer.

The mean value for the 23rd item x̄= 4,5926 and the minimum choice 4 and the maximum choice 5 show that the participants agreed on the motivating power of the provided chance to choose their seats. Item 24 targets revealing what the participants thought about having opportunity to choose their partners in the activities requiring collaboration. The mean value x̄= 4,3333 indicates that most of the participants thought that they performed better in the activities in which collaboration with classmates was a prerequisite on the condition that they were given the chance to select their partners. One of the participants said in the interview in January:

Extract 26: *I feel more comfortable if I work with a friend I choose.*

Item 25 takes its place in the questionnaire to seek what the participants considered about the mistakes being appreciated by their teacher. The mean value x̄= 4,5556 shows that an overwhelming number of the participants believed that they felt safer and more comfortable once their mistakes were appreciated. The standard deviation value S=,57735 is a signal of how the participants' responses to this item were close to each other. The content analysis of the interview carried out in January showed that the participants felt comfortable as their mistakes were appreciated. One of the participants stated:

Extract 27: *When I was at high school, my teacher never tolerated making mistakes but you always welcomed our mistakes and this motivated us more.*

Brain-compatible learning principles and the strategies springing out of these principles manifest a link between brain-compatible learning and independent learning. The 26th item can reveal if the participants did their best when they took charge of their own learning. The mean value x̄= 4,3704 indicates a tendency among the participants to study harder when they take control of their learning. One of the participants in the interview conducted in May said:

Extract 28: *I want to continue applying brain-compatible learning principles because when I apply them, I get control of my learning.*

Item 27 has been involved in the questionnaire so as to find out the participants' thoughts about actively engaging in classroom activities. The mean

value x̄= 4,0370 indicates that the majority of the participants felt honoured and more comfortable in the classroom when they took part in the classroom activities. The 28th item in the questionnaire reveals better what the participants thought about listening to music when they were dealing with a task. The mean value x̄= 3,7407 shows that there were some participants getting distracted by the background music.

The 29th item looks for the participants' thoughts about the use of colourful board markers during lessons. The mean value x̄= 4,1852 demonstrates that most of the participants advocated the use of colourful board markers for they helped them better concentrate. Item 30 aims at revealing the participants' perceptions of working with the classmates with the same interests and abilities. Even though the mean value x̄= 4,1111 points out a disposition amongst the participants to work with the classmates with similar interests, the standard deviation value S= 1,12090 and the minimum choice 1 and the maximum choice 5 indicate that the participants' responses to this item differed greatly. The 31st item was added to the questionnaire to figure out the participants' thoughts about the correlation between feeling safer and motivated, and expressing their ideas in the classroom and in debates. The mean value x̄= 4,3704 demonstrates that the participants felt safer and motivated when they expressed their ideas in the classroom and in debates. The researcher wrote down her observations in her diary about the participants' reactions towards debates.

Extract 29: *My learners feel safer and motivated when they engage in debates. This was obvious in today' debate because even the learners who do not prefer to talk in lessons actively participated in the debate.*

Item 32 was included in the questionnaire to find out the participants' thoughts concerning better learning that may result from debates and discussions in the classroom. The mean value x̄= 4,2222   demonstrates   that the participants associated engaging in debates and discussions in the classroom with better learning. The 33rd item targets digging out what the participants' thought about the influence of different techniques used by the teacher on learning. The mean value x̄= 4,2593 indicates that the participants viewed different techniques as useful means to foster learning. The standard

deviation value S= ,59437 ,indicates that no wide variation among the participants' responses to this item existed. Item 34 searches for the participants' thoughts about chunks. The mean value $\bar{x}=$ 4,5185 shows that it was easier for most of the participants to remember by the medium of chunks.

Item 35 was encompassed in the questionnaire to figure out the participants' ideas about drinking water during lessons. The mean value for this item $\bar{x}=$ 4,2593 indicates that the participants were in favour of drinking water in the classroom. However, few learners did not support drinking water during lessons. The teacher's diary involves some notes about the participants' compliance with drinking water, which is given in extract 30:

Extract 30: *I drink water in the lessons every day and all of my learners have started to bring bottles of water and drunk it during lessons.*

The last item, item 36, aims at revealing what the participants' thoughts about eating nuts during lessons are. The mean value $\bar{x}=$ 4,5556 indicates that the participants all agreed on the positive correlation between learning and eating snacks as the minimum choice is 4 designating agree and the maximum choice is 5 designating strongly agree. One of the participants stated his ideas about eating nuts in the lessons during the semi-structured interview in January:

Extract 31: *I never ate something when I studied before but now I do. I eat nuts while studying and this motivates me.*

4.10. Content Analysis of the First Semi-Structured Interview

Participants' perceptions of brain-compatible learning were unveiled by administering the brain-compatible learning questionnaire at the end of the training. Bearing in mind the difficulty in uncovering perceptions, it was thought that conducting an interview following the administration of the perception questionnaire could deepen the understanding of the participants' perceptions of brain-compatible learning. With the intent of extending the data regarding the focus group participants' perceptions a semi-structured interview was carried out with the participants in the focus group in the last week of January subsequent to the end of the brain-compatible learning intervention. Following sub-headings provide the findings attained from the content analysis of each question in the semi-structured interview.

4.10.1. Focus Group Participants' Thoughts about Their Proficiency Level after the Intervention

At the outset of the study the participants were asked about their level of proficiency in English in the background information questionnaire. Focus group participants' thoughts about their level of proficiency were found out at the end of the training by asking in the semi-structured interview the question of what they thought about their proficiency level after being exposed to the brain-compatible learning environment. Table 35 illustrates the focus group participants' thoughts concerning the improvement in their proficiency level.

Table 35

Focus Group Participants' Ideas about Their Proficiency Level after the Intervention

Category	N	%
Improvement in proficiency	27	100
No improvement in proficiency	0	0
Total	27	100

Table 35 displays that all of the participants in the focus group thought that their level of proficiency improved in the last four month. This question in the semi-structured interview was carried on with the question of how the focus group participants explained the improvement in their proficiency level in English.

4.10.2. Focus Group Participants' Explanations Regarding the Improvement in Their Language Proficiency

The participants in the focus group stated that their level of proficiency in English improved in the last four months during which they were subjected to the brain-compatible learning intervention. However, this answer would make better sense as long as the participants provided explanations regarding the improvement in their level of proficiency. Table 36 displays the frequency values of the focus group participants' explanations recorded during the interview carried out in January.

Table 36

Focus Group Participants' Explanations Regarding the Improvement in Their English Proficiency

Category	N	%
Improvement in four skills	11	40,7
Abolition of grammar-based teaching	4	14,8
Abolition of memorization	4	14,8
Motivating teacher	3	11,1
Attitude change towards English	3	11,1
Comprehension-based lessons	1	3,7
Improvement in speaking	1	3,7
Total	27	100

As shown in Table 36, 40,7% of the participants stated that their proficiency in four skills improved due to the brain-compatible learning intervention. Four of the participants highlighted during the interview that their level of proficiency in English improved owing to the abolition of grammar-based teaching in the brain-compatible lessons. Four of the participants noted that abolition of memorization during the brain-compatible learning intervention helped them improve their language proficiency. Three of the participants stated that the teacher conducting the brain-compatible lessons was a motivating teacher and the lessons done by a motivating teacher enabled the improvement in their proficiency level. 11,1% of the participants stated that their level of proficiency in English improved because the brain-compatible lessons changed their attitudes towards English and this helped them study harder and comprehend better in enjoyable lessons. One of the participants stated that the lessons were comprehension-based lessons and since comprehension was paramount, their proficiency level in English improved during the intervention. One of the participants expressed how the brain-compatible lessons contributed to the improvement in her level of proficiency by mentioning the improvement in her speaking skill.

4.10.3. Focus Group Participants' Thoughts about the Effectiveness of Brain-Compatible Learning

Another question in the semi-structured interview in February was included in the interview in order to find out what the focus group participants thought about the effectiveness of brain-compatible learning. Table 37 displays the participants' thoughts about the effectiveness of brain-compatible learning.

Table 37

Focus Group Participants' Thoughts Concerning the Effectiveness of Brain-Compatible Learning

Category	N	%
Effective	27	100
Ineffective	0	0
Total	27	100

As shown in Table 37, all the focus group participants thought that brain-compatible learning according to whose principles they were taught for four months was effective.

4.10.4. Comparison of Previous Language Learning Experiences with Brain-Compatible Learning Experience

So as to extend the findings regarding the focus group participants' thoughts about the effectiveness of brain-compatible learning the participants were asked to compare their brain-compatible learning experience with their previous language learning experiences. Table 38 displays the statistical values for the participants' comparison of their previous English language learning experiences with the brain-compatible learning experience.

Table 38

Focus Group Participants' Thoughts Concerning Brain-Compatible Learning and Their Prior Language Learning Experiences

Category	N	%
Brain-compatible learning more effective	27	100
Past English lessons more effective	0	0
Total	27	100

As can be seen in Table 38, all of the participants in the focus group stated that the brain-compatible learning intervention was more effective in terms of their learning in comparison to their past language learning experiences. Table 39 below shows how the participants described their previous language learning experiences, and therefore, can function as a means to sort out why they perceived the brain-compatible lessons more effective than the lessons they had taken before.

Table 39

The Themes that Emerged Regarding the Focus Group Participants' Past English Lessons

Category	N	%
Grammar-based	16	59,3
Memorization	5	18,5
Translation	2	7,4
Mistakes were not welcomed	1	3,7
Reading dominant	1	3,7
Speaking dominant	1	3,7
Course book-based	1	3,7
Total	27	100

As can be seen in Table 39, 59,3% of the participants stated that the previous English lessons were grammar-based. 18,5% of the participants stated that the lessons were memorization-based lessons. Two of the participants verbalized that the lessons were translation-based lessons. One of the participants in the focus group remarked that learner mistakes were not welcomed in the English lessons she had taken before the brain-compatible learning experience. One of the participants noted that improving learners' reading skill was the main objective in her previous English lessons. One of the last two participants stated that his previous English lessons were speaking dominant and the other one denoted that the lessons centred upon covering the units in the selected course book.

4.10.5. Focus Group Participants' Thoughts about How Comfortable the Learning Environment Was

The question of how the focus group participants evaluated the comfort of the learning environment whilst implementing the brain-compatible learning intervention was asked with the purpose of digging out the participants' thoughts about how comfortable they were in the brain-compatible lessons. Table 40 shows the statistical values depicting the participants' thoughts.

Table 40

Focus Group's Thoughts about How Comfortable They were in the Brain-Compatible lessons

Category	N	%
Comfortable	27	100
Uncomfortable	0	0
Total	27	100

As displayed in Table 40, all of the participants stated that they were comfortable in the brain-comfortable lessons. It was considered that the values presented in Table 40 could make more sense by asking the focus group participants about why they felt comfortable in the brain-compatible classes. Table 41 displays the reasons uttered by the participants during the interview.

Table 41

Focus Group Participants' Thoughts about Why They were Comfortable during the Brain-Compatible Lessons

Category	N	%
The teacher	13	48,1
Freedom to choose partners	5	18,5
Talking to everyone	2	7,4
Listening to music	2	7,4
Mistakes are welcomed	2	7,4
Pair work-group work	1	3,7
Freedom	1	3,7
Friendly environment	1	3,7
Total	27	100

As seen in Table 41, 48,1% of the participants stated that the main factor that enabled them to feel comfortable was the teacher. 18,5% of the participants in the focus group noted that they were comfortable in the lessons because they were given an opportunity to choose their partners. Two of the participants stated that they talked to everyone in the classroom and this made them feel comfortable during the lessons. Two of the participants put forth that listening to music helped them feel comfortable in the lessons.

Table 41 also demonstrates that two of the participants remarked that they were comfortable as the teacher welcomed their mistakes. One of the participants brought forward that integrating pair and group work activities into the lessons helped her feel comfortable. Another participant noted that because there was freedom in the classroom, she was comfortable in the lessons. One of the participants stated that the friendly environment was the fundamental reason for feeling comfortable during the brain-compatible lessons.

4.10.6. The Impact of Brain-Compatible Learning on Focus Group Participants' Approach towards English

Another question in the semi-structured interview was whether or not brain-compatible learning changed their approach towards English. Table 42 demonstrates the values signifying the frequency values for the participants who thought and did not think brain-compatible learning changed their approach towards English.

Table 42

Focus Group Participants' Thoughts about Whether Brain-Compatible Learning Changed Their Approach towards English

Category	N	%
Yes	27	100
No	0	0
Total	27	100

As shown in Table 42, all of the participants in the focus group stated that the brain-compatible learning intervention changed their attitude towards English. The next question in the interview aims at finding out answers to the question of how brain-compatible learning changed their attitude towards

English. Table 43 demonstrates the focus group participants' thoughts about in what ways brain-compatible learning changed their attitudes towards English.

Table 43

Focus Group Participants' Explanations about the changes in Their Attitudes towards English

Category	N	%
A learnable language	14	51,9
Easier to learn	7	29,6
Enjoyable to learn	5	18,5
Total	27	100

As seen in Table 43, 51,9% of the participants stated that brain-compatible learning changed their ideas about the learnability of English. They noted that they started to consider English as a learnable language thanks to the brain-compatible learning intervention they were subjected to for four months. 29,6% of the participants verbalized that they had thought before the brain-compatible learning intervention that English was difficult to learn, yet brain-compatible learning changed their attitude towards English in that anymore they believed that English was easier to learn. 18,5% of the participants remarked that after the brain-compatible learning intervention they started to think that English is enjoyable to learn.

4.10.7. Focus Group Participants' Thoughts about Continuing Applying Brain-Compatible Learning Principles

Another question in the semi-structured interview conducted with the participants in the focus group in January was whether or not the focus group participants wanted to continue applying brain-compatible learning principles. Table 44 displays the statistical values for if the participants wanted to continue employing brain-compatible learning principles or not.

Table 44

Focus Group Participants' Thoughts about Continuing Applying Brain-Compatible Learning Principles

Category	N	%
Wants to continue	27	100
Does not want to continue	0	0
Total	27	100

Table 44 shows that all the participants in the focus group stated that they wanted to continue learning English in accordance with brain-compatible learning principles. The question of why they wanted to continue applying brain-compatible learning principles in the future will be answered by the statistical values in Table 45.

Table 45

Why the Focus Group Participants Wanted to Continue Applying Brain-Compatible Learning Principles

Category	N	%
To be the agent in learning	1	3,7
More effective	26	96,3
Total	27	100

As shown in Table 45, one of the focus group participants stated that she wanted to take control of her own learning and because she thought that she could act as the agent if she continued learning English in compliance with brain-compatible learning principles. The rest of the participants, 26 participants, remarked that because brain-compatible learning is a more effective method, they wanted to continue learning in accord with brain-compatible learning.

4.11. Content Analysis for the Second Semi-Structured Interview

Following the administration of the retention exam that was conducted in May in order for exploring the influence of brain-compatible learning on the retention of knowledge, a second semi-structured interview was carried out with the intent of figuring out whether or not the focus group participants' thoughts

about brain-compatible learning changed. The following paragraphs are devoted to presenting the participants' responses to the questions asked in the interview.

4.11.1. Focus Group Participants' Thoughts about Their Level of Proficiency after Taking the Retention Exam

The first question in the semi-structured interview carried out in May aims at finding out what the focus group participants thought about their current level of proficiency after taking the retention exam. Table 46 displays the participants' thoughts about their level of proficiency in English in May.

Table 46

Focus Group Participants' Thoughts about Their Level of Proficiency

Category	N	%
Satisfied with the current level of knowledge	7	25,93
Needs improvement in proficiency level	20	74,07
Total	27	100

As seen in Table 34, seven of the participants in the focus group were content with their proficiency levels while the rest 20 participants stated during the interview that they needed to improve their levels of proficiency in English.

4.11.2. Focus Group Participants' Thoughts about the Efficiency of Brain-Compatible Learning

The semi-structured interview conducted in May involved a question asking for the focus group participants' perceptions of the efficiency of the brain-compatible learning intervention they were exposed to for four months. The same question was asked in the semi-structured interview that was conducted in January. The rationale behind asking the same question is to find out whether there occurred any change in the focus group participants' thoughts about the efficiency of brain-compatible learning. Table 47 demonstrates the statistical values shedding light on this question.

Table 47

Focus Group Participants' Thoughts about the Efficiency of the Brain Compatible Learning Intervention

Category	N	%
Efficient period	27	100
Inefficient period	0	0
Total	27	100

Table 47 shows that all of the focus group participants found the brain-compatible learning intervention efficient. The participants' responses to the second question need to be illuminated by asking them why they found the intervention an efficient intervention. Table 48 shows the participants' explanations to clarify their perceptions regarding the efficiency of the brain-compatible learning intervention.

Table 48

Focus Group Participants' Reasons to Justify Their Thoughts about the Brain-Compatible Learning Intervention

Category	N	%
More effective than traditional methods	22	81,5
More logical learning method	2	7,4
Teaches how to learn English	2	7,4
More enjoyable	1	3,7

As seen in Table 48, an overwhelming number of the participants, 22 participants, stated that the brain-compatible lessons were more effective in comparison to the lessons conducted traditionally they had been exposed to before being taught in accordance with brain-compatible learning principles. 7,4% of the participants remarked that since brain-compatible learning was more logical, the intervention was effective for them. Another 7,4% of the participants denoted that they learnt how to learn English by means of the brain-compatible learning intervention and thus they thought that the intervention in brain-compatible learning was efficient. One of the focus group participants

noted that the brain-compatible learning intervention was efficient in that the brain-compatible lessons were more enjoyable.

4.11.3. Focus Group Participants' Thoughts about How Comfortable They Were during the Intervention

The third question in the semi-structured interview carried out in May targeted figuring out the focus group participants' thoughts about how comfortable they were in the classroom. This question, which was also asked in the semi-structured interview conducted in January, would reveal a change, if any, that took place in the focus group participants' perceptions regarding the comfortable learning environment created by the implementation of brain-compatible learning principles. Table 49 displays descriptive statistical values regarding the participants' thoughts about how comfortable the classroom environment was during the intervention.

Table 49

Focus Group Participants' Thoughts about How Comfortable the Classroom Environment Was

Category	N	%
Comfortable	27	100
Uncomfortable	0	100
Total	27	100

As shown in Table 49, all of the focus group participants thought that the classroom environment in which the brain-compatible learning intervention took place was comfortable. The participants were asked to share details about how this comfortable learning environment was created. Table 50 below demonstrates the factors articulated by the focus group and contributing to establishing a comfortable learning environment.

Table 50

Factors Contributed to Establishing Comfortable Learning Environment

Category	N	%
Unrestricting classroom environment	5	18,5
Listening to music	4	14,8
Availability of options	4	14,8
Learners' demands on the forefront	3	11,1
Eating nuts and drinking water	3	11,1
Home-like classroom environment	3	11,1
Freedom to choose seats	2	7,4
Welcomed mistakes	2	7,4
Learners determining the flow of the lesson	1	3,7
Total	27	100

Table 50 shows that 18,5% of the participants verbalized that due to unrestricting classroom environment they were taught in a comfortable learning environment. 14,8% of the participants stated that listening to music during the lessons made a comfortable learning environment possible. Another 14,8% of the participants mentioned the availability of choices as the reason for the existence of the comfortable learning environment. Three of the participants in the focus group remarked that the classroom environment was comfortable for them in that their demands were on the forefront.

As seen in Table 50, another factor enabling the creation of the comfortable learning environment and put forth by three of the participants is eating nuts and drinking water during the lesson.11,1% of the participants noted that the classroom in which they were taught was like their home and that is why they were comfortable during the lessons. Two of the participants in the focus group brought forward the freedom of choosing seats. Since they were able to choose their seats, the classroom was comfortable for them. 7,4% of the participants stated that because their mistakes were appreciated, the classroom environment was comfortable for them. The classroom environment during the intervention was comfortable for one of the participants because she stated that it was the learners not the teacher determining the flow of the lesson.

4.11.4. The Influence of Brain-Compatible Learning on the Participants' Approach towards English

The semi-structured interview conducted in May involved a question in order to find out whether or not the brain-compatible learning intervention changed the way they approached English like the question asked in the interview conducted in January. Table 51 below displays the frequency values that can provide an answer to the abovementioned question.

Table 51

Focus Group Participants' Responses to Whether the Intervention Changed Their Approach to English

Category	N	%
Changed the way I approached English	27	100
Did not change how I approached English	0	0
Total	27	100

As displayed in Table 51, all of the participants stated that the brain-compatible learning intervention changed the way they approached English. However, this value needed to be furthered by the values that could be obtained by analysing the data gathered through asking the question of in what angles it changed the way they approached English. Table 52 depicts the focus group participants' explanations about how the brain-compatible learning intervention changed the way they approached English.

Table 52

How the Brain-Compatible Learning Intervention Changed the Focus Group's Approach towards English

Category	N	%
English is a learnable language	20	74,1
Learning English is enjoyable	5	18,5
Comfortable while writing and speaking	1	3,7
Realizing the importance of learning style	1	3,7
Total	27	100

Table 52 shows that a huge proportion of the participants, 74,1%, stated that they thought English was a learnable language for them anymore as at the times they had not experienced the brain-compatible learning intervention they had thought that they would not be able to learn English. Five of the participants stated that learning English was enjoyable with the help of brain-compatible learning; however, in the past they had thought that English was one of the boring lessons they had to take. One of the participants in the focus group remarked that the brain-compatible learning intervention reduced the stress he faced while writing and speaking. One of the participants stated that the brain-compatible learning intervention helped her realize the significance of learning styles in learning English. She added during the interview that she would continue learning English by keeping in sight the features of her learning style.

4.11.5. Focus Group Participants' Thoughts about Continuing Applying Brain-Compatible Learning Principles

Another question in the semi-structured aimed at figuring out the participants' perceptions about whether or not they were planning to continue learning in accordance with brain-compatible learning. Table 53 below depicts the values showing whether or not the focus group participants would continue learning by applying brain-compatible learning principles.

Table 53

Focus Group's Thoughts about Continuing Applying Brain-Compatible Learning Principles

Category	N	%
Yes	27	100
No	0	0
Total	27	100

As displayed in Table 53, all the participants in the focus group stated that they were planning to continue learning in accordance with brain-compatible learning principles and strategies. The question of why they were planning to apply brain-compatible learning principles will be answered by the values in Table 54 given below.

Table 54

Why the Focus Group Wants to Continue Applying Brain-Compatible Learning Principles

Category	N	%
More effective	16	59,3
Enables retention of knowledge	9	33,3
Increases motivation	1	3,7
Increases concentration	1	3,7
Total	27	100

Table 54 shows that an overwhelming number of the participants, 16, stated that they would continue learning English via applying brain-compatible learning principles as they thought that brain-compatible learning was effective. 33,3% of the participants in the focus group noted that they would continue applying brain-compatible learning principles and strategies in that they enabled the retention of knowledge.

As displayed in Table 54, one of the participants remarked that brain-compatible learning was a means of increasing their motivation and because of this, she would continue applying brain-compatible learning principles. Another participant mentioned during the interview that brain-compatible learning increased his concentration and this reality pushed him to apply brain-compatible learning principles in the future.

4.11.6. The Impact of the Brain-Compatible Learning Intervention on the English Lessons the Focus Group Participants Took in Their Own Departments

The last question in the semi-structured interview conducted in May targeted figuring out what the focus group participants thought about the effect of brain-compatible learning on the English lessons in their own department. The following table, Table 55, demonstrates the statistical values providing information about the participants' thoughts about the effect of brain-compatible learning on the English lessons they took in their department.

Table 55

The Effect of Brain-Compatible Learning on the Participants' English Course in Their Own Departments

Category	N	%
Positive effect	27	100
Negative effect	0	0
No effect	0	0
Total	27	100

As seen in Table 55, all of the participants in the focus group thought that the brain-compatible learning intervention had a positive impact on the participants' performance in the English lessons they took in their own departments. These findings needed to be furthered by the findings that would be attained by asking the question of why brain-compatible learning principles had a positive impact on the English courses they had in their own departments. Table 56 shows the reasons put forth by the participants explaining why they thought that brain-compatible learning exerted a positive influence on their English lesson.

Table 56

Why Brain-Compatible Learning Had a Positive Effect on the Participants' Current English Lesson

Category	N	%
Easier to learn English	18	66,7
More retention of knowledge	3	11,1
Boosted self-confidence	3	11,1
More enjoyable	2	7,4
Helps concentration	1	3,7
Total	27	100

As displayed in Table 56, 18 of the participants stated during the interview that the participants learned better because it was easier to learn English by employing brain-compatible learning principles. 11,1% of the participants explained the positive influence of brain-compatible learning

principles by drawing the attention to the retention of knowledge enabled by brain-compatible learning. Another 11,1% of the participants stated that brain compatible learning boosted their self-confidence and for this reason, it had a positive influence on the English lesson they took in their departments. Two of the participants remarked that it had a positive impact on their departmental English lesson as learning English was enjoyable when they continued employing brain compatible learning principles. One of the participants noted that brain-compatible learning helped her concentrate while studying and because of this, it had a positive impact on her performance in the English lesson in her own department.

4.12. Conclusion

This chapter presented the findings obtained from the analysis of the data provided by lived English language learning experiences questionnaire, pre- and post-administration of BALLI, pre- and post-proficiency exam, perceptions about brain-compatible learning questionnaire, retention exam, learners' diaries, teacher' s diary, McCarthy's hemispheric mode indicator, Kolb's learning styles inventory, and the semi-structured interviews conducted in January and May. The succeeding chapter will dwell on the comparison of this study's findings with the findings of the studies in the related literature.

CHAPTER V

DISCUSSION

5.1. Introduction

This section of the dissertation targets the interpretation of the findings providing answers to the research questions by comparing them with the findings of other studies which have also been conducted in order for exploring the impact of brain-compatible learning on English language teaching and other subject areas.

5.2. Discussion

Following paragraphs will compare the findings pertaining to each research question with the findings of the studies in the related literature.

Research Question 1

The first research question was posed so as to shed light on the participants' lived English language learning experiences. The lived English language learning experiences questionnaire was administered both in the focus and control group with a view to depicting whether or not the focus and control group participants had similar prior English language learning experiences. Now that prior learning experiences do exert impact on learners' current learning experiences, the rationale behind questing for the similarities and differences between the focus and control group in terms of prior English language learning experiences becomes apparent.

The content analysis conducted to find out the focus group participants' prior English language learning experiences reveals the explicitness of the participants' negative memories about English language learning as the majority of the participants described the past English lessons they had taken as course book-based and grammar-based lessons. Solely one of the focus group participants out of 27 students remarked that the previous English lessons he had taken attached more importance to improving learners' speaking skills while the remaining participants stated how ineffective the prior English lessons they had attended before were. This finding appears to be congruent with the

common criticism directed to English language teaching in Turkey keeping in sight Turkish learners' inability to communicate in oral mode.

The statistical values obtained by the content analysis of the control group participants' answers to the question of how the previous English lessons they took were conducted indicate that the control group had similar kinds of lessons to those of the focus group as with the way the lessons were structured. The majority of the participants in the control group also noted that grammar teaching and finishing merely the selected course books was the route followed by their English teachers.

The way the English lessons the participants in the focus and control group had taken before was conducted apparently affected the participants' thoughts about the efficiency of the previous English lessons they took in that 21 participants in the focus group and 22 participants in the control group found their previous English lessons inefficient. The reasons put forth by the participants for justifying their thoughts about the inefficiency of the prior English lessons were linked to the dominance of course book-based and grammar-based lessons, yet that is not to say that they did not set forth other reasons like inadequate class hours, memorization, demotivated learners, devaluing English lesson, teacher centeredness, lazy teachers et cetera to explain why the lessons were inefficient.

The participants had learnt English for approximately nine years till they started their prep class education at the university where this study was carried out. Considering the time span the learners spent learning English, it was thought that it would be meaningful to ask the participants if they were at the level they wanted to be. Twenty-five participants in the control group and 26 participants in the focus group stated that they were not at the level they wanted to be in spite of all the years in which English had been one of the school subjects. One participant in the focus group and one in the control group stating that they were at the level they wanted to be noted that this was owing to their hard-working English teachers. The participants stating that they did not reach the level at which they wanted to be wrote down the reasons for their claims. Ineffective ways of teaching English was the most frequently emerging theme in the content analysis conducted for the responses given by both the focus and control group. Devaluing English, grammar based-lessons, not studying

enough, lazy teachers, and frequent change of teachers are the other reasons noted by the participants.

The results of the content analysis of the data gathered through the lived English language learning experiences questionnaire revealed that the focus and control group participants had similar lived English language learning experiences and this could be interpreted as the participants' lived English language learning experiences would impact the focus and control group participants similarly.

Research Question 2

The second research question aims at figuring out statistically significant differences between the pre- and post-proficiency exam results of the focus and control group. ANOVA results of the pre- and post-proficiency exam display that the focus group participants' performance on the post-proficiency exam surpassed the control group participants' performance. In addition to the ANOVA results, the mean values belonging to the pre- and post-proficiency exam for the focus and control group indicate that there has been an increase in the mean value for the focus group's performance on the post-proficiency exam result. Though there is an increase in the control group's performance on the post-proficiency exam, the increase in the focus group resulted in a statistically significant difference in comparison to the one in the control group.

The literature contains studies the findings of which are in parallel with the findings of this study. One of these studies is conducted by Baş (2010) with 6th grade learners' to explore the participants' achievement levels in English. The findings of this experimental study revealed that the participants in the experimental group had higher grades as compared to those of the control group. In addition, Huang (2006) studying the influence of brain-compatible learning on the participants' achievement levels in English reported that brain-compatible learning did have a positive impact on the participants' achievement levels in English.

The literature review on the effect of brain-compatible learning on learner's academic achievement puts forward that there are more studies that have been conducted up till today so as to examine the influence of brain-compatible learning on improving learners' academic achievement in subject areas other than English. One of these content areas is science lesson. The

study based on experimental research design and carried out by Akyürek & Afacan (2013) yielded that the experimental group exposed to brain-compatible learning had higher grades from the achievement test in comparison with the ones the control group had. Similar results were attained from the study conducted by Özden & Gültekin (2008) with 5th grade learners. The findings attained from this experimental research showed that the experimental group participants outperformed the participants in the control group in the post-test like the performance of the focus group participants in this study.

Cowan (2009) conducted a study to examine the impact of brain-compatible learning on improving reading skills of elementary level learners. The results of the study revealed that brain-compatible learning did exert a positive influence on augmenting the participants' reading skills. The findings of this study comply with the findings of this thesis though this thesis is concerned with investigating the impact of brain-compatible learning on the overall language proficiency whereas the study carried out by Cowan (2009) targeted elucidating the influence of brain-compatible learning solely on reading skill. Even though the study done by Cowan (2009) shows similarity with this thesis with respect to the positive impact of brain-compatible learning, the findings reported by Blackburn (2009) and McNamee (2011) are not in line with the findings of this study in that brain-compatible learning intervention did not result in improvement in the participants' reading skills in those studies.

Another subject area on which the impact of brain-compatible learning is examined is writing. The findings of the study conducted by Getz (2003) contradict with the findings of this study as the results yielded by the study did not report any improvement in the writing skills of the experimental group being subjected to the intervention in brain-compatible learning.

Social studies is another subject area on which studies aiming to examine the effect of brain-compatible learning have been conducted. Çengelci (2007) carried out a study so as to depict the impact of brain-compatible learning on social studies. In line with this thesis in terms of the research design, data collection tools, and the findings, the study revealed that the experimental group participants outperformed the participants in the control group in regards to their academic achievement level. Another study in which the participants were pre-service social studies teachers was conducted by

Duman (2010) in an effort to investigate the effect of brain-compatible learning on the participants' performance on measurement and evaluation course. The findings of this study based on pre/post-test control group research design revealed that the participants in the experimental group outperformed the participants concerning the grades they got on the achievement test, which is congruent with the findings of this thesis.

Research Question 3

The third research question quests for answers to the question of whether there is a statistically significant difference between pre- and post-proficiency exam results of the male and female participants in the focus and control group. The results of this study showed that a statistically significant difference between the male and female participants in the focus and control group in terms of their grades on the pre- and post-proficiency exam did not exist. This shows that the impact of brain-compatible learning does not show a change according to learners' sexes. Nonetheless, a study with the findings of which this study's findings regarding the impact of brain-compatible learning on different sexes can be compared could not be found.

Research Question 4

The fourth research question aims to answer the question of whether there is a statistically significant difference between the pre- and post-proficiency exam results of the focus and control group with respect to the participants' learning styles. The results of this study showed that the participants' performance in the focus and control group did not show a statistically significant difference in accordance with the participants' learning styles. This finding indicates that the impact of brain-compatible learning does not change in accord with learners' learning styles. The finding of this study with respect to the influence of brain-compatible learning on the participants with different learning styles is in parallel with the finding attained from the study carried out by Duman (2010). The study done by Duman (2010) revealed that the scores of the participants in the experimental group did not yield any statistically significant difference in accordance with the experimental group participants' learning styles. Nevertheless, the related literature does not encompass a large body of research in the correlation between brain-compatible learning and learning styles.

Research question 5

What is sought by the results obtained through posing the fifth research question is whether brain-compatible learning can lead to a change in the participants' brain dominance. The findings reached by using chi-square test reported that a statistically significant difference in the change of the focus group participants' hemispheric dominance existed between the administration of McCarthy's hemispheric mode indicator at the beginning and at the end of the brain-compatible learning intervention. No study exploring the effect of brain-compatible learning on the change in learners' hemispheric dominance has been carried out in the literature so far. For this reason, this study can be accepted to be one of the first studies that have examined the impact of brain-compatible learning on the change in learners' hemispheric dominance. Nevertheless, it needs to be kept in mind that altering a person's dominant hemisphere is considerably difficult, specifically by the medium of an intervention lasting four months, and thus the results attained in this study may be associated with measurement error.

Research Question 6

The sixth research question in this study seeks answers to the question of whether there is a statistically significant difference between the grades the participants in the focus group got on the post-proficiency and retention exam. The statistical analysis of the data was conducted by implementing paired samples t test. The finding obtained from the t test revealed that there was no statistically significant difference between the scores the focus group participants got on the post-proficiency and retention exam, which points out that brain-compatible learning enables the retention of knowledge. In the literature meagre amount of research aiming at investigating the influence of brain-compatible learning on the retention of knowledge exists.

The research carried out by Çengelci (2007) is one of the studies aiming at investigating the relation between brain-compatible learning and retention of knowledge. The finding obtained from the study done by Çengelci (2007) is in tune with the finding of this thesis in that both studies reported that brain-compatible learning makes knowledge retention possible. The study conducted by Özden & Gültekin (2008) with the participation of 5th graders to examine the interconnection between brain-compatible learning and retention of knowledge

yielded results that are in parallel with this study's findings as well because the retention exam revealed that brain-compatible learning to which the participants in the experimental group were exposed enabled knowledge retention.

Research Question 7

Research question 7 was posed to examine whether there was a statistically significant difference between the pre- and post-beliefs of the focus and control group about language learning. The analysis of the data collected by the administration of BALLI both in the focus and control group both before the outset of and after the end of the brain-compatible learning intervention showed that brain-compatible learning intervention led to a positive change in the focus group participants' beliefs about language learning. However, a statistically significant difference did not occur between the pre- and post-administration of BALLI in the control group. In addition to BALLI, valuable data about the focus group participants' beliefs about language learning is obtained in the semi-structured interviews. The data gathered through the content analysis of the interviews showed that the focus group participants' viewpoints about language learning varied subsequent to being exposed to the brain-compatible learning intervention. Nevertheless, the related literature does not encapsulate research investigating the influence of teaching in compliance with brain-compatible learning on learners' beliefs about language learning, which does not enable the comparison of this study's findings with others.

Research Question 8

The eight research question in this thesis aims to elucidate the focus group participants' perceptions of the brain-compatible learning intervention. The data related to the focus group participants' thoughts about brain-compatible learning were collected by the perceptions about brain-compatible learning questionnaire and the semi-structured interview conducted in January following the end of intervention and the one carried out after the retention exam. In addition, the learners' diaries served for unveiling the focus group participants' perceptions of brain-compatible learning. The results attained by the analysis of the above-mentioned data collection tools, which are presented in detail in chapter four, indicate that the focus group participants have positive perceptions of brain-compatible learning. During the semi-structured interviews carried out in January and May all of the participants came to an agreement on

the effectiveness of brain-compatible learning in learning English. Similar to the data gathered by the semi-structured interviews, the participants' preferences for the options in the perceptions about brain-compatible learning questionnaire are the indicators of the participants' positive perceptions about brain-compatible learning.

The available literature on brain-compatible learning embraces studies exploring learners' perceptions of brain-compatible learning, one of which is done by Avcı & Yağbasan (2010). The interview conducted at the end of the study revealed that the participants had positive views about brain-compatible learning. Another study unveiling the learners' perceptions of brain-compatible learning is carried out by Weimer (2007). The participants perceived brain-compatible learning as a medium for augmenting engaged learning and long-term memory enhancement. The research conducted by Çengelci (2007) also provided data about the participating learners' perceptions of brain-compatible learning. The analysis of the qualitative data revealed that the participants did possess positive attitudes towards brain-compatible learning. Additionally, the research done by Duman (2010) aimed at uncovering the participants' perceptions of brain-compatible learning as well as exploring the influence of brain-compatible learning on the participants' performance in the test designed to measure the participants' acquisition of knowledge and skills in measurement and evaluation course. The findings of the study reported that the participants considered brain-compatible learning as an effective and enjoyable learning method.

5.3. Conclusion

This chapter of the dissertation aimed at presenting the interpretations of the results and comparing the findings of this study with the findings of the studies in the related literature so as to picture how this study fits in the available literature. However, due to the absence of studies in the literature, a number of the results of this study could not be compared with other studies. The following chapter, which is the last chapter of the dissertation, will provide the pedagogical implications of the study, the contribution of the study to the field and the limitations of the study, and recommendations for further studies.

CHAPTER VI

CONCLUSION

6.1. Introduction

This chapter of the dissertation will dwell on presenting the pedagogical implications of the study, the contributions of this study to the field of English language teaching and learning, the limitations of the study, and recommendations for further research.

6.2. Pedagogical Implications

The findings attained from the analysis of the quantitative and qualitative data do present several implications for English language teachers, English language learners, Ministry of National Education, teacher trainers, and school principals.

English language teachers could benefit from the findings of this study in that the results of this study reveal that implementing brain-compatible learning principles in English lessons can improve learners' language proficiency in English. Even though adults comprise the participants of this study, brain-compatible learning principles and strategies can be applied to all English language classes irrespective of learners' ages taught in these classes. Considering the initiatives taken by English language teachers with a view to teaching in a more effective way so that their teaching can get learners to learn better, applying brain-compatible learning to learning environments may serve for producing better outcomes on the part of learners. Besides, for teachers who complain about learners' poor learning outcomes, the results of this study might be stimulating as they may think, by taking into consideration the findings that brain-compatible learning can alter the ongoing failure in teaching and learning English, they can convert teaching and learning English to a success story. One point worth to keep in sight is that although the major concern of this study is examining the impact of brain-compatible learning on improving adult learners' language proficiency in English, teachers teaching other foreign languages might be eager to create a brain-compatible learning environment via applying brain-compatible learning principles too.

One of the attention-grabbing findings of this study is that the participants of this research not only plan to continue learning English by going on implementing brain-compatible learning principles but also plan to attempt to learn other subjects through the same principles. This finding indicates that on the condition that young learners are taught English in accord with brain-compatible learning principles, they may be liable to apply brain-compatible learning principles as mediums for maximizing their learning potential in the following years. Nonetheless, it needs to be kept in mind that it is under teachers' responsibility to maintain the initial exposure of learners to brain-compatible learning; by so doing, learners might have the opportunity to experience how effective a method brain-compatible learning is and they could take the responsibility for implementing brain-compatible learning principles in the absence of their teachers.

Apart from practitioners and English language learners, Turkish Ministry of National Education may evaluate the results of this research as worth taking into account, and could make a decision to take steps accordingly. The authorized officers in the department of General Directorate of Teacher Training and Education of Ministry of National Education might conceive to organize in-service trainings for practising teachers to equip them with the knowledge of what brain-compatible learning is and how brain-compatible learning can be implemented in classroom. In- service trainings can be extended to all the regions in Turkey so that all English teachers will be provided with the training in brain-compatible learning.

In addition to Ministry of National Education, academics teaching at the departments of English language teaching may take advantage of the findings of this dissertation by integrating brain-compatible learning into teacher education curriculum. The education given to pre-service teachers is no less significant than the in-service trainings that might be provided to practising teachers; contrarily, equipping prospective English language teachers with the knowledge of current language teaching methods, including brain-compatible learning, is a prerequisite to help them get ready as much as they can before they start to teach in the field. However, it should be emphasized that pre-service teachers are to be provided with chances to apply brain-compatible learning principles as well as presenting theoretical information about how the

human brain learns and the ways brain-compatible learning principles are implemented in actual learning environments.

In addition to the academics, teacher trainers may take advantage of this study's findings because what is demanded by English language teachers encapsulates learning about different methods and techniques to enrich their teaching repertoire. Therefore, teacher trainers may prepare training programmes through taking into consideration what is presented in this thesis and by reading more about brain-compatible learning.

The last but not the least, principals of school of foreign languages can take steps in cooperation with professional development unit to incorporate trainings in brain-compatible learning into training programs for English language instructors. Provided that principals read and believe in the effectiveness of brain-compatible learning, they will probably be willing to train instructors in brain-compatible learning principles. This implication is not valid solely for principals of school of foreign languages as principals of elementary and high schools may embark on an enterprise as well subsequent to learning about how brain-compatible learning intervention can positively influence learners' language proficiency.

6.3. Contribution to the Field and Limitations of the Study

This study could contribute to the field bearing in mind the paucity of research in brain-compatible learning and the influence of brain-compatible learning on improving learners' language proficiency. So as to make how this study contributes to the field evident it may be useful to refer to chapter five because it could not be possible to compare some of the findings of this study with those of other studies due to the meagre amount of studies on brain-compatible learning and its influence on improving language proficiency.

This study contributes to the field of English language teaching and learning in that it stands out as one of the first studies in Turkey and abroad in terms of investigating the influence of brain-compatible learning on adult learners' language proficiency. The duration of the intervention in brain-compatible learning is another contribution of this study to the field as the intervention lasted around 336 hours, which is higher than the amount of time allocated to the trainings in brain-compatible learning to improve participants'

academic achievement in subjects both in English and other subject areas. As well as the duration of the intervention, the variety of the data collection tools used in this study is another factor that should be mentioned while writing about how this study contributes to the field. In the studies conducted to explore the impact of brain-compatible learning data are generally collected by statistically analysing participants' grades on achievement exams and through conducting interviews, yet the perceptions about brain-compatible learning questionnaire developed by the researcher, two semi-structured interviews, two proficiency exams' results, pre- and post-administration of BALLI, pre- and post-administration of Kolb's learning styles inventory, pre- and post-administration of McCarthy's hemispheric mode indicator, field notes and lived English language learning experiences questionnaire were employed to gather the data in this study.

Another contribution of this study to the field is the raised research questions. This research questions aiming to explore the effect of the brain-compatible learning intervention on knowledge retention, on the participants' beliefs about language learning, on the relationship between the participants' learning styles and their performance in proficiency exams, on the connection between the participants' sexes and their performance on the proficiency exams and on whether brain-compatible learning results in an alteration in the participants' dominant hemispheres are the research questions that have been rarely or never posed in the literature.

In addition to the contributions of this study to the field, this study has some limitations like several other studies both in the field English language teaching and in different disciplines. One of the limitations is that the intervention lasted one semester, four months; however, if the training had been conducted for two semesters, it would have better illuminated the influence of brain-compatible learning on adult learners' language proficiency. Another limitation of the study is that the retention exam could not be conducted in the control group because of the difficulty in reaching the participants in the control group. But providing the retention exam could have been conducted in the control group as well, the effect of the brain-compatible learning intervention on the retention of knowledge would have been better manifested.

6.4. Recommendations for Further Research

The findings of this study shed lights into the role of brain-compatible learning in language learning and teaching, yet a larger population can increase the chance of generalization of the findings. In addition, brain-compatible learning intervention can be designed to last a longer period of time in the future studies to obtain more reliable results as to the impact of brain-compatible learning on improving learners' language proficiency.

The participants' perceptions of the brain-compatible learning intervention were investigated through the semi-structured interviews and the diaries kept by the participants till the end of the intervention besides the quantitative data collection tool used to examine the participants' perceptions of brain-compatible learning. Studies that will be conducted in the future can aim to unveil teachers' perceptions of the impact of brain-compatible learning on improving learners' language proficiency. This can be achieved in a study sequenced in such as a way that teachers will be exposed to a training in brain-compatible learning and their perceptions regarding brain-compatible learning will be collected and then, teachers will implement brain-compatible learning principles in their classes and whether or not there occurs a change in their perceptions will be explored.

Another recommendation that can be given for further studies is that researchers can select one or two skills and work on investigating the influence of brain-compatible learning principles on the chosen skills over a longer period of time. In addition to these, researchers may conduct studies to elucidate the influence of brain-compatible learning on young learners' English language proficiency and also to investigate whether the impact of brain-compatible learning changes in accordance with learners' ages. For instance, both adult and young learners could be subjected to brain-compatible learning principles and how they are impacted by brain-compatible learning principles can be examined.

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APPENDICIES

Appendix 1. Informed Consent Form for Participants

Informed Consent Form for Participants

The Influence of Brain Compatible Learning on English Language Proficiency of Adult Learners

By

Gülten Koşar

The purpose of this study is to examine the influence of brain-compatible learning on adult EFL learners' English language proficiency. This research is a significant part of my PhD program at the University of Çukurova and I would love to thank you for considering participation in the study.

In due course of the administration of the study your participation will comprise filling in *beliefs about language learning inventory, perceptions about brain compatible learning questionnaire, learning styles inventory, hemispheric mode indicator, lived experiences questionnaire*, and being subjected to the training on brain-compatible learning. The questionnaires, consent forms and all the other documents to be gathered from you will be kept in a locked file cabinet. I do believe that this training will be a useful experience for you and the results which will be obtained from the study will shed clearer light on the impact of brain-compatible learning on English language proficiency. There will be no problems concerning confidentiality; that is to say, your name will not be reported anywhere in the thesis. This study does not involve risks; on the contrary, it may empower you in your language learning journey.

You do have the right to or not to take part in the study and ask questions to me, the researcher, about the research at the outset of the study, during its administration or at the end of the study. You may decide to discontinue participating in the study by informing me. Your participation will be terminated if you are no longer enrolled in the School of Foreign Languages at Yıldırım Beyazıt University.

Participant Authorization

I have read and understand this consent form. A copy of this form will be given to me. I decide to participate in this study voluntarily and accept to fill in the questionnaires that will be used as data collection tools. I understand that I can decide to discontinue this study and do have the right to terminate my participation. I understand that the training that will be provided to me during this study might improve my language proficiency. I further understand that I can get in contact with the researcher to receive responses to any question I do pose related to the procedure or the study.

Participant Name: _____

Participant Signature: _____

Date: _____

Appendix 2. Background Information Questionnaire

BACKGROUND INFORMATION QUESTIONNAIRE

1- Name

_____

2- Age _____

3- Sex _____

4- Language/s you speak at home

_____

5- How long have you been studying English

_____

6- How do you rate your overall proficiency in English?

Excellent   Good   Fair   Poor

7- How important is it for you to become proficient in English?

Very important   Important   Not so important

8- Why do you want to learn English?

Interested in English

Interested in British/American culture

Have friends who speak English

Required to graduate

Need it for my future career

Need it for travel

Other _____

9- Do you enjoy learning English?

Yes   No

10- What has been your favourite experience in language learning?

Appendix 3. Yaşanılmış İngilizce Öğrenme Tecrübeleri Anketi (Turkish Version)

1- Bu güne kadar katıldığınız İngilizce dersleri nasıl yürütülürdü (Ödevlendirme, metinleri sesli bir şekilde okuyup metinlere ait soruları yanıtlandırma, diyalog aktiviteleri vb.)?

2- Bu güne kadar katıldığınız İngilizce derslerinin verimliliği konusunda ne düşünmektesiniz?

3- Yaklaşık 9 yıldır İngilizce dersleri almaktasınız. İngilizce öğreniminin bir parçası olduğu bu süre zarfını düşündüğünüz de, İngilizce 'de gelmek istediğiniz seviyede olduğunuzu düşünüyor musunuz? Gelemediyseniz sebepleri nelerdir? Geldi iseniz, bu sürece katkı sağlayan unsurlar neler olmuştur?

Lived English language learning Experiences Questionnaire (English Version)

1- How were the English lessons you had taken before structured (Assignments, reading passages aloud and answering comprehension questions, listening activities etc.)?

2- What do you think about the efficiency of the English lessons you have taken so far?

3- You have been learning English for approximately 9 years. Bearing in mind the place held by English in this time span, do you think you are at the proficiency level you want to be?

Appendix 4. Kolb's Learning Styles Inventory

The learning style inventory describes the way you learn and how you deal with ideas and day-to-day situations in your life. Below are 12 sentences with a choice of four endings. Rank the endings for each sentence according to how well you think each one fits with how you would go about learning something. Try to recall some recent situations where you had to learn something new. Then, using the spaces provided, rank a "4" for the sentence ending that describes how you learn best, down to a "1" for the sentence ending that seems least like the way you would learn. Be sure to rank all the endings for each sentence unit. Please do not make ties.

0-   When I learn, …
__4__ I am happy.
__1__ I am fast
__2__ I am logical.
__3__ I am careful.

1-   When I learn, …
_____ I like to deal with my feelings.
_____ I like to watch and listen.
_____ I like to think about ideas.
_____ I like to be doing things.

2-   I learn best when …
_____ I trust my hunches and feelings.
_____ I listen and watch carefully.
_____ I rely on logical thinking.
_____ I work hard to get things done.

3-   When I am learning, …

_____ I have strong feelings and reactions.

_____ I am quiet and reserved.

_____ I tend to reason things out.

_____ I am responsible about things.

4-   I learn by …

_____ feeling

_____ watching

_____ thinking

_____ doing

5-   When I learn, …

_____ I am open to new experiences.

_____ I look at all sides of issues.

_____ I like to analyse things and break them down into their parts.

_____ I like to try things out.

6-   When I am learning, …

_____I am an intuitive person.

_____I am an observing person.

_____I am a logical person.

_____I am an active person.

7-   I learn best from …

_____ personal relationships.

_____ observation.

_____ rational theories.

_____ a chance to try out and practice.

8-   When I learn, …

_____ **I feel personally involved in things.**

_____ **I take my time before acting.**

_____ **I like ideas and theories.**

_____ **I like to see results from my work.**

9-   I learn best when …

_____ **I rely on my feelings.**

_____ **I rely on my observations.**

_____ **I rely on my ideas.**

_____ **I can try things out for myself.**

10-   When I am learning, …

_____ **I am an accepting person.**

_____ **I am a reserved person.**

_____ **I am a rational person.**

_____ **I am a responsible person.**

11-   When I learn, …

_____ **I get involved.**

_____ **I like to observe.**

_____ **I evaluate things.**

_____ **I like to be active.**

12-   I learn best when …

_____ **I am receptive and open-minded.**

_____ **I am careful.**

_____ **I analyse ideas.**

_____ **I am practical.**

Appendix 5. Beliefs about Language Learning Inventory

Beliefs about Language Learning Inventory

Below is the questionnaire comprised of some beliefs about language learning. It has been delivered to you in order to find out your beliefs about language learning. Each belief, apart from belief *4* and *15*, has five options (Strongly disagree, disagree, neutral, agree and strongly agree). Read the beliefs and put a ✓ under the option which is true of you. For the beliefs *4* and *15* you are expected to circle one of the options from *a* to *e* that is in compliance with your belief.

No	Belief	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1	It is easier for children than adults to learn a foreign language.					
2	Some people have a special ability for learning foreign languages.					
3	Some languages are easier to learn than others.					
4	English is:	a. a very difficult language. b. a difficult language. c. a language of medium difficulty. d. an easy language. e. a very easy language.				
5	I believe that I will learn to speak English very well.					
6	People from my country are good at learning English.					
7	It is important to speak English with an excellent pronunciation.					
8	It is necessary to know about English-speaking cultures in order to speak English.					

No	Belief	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
9	You shouldn't speak anything in English until you can say it correctly.					
10	It is easier for someone who already speaks a foreign language to learn another one.					
11	People who are good at mathematics or science are not good at learning foreign languages.					
12	It is best to learn English in an English-speaking country.					
13	I enjoy practising English with the native speakers I meet.					
14	It's OK to guess if you don't know a word in English.					
15	If someone spent one hour a day learning a language how long would it take them to speak the language very well?	a. less than a year b. 1-2 years c. 3-5 years d. 5-10 years e. You can't learn a language in 1 hour a day				
16	I have a special ability for learning foreign languages.					
17	The most important part of learning a foreign language is learning vocabulary.					
18	It is important to repeat and practice a lot.					

No	Belief	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
19	Women are better than men at learning foreign languages.					
20	People in my country feel that it is important to speak English.					
21	I feel timid as speaking English with other people.					
22	If beginning students are permitted to make errors in English, it will be difficult for them to speak correctly later on.					
23	The most important part of learning a foreign language is learning the grammar.					
24	I would like to learn English so that I can get to know international people better.					
25	It is easier to speak than to understand a foreign language.					
26	It is important to practice with online resources.					
27	Learning a foreign language is different from learning other academic subjects.					

No	Belief	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
28	The most important part of learning English is learning how to translate from my native language.					
29	If I learn English very well, I will have better opportunities for a good job.					
30	People who speak more than one language are very intelligent.					
31	I want to learn to speak English well.					
32	I would like to have non-Turkish English speaking friends.					
33	Everyone can learn to speak a foreign language.					
34	It is easier to read and write English than to speak and understand it.					

Appendix 6. Perceptions about Brain-Compatible Learning Questionnaire

Below is the perception questionnaire delivered to you with the intention of learning about what you think of each item. The questionnaire comprises 36 items each of which has five options (strongly disagree, disagree, neutral, agree and strongly agree). You are expected to read the items and put a ✓ under the option that describes you best.

No	Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I learn better if I am allowed to engage in activities with my body as well as my brain.					
2	Learning becomes meaningful for me as long as I am involved in the learning process.					
3	Engaging in collaboration with classmates is a way of stimulating learning.					
4	I feel more motivated and learn better if my interests and purposes are taken into account.					
5	Learning English is easier for me if I can link new patterns to what I have already understood.					
6	I feel honoured if my emotions are appreciated by the teacher.					
7	I learn better if I engage in activities with my emotions.					
8	I make sense of learning experiences by paying attention to details alongside the big picture.					

9	I learn better if my attention is consciously directed to target linguistic elements.					
10	I internalize the newly transmitted information if adequate time is allocated to reflect on it.					
11	I remember what I listen to and read better if multiple ways such as debates, visuals, songs etc., are utilized to help me remember.					
12	I learn better if my prior language learning experiences are asked and dealt with.					
13	I feel valued if the teacher keeps in mind that I am different from my classmates.					
14	I don't feel comfortable if I see that what is presented in class is threatening.					
15	I learn better if I am provided with a challenging but supportive learning environment.					
16	I learn better in safe learning environments.					
17	I feel honoured and learn better if my individual abilities are appreciated by the teacher.					

18	I learn better when the teacher provides me with the activities, tasks or projects which are prepared by bearing in mind my individual abilities.					
19	I perform better if the teacher lets me choose the tasks I want to work on from a bundle of activities.					
20	I feel comfortable if I see that what is presented in class is threatening.					
21	Listening to music during classes distracts my attention.					
22	I can answer the questions asked by the teacher if I am given time to think after the teacher asks the questions.					
23	I feel more motivated and safer if I am given the chance to choose my seat.					
24	I can perform better in pair or group activities if I am allowed to choose my partners.					
25	I feel safer and confident if the mistakes I make in classroom are appreciated.					
26	I try to do my best if I take charge of my learning.					
27	I feel honoured and relaxed in classroom environments where I am involved more in activities.					
28	Listening to music during classes makes me concentrate on the assigned task.					

29	Colourful board markers attract my attention more.					
30	I perform better in groups in which members have similar interests and abilities.					
31	I feel valued, safer and motivated if I am given the opportunity to express my ideas and engage in debates.					
32	I learn better in environments where discussions and debates are promoted.					
33	I learn better if the teacher uses different kinds of techniques in classes such as using video clips.					
34	Chunks are easier for me to remember.					
35	I learn better if I drink water during lessons.					
36	I learn better if I eat snacks such as nuts, apples etc during lessons.					

Appendix 7. Ocak Ayında Yürütülen Yarı-Yapılandırılmış Mülakat Soruları (Turkish version)

1- Eylül 2014'ten beri Yıldırım Beyazıt Üniversitesi'nde İngilizce öğrenimi görmektesiniz? Şu anki İngilizce bilginizi göz önünde bulundurursanız gelişiminiz bakımından ne söyleyebilirsiniz?

2- Beyin temelli öğrenimin baz alındığı yaklaşık dört aylık İngilizce öğrenimine tabi oldunuz. Genel olarak bu sürecin verimli geçtiğine inanıyor musunuz? Geçmiş yıllardaki dil öğrenim tecrübelerinizle kıyaslayarak cevap veriniz.

3- Bu süreçte derslerde genelde rahat bir ortam mevcut muydu? Yanıtınız evet ise bu ortamı öğretmeniniz nasıl oluşturdu (sınıf içerisinde hareketin serbest olması, seçeneklerin sunulması ve istekleriniz doğrultusunda aktivitelerin seçilmesi, klasik ve yüksek tempolu müzikler eşliğinde derslerin işlenmesi, su içilmesi gibi)?

4- Beyin temelli öğrenme dil öğrenimine bakış açınızı değiştirdi mi? Yanıtınız evet ise, nasıl bir değişiklik gözlemliyorsunuz?

5- Bundan sonraki süreçte beyin temelli öğrenme esaslarına göre öğrenmeye devam etmeyi düşünüyor musunuz? Sebepleri ile açıklayınız?

The Semi-Structured Interview Conducted in January (English Version)

1- You have been learning English in Yıldırım Beyazıt University since September, 2014. Considering your current proficiency level, what can you say about your improvement in English?

2- You have been taught English according to brain-compatible learning principles for around 4 months. Do you think this time span has been generally effective? Please answer this question by comparing brain-compatible learning with your prior English language learning experiences.

3- Has the learning environment been comfortable for you over the last four months? If your answer is yes, how did your teacher create this environment (freedom of movement in the classroom, availability of choices and the dominance of your preferences in selecting activities, listening to classical music or music with quick tempo during lessons, drinking water etc.)?

4- Has brain-compatible learning changed your approach towards language learning? If your answer is yes, what sorts of change do you observe?

5- Are you planning to continue learning English by applying brain-compatible learning principles? If your answer is yes, please give details.

Appendix 8. Mayıs Ayında Yürütülen Yarı-Yapılandırılmış Mülakat Soruları (Turkish Version)

1-	Eylül 2014'ten beri Yıldırım Beyazıt Üniversitesi'nde İngilizce öğrenimi görmektesiniz ya da 2015 Şubat itibariyle kendi bölümünüzde öğreniminize devam etmektesiniz? Şu anki İngilizce bilginizi göz önünde bulundurursanız gelişiminiz bakımından ne söyleyebilirsiniz?

2-	Beyin temelli öğrenimin baz alındığı yaklaşık dört aylık İngilizce öğrenimine tabi oldunuz. Genel olarak bu sürecin verimli geçtiğine inanıyor musunuz? Geçmiş yıllardaki dil öğrenim tecrübelerinizle kıyaslayarak cevap veriniz.

3-	Bu süreçte derslerde genelde rahat bir ortam mevcut muydu? Yanıtınız evet ise bu ortamı öğretmeniniz nasıl oluşturdu (sınıf içerisinde hareketin serbest olması, seçeneklerin sunulması ve isteklerinizi doğrultusunda aktivitelerin seçilmesi, klasik ve yüksek tempolu müzikler eşliğinde derslerin işlenmesi, su içilmesi gibi)?

4-	Beyin temelli öğrenme dil öğrenimine bakış açınızı değiştirdi mi? Yanıtınız evet ise, nasıl bir değişiklik gözlemliyorsunuz?

5-	Bundan sonraki süreçte beyin temelli öğrenme esaslarına göre öğrenmeye devam etmeyi düşünüyor musunuz? Sebepleri ile açıklayınız?

6- Beyin temelli öğrenme üzerine aldığınız eğitim Ocak ayı itibariyle tamamlandı. Pek çoğunuz bölümlerinizde eğitim almaya başladınız (ya da hazırlık birimindeki öğreniminize devam etmektesiniz). Beyin temelli eğitimin şu anda almakta olduğunuz İngilizce eğitimine etkisini nasıl anlatırsınız?

Olumlu, çünkü; ……………………………….

**The Semi-Structured Interview Conducted in May (English Version)**

1- You have been either learning English in Yıldırım Beyazıt University since September, 2014 or you are continuing your academic education in your own department. What can you say about your improvement in English considering you current knowledge of English?

2- You were taught English according to brain-compatible learning principles for around 4 months. Do you think that time span was generally effective? Please answer this question by comparing brain-compatible learning with your prior English language learning experiences.

3- Was the learning environment comfortable for four months for you? If your answer is yes, how did your teacher create this environment (freedom of movement in the classroom, availability of choices and the dominance of your preferences in selecting activities, listening to classical music or music with quick tempo during lessons, drinking water etc.)?

4- Has brain-compatible learning changed your approach towards language learning? If your answer is yes, what sorts of change do you observe?

5- Are you planning to continue learning English by applying brain-compatible learning principles? If your answer is yes, why?

6- The intervention in brain-compatible learning was completed last January. You have either been learning English in Yıldırım Beyazıt University since then, or you are continuing your academic education in your own department. How does the brain-compatible learning intervention influence the English lesson you are currently taking? Positively, because………………

Appendix 9. Hemispheric Mode Indicator

HEMISPHERIC MODE INDICATOR (HMI) 57

INSTRUCTIONS: For each numbered item there are four possible choices. Either choose "a lot" or "somewhat" from the column A side, or "a lot" or "somewhat" from the column B side. For example: I prefer dogs "a lot" or "somewhat" – or – I prefer cats "a lot" or "somewhat." Choose one answer for each numbered item. Place an O in the appropriate blank.

Example:

Column A   Column B

prefer dogs | O | | | | prefer cats
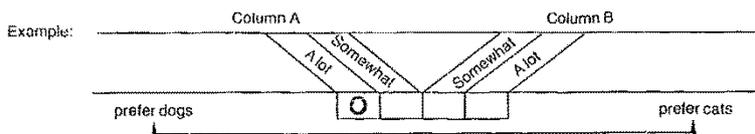
Column A	A lot	Somewhat	Somewhat	A lot	Column B
1. bases decisions on facts					bases decisions on feelings
2. prefers organized structure in a work setting					prefers open-ended work setting
3. carefree, spontaneous					careful, deliberate
4. understands how the pieces fit together					understands from experience
5. tries hunches					approaches problems logically
6. like an athlete or artist					like an accountant or chemist
7. like a tax lawyer					like a criminal lawyer
8. neat					sloppy
9. process oriented					product oriented
10. improvising new ideas					thoughtful, both feet on the ground
11. prefers change and the unusual					prefers order and stability
12. recalls information, names					recalls faces, dress, actions
13. precise in language					free, sweeping terms
14. focus on words said and the message					takes in body language, emotional tone
15. holistic, intuitive					orderly, sequential
16. words and numbers					space and form
17. synthesizing					analyzing
18. abstract					concrete
19. emotional					rational
20. objective					subjective
21. waking					dreaming
22. timebound					timeless
23. realistic					idealistic
24. lead by the heart					lead by the mind
25. specific					ambiguous
26. community					agency
27. outlook					insight
28. cause and effect					resemblances
29. lumper					splitter
30. intellectual rigor					imagination
31. soft					sharp
32. persist					encompass

Appendix 10. Sample Lesson Plans

Sample Lesson Plan 1

Lesson Plan

Information about the class and lesson

Date and time   : 22.09.2014/14.00-14.45
Level and Class   : B
Materials and Aids : Dictionary, mobile phone, pen & paper
Class Profile:

- 10 male and 17 female students,

- Average age is 18,

- 4 students from the engineering faculty , 2 students from the faculty of business, 10 students from the faculty of law, 8 students from the faculty of medicine, 3 students from the faculty of science and letters.

Theme: Leisure time

Physical environment: The class is aired by the teacher and the windows of the class, at least one of them, are left open without being concerned about the noise that might come from the nearby environment as the building where the lessons are done is located in a quiet area. Classical music (from Chopin) is preferred as the background music. However, music type is changed according to the activity type the students engage in; for instance, music with quick tempo will replace the performance of Chopin as students commence the survey the details of which are given in the following lines. Seats are arranged in a U shape with the aim of enabling students to see each other, and sunlight is sufficient in the class.

Objective/s

➢ By the end of the lesson:

- The students will talk about their leisure time activities and habits in simple phrases and sentences.
- The students will ask and talk about others' leisure time activities.

Procedures

➢ Warm-up Pre-survey activity (5 minutes): The teacher will ask her students about what they did the day before particularly to learn about anything exciting or odd that happened to them and to find out the leisure time activities of the students. Watching TV, playing football, listening to music, going to cinema and so forth are among the expected activities. Following the students' answers, the teacher will direct the students' attention to the theme of the lesson, leisure time. The teacher will suggest doing a leisure time survey in the class.

➢ While-survey activity: The students will work in groups of four and will be given the chance to choose their group members. The students will walk around the class freely and choose the place in the class where they want to do the survey. Via conducting the survey, the students will find out who watches TV most, has the most interesting leisure time activity, and has more leisure time activities. The teacher will be walking by the groups to support them whenever a need arises. The act of carrying out the survey will be accompanied by music with quick tempo and the students will be promoted to drink water and eat nuts during the administration of the survey. The survey will be completed in 30 minutes.

➢ Post-survey activity: The groups will share the results with the class and the teacher will recommend the students interested in the same leisure time activities to come together and enjoy doing the same things together. Presentation of the results will be completed in 10 minutes.

Sample Lesson Plan 2

Lesson Plan

Information about the class and lesson

Date and time   : 29.9.2014/8.30/12:55
Level and Class   : B2
Materials and Aids : Dictionary, mobile phone, videos, visuals, course book
Class Profile:

- 10 male and 17 female students,

- Average age is 18,

- 4 students from the engineering faculty , 2 students from the
faculty of business, 10 students from the faculty of law, 8
students from the faculty of medicine, 3 students from the faculty
of science and letters.

Applied brain-compatible learning principles: The brain/mind is social
(Realized by stimulating pair
and group).
Emotions are critical to
patterning (Realized by talking
about different countries and
their hometowns before delving
into the reading text).
Complex learning is enhanced
by challenge and inhibited by
threat associated with
helplessness and/or fatigue
(Realized by the use of
background music, allowing the
learners to choose their
partners, help of the teacher by
monitoring the learners).
The search for meaning occurs
through patterning (Realized by
promoting the learners to detect

the forms of present simple and present continuous tense by looking at the sample sentences and then focussing on the function of both tenses in pairs and stimulating the learners to refer to their existing knowledge of present simple and present continuous tense).

All learning engages the physiology (Realized by encouraging learners to move around and to get out of sitting position via inviting them to look at the map of the world, watching a video, by promoting the learners to drink water and eat nuts, and by prepping the class to be an airy, well-lit, and comfortable environment before the lesson).

Theme: Human Planet

Physical environment: The class will be aired by the teacher and the windows of the class, at least one of them, will be left open without being concerned about the noise that might come from the nearby environment as the building where the lessons are done is located in a quiet area. Classical music (from Chopin) will be preferred as the background music. However, music type will be changed according to the activity type the students will engage in.

Objective/s

➢ By the end of the lesson:

- The students will be able to differentiate present simple and present continuous tense.
- The students will be able to talk about the seasons in their hometowns, and the countries they know through using the words related to weather conditions and present simple tense.
- The students will be able to talk about places, things, and weather conditions via using modifiers.

Procedures

➢ Warm-up (10 minutes): The teacher will ask her students what they did last weekend and want to learn about how the students coming from different cities felt at the first weekend they had to spend away from their families. The teacher will underline the significance of the main purpose they need to keep in their mind throughout this year, which is improving their English.

➢ The teacher will turn on the projector and reflect some questions as to the number of different languages in the world, how many different countries speak English as their mother tongue or what percentage of the internet is in English, and will initiate a classroom discussion on these questions. The teacher will remind her students that English is the lingua franca of the world (15 minutes).

➢ The teacher will play a video including beautiful sides of the world. Then, the students will read the homepage of *My World, Our World* individually, which will be accompanied by Vivaldi's performance. Then, the students will answer the questions in pairs. The students will have the opportunity to choose their partners. After that, the pairs will share their answers with their classmates (20 minutes).

➢ Break for ten minutes

➢ The teacher will draw the attention of the students to the website being focused on before the outset of the break. The teacher will say that she

will play the recording related to the website. Prior to playing the recording the teacher will want her students to read the questions so that it will be easier for the students to find out the answers to the questions. The teacher will encourage her students to drink water (10 minutes).

➢ The teacher will open a webpage demonstrating the world map. She will invite her students to the board and analyze it and while analyzing she will want them to match the countries with the continents which she will have written on the board by means of using colorful board markers. Then, the students will work in pairs and ask each other whether they have ever been to those countries or they do have acquaintants in any of these countries (15 minutes).

➢ The students will work in groups of three to look at a few sentences given in their course books and identify which are in present simple and which are in present continuous tense and then, decide on the functions of the forms. The teacher will recommend some useful websites to her students so that they will have the chance for further study (20 minutes).

➢ Ten-minute break

➢ The teacher will give her students a few minutes to brainstorm about the questions concerning their favorite season, the coldest cities in Turkey and in the world, and then the students will talk about their opinions (20 minutes).

➢ The students will read a text entitled "Surviving Siberia" silently, which will be accompanied by Vivaldi's performance. Then, the students will work in pairs to match the given questions with the correct paragraphs which will be accompanied by a song with a quick tempo (25 minutes).

➢ Ten-minute break.

➢ The teacher will write the title "Weather Words" on the board and invite the students to the board in order to write the weather words they know. The teacher introduces modifiers with the help of using the weather words written by the students (15 minutes).

➢ The teacher will tell her students to work in groups of four and analyze the questions that will have been matched with the paragraphs. The primary aim of this activity is to understand the differences between present simple and present continuous tense questions. The teacher will

walk around the classroom and monitor her students to help them whenever they need (15 minutes).

➢ The teacher will ask her students to raise any questions about the forms used to make questions in present simple and present simple continuous tense. Following the discussion about these tenses, the students will do extra practice in present simple and present simple continuous tense in pairs (15 minutes).

➢ Ten-minute break

➢ Pre-video watching: The teacher will want her students to work in pairs in order for collecting data about how climate affects people in Turkey. After that, they will share their ideas with the rest of the students. The students will be told to read the questions that could be answered by taking notes while watching the video (15 minutes).

➢ While video watching: The students will watch the video and take notes to be able to answer the questions about the video (10 minutes).

➢ Post-video watching: The students will discuss the questions (10 minutes).

➢ The teacher will invite the students to wrap up what the students will have dealt with (10 minutes).

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Sample Lesson Plan 3

Lesson Plan

Information about the class and lesson

Date and time   : 14.10.2014/8:30/10:10
Level and Class   : B2
Materials and Aids   : Dictionary, mobile phone, videos, visuals, course book
Class Profile:

-10 male and 17 female students,

- Average age is 18,

- 4 students from the engineering faculty , 2 students from the
faculty of business, 10 students from the faculty of law, 8
students from the faculty of medicine, 3 students from the faculty
of science and letters.

Theme: Health

Physical environment: The class will be aired by the teacher and the windows of
the class, at least one of them, will be left open without
being concerned about the noise that might come from
the nearby environment as the building where the
lessons are done is located in a quiet area. Classical
music (from Chopin) will be preferred as the background
music. However, music type will be changed according to
the activity type the students engage in; for instance,
music with quick tempo will replace the performance of
Chopin as students commence the survey the details of
which are given in the following lines. Seats are arranged
in a U shape with the aim of enabling students to see
each other and sunlight is sufficient in the class.

Objective/s

➤ By the end of the lesson:

• The students will be able to use the words that
describe nature.

- The students will be able to read for detailed information.

Procedures

➢ Warm-up (10 minutes): The teacher will revise what the students learned last week and deliver the second drafts of the second portfolio to the students. The teacher will ask some questions to revise present perfect tense and articles the students learned the day before.

➢ The students will work in pairs and look at the photo and decide what they can see in the photo (5 minutes).

➢ The teacher will ask the students to work in pairs again in order to match the adjectives to the words about an island. (5 minutes).

➢ The students will read a short passage about Bora Bora island and answer true/false questions about the text with their partners through discussing about the text (10 minutes).

➢ The students will draw the picture of the Bora Bora island about which they will have read and that is a contest, the winner will be chosen (10 minutes).

➢ Ten-minute break

➢ The students will listen to a TV program about islands and before they start to listen, the students will read the numbers and listen carefully what these numbers stand for. After listening to the track once, the students will start to answer the questions, which will be followed by a second listening to answer the question of which island each sentence refers to (15 minutes).

➢ The students will look at the text again and underline the sentences formed by using comparisons. The teacher will ask questions to the students so that they will have the chance to activate their schemata. Then, the teacher will remind the rules regarding comparatives and superlatives to the students by going over the sentences made by comparatives and superlatives (15 minutes).

Appendix 11. Field Note

13.11.2014

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FIELD NOTE

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I observed the lesson consisting of two class hours and they had the following features which are associated with brain-compatible teaching/learning.

The Learning Environment

The lesson took place in a classroom environment which was content rich, pleasant, colourful, and welcoming students to motivate them for the topic they would be studying.

Meaningful Learning

The researcher immersed students in complex, interactive experiences that were both rich and real. Students worked on problem solving activities in pairs and the teacher gave feedback about their progress. The materials used were utilizing real world examples which encouraged students to be intrinsically motivated. Students were observed to be generating new thoughts on an individual basis.

Mind and Body: Worked Together

While working in groups, the students were instructed to compare their products with the other groups. This allowed the students to move around the class which positively affected the learning since movement increased neural stimulation within the brain and thus increases the synaptic nerve interconnections, resulting in the capacity to learn to grow.

Differentiated Activities

The researcher used different teaching methods and materials through music, visual aids, and manipulatives. She also considered the different learning styles of students and was able to apply brain-compatible strategies that worked best for all students.

CURRICULUM VITAE

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EDUCATION

Hacettepe University, Ankara, Turkey

B.A. English Language and Literature, June 2004

Anadolu University, Eskişehir, Turkey

B.A. Public Administration, June 2010

Çukurova University, Adana, Turkey

M.A. English Language Teaching, July 2011

Thesis: Improving Adult EFL Learner's Speaking Skills Through Strategies-Based Instruction

Advisor: Hasan Bedir, Ph. D. (Çukurova University)

Çukurova University, Adana, Turkey

Ph.D English Language Teaching, 2012 -2016

AWARDS

Feke / Adana Governorship, certificate of high achievement

Ministry of National Education, award by salary payment

Ministry of National Education, certificate of appreciation

SCHOLARSHIP

Çukurova University Research Fund, financial support for Gülten Gençoğlu's M.A. thesis, 2010.

WORK EXPERIENCE

English Instructor, Language Center, Social Sciences University of Ankara, Turkey, 2013 - present

English Instructor, School of Foreign Languages, Sütçü İmam University, Kahramanmaraş, Turkey, 23 February 2009 – 2013

English Teacher, Karacaoğlan Primary Shool, Adana, Turkey, 1 September 2005 – 15 February 2009

ADMINISTRATIVE DUTIES

Vice-Principal, Karacaoğlan Primary School, Turkey, January 2007- August 2008

PUBLICATIONS

Bedir, H., & Koşar, G. (2014). Strategies-based instruction: A means of improving adult EFL learners' speaking skills. *International Journal of Language Academy. 4, 12-26.*

Çubukçu, H., Doğan, F. Ş., & Koşar, G. (2014). Are we consuming goods or cultural values through commercials? A study on television advertisements on communication service providers*. Galatasaray Üniversitesi İletişim Fakültesi, 20,* 117-139*.*

Gençoğlu, G., & Akbana, Y. E. (2011). Language Learning and Teaching: Second language acquisition of English reflexive pronouns by Turkish university students.

Koşar, G. (2014). A comparison of multiple and single exemplar in verb learning and extension. *Journal of Child Language Acquisition and Development, 2(4),* 16-24.

Koşar, G., & Bedir, H. (2015). Raising cultural awareness of Turkish university students attending EFL preparatory classe*s. International Journal of Language Academy,7,* 37-43*.*

COFERENCE PRESENTATIONS

Gençoğlu, G. Speaking and Language Learning Strategies. 8th METU International Postgraduate Conference. METU, Ankara, Turkey. 24-25 November 2011.

Gençoğlu, G. The Impact of Social-Affective Strategies on Speaking. 15th International Inged ELT Conference. Hacettepe University, Ankara, Turkey. 20-22 October 2011.

Gençoğlu, G. Developing Materials within the Framework of ESP as a Supporter of Increased Motivation among University Prep-Class Students. International English Teaching Conference. Aydın University, İstanbul, Turkey. 24-26 November 2010.

Gençoğlu, G. Second Language Acquisition of English Reflexive and Referring Pronouns by Turkish University Prep-Class Students. Literature, Languages and Linguistics. Athens, Greece. 12-15 June 2010.

Gençoğlu, G. Raising Cultural Awareness of Turkish University Students Attending EFL Preparatory Classes. Foreign/Second Language Acquisition. Poland. 27 April - 5 May 2010.

Gençoğlu, G. The Relationship between Metacognitive Strategies and Autonomy in Adult EFL Classes. Zirve University, Gaziantep, Turkey. 1-3 June 2010.

DUTIES UNDERTAKEN in CONFERENCE ORGANIZING COMMITTEES

Organizing Committee Member of Çukurova International ELT Teachers Conference, 28-29 April, 2016.

Organizing Committee Member of Çukurova International ELT Teachers Conference, 21-22 May, 2015.

The Fourth International ELT Students Conference, Adana, Turkey 6-8 May, 2013.

CONFERENCES and SEMINARS ATTENDED WITHOUT PRESENTATION

Marco Polo Effect ELT Conference, Antalya, Turkey, May 2012.

2nd International ELT Conference. Sabancı University, İstanbul, Turkey. 2-4 June 2011.

Linguistics Congress, Çukurova University, Adana, Turkey. 5-7 May 2011.

2nd ELT Symposium, Çankaya University Ankara, Turkey. 16 April 2011.

First Local Training Program, Sütçü İmam University, Kahramanmaraş, Turkey. 1 April 2010.

Intercultural Education. Germany. 22-27 May 2008.

E-Twining. Italy. 14-18 April 2008