

Original Article

Effectiveness of Brain-based learning training in Psychopathology: Cognitive and Emotional Outcomes of Learning in Student Tutors

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Abstract

The present study aimed to determine the effectiveness of brain-based learning training in the cognitive and emotional outcomes of learning in student tutors. This research was conducted with a quasi-experimental design with pre-test-post-test and a control group. Using cluster sampling, two classes were selected from the student tutor population of Ardabil male training centers in the academic year of 2021-2022. One of the classes was considered as the experimental group and the other class as the control group. Brain-based learning package was implemented for the experimental group during 10 sessions of 60 minutes, and the control group received no intervention. In the two stages of pre-test and post-test, the dependent variables were measured using Pekran's academic excitement questionnaire, Harter's academic motivation, Frederick's academic enthusiasm, cognitive ability test and researcher-made English language academic performance test. Data analysis using multivariate analysis of covariance showed that brain-based learning training had significant effects on academic emotions ($F = 147.08, p < 0.05$), academic motivation ($p < 0.05, F = 142.72$), academic enthusiasm ($F = 127.38, p < 0.05$), cognitive ability ($F = 177.31, p < 0.05$) and academic performance ($F = 10.54, p < 0.05$). Consequently, it can be concluded that brain-based learning improves the cognitive and emotional outputs of learners.

Keywords

Brain-based learning
Academic motivation
Academic excitement
Academic enthusiasm
Cognitive ability

Received: 2023/09/16

Accepted: 2024/07/15

Available Online: 2024/08/15

Introduction

The brain is the most important organ of the body, which has a significant role in human thinking. According to Edelman (2017), learning is one of the most important topics, which is highly associated with the human brain. On the other hand, Goswami (2008) has stated that despite the uniform structure of the brain, this phenomenon is the most prominent outcome of evolutionary processes that receives and collects external data.

Studies show that in the early years of life, the human brain creates about a thousand trillion synapses, accordingly, the nerve cells that are used are strengthened, and what strengthens synaptic connections are experiences that an individual acquires in interaction with their environment and due to these connections, quick and meaningful learning is realized (Schiller, 2010).

Considering what and how learning processes occur in

the brain as well as developing educational programs in accordance with the way the brain learns in students has been one of the most important concerns of neuropsychologists and specialists in the field of education, and in this regard, Hart (2002) has stated that regarding the functions of the brain and learning process has caused changes in educational goals in educational systems, accordingly, curricula have been modified.

Although the brain-based learning approach dates back to the end of the 20th century, in the 21st century, researchers have focused on close relationship between educational neuroscience and curriculum so that cognitive neuroscience is considered as an essential topic in the curricula (Tokuhama -Espinoza, 2011).

According to Geke (2005) and Goswami (2008), the study of learning is the starting point of connection between cognitive neuroscience and education, therefore, as an educational method, Abou-Elgheite (2012) states that brain-based learning reveals the connection between science of mind and education through designing natural

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processes so that the best learning in students could be achieved. According to the definition of [Edie and Schmid \(2007\)](#), brain-based learning is a type of learning in accordance to the natural functioning of the brain and is an approach in which the results of cognitive neuroscience are used in the field of education, besides natural functioning of the brain in learning process are used, as well.

In other words, brain-based learning is identifying the principles and rules of the brain in developing meaningful changes and organizing a type of learning based on these principles ([Vander Niet, 2014](#)). According to [Baldenspreger \(2014\)](#), the foundations of this type of learning is that the neural structures of the brain are organized for meaningful learning, therefore, in the educational and teaching processes, considering these brain processes is essential so that persistent modifications could be obtained in learners. In this regard, [Vander Bij and Geijsel \(2016\)](#) proposed that educational planning without considering brain and nervous processes is the same as ignoring the learners' capacities in designing curriculum. In addition, [Casey, Junc, and Hie \(2018\)](#) stated that designing educational experiences based on brain function is an approach in which the learner is of a central importance and in which the learner, himself/herself is engaged in shaping his/her knowledge in the educational setting. It is possible since learning consolidates when its procedures are adapted and planned based on the needs, abilities and interests of the learners.

According to [Bas \(2010\)](#), functions such as memory, emotion, intelligence and perception are among the elements that the brain focuses on in learning and educational processes. In this regard, [Lidiastuti et al. \(2019\)](#) have stated that the human brain stores information through neural messages as well as stable optical links between cells. In addition, [Lago and Seepho \(2012\)](#) suggested that in memory activities, the nerve activity level play an essential role in the formation of short and long-term memories.

On the other hand, regarding the role of emotion in learning processes [Jensen \(2010\)](#) proposed that emotions are one of the main features of educational and learning processes so that information becomes meaningless and not consolidated without emotions, therefore, in the course of learning, emotion is highly contributed. Moreover, regarding the role of intelligence in brain-based learning, [Susa \(2016\)](#) has stated that the factor of intelligence along with its components (fluid, crystallized and spatial-visual reasoning) is related to the ability to solve new problems and innovation, the application of acquired experiences, as well as the use of images and visual communication in solving problems. Finally, [Avola \(2011\)](#) has shown that learners' perceptions play a role in shaping learning consciously and unconsciously. Therefore, [Duman \(2011\)](#) has stated that in teaching-learning processes, it is essential to set the stage for learners to recall past emotional experiences, so, the multiple principles of brain-based learning are the basis for the involvement of the features such as memory,

emotion, intelligence and perception in the learning and curriculum planning processes, and the application of these principles result in positive outcomes in educational objectives.

In order to investigate the effectiveness of brain-based learning in the behavioral, emotional and motivational outputs of students, various studies have been conducted. Due to a study by [Lunde \(2014\)](#) a learning that is in accordance with the brain is effective in improving students' academic performance and motivation. On the other hand, [Bas \(2010\)](#) has showed that brain-based learning is effective in improving students' cognitive, emotional, and behavioral outputs. In this regard, findings of a study by [Nouri \(2011\)](#) has demonstrated that brain-based learning is a combination of relaxed awareness, coordinated immersion in complex experiences, and active processing of experiences that are able to influence students' motivational and emotional processes in learning procedure. Moreover, the study of [Mehdizadeh Moghadam Arani \(2011\)](#) has shown that brain-based learning has not been regarded in the Iranian education system and its basics are not very clear for those involved in education. On the other hand, the study of [Kajiura et al. \(2021\)](#) in the study of the effectiveness of teaching writing based on the brain-based learning method has shown that the brain-based learning method could improve the level of students' motivation in writing and resulted in the improvement of students' performance. Also, [Karimi's \(2016\)](#) research has revealed that brain-based learning can enhance the learning and students' technological skills.

Although, during the last decade, various studies have revealed the relative effectiveness of brain-based learning in students' behavioral and cognitive outputs, not many studies have been conducted regarding the emotional and motivational features of learning and there is a research gap.

In addition, since the emotional and motivational areas, as the basic and primary stimulus of learning, are not paid much attention by the teachers in the classrooms, so clarifying this matter requires extensive research. Therefore, the present study aims to design and determine the effectiveness of the brain-based learning in the cognitive and emotional outputs of learning.

Method

Participants

This study was conducted with a multivariate quasi-experimental design (pre-test-post-test and with a control group). Therefore, using cluster sampling method, two classes were selected from the student tutor populations of Ardabil male training centers in the academic year of 2021-2022, and one of the classes was considered as the experimental group and the other class as the control group. The brain-based learning training package was implemented for the experimental group during 10 sessions of 60 minutes, and no intervention was implemented for the control group (for this group, 3

training sessions were implemented after the completion of the study). In the two stages of pre-test and post-test, the dependent variables were measured.

Instrument

Pekran Academic Emotions Questionnaire (AEQ):

Academic Emotions Questionnaire (AEQ) was designed by Pekran et al. (2002) and measures positive and negative emotions. Emotions related to learning, which includes 75 items, measure the components of learning such as enjoyment, hope, pride, anger, anxiety, shame, disappointment, and fatigue in a five-point Likert scale. Pekran et al. (2002) obtained the content validity. Moreover, in the study of Kadivar et al. (2009) the validity of the questionnaire has been confirmed. Kadivar et al. (2009) have validated this questionnaire for Iranian students and using confirmatory factor analysis, they showed the items of the questionnaire had an appropriate fitness. Also, consistent with the results of Pekran et al.'s study (2002; 2017), they showed that the academic emotions questionnaire had appropriate internal consistency and calculated Cronbach's alpha coefficients for its subscales between .74 and .86.

Academic Enthusiasm Questionnaire:

The Academic Enthusiasm questionnaire was developed by Fredericks et al. (2004), which has 15 items. It measures three subscales: behavioral, emotional, and cognitive in a five-point Likert scale. Fredericks et al. (2004) have reported the reliability coefficient as 0.86. Also, Abbasi et al. (2014) reported Cronbach's alpha coefficient as 0.66. In the present study, confirmatory factor analysis method was used to examine the construct validity and the results showed that the questions of this questionnaire loaded (above .60) on three behavioral, emotional and cognitive factors.

Academic Motivation Questionnaire:

Harter's Academic Motivation Questionnaire, which contains 33 items, was used to measure the level of academic motivation. This instrument is a modified form of the Harter scale (1981-1980) for the measurement of internal and external academic motivation. Since both external and internal motivation play a role in many academic subjects, Lapper et al. (2005) converted Harter's scale into a common scale,

where each question considers only one of the reasons for internal or external motivation. This questionnaire is scored on a Likert scale (never 1, rarely 2, sometimes 3, most of the time 4, always 5). The reliability of this questionnaire was obtained by Bahrani (2008) using Cronbach's alpha coefficient of .78. In the present study, the reliability of this questionnaire was obtained using Cronbach's alpha coefficient of .80.

Cognitive Abilities Test:

This test was designed by Nejati (2012) to measure cognitive abilities and contains 37 items that are scored on a five-point Likert scale from almost never (1) to almost always (5). Through a study using exploratory factor analysis, Nejati (2012) has extracted seven factors of memory, inhibitory control and selective attention, decision making, planning, sustained attention, social cognition and cognitive flexibility. In addition, the total reliability of the test has been obtained using Cronbach's alpha coefficient, .83. In their study, Zare et al. (2019) also reported the total Cronbach's alpha coefficient of .83.

English language academic performance test:

To evaluate the English language academic performance, the researchers, based on the study objectives developed two parallel tests descriptively. For content validity, they obtained the CVI content validity index as .81.

Brain-based learning package:

The content of the brain-based learning package was prepared based on the theories by Goswami (2006), Handayani (2016), Griffiee (2007), Ghosh et al. (2010) and Duman (2011). It was implemented as 10 sessions for one hour. The Delphi group method was used to prepare the content of the package. In the implementation of this package, the 12 principles of Caine and Caine (2002) were taken into consideration, based on these principles, relaxed awareness, complex immersion and active processing were considered as practical guidelines in the implementation of sessions. During the sessions by focusing on the *general English language course*, the brain-based learning process was implemented. Table 1 shows the summary of training sessions:

Table 1. Brain-based learning package

Session 1	<p><i>First lesson:</i> welcome, overview of meetings and related rules</p> <p>- <i>Exercise:</i> become familiar with each other</p> <p>- <i>Second lesson:</i> Getting to know the different dimensions of language learning through a new method and preparing the instrument needed for the next session and changing the way the learners sit in groups.</p> <p>- <i>Exercise:</i> Review and comment on the physical change of the class, light and the students' food</p>	Session 2	<p><i>First lesson:</i> the beginning of the subject of character (the first lesson of the book) by pasting the shape of different emotions on the board</p> <p>- <i>Exercise:</i> Expressing the emotions they felt during the day in the form of group conversations</p> <p>- <i>Second lesson:</i> Verbal explanation about different types of personality and solving the problems of emotions that were wrongly named.</p> <p>- <i>Exercise:</i> Writing down the personality traits of each of their friends in their notebooks and reading</p>
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	<p>timetable</p> <p><i>Homework:</i> Changing the classroom situation to a brain-based learning style and writing, and eating throughout the day</p>		<p>them in class</p> <p><i>Homework:</i> Writing the personality traits of each family member in the form of a story for the next session</p>
Session 3	<p>- <i>First lesson:</i> Playing an educational video about personality and emotions</p> <p><i>Exercise:</i> Presenting the previous session's assignments and finding personality similarities between family members and the characters of the educational video</p> <p>- <i>The second lesson:</i> Teaching grammar (am, is, are) in the form of verbal explanation and asking questions from the learners and correcting grammatical mistakes</p> <p>-<i>Exercise:</i> Writing a sentence about the most important characteristic of their personality, their close friend and their group in their notebook.</p> <p><i>Homework:</i> Each group should prepare a short piece and play in class about the character (maximum 10 minutes for each group)</p>	Session 4	<p>- <i>First lesson:</i> performing the play and criticizing and correcting the mistakes that happened</p> <p>-<i>Exercise:</i> Playing the file (listening) about the character</p> <p>- <i>Second lesson:</i> Doing the book assignments individually and examining the strengths and weaknesses of the learners individually</p> <p>-<i>Exercise:</i> A text is given to the learners and they are asked to individually identify the personality factors in the text with green color and the verbs (to be) with blue color.</p> <p><i>Homework:</i> Students are asked to compare the characteristics of the people of the two countries to improve their writing skills</p>
Session 5	<p>- <i>First lesson:</i> The teacher enters the class with a suitcase, an imaginary ticket in his hand, and a passport. (Topic: Travel)</p> <p>-<i>Exercise:</i> Each learner expresses his/her experiences about what he/she did for the trip</p> <p><i>Second lesson:</i> The educational video of a tourist's trip is played and the terms required for this lesson are repeated.</p> <p><i>Homework:</i> Imagine you have a trip tomorrow, what you need to take and how to prepare. Just write down the words</p>	Session 6	<p>- <i>First lesson:</i> Correcting the mistakes of learners' assignments and presenting an audio file about the trip</p> <p>-<i>Exercise:</i> Each group should summarize what they have heard and understood.</p> <p>- <i>Second lesson:</i> presenting grammar based on a mental map (teaching ing)</p> <p>- <i>Exercise:</i> Each group refers to the education center and write what is currently being done and read in class (grammar practice).</p> <p><i>Homework:</i> Each learner should write a paper about how a tourist travels either through watching TV or going to a hotel (vocabulary practice).</p>
Session 7	<p><i>First lesson:</i> Reading the paper of each learner and fixing the problems</p> <p>-<i>Exercise:</i> based on what the students have learned, we want each group to prepare a play. We perform the play in the open space and in the park near the education center.</p> <p>- <i>Second lesson:</i> Referring to the topics of the book and answering anyone who has questions about the topics.</p> <p>-<i>Exercise:</i> Giving a text to the learners and ask them to fill in the blanks individually.</p> <p><i>Homework:</i> Imagine you have a trip to another country tomorrow, what should you do? (enhancing writing skills).</p>	Session 8	<p><i>First lesson:</i> reading the homework of the previous session and providing individual feedback</p> <p>-<i>Exercise:</i> Asking the learners to express everything they have learned from the previous two lessons</p> <p><i>Second lesson:</i> Completing the mentioned topics and the important points of the two lessons</p> <p>- <i>Exercise:</i> Taking exam from the first two lessons of the book of 9th grade.</p> <p>-<i>Homework:</i> Writing 10 sentences of what learners have experienced during the last week based on grammar topics</p>
Session 9	<p>- <i>First lesson:</i> The teacher enters the class with a small cake on the pretext of one of the students' birthday.</p> <p>-<i>Exercise:</i> Expressing the desired vocabulary for ceremonies and celebrations that are common.</p> <p>- <i>Second lesson:</i> Practicing a national or religious celebration in a dramatic way.</p> <p>- <i>Exercise:</i> Reading the words in the book and everyone says which one they do in which celebration or event.</p> <p><i>Homework:</i> Each learner writes the most memorable national or religious celebration they have experienced</p>	Session 10	<p>- <i>First lesson:</i> Presenting assignments and solving the problems of each learner and watching an educational video about the celebration of one of the countries</p> <p>- <i>Exercise:</i> Expressing the differences and similarities of national and foreign celebrations.</p> <p>- <i>Second lesson:</i> The topics of the book are reviewed and the conversation of the book is performed in the form of a role play.</p> <p><i>Exercise:</i> Each group prepares papers based on a national, domestic or foreign religious festival and presents them in the education center as a small exhibition.</p> <p>-<i>Homework:</i> Based on the three topics that were taught, the learners are asked to write a story individually and use the vocabulary of each lesson.</p> <p>* The final evaluation was done in the form of a quiz, but in all sessions, individual differences and requested homework were also measured in formative evaluations.</p>

Results

Table 2. Mean and SD participants' scores in academic motivation, academic excitement, cognitive ability, academic performance

Groups Test variables	Experimental Group				
	Pretest		Posttest		n
	Mean	SD	Mean	SD	
academic motivation	92.82	8.24	110.75	11.11	30
academic excitement	329.91	23.26	377.71	31.12	30
academic enthusiasm	41.92	7.13	53.11	7.72	30
cognitive ability	37.96	6.14	45.72	7.36	30
academic performance	15.44	2.13	16.53	2.16	30
Control Group					
academic motivation	92.72	9.02	93.91	9.08	30
academic excitement	325.02	25.02	332.79	26.12	30
academic enthusiasm	40.21	2.09	41.77	8.19	30
cognitive ability	36.12	6.41	37.16	7.13	30
academic performance	14.92	2.44	14.99	2.54	30

Table 2 shows the mean and standard deviation of the variables studied in pretest and posttest: 1) The level of motivation, excitement, academic enthusiasm, cognitive and academic performance in the pre-test in both groups is closer to each other, but in the post-test, compared to the control group the mean of dependent variables in the experimental group was increased.

On the other hand, multivariate analysis of covariance was used to test the hypotheses. Accordingly, the assumptions of this method, including the normality of the distribution of the dependent variables, were examined using the Kalmogorov-Smirnov test, and the

results showed that the normality of the distribution of the dependent variables was assumed in the study sample ($P > .01$). In addition, homogeneity of error variance was examined by Levene's test and the results showed that this assumption was also been assumed ($P > .01$). Also, the assumption of homogeneity of covariance matrices was examined using M-Box test and the results ($F = 3.19$, $P > .01$) showed that this assumption was also assumed. Hence, Multivariate Analysis of Covariance was used to analyze the data (Table 3):

Table 3. Multivariate analysis of covariance of the effectiveness of brain-based learning in the weighted combination of dependent variables

Source	Test	F	sig	η^2
Method	Wilk's Lamda	38.81	.001	.55

Table 3 shows that brain-based learning is significantly effective in the weighted combination of dependent variables (academic motivation, academic excitement, academic enthusiasm, cognitive and academic

performance) ($F = 38.81$, $p < .05$). In order to determine the effectiveness of brain-based learning in each of the dependent variables, univariate analysis of covariance was used as described (Table 4):

Table 4. Results of univariate analysis of covariance for Cognitive and Affective outcomes of learning

Source	Dependent variable	F	p	η^2
Group	academic motivation	142.72	.0001	.73
Group	academic excitement	147.08	.0001	.74
Group	academic enthusiasm	127.38	.0001	.71
Group	cognitive ability	177.31	.0001	.77
Group	academic performance	10.54	.01	.17

Table 4 shows: 1) brain-based learning training is significantly effective in improving academic motivation ($F = 142.72$, $p < .05$). 2) Brain-based learning is significantly effective in academic excitement ($F = 147.08$, $p < .05$). 3) Brain-based learning is significantly effective in academic enthusiasm ($F = 127.38$, $p < .05$). 4) Brain-based learning training is significantly effective in improving cognitive ability, ($F = 177.31$, $p < .05$). 5) brain-based learning training is significantly effective in academic performance ($F = 10.54$, $p < .05$).

Discussion

Results showed that brain-based learning was effective in improving the academic motivation of learners. This finding is consistent with studies showing the effect of brain-based learning on academic motivation (Saleh, 2018; Liu & Brantmeier, 2019; Özdemir & Sadyk, 2015; Sani et al., 2019; Tardif et al., 2015; Tüfekçi & Demirel, 2009; Uzezi & Jonah, 2017; Martín-Lobo et al., 2018; Von Anthony & Zenaida, 2016; Diyaddin, 2017). In addition, findings of the study by Alizadeh (2017) show that brain-based learning could have a positive effect on the motivational and emotional processes of learners. Accordingly, Saleh (2011)

positively reported the impact of brain-based learning on increasing academic achievement and students' learning motivation in mathematics.

Regarding motivational factors, the study by [Kajiura et al. \(2021\)](#) has shown that brain-based learning had a positive effect on learners' motivation, and the role of brain-based learning in improving learners' motivation is particularly important. It can be explained that one of the objectives of brain-based learning is to select active teaching methods in order to increase the enthusiasm and interest in the class ([Bada, 2022](#)). Since in this method, each person learns in different ways, therefore, the multidimensional educational model should be used to allow learners to acquire different types of knowledge in interesting and entertaining ways, which leads to meaningful learning ([Doman, 2006](#)). Accordingly, [Bada \(2022\)](#) has proposed that the use of different educational methods that can combine visual and auditory skills in all kinds of education could help the learners to learn more effectively than other methods. Also, [Uzezi & Jonah \(2017\)](#) suggested that the more active the learners' motivation is through brain-based learning, the better the learners' academic performance. In addition, [Tokuhama-Espinosa \(2008\)](#) stated that when learners feel threatened, helpless and tired, they are only able to remember limited things and are unable to process critically, so in such situations, emotions determine what learners pay attention to and this causes the whole learning process to be influenced. Therefore, it is stated that thinking and learning processes require a low level of stress. In addition, it could be concluded that in brain-based learning process, the learning materials are related to the real life of the learners, and the connection of the educational materials with the real life is considered an essential source for improving the learning motivation of the learners. On the other hand, a content associated with real life helps learners to participate in the learning process and thereby increase their motivation to learn. Therefore, it can be said that a teaching method that can involve the learners in emotional issues can create more motivation for learning since the interest of the learners increases the speed of learning and due to the fact that the driving force of learning engagement is the learner's motivation, therefore brain based learning could result in the success of learners through creating a sense of curiosity; and positive motivation, in turn, affects the metabolism of the brain.

In addition, findings showed that the brain-based learning method had a positive effect on the cognitive and academic performance of learners. These findings are consistent with the results of [Kajiura et al. \(2021\)](#), [Özdemir & Sadık \(2015\)](#), [Gulden & Hasan \(2018\)](#), [Akman et al. \(2020\)](#), [Martín-Lobo et al. \(2018\)](#) and [Legault et al. \(2018\)](#), regarding the fact that the use of brain-based learning strategies improves the cognitive efficiency and academic performance of learners.

It can be explained that education is a complex process with different dimensions, and the realization of its goals requires the examination of all individual and

interpersonal aspects of learners in learning engagement. On the other hand, one of the efficiency indicators of any educational system is the academic progress of the learners, and various studies have been conducted on the factors influencing the improvement of the academic performance of the learners ([Ali et al., 2020](#)).

One of the objectives of brain-based learning (BBL) is to prepare learners to be active and enjoy learning. BBL is a cognitive-neurological process related to the normal functioning of the brain ([Jensen, 2010](#)) and the role of the teacher in this process is very important so that he/she tries to motivate the learners and provides instructive support during the learning process and a positive situation for the learners. ([Kartikaningtyas et al., 2018](#)). Accordingly, it has been stated that learners are the main subject of the learning process and as a result, some activities are performed to reach the best situation. However, in the brain-based learning method, special emphasis is on the learning context, in which the process of building knowledge in learners is facilitated and actively involves learners to solve real problems, so that they can share their idea through group discussion ([Demir, 2016](#)).

Moreover, it can be proposed that the reason for the weakness in teaching and learning English in educational centers is that allocating three or four hours a week for language teaching is not enough and appropriate, and the lack of English language teaching hours is one of the points, which has been criticized. It has been stated that the non-standard conditions of English language education aggravate the problems caused by the lack of time. However, the use of media helps the teacher in better presentation of lesson materials and classroom management, and more accurate explanation of concepts, as well as precise designing of educational materials. Also, the use of active, cooperative and interactive teaching methods has always been emphasized in the effectiveness of brain-based learning in English language teaching ([Noureen et al., 2017](#); [Arzy-Mitchel, 2013](#)).

On the other hand, it can be proposed that reading is not naturally performed in the brain, that is, like many skills, it must be learned. Therefore, it can be concluded that in order for learning to be achieved, it is necessary to go through educational processes, hence, it is necessary for the educators to clarify which components of reading are progressing and developing in the brain during the education process and which ones need more support, training or practice. Therefore, the notion that the same brain processes are involved in learning in all learners is a wrong conclusion and in accordance with the findings of cognitive neuroscience, there are significant differences in the brain processes of learners during learning. Consequently teaching reading and the fact that learners become skilled readers requires progressive efforts of educators. Besides, evidence suggest that the brain of each learner is unique, and considering individual differences in the educational process makes the learners to maximize efforts so that

reach the goals and experience of success in reading, decoding, understanding and enjoying the text. Therefore, in order to learn each of these skills, it is necessary that the learner is challenged and according to individual differences, each learner can activate their brain areas based on their needs. Thus, it has been stated that constructing meaning is important in learning language cognitive skills. Therefore, [Tüfekçi & Demirel \(2009\)](#) believe that brain-based learning is different from traditional learning methods that focus on memorization instead of meaningful learning. In other words, the brain does not easily learn logical and meaningful things, so designing the structure of concepts is very important, and educators need to help learners learn the meaning of new information, and making meaningful connections between concepts requires cooperation of the instructor and learner and in this process, the use of stories, exciting topics and metaphors could be effective ([Bawaneh et al., 2012](#)). On the one hand, it has been emphasized that the brain activity reaches its optimal maximum when it is faced with appropriate stimuli according to its capacity, and on the other hand, when faced with information, suitable patterns are presented and the learning environment is also non-threatening, so that this phenomenon was called by cognitive scientists "flow" ([Radin, 2009](#)).

Moreover, findings showed that the brain-based learning method had a positive effect on the emotional outcomes (enthusiasm and academic excitement) of the learners. It is consistent with the results of [Handayani and Corebima \(2016\)](#), [Thomas and Swamy \(2014\)](#), [Sharma \(2015\)](#), [Riskiningtyas et al. \(2017\)](#), [Papatzikis \(2017\)](#), [Balushi and Balushi \(2018\)](#), [Robb \(2016\)](#), [Wahyuni \(2021\)](#), [Murphy \(2017\)](#) and [Arifah et al. \(2022\)](#), indicating that brain-based learning is effective in increasing students' enthusiasm and positive academic emotions. It could be explained that the instructor's awareness of the structure and function of the brain, as well as its optimal use, and considering its positive and negative influencing factors, help designing an appropriate teaching method and presenting lesson plans based on this method. In the meantime, considering the effect of stress on the brain and learning, the instructor contributes to a pleasant and relaxed learning environment, remove the factors that cause stress (external reward, intense competition, etc.) therefore tries to create a learning condition without stress so that the learners' sense of self-efficacy, flexibility and self-regulation is strengthened and their cortex becomes more active so that learning and understanding the material could be enhanced, thereby positive academic excitement, including joy and hope, could be developed in learners. In addition, according to the opinion of [Lidiastuti et al. \(2019\)](#), the adaptation of educational processes to the neurocognitive changes of the learners' brains has facilitated the process of receiving visual and auditory stimuli in the classroom, so little stress is imposed on the brain, and the variety of visual and auditory stimuli stimulate learners' attention, so the achievement of the learning goals in such a

context creates a sense of self-worth in the learners, as a result, the learners' effort to learn increases. Besides, learners dealing with education topics in a state of relaxation along with active participation result in academic enthusiasm.

Conclusion

In general, it can be concluded that the brain is a complex adaptive system and a parallel processor that can perform several activities at the same time, and it is necessary to note that in performing a complex and multifaceted task, it is necessary to help to realize learning by different methods. Therefore, by changing activities and teaching learning styles, it is possible to stimulate thought and action in second language teaching classes so that the brain could perform on both conscious and unconscious levels. Accordingly, it is necessary for the instructor to pay attention to the unconscious factors in the class, and this is possible through various teaching methods, since learning and teaching include focused attention and understanding of the environment ([Papadatou-Pastou et al., 2017](#)). On the other hand, [Alanazi \(2012\)](#) suggested that brain-based learning is achieved through the participation of learners in group interactions to reflect on ideas, work on creative projects and learn from different sources. Hence, it can be proposed that the use of brain-based learning strategies could be effective in the academic progress of English language learners, and by this method they can meaningfully apply what they have learned in various environments and become more efficient.

The most important limitation of this research was that the subjects of the study were all male and the obtained results cannot be generalized to female subjects. Also, the study population was student tutors in Ardabil, so the results could not be generalized to other groups. It is suggested that this research be conducted in other educational, age and gender categories so that the findings can be compared. In addition, in order to examine the effectiveness of brain-based learning, it is suggested that several courses be taught using this method, and this depends on the fact that in tutor training courses, brain-based learning teaching methods should be taught.

Conflict of Interest

No potential conflict of interest was reported by the authors.

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