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# DOES AWARENESS ON THE PRINCIPLES OF BRAIN-BASED LEARNING HAVE ANY EFFECT ON STUDENTS' ACADEMIC ACHIEVEMENT?

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## Abstract

When the planning, presentation and gains of the lesson are in compliance with the working principles of the brain, positive contributions can be made to students' motivation, attitudes, and academic achievement. This quasi-experimental study aims to figure out whether training students on brain-based learning to provide an awareness on brain facts might help them to consider their current study skills, and adapt and adopt brain compatible ways to study more effectively. Therefore, a quasi-experimental study was conducted with two groups of students with similar first-term averages. Two groups with similar first-term averages were identified. To see whether training learners on brain-based learning improves foreign language achievement or not, grades gained in achievement exam which is administered at the beginning of the term and first term averages are compared. The experimental group was informed about how brain works and the principles of brain-based learning. The instructor of the experimental group was also informed about the subject in detail. Also, they were asked to evaluate their first-term learning and study performance. Then, language learning strategies survey was conducted to find out whether students are aware of the strategies they can benefit from for a more effective learning process. The aim of the study is to help students benefit from the insights on brain as they recognize how they can immerse themselves into the content deeply. Thus, they can process the learning according to their understanding and construct meaning. Students who gain awareness of their learning styles feel both cognitively and affectively relaxed. The related literature also indicates that brain-based learning approach is more effective in increasing student achievement than the traditional approach.

***Keywords:*** brain-based learning; brain functions; brain exercise



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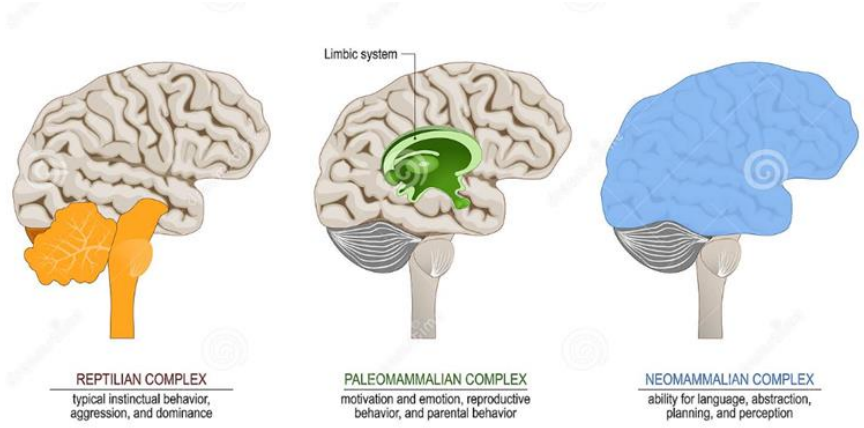
## 1. Introduction

When the planning, presentation and gains of the lesson are in compliance with the working principles of the brain, positive contributions can be made to students' motivation, attitudes, and academic achievement (Godwin, 2000; Jensen, 2008; Kotulak, 1997; Sousa, 2006; Wolfe, 2002; Zadina, 2004; Zull, 2002). As Duman (2010) suggested, brain-based learning might help students to recognize features of their brain and their learning styles. Students benefit from the insights on brain as they recognize how they can immerse themselves into the content deeply. Thus, they can process the learning according to their understanding and construct meaning. Students who gain awareness of their learning styles feel both cognitively and affectively relaxed. This relaxation and awareness improve students' self-concept (Bandura, 1997) and increases their motivation. The related literature indicates that brain-based learning approach is more effective in increasing student achievement than the traditional approach (Bowman, 2003; Brodnax, 2004; Caine and Caine, 1994; Caine, 2000; Caulfield, Kidd & Kocher 2000; Cengelci, 2005; Erlauer, 2003; Getz, 2003; Jeffrey, 2004). Thus, this quasi-experimental study aims to figure out whether student awareness on brain facts might help them to consider their current study skills, and adapt and adopt brain compatible ways to study more effectively.

The human brain with its 3-pound-weight and 100 billion nerve cells is a highly complex organ. The most popular theory scientists use to describe the brain's overarching structural organization is the triune theory (MacLean, 1990; Caine & Caine, 1991; Medina, 2008) which suggests that the structure of the brain took millions of years to evolve to its present form. The most ancient neural structure is the brain stem: the reptilian (R-Complex) or lizard brain. The brain stem or basal ganglia controls most of the body's housekeeping: its neurons regulate breathing, heat rate, sleeping, and walking.

Figure 1. Triune theory of the brain




The limbic system or paleomammalian (P-Complex) brain which consists of the septum, amygdala, hippocampus, and thalamus is at the top of the brain stem. The limbic system is responsible for animal

survival, and most of its functions revolve around fighting, feeding, fleeing, and reproductive behavior. The amygdala is responsible for both the creation of emotions (rage, fear, or pleasure) and for the memories they generate. The hippocampus converts short-term memories into long-term memories. The thalamus processes input from nearly every sensor and then routes this to specific areas throughout the brain. The outer portion of the brain consists of the neomammalian (NComplex) brain: known as the neocortex, or simply cortex. This structure is found uniquely in mammals and makes language (including speech and writing) possible. Much of the processing of sensory data occurs in the cortex. The cortex makes formal thinking and planning for the future possible (Fuster, 2003; Freiberg, 2008).

Many of the new inputs are held in the frontal lobe for short-term memory of 5 to 20 seconds. Most of these inputs are filtered, and then dismissed without being memorized, as the inputs may be irrelevant, trivial, or not compelling enough to be considered. If the inputs are considered relevant, the inputs are routed to and held in the hippocampus (Jensen, 2008). Along with the cognitive science, educators and psychologists (Armstrong, 2009; Caine et al., 2009; Goleman, 1994; Jensen, 1995, Sousa, 2006) have applied the results of neurological research on the methodologies of education for a more effective teaching and learning; brain-based learning. It is defined as "learning in accordance with the way this complex organ is naturally designed to learn" (Jensen, 1995).

Experiences physically change the brain through internal and external stimuli (Roberts, 2002). According to Zull (2002), change is learning. Learning is a process, and it occurs through experiences. Without knowing the working system of the brain, it is not possible to understand the nature of learning. According to Zull (2002), the art of teaching must be the art of changing the brain. Kolb's learning cycle model accounts for students' gaining internal in¬sights about their own learning preferences. Through experiences and physical activities, students can strengthen the synaptic links between neurons. The related research put forward certain facts about what happens in the human brain during classroom learning process:

1. The inputs (words, text, and pictures) to the brain of the students during classes are captured by their senses or generated internally by them.
2. These inputs are initially processed in the thalamus, which is the "server" or central switching area of the brain.
3.Simultaneously, these inputs are routed to other specific areas for processing (this routing is done instantly because the input may signal an emergency that requires instant action by the student): visual inputs are routed to the occipital lobe, language to the temporal lobe, and so on.
4. Based on these instantaneous inputs, the brain immediately forms a rough sensory impression of the incoming information.
5. If there is any threatening information, the amygdala is activated, and it will jump-start the rest of the sympathetic nervous system to enable a quick response (Jensen, 2008).

Below is the list of principles of brain-based learning (Caine and Caine, 1994):

1. The brain is a parallel processor: The brain performs many tasks simultaneously, including thinking and feeling.
2. Learning engages the entire physiology: The brain and the body are engaged in learning. In the body brain partnership, each sends messages to the other which alters the messages that are sent back. The brain does not function separately from the body. In the classroom, it is important to have stress and threat free atmosphere in teacher-student and student-student relationships.
3. The search for meaning is innate: "The brain's/mind's search for meaning is very personal. The greater the extent to which what we learn is tied to personal, meaningful experiences, the greater and deeper our learning will be" (Caine and Caine 1994, 96).
4. The search for meaning occurs through patterning: "The brain is designed to perceive and generate patterns, and it resists having meaningless patterns imposed on it" (Caine and Caine 1994, 88).
5. Emotions are critical to patterning: Emotions drive attention, attention drives learning, memory and problem-solving (Hart, 2002). Making instruction engaging for the learner is a learning imperative since students will not pay attention due to boring circumstances as a result of a normal body brain partnership.
6. The brain processes parts and wholes simultaneously: The left and the right hemispheres have different functions, but they are designed to work together.
7. Learning involves both focused attention and peripheral perception: People hold general perceptions of the environment and pay selective attention to various parts of it.
8. Learning always involves conscious and unconscious processes: As Jensen (2000) put forward, ninety-nine percent of our learning is non-conscious; we are merely sponges, as we soak up visual cues, sounds, experiences, aromas, and feelings. In fact, simply absorbing an experience is valuable to our learning process as our brain expands its perceptual maps (Jensen, 2000).
9. We have at least two different types of memory: spatial (autobiographical) and rote learning (taxon memory). The taxon or rote memory systems consist of "facts and skills that are stored by practice and rehearsal" (Caine and Caine 1994, 169). Spatial, or autobiographical, memory "builds relationships among facts, events, and experiences" (Caine and Caine, 1994, 170).
10. Learning is developmental: When presenting the actual content (learning standard) of the lesson, make connections with the new information and other information familiar to them.
11. Learning is enhanced by challenge and inhibited by threat: Students optimally benefit when their assignments are challenging and the classroom environment feels safe and supportive.
12. Each brain is uniquely organized: Each student has his or her own unique set of brain strengths and weaknesses.

The related literature indicates that brain-based learning approach is more effective in increasing student achievement than the traditional approach (Bowman, 2003; Brodnax, 2004; Caine and Caine, 1994; Caine, 2000; Caulfield, Kidd & Kocher 2000; Cengelci, 2005; Erlauer,

2003; Getz, 2003; Jeffrey, 2004). When curriculum is designed in compli¬ance with the working principles of the brain, positive contributions can be made to students' motivation, attitudes, and academic achievement (Godwin, 2000; Jensen, 2008; Kotulak, 1997; Sousa, 2006; Wolfe, 2002; Zadina, 2004; Zull, 2002). Teachers might have a deep understanding of the issues which might have great influence on language learning by learning about the way the brain is naturally designed to learn and certain facts about what happens in the human brain during classroom learning process. Moreover, training students on brain facts might make them their current study skills, and help them to adapt and adopt brain compatible study skills for better academic success.

## 2. Method

### 2.1. Research design

Thus, this study aims to figure out whether the students at Zonguldak Bülent Ecevit University Foreign Languages College are aware of how brain works and how they can improve their study skills. Therefore, a quasi-experimental study was conducted with two groups of students with similar first-term averages. The study addresses the following research questions:

1. Are the students aware of the language learning strategies?
2. Does training students on brain-based learning have an effect on foreign language achievement?
3. Did students find the training useful?

### 2.2. Participants

Two groups with similar first-term averages were identified; D4, being experimental group and D8 control group. To see whether training learners on brain-based learning improves foreign language achievement or not, grades gained in achievement exam which is administered at the beginning of the term and first term averages are compared in Table 4. As seen in the table below, there is a significant difference between the overall averages of the first term grades of beginner/ elementary level control and experimental groups.

Table 1. The Average Grades of the Randomly Chosen Classes at the end of 1st Term

| | QUIZ 1 | QUIZ 2 | STUDENT PORTFOLIO | MIDTERM 1 | MIDTERM 2 |
|---|---|---|---|---|---|
| PREP 4 | 62.79 | 51.04 | 73.93 | 46.77 | 35.72 |
| 8 PREP | 65.9 | 52.36 | 83.63 | 49.57 | 44.14 |

### 2.3. Data collection tools

The experimental group was informed about how brain works and the principles of brain-based learning. The instructor of the experimental group was also informed about the

subject in detail. They were also asked to evaluate their first-term learning and study performance. Language learning strategies survey (Oxford, 1990) was conducted to find out whether students are aware of the strategies they can benefit from for a more effective learning process.

## 2.4. Procedure

The experimental group was trained on language learning strategies. They were specifically trained on vocabulary study strategies, and vocabulary notebooks were given to make them study vocabulary regularly. They were informed about techniques to help their brain learn better: chunking, acronyms/ acrostic, using mnemonics, key words and mind maps. The instructor checked the notebooks every week giving them feedback on their study. They were also encouraged to write about and share their feelings in the vocabulary notebooks. They were also informed about five things to do for their physical and mental health: exercise regularly a few times a week, get enough sleep, allow themselves to unplug from social media and the Internet, put the tough stuff first and avoid cramming.

As the related research indicates, hippocampus, the part of the brain involved in memory forming, has limits on how much information it can hold. Thus, students subjected to continuous lecture for more than 15-minute chunks may not be processing the information effectively. things that are presented at the beginning of a lesson are the most memorable, followed by the things that are presented at the end, and lastly by the things that are presented in the middle (Jensen, 2000). Therefore, the instructor divided the lessons into episodes of 15 minutes to adapt the instruction to the principles of brain-based learning. At the beginning of every lesson, the previously learned subject was reviewed via mini quizzes and brain compatible activities. The instructor, a middle-aged female, had a positive mood herself, and as an experienced teacher (20 years), she established a sense of relatedness among students creating a social family within her classroom which provided the necessary positive environment for learning. As Tarhan (2009) suggested, female middle-aged teachers who have taught for more than ten years are advantageous in effective teaching. Their experience provides them with insights in profession as they feel how to adapt their instruction to brain compatible way.

## 2.5. Data analysis

At the end of the term, the grades were compared and students were asked to reflect on their experience after the presentations and the training to find out whether training students on brain-based learning have an effect on foreign language achievement or not.

## 3. Results

This study aimed to find out whether the students are aware of the language learning strategies they can benefit in their language learning process and whether awareness on the brain facts might assist them during their study. The study addresses three research questions:

*Are the students aware of the language learning strategies?*

The experimental group was asked to indicate the frequency of their employment of the strategies given. Students were given Oxford's SILL (1990) questionnaire with fifty strategies and asked to rank their employment of these strategies on a 5-point Likert scale that went from „never or almost never' to „always or almost always'. The results of this section were analyzed according to Oxford's (1990) key to averages. Table 2 below shows the meaning of each score.

Table 2 Key to SILL Averages (Oxford, 1990)

| Frequency | Description | Score |
|---|---|---|
| High | Always or almost always used | 4.5 to 5.0 |
| | Generally used | 3.5 to 4.4 |
| Medium | Sometimes used | 2.5 to 3.4 |
| | Generally not used | 1.5 to 2.4 |
| Low | Never or almost never used | 1.0 to 1.4 |

The results described in Table 2 show that the experimental group sometimes use strategies to remember more effectively (part A). They "*think of relationships between what they already know and new things they learn in English" and "*use new English words in a sentence so they can remember them". They reported that they sometimes use their mental processes (part B) such as "say or write new English words several times.*"* or "watch English language TV shows spoken in English or go to movies spoken in English.". They reported that they sometimes organize and evaluate their learning (part D) by "paying attention when someone is speaking English." or "trying to find out how to be a better learner of English." and "planning their schedule so they will have enough time to study English." The results suggest that the students in experimental group are aware of the language learning strategies that may help them take control over their learning process leading to better language proficiency. However, the fact that they sometimes use language learning strategies and few of them indicates that they have weak control over their learning process. They are aware of the strategies that may provide them necessary help in their language learning process; however, they fail to use them effectively.

*Table 3. The Result of the Strategy Survey of Experimental Group*

| Part | Experimental Group Strategy (Direct Strategies) | X | SD |
|---|---|---|---|
| Part A Cognitive Strategies | 1. I think of relationships between what I already know and new things I learn in English. | 3,10 | ,912 |
| | 2. I use new English words in a sentence so I can remember them. | 2,90 | ,912 |
| | 3. I connect the sound of a new English word and an image or picture of the word to help remember the word. | 3,20 | 1,473 |
| | 4. I remember a new English word by making a mental picture of a situation in which the word might be used. | 3,25 | 1,482 |
| | 5. I use rhymes to remember new English words. | 3,05 | 1,395 |
| | 6. I use flashcards to remember new English words. | 2,50 | 1,147 |
| | 7. I physically act out new English words. | 2,45 | 1,317 |
| | 8. I review English lessons often. | 3,25 | 1,070 |
| | 9. I remember new English words or phrases by remembering their location on the page, on the board, or on a street sign. | 3,30 | 1,302 |
| Part B Memory Strategies | 10. I say or write new English words several times. | 3,75 | ,851 |
| | 11. I try to talk like native English speakers. | 3,15 | 1,182 |
| | 12. I practice the sounds of English. | 2,70 | 1,380 |
| | 13. I use the English words I know in different ways. | 2,70 | 1,174 |
| | 14. I start conversations in English. | 2,50 | 1,912 |
| | 15. I watch English language TV shows spoken in English or go to movies spoken in English. | 4,10 | ,912 |
| | 16. I read for pleasure in English. | 3,80 | 1,056 |
| | 17. I write notes, messages, letters, or reports in English. | 2,70 | 1,031 |
| | 18. I first skim an English passage (read over the passage quickly) then go back and read carefully. | 3,65 | 1,309 |
| | 19. I look for words in my own language that are similar to new words in English. | 3,30 | 1,380 |
| | 20. I try to find patterns in English. | 3,05 | 1,395 |
| | 21. I find the meaning of an English word by dividing it into parts that I understand. | 1,75 | 1,070 |
| | 22. I try not to translate word-for-word. | 3,10 | 1,021 |
| | 23. I make summaries of information that I hear or read in English. | 1,85 | 1,040 |
| Part C Compensation Strategies | 24. To understand unfamiliar English words, I make guesses. | 3,40 | 1,142 |
| | 25. When I can' t think of a word during a conversation in English, I use gestures. | 3,40 | 1,188 |
| | 26. I make up new words if I do not know the right ones in English. | 2,80 | 1,240 |
| | 27. I read English without looking up every new word. | 2,75 | 1,333 |
| | 28. I try to guess what the other person will say next in English. | 2,85 | 1,461 |
| | 29. If I can' t think of an English word, I use a word or phrase that means the same thing. | 3,50 | 1,504 |

*Table 4. The Result of the Strategy Survey of Experimental Group (Continued)*

| Part | Experimental Group Strategy (Indirect Strategies) | X | SD |
|---|---|---|---|
| Part D Metacognitive Strategies | 30. I try to find as many ways as I can to use my English. | 3,35 | 1,226 |
| | 31. I notice my English mistakes and use that information to help me do better. | 3,50 | 1,051 |
| | 32. I pay attention when someone is speaking English. | 4,35 | ,988 |
| | 33. I try to find out how to be a better learner of English. | 4,55 | ,686 |
| | 34. I plan my schedule so I will have enough time to study English. | 3,05 | ,887 |
| | 35. I look for people I can talk to in English. | 4,00 | 1,170 |
| | 36. I look for opportunities to read as much as possible in English. | 3,55 | 1,099 |
| | 37. I have clear goals for improving my English skills. | 3,90 | 1,119 |
| | 38. I think about my progress in learning English. | 3,35 | 1,309 |
| Part E Affective Strategies | 39. I try to relax whenever I feel afraid of using English. | 3,60 | 1,231 |
| | 40. I encourage myself to speak English even when I am afraid of making a mistake. | 2,50 | 1,235 |
| | 4l. I give myself a reward or treat when I do well in English. | 3,10 | 1,553 |
| | 42. I notice if I am tense or nervous when I am studying or using English. | 4,05 | 1,276 |
| | 43. I write down my feelings in a language learning diary. | 1,95 | 1,177 |
| | 44. I talk to someone else about how I feel when I am learning English. | 3,40 | 1,569 |
| Part F Social Strategies | 45. If I do not understand something in English, I ask the other person to slow down or say it again. | 4,05 | 1,191 |
| | 46. I ask English speakers to correct me when I talk. | 3,90 | 1,294 |
| | 47. I practice English with other students. | 2,25 | 1,070 |
| | 48. I ask for help from English speakers. | 3,95 | 1,099 |
| | 49. I ask questions in English. | 2,90 | 1,410 |
| | 50. I try to learn about the culture of English speakers. | 3,15 | 1,424 |

*Does training students on brain-based learning have an effect on foreign language achievement?*

To see whether training learners on brain-based learning improves foreign language achievement or not, midterm averages are compared in Table 4. Midterms 1 and 2 are conducted in the first term before the training, and midterms 3 and 4 are conducted in the second term during the study.

*Table 5. The averages of Midterms 1-2 (Taken in the 1st term) and Midterms 3-4 (Taken in the 2nd term)*

| | MIDTERM 1-2 | MIDTERM 3-4 |
|---|---|---|
| PREP 4 | 45.13 | 50.23 |
| PREP 8 | 46.86 | 55.50 |

The study did not find a significant difference between the average grades of control and experimental groups.

*Did students find the training useful?*

Students were asked to reflect on the experience they have gone through. In their written statements, they indicated being really inspired by learning how brain works which motivated to study. Almost all of them wrote that the way they used to study was totally different from what they have learned in the presentations, so they would try to change their study habits. They especially liked

vocabulary study techniques since they reported that learning vocabulary is a challenging process for them. The original pieces of student writings are as follows:

1.Hafıza teknikleri ve Beynimizi tanıma sunumu gerçekten başarılı, amacına uygun ve açık bir şekilde başarılı geçmiştir. Çok etkilendiğimi söyleyebilirim.

**(The presentation of memory techniques and getting to know our brain was really successful, relevant and clearly successful. I can say that I am very impressed.)**

2. Yapılan sunumun çok verimli olduğunu düşünüyorum çünkü biz öğrenciler için hem bakış açısı kazandırdı hem de nasıl bir çalışma yolu izlemeliyim konusunda faydalı bir sunum oldu teşekkürler.

**(I think the presentation was very productive because it gave us a perspective for students and it was a useful presentation on how to study, thank you.)**

3.Çok verimli bir sunumdu bu tarz sunumların olmasını isterim motivasyonumu arttırdı. Çok teşekkür ederim bu sunum için.

**(It was a very productive presentation, I would like to have such presentations, it increased my motivation. Thank you very much for this presentation.)**

4.Çarşamba günü olan sunum beni gerçekten çok etkiledi. Ben ders çalışma konusunda eksikmişim yöntemi bilmemekle beraber ne yaparsam anlarım, aklımda nasıl kalır hiç düşünmemişim ve sürekli bir şeylere çalışıp neden anlamıyorum diye kendimi paraladım:) şu an, sizin sayenizde çalışma tekniğimi değiştirdim, deniyorum. Böyle bir sunum günü düzenlediğiniz için teşekkür ederim.

**(The presentation on the 4th Wednesday really impressed me. I was lacking in studying, although I don't know the method, I understand what I do, I never thought about how I would stay in my mind, and I was constantly trying to do something and I was torn about why I didn't understand :) now, thanks to you, I changed my study technique, I'm trying. Thank you for organizing such a presentation day).**

## 4.Discussion

Several studies show a direct connection between the biology of the human brain and teaching and learning (Madrazo & Motz, 2005). The knowledge about brain function and its effects on learning have the potential to revolutionize teaching and learning. This requires instructors to understand how the brain works and how to design instruction with that information in mind (Stevens & Goldberg, 2001). To be able to do so, it is essential that teachers have the knowledge about the basics of brain based learning and what do they feel about it. The related research indicates that taking the scientifically proven brain facts into consideration while preparing curriculum leads to higher student achievement (Bowman, 2003; Brodnax, 2004; Caine and Caine, 1994; Caine, 2000; Caulfield, Kidd & Kocher 2000; Cengelci, 2005; Erlauer, 2003; Getz, 2003; Jeffrey, 2004).

Koşar (2018) reported that the participants in her study viewed brain-compatible learning as a means of improving their proficiency in English. Participants' responses to the questions in

the interview show that brain-compatible lessons may be able to set a learning environment conducive for enhancing student learning.

Although the related research suggests that training students on brain facts to deepen their understanding on how our brain is naturally designed to learn fosters their academic success, the findings of this study does not indicate a significant difference between their first and second term averages. The fact that each class had three instructors, and only one of them was trained on brain-based learning might be one of the reasons for the issue. However, students reported that learning about brain compatible techniques to study have provided them with an opportunity to evaluate the effectiveness of their current study skills and make changes. Moreover, being informed on cognitive and metacognitive strategies that could assist them in their learning process showed them effective ways to study.

## 5.Conclusions

Surprisingly, this study indicates that training students on brain-based learning to provide an awareness on how the brain naturally learns did not lead to better foreign language proficiency, particularly in lower levels. The fact that curriculum was not designed accordingly might be the main factor behind this result. Moreover, together with the instructor/ researcher, two other instructors gave lessons in the same class. Thus, only 1/3 of the instruction was in accordance with brain-based learning.

However, the students reported that they benefitted from the training, they evaluated the way they study in terms of brain compatible techniques and changed their study habits. A further study could include curriculum and classroom instruction based on the principles of brain-based learning.

As several studies show a direct connection between the biology of the human brain and teaching and learning (Madrazo & Motz, 2005), instructors need to understand how the brain works and how to design instruction with that information in mind (Stevens & Goldberg, 2001). The following classroom imlications are proven to be effective in providing fostering classroom learning environment and higher academic success:

1. Things that are presented at the beginning of a lesson are the most memorable, followed by the things that are presented at the end, and lastly by the things that are presented in the middle (Jensen, 2000).
2. Our brain needs time to go in and link up the present with the past and the future and without this time, learning drops dramatically. Teachers must pay attention to students and not assume that a student is goofing off, particularly when a good student is not paying attention, it could be that something has triggered their memory or shifted their focus inward (Jensen, 2000).
3. The use of novelty can have a great impact on getting the students attention. "Any stimuli introduced into our immediate environment, which is either new (novel) or of sufficiently strong emotional intensity (high contrast), will immediately gain our attention" (Jensen, 2000, p. 122).
4. "Constant focused learning is increasingly inefficient. In fact, the whole notion of 'time on task' is in conflict both biologically and educationally with the way the brain naturally learns" (Jensen, 2000, p. 48).

*5.* "Emotion drives attention and attention drives learning" (Wolfe, 2001, p. 86). "The brain is biologically programmed to attend first to information that has strong emotional content" (Wolfe, 2001, p. 88). We are actually programmed to remember this information longer. The brain, mind, body and emotions form a connected system.
*6.* We often prepare our brains to pay attention to certain stimuli over others, such as looking for a friend in a crowd of people or, when directed by the teacher, to see a shape of a certain color among a large number of differed colored shapes. This is why we tell our students our learning objectives. "It allows the brain to anticipate the critical features or ideas and increase the likelihood that the brain will focus on the essential information" (Wolfe, 2001, p. 34).
7. We need to teach content within a context that is meaningful to students, and that connects to their own lives and experiences. This is teaching to both halves of the brain. If we don't connect the curriculum to the learner's experience, much of the information gets lost, and we waste time having students engage in meaningless memorization rituals" (Wolfe, 2001, p. 48).
8. "Visuals are an important key to remembering content. Make lectures or presentations more compelling to the brain with objects, photographs, graphics, charts, graphs, slides, video segments, bulletin board displays, and color" (Jensen, 2000, p. 59). "With direct instruction only, audience recall drops quickly, but with the addition of peripherals, effortless, subject-specific, longer-lasting recall is generated" (Jensen, 2000, p. 60).
9. Learning depends on categorization and memory and memory depends on categorization. Knowing facts may supply answers when we take tests, but it is pattern detection that aids learners in becoming thinking adults (Jensen, 2000).

## " Declaration of Conflicting Interests and Ethics

"The authors declare no conflict of interest."

## References

Bowman, J. B. (2003). Satisfaction with and preference for on-line learning: an investigation of the impact of social and emotional learning strategies. Doctoral dissertation, Pennsylvania State University, Pennsylvania.

Brodnax, R. M. (2004). Brain compatible teaching for learning. Doctoral dissertation, Indiana University, Indiana.

Caine, R. & Caine, G. (1994). Making connections: Teaching and the Human Brain. Rev. ed. Menlo Park, California: Addison-Wesley

Caine, R. N. (2000). Building the bridge from research to classroom. Educational Leadership, 58(3), 59- 65.

Caulfield, J., Kidd, S., & Kocher, T. (2000). Brain-based instruction in action. Educational Leadership, 58 (3), 62-65.

Cengelci, T. (2005). The effects of brain-based learning to success and retention in social studies. Anadolu University, Institution of Educational Sciences, Eskisehir.

Damasio, A. (2000). The Feeling of What Happens: Body and Emotion in the Making of consciousness. Mariner, London.

Duman, B. (2010). The Effects of Brain-Based Learning on the Academic Achievement of Students with Different Learning Styles. Educational Sciences: Theory & Practice 10 (4),Autumn 2010, 2077-2103.

Erlauer, L. (2003). The brain-compatible classroom: Using what we know about learning to improve teaching. Alexandria, VA: ASCD.

Genesee, F. (2000). Brain Research; Implications for Second Language Learning. EDO-FL-00-12 December 2000.

Getz, C. M. (2003). Application of brain-based learning theory for community college developmental English students: A case study. Doctoral dissertation, Colorado State University.

Gibb, B. J. (2007). The Rough Guide to the Brain. 2007. Rough Guides Ltd; New York.

Godwin, M. (2000). Who are you? 101 ways of seeing yourself. New York: Penguin Books.

Goleman, D. (1994). Emotional Intelligence: Why It Can Matter More Than IQ. New York:

Gülpınar, M. A. (2005). Beyin/zihin temelli öğrenme ilkeleri ve eğitimde yapılandırmacı modeler. Kuram ve Uygulamada Eğitim Bilimleri, 5, 271-306.

Hart, L. (2002). Human Brain & Human Learning.2002; New York, Longman.

Jeffrey, J. M. (2004). Brain-based learning and ındustrial technology education practice: Implications for consideration. Doctoral dissertation, Central Michigan University.

Jensen, E. (2001). Fragile brains- Damage to the brain and environmental influences can account for certain learning problems. Educational leadership 59 (3): 32.

Jensen, E. (2005). Teaching with the Brain in Mind. 2nd ed. Alexandria, Va.: Association for Supervision and Curriculum Development.

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. New Jersey: Prentice-Hall.

Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing learning in higher education. Academy of Management Learning and Education, 4 (2), 193-212.

Kotulak, D. (1997). Recognition memory, circadian rhythms, and sleep. Perceptual Motor Skills, 85 (1), 99-104.

Krashen, S.D. (1994), The input hypothesis and its rivals, Implicit and Explicit Learning of Languages, Academic Press, London: Ellis

LeDoux, J. (1996). The Emotional Brain: The Mysterious Underpinnings of Emotional Life. New York: Touchstone.

Montanaro, S. (2001). Language Acquisition. NAMTA Journal, 26 (2), 1-7.

Schiller, P. (1999). Start smart: Building brain power in the early years. Beltsville, MD. Gryphon House.

Schiller, P. & Willis, C, A. (2008). Using Brain-Based Teaching Strategies to Create Supportive Early Childhood Environments That Address Learning Standards, Young Children on the Web, 2008.

Slegers, B. (1997). Brain development and its relationship to early childhood education. Presented at EDEL seminar in elementary education, Long Beach, CA, April 17, 1997.

Shonkoff, J.P., & Phillips, D. A. eds., (2000). From neurons to neighborhoods: The science of early childhood development. Report of the National Research Council and Institute of Medicine. Washington, DC: National Academies Press.

Sousa, D. (2006). How the brain learns. Thousand Oaks, CA: Corwin.

Sylwester, R. (1994) How Emotions Affect Learning; Educational Leadership, October, 52/2; 60-65.

Tileston, D. (2005). 10 best teaching practices: How brain research, learning styles and standards define teaching competencies (2th ed). Thousand Oaks, California: Corwin Press.

Wasserman, L, H. (2007). The Correlation Between Brain Development, Language Acquisition, and Cognition, Early Childhood Education Journal, Vol.34, No.6, June 2007.

Wolfe, P. (2002). Brain matters: Translating research into classroom practice. Alexandria, Virginia: Association for Supervision and Curriculum Development.

Zadina, J. N. (2004). Brain research-based effectives strategies to enhance learning and energize instruction. English Language Acquisition Summit Conference. U.S.A.

Zull, J. E. (2002). The art of changing the brain: Enriching teaching by exploring the biology of learning. Sterling, VA: Stylus.

http://www.ninds.nih.gov/disorders/brain_basics/know_your_brain.htm

http://www.innerbody.com/image/nerv02.html

http://science.howstuffworks.com/life/inside-the-mind/human-brain/brain.htm

http://science.nationalgeographic.com/science/health-and-human-body/human-body/brain-article/

http://www.livescience.com/29365-human-brain.html