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Multiple Pathways to the Student's Brain: An Appropriate Tool to Impact on EFL Learners' Stress, Anxiety, Depression, and Perceived Supportive Learning Climate

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Abstract

The impetus behind the current study was to get the best use of all possible pathways of the learner's brain. Multiple-pathway model, one model of brain-based instruction, on which the current study was based, has synergic effect addressing sensory-motor, emotion, reward, attention, memory, language, frontal lobe (executive function), and social pathways of the learner's brain altogether. To this aim, this quasi-experimental research, with pretest-intervention-posttest design, was carried out. The participants, who were selected through a convenient sampling method, included 30 BA University students studying TEFL at Islamic Azad University, Aliabad Katoul Branch, and 30 BA University students studying TEFL at Islamic Azad University, Gorgan Branch, were placed into two experimental and control groups, respectively. The instrumentation included DASS 21 and Learning Climate Questionnaires (LCQ) which were used as the pretest and posttest prior to and after the 10 session intervention of brain-based instruction for the experimental group. Descriptive and inferential analysis of collected data indicated the significant impact of the instruction on the participants' stress, anxiety, depression, and perceived supportive learning climate in the experimental group.

Keywords: multiple pathways, stress, anxiety, depression, perceived supportive learning climate

Introduction

Emotional and psychological conditions of the learners can be considered an important factor in improvement or failure in learning (Gläser-Zikuda, Stuchlíková & Janík, 2013). Among physical and mental disorders, depression, according to World Health Organization, is one of the most important mood disorders which comes commonly with mood reduction, losing interest, feeling guilty, energy reduction, and poor concentration (Lewin, 2007). In addition, according to Tobias (1983), anxiety and stress also have negative impacts, particularly in educational and learning fields. He maintains that anxiety can affect the ability of processing and retrieval of the received information. The learners suffering from anxiety often experience uncontrollable worries. They are usually worried about their performances and interpret the conditions often much worse than as they really are (Vanin, 2008).

The results of the studies in the last decade in Iran, according to Noorbala (2001), indicate that adolescents are more vulnerable and at risk of mental disorders. He maintains that the importance of evaluating interventions to reduce mental disorders has been raised more and more and so does the attention of policy makers; moreover, it has attracted health promotion planners in the country. Biabangard (1999) also remarks in this regard that some learners might have high intelligence and considerable learning capacity but they cannot have desirable educational achievement merely because of reasons such as emotional poverty, insufficient motivation, lack of self-confidence, psychological disorders such as stress, anxiety, depression, and also more importantly because of unsupportive learning climate.

Gewirtz and Radke (2010) emphasize that stress affects greatly memory and learning in human. They believe that both strengthening and harmful effects of stress strongly impact the activation of Amygdala, which in turn influences brain's flexibility. In the same vein, as Roohi (2013) puts it, in such a modern world, it is very difficult to keep calm and be peaceful because anxiety is constantly with us side by side and learners are not exceptional. He continues that no matter how much intelligent and hardworking the students are, if they suffer from stress and anxiety, they

will encounter learning problems. Roohi argues that fear and worry impact the brain (the structure and functions), especially, in young learners who are growing up.

In addition, as learners spend a lot of time at schools, universities or in any educational environments, the climate which strongly affects the learners' emotions is extremely important (Ofoghi, Sadeghi, & Babaei, 2016). Accordingly, the learners' perception of the supportive learning climate was also studied in the current study. The learners' perception of the supportive learning climate is founded on the self-determination theory developed by Deci and Ryan (2002). Perceived supportive climate refers to the atmosphere in which learners' autonomy is supported (Deci, & Ryan, 1985) that provides appropriate climate to meet their basic needs. According to Ryan, Kuhl, and Deci, (1997), self-determination theory is a theory of human personality and motivation. The theory defines how an individual's interactions are influenced by the social environment (Deci, 2000). In fact, self-determination theory, according to Legault (2017), is a theory which tries to explain the strong effect of social and cultural conditions in which learners are learning, the conditions which may facilitate or frustrate the learners' fundamental psychological needs, their achievements and their well-being. Deci and Ryan (1995) propose competence, autonomy and relatedness as the basic needs of human being, or more specifically learners, which must be satisfied to create the sense of integrity and wellbeing. Deci and Ryan (1985) emphasizes that these are to be the most important concerns of the teachers. Accordingly, the LCQ was developed in order to examine the perception of the learners about the learning climate. In the current study, it was found significant to examine the impact of the brain-based instruction on the participants' perception of the supportive learning climate in which they are learning.

Among the methods that improve the mental state of the students, the brain-based instruction method due to the use of all brain pathways by improving the educational environment and creating a supportive climate, can have a significant impact on reducing the level of stress, anxiety and depression of learners. Therefore, referring to Jenson (2000), in brain-based instruction, learning is found to be as an interdisciplinary reply to the quest of the most effective method of the brain's learning mechanism. The effect

of brain-based instruction in learning has been broadly studied and the great impact has also been reported in the literature; for instance, Alizadeh Oghyanous (2017), Altiti (2014), Bruer (1996), Gözüyeşil, and Dikic (2014), Handayani and Corebima (2017), Herson (2006), Jenson (2011), Jazuli, Solihatin, and Syahrial (2019), Hasani, Dastjerdi, and Pakdamn (2015), Shabatat and Al-Tarawneh (2016),Tüfekçia, and Demirel (2009), to name a few.

For Caine, R. and Caine, G. (1991) brain-based learning is the recognition of the brain's codes for a meaningful learning and adapting the teaching process in relation to those codes. Therefore, in brain-based learning, the focus is on meaning (Ramakrishnan, 2013) and gets the better use of one's brain. The brain-based instruction has been implemented in many different ways and models. One of the models on which the current study was founded, is multiple pathway model, developed by Zadina (2014). According to Zedina, multiple pathway model is "a means of making sense of the ever-increasing new research on learning" (p. 3). In this model, arbitrary pathways of the brain are involved: sensory-motor, emotion, reward, attention and memory, language, frontal lobe and executive function, and social pathways. She argues that unlike the learning styles model (Fleming and Mills' VARK model, 1992), multiple pathway model has synergistic effect. In other words, addressing all pathways of the brain will create a synergy. She further explains that the whole is much "greater than the sum of its parts" (p. 4).

In multiple pathway model, according to Zedina (2014), teachers apply diverse brain-based instructions in order to get the following desired changes in students' brains:

1) Empowering the current networks to prepare them for the new information: the focus is on finding the gaps in the learners' current neural networks to ascertain that the network is strong enough to receive the new information. Halloun (2017) also believes that change in neural network results in change in memory capacity and learning
2) Growing the neural network: This can be done through assigning reading tasks to increase the learners' current neural networks

3) Wiring the neural networks: Zedina uses the concept of firing the incoming information. She believes that when a student understands new incoming information the information is fired. What is important here is for a learner to be able to wire, or in other words connects, the received information to the information he or she has already had in the mind. By wiring, Zedina means connecting. Creating connections is a matter of meaningful learning.
4) Maintaining diversities: By assigning diverse tasks for the learners to do out of the class, they can work with the materials in different and alternative methods. In other words, the learners are suggested to be given a menu to do rather than just one single type of assignment.

Furthermore, according to Zedina (2014), in order for learning to occur, the networks in the brain are to be wired. She goes on that when the learners have learned the materials, they can fire up the network which is created by connecting the information in the brain. In fact, the more active the learners are, the more connections and networks are created. Then, this is the role of the teachers to make the learner's brain and the pathways as much more active as possible. Addressing all pathways in the brain while teaching, the teacher can create more networks in the learners' brain. The impact of brain-based instruction on learning diverse subjects and materials has been widely studied; however, the impact has not yet been studied on learners' emotions and mental states. Therefore, taking into account all above-mentioned advantages of multiple pathway model, the following research hypotheses were formulated:

RH1: Brain-based instruction has impacts on EFL learners' stress.

RH2: Brain-based instruction has impacts on EFL learners' anxiety.

RH3: Brain-based instruction has impacts' on EFL learners' depression.

RH4: Brain-based instruction has impacts on EFL learners' perceived supportive learning climate.

Method

Participants

The participants of the current study were selected applying convenient sampling method. Thirty BA university students studying TEFL at Islamic Azad University, Aliabad Katoul Branch, and 30 BA university students

studying TEFL at Gorgan Branch, were placed into two experimental and control groups, respectively.

Instruments

In the current study, two questionnaires were applied as the pretest and posttest:

1) The Depression Anxiety Stress Scale-21 (DASS-21), developed by Lovibond, S. and Lovibond, P. (1995), is a screening instrument for assessing depression, anxiety, and stress. It has 21 items, divided into three 7-item subscales. In order to remove misunderstanding, the Persian version was used. The reliability estimated was .89 for depression, .84 for anxiety, and for stress .82.

2) The learning climate questionnaire (LCQ), developed by Williams and Deci (1996), estimates the participants' perception of their needs of autonomy, competence, and relatedness as being met by participating in the intervention programs. LCQ contains 24 items with the subscales of autonomy (15 items), competence (4 items), and relatednesse (5 items). In this scale, *autonomy* refers to the ability to make choices and acting in accordance with one's sense of self, *competence* refers to feeling a sense of mastery within one's environment and experiencing opportunities to display skills, and *relatedness* refers to a sense of belonging both with other individuals and with one's community. The reliability was estimated as .82.

Procedure

The current study was carried out in the second academic semester of 1398-1399. The instruments, the DASS 21 Questionnaire, and LCQ, were sent to the participants (both experimental and control groups). The questionnaires were sent online. Then, the experimental group received 10 sessions of brain-based intervention. The intervention program was designed based on Zedina (2014)'s multiple pathway model. Instead of using only one pathway, as commonly used in most classes, in Zedina's multiple pathway model, 5 pathways of frontal lobe, sensory-motor, emotional, attention and memory, reward and social pathways were addressed as follows:

- *Frontal lobe and executive function pathway*

Session 1 and 2: The activities focused on frontal lobe pathway. The course materials, as well as the course syllabus were presented. Meta cognitive strategies were also introduced in the very first session. The students were asked to explain what strategy they used in order to improve. Then, they were also asked to write progressive daily report.

- *Sensory-motor pathway*

Session 3, 4, and 5: Due to the Coronavirus epidemic conditions, the university classes were cancelled. Therefore, the classes were online after the third session. The sensory-motor pathway includes three sub pathways: visual, auditory, and kinesthetic. In the third session, visual pathway was addressed; the materials were introduced applying video clips or images and pictures.

In the fourth session, the auditory pathway was addressed; the materials were introduced by playing audio files. The students were also assigned to record and send their voices telling the summary of the lessons or stories (some of the sessions were on the social networks through whatsApp or telegram). Kinesthetic pathway was addressed on the fifth session. The participants were asked to stand up, sit down, walk, or acting out the role plays. They were also assigned to write down stories or summary of the lessons.

- *Emotional pathway*

Session 6: The activities in this session focused on creating positive emotions and psychological physical security. In particular, due to the pandemic coronavirus conditions, they were provided with motivational programs including motivational and funny video clips; they were also induced to drink water from time to time during the session. They were then given projects to do in groups, such as creating materials related to the topic of the session, in groups to encourage cooperation.

- *Reward pathway*

Session 7: In session 7, the activities focused on creating happiness in order to discharge Dopamine: Storytelling, role-plays, encouraging competitions and rewarding. Some tasks were given as a competition and the winners were rewards (some points).

- *Attention and memory pathway*

Session 8: In Session 8, the students' activities concentrated on only one selected task by the learners. The important aspect of this session was focusing on metacognitive strategies in order to address attention and memory. Meanwhile, they were also encouraged to have deep breathing several times during the activities. A very short meditation was also done. In addition, the students were invited into a meditation group (21 day-abundance meditation) in social networks.

- *Social pathway*

Session 9: The activities in Session 9, focused on self-management, sympathizing, cooperation (instead of competition), and respecting everyone's point of view.

Session 10: In this session, emotional intelligence was addressed. First, the concept was introduced. Then, practices including self-evaluation, self-awareness of feeling were done applying some informal checklists. Furthermore, to encourage cooperation, some group works were also assigned.

After the intervention with the experimental group, the same questionnaires were sent as the posttest to both experimental and control group. The control group, in the current study, was only used as a benchmark to indicate that the treatment had some effects. Therefore, they only participated in the pretest and posttest. Finally, the collected data was statistically analyzed.

Design

The current study had a quasi-experimental with pretest- treatment-posttest and one experimental and one control group design since the random selection of the participants was not possible. The intervention of brain-based instruction was the independent variable in the study. The pretest and posttest of stress, anxiety, and depression as well as the perceived supportive learning climate were the dependent variables.

Results

The two questionnaires of DASS 21 and LCQ were administered before and after the treatment in two groups of experimental and control (the

control group did not receive the treatment). The total scores of the participants were then compared applying SPSS 25. Firstly, the normality of the data was examined to identify which tests (parametric or nonparametric) are appropriate to use. Table 1 shows the results of Kolmogorov–Smirnov test of normality.

Table1

Results of Kolmogorov–Smirnov Test of the Normality of Data

Statistical parameters	Z	Significance
Pretest stress	0.787	0.565
posttest stress	10.080	0.194
pretest anxiety	0.839	0.482
posttest anxiety	1.111	0.169
pretest depression	1.159	0.126
posttest depression	1.156	0.155
pretest LCQ	1.013	0.257
Posttest LCQ	1.020	0.257

The results of Kolmogorov–Smirnov test in Table 1 indicated that the data was not normal and nonparametric tests would be appropriate. In order to answer the research questions, the covariance analysis was used. First, the covariance assumption, the homogeneity of regression slope, was tested for all the hypotheses. The results are presented in Figures 1-4.

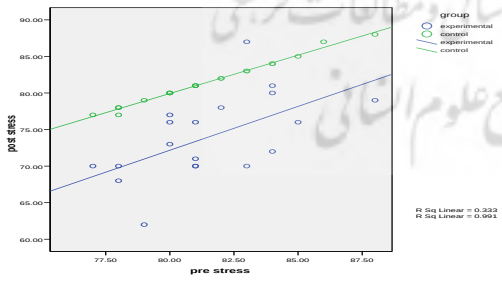

Figure1. Regression Homogeneity Slope of Stress

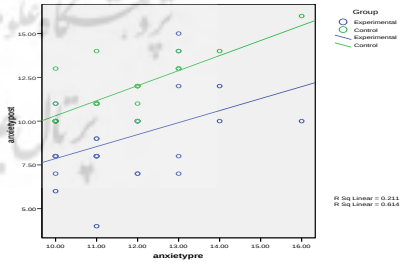

Figure 2. Regression Homogeneity Slope of Anxiety

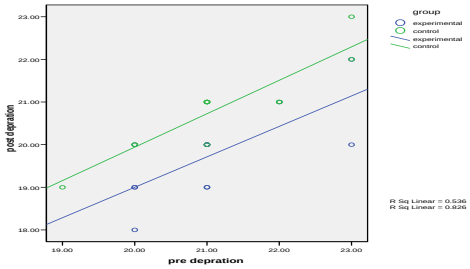

Figure 3. Regression Homogeneity Slope of Depression

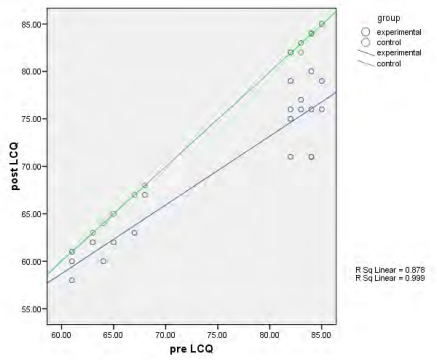

Figure 4. Regression Homogeneity Slope of LCQ

As Figure 1 indicates, there is a linear relationship between the variables (the pretest and posttest of stress) in the experimental and control groups and the slope of the regression lines is parallel. In addition, the R^2 of 0.99 indicates the degree of the relationship. The results of the scores of two groups in anxiety, as depicted in Figure 2, show the linear relationship between the variables in two groups. Moreover, the estimate of R^2(0.61), shown in Figure 2, reveals that the relationship is significant between the variables. The regression homogeneity and the slop of depression depicted in Figure 3 also reveal the linear relationship between the variables. The estimate of 0.82 of R^2 indicates the degree of the relationship. Finally, the last figure, Figure 4 shows the regression homogeneity slope of LCQ. The linear relationship between the pre and posttests of learning climate questionnaire and the R^2 estimate of 0.99 indicate the significance of the relationship. Therefore, the conditions for the homogeneity of the variances are met. The F test results for examining the homogeneity of the errors of variances shown in Table 2.

Table 2
The results of F Test for Equality of Errors of Variances for all Variables

	F	DF	df of Error Variance	Sig
Stress	3.685	1	58	0.152
Anxiety	2.015	1	58	0.395
Depression	3.47	1	58	0.136
LCQ	0.026	1	58	0.873

Table 2 presents the results of the F test for the equality of the errors of variances. As the table results indicate, the estimate of F (3.685, 2.015, 2.47, and 0.026), for stress, anxiety, depression and LCQ, respectively, with the p value of 0.05 and df of 58 are not significant for all variables. Therefore, it can be concluded that the conditions for the equality of the variances are met. In order to investigate the impact of the treatment in the experimental group, the covariance data analysis was carried out. The results of the covariance test analyses for the variable of stress is shown in Table 3.

Table 3
The Results of Covariance Test of Stress

Change sources	Square of changes	F	Sig	Eta	Df
Intercept	9.381	8.571	0.005	0.131	1
Group	25.350	23.161	0.001	0.289	1
Pretest	76.847	70.212	0.001	0.552	1
Error	76.847				57
Sum	8685				60

The results in Table 3 show that there is a significant relationship. The pretest of stress is significant with the value of 0.001. In addition, the F of 23.161 for the group with the p value of 0.05 and df=1 is significant (0.001). Therefore, we can conclude that there is difference between the groups in the posttest after the treatment. The eta estimate of 0.289 indicates that 28.9% of the changes observed in the posttests is the results of the treatment. The means are also compared in two groups. The results are shown in Table 4 which depicts that the mean difference is significant at the 0.05 level.

Table 4
The experimental and control group means comparison (Stress)

Groups		Mean Differences	Std.Error	Sig
Experimental	Control	-1.30	0.270	0.000
Control	Experimental	1.300	0.270	0.000

Therefore, based on the results shown in Figure 1, Table 3 and Table 4, it can be concluded the treatment of the brain-based instruction has positive impacts on the participants' stress. The first hypothesis is then confirmed. In order to examine the second hypothesis, the covariance data analysis was carried out. Table 5 presents the results of the covariance for anxiety.

Table 5
The Results of Covariance Test of Anxiety

Change sources	Square of changes	F	Sig	Eta	Df
Intercept	1.909	0.741	0.393	0.131	1
Group	110.029	42.739	0.001	0.429	1
Pretest	74.490	28.935	0.001	0.337	1
Error	76.847				57
Sum	6629				60

As the results in Table 5 depicts, there is a significant difference between the groups which reveals that the variable of the pretest of anxiety is significantly related to the posttest. In addition, the effect of the group is significant at 0.05 level with the p value of 0.001. The partial eta of 0.429 shows that 42.2% of the change in the results is because of the impact of the treatment in the experimental group. The pairwise comparison of the means, shown in Table 6, depicts the significant difference at the 0.05 level.

Table 6
The Experimental and Control Group Means Comparison (Anxiety)

Groups		Mean Differences	Std.Error	Sig
Experimental	Control	-2.710	0.415	0.000
Control	Experimental	2.710	0.415	0.000

Therefore, as the results show in Figure 2, Table 5 and Table 6, it can be concluded the treatment of the brain-based instruction has positive impacts

on the participants' anxiety. The second hypothesis is then confirmed. In order to examine the third hypothesis, the covariance data analysis was also carried out. Table 7 presents the results of the covariance for depression.

Table 7
The Results of Covariance Test of Depression

Change sources	Square of changes	F	Sig	Eta	Df
Intercept	.471	0.046	0.831	0.001	1
Group	183.064	17.891	0.000	0.239	1
Pretest	402.714	39.359	0.000	0.408	1
Error	583.000				57
Sum	1180.333				60

As the results illustrate in Table 7, there is a significant relationship between the groups and the pretest of depression has a significant impact (0.001). The estimate of F for the group (17.891) at the p value of 0.05 is significant, which reveals the significant impact of the treatment in the reduction of the stress in the posttests of the experimental group. The eta of 0.239 presents the effect of the treatment in the 23.9% of the change in the posttest. The pairwise comparison of the means, shown in Table 8, depicts the significant difference at the 0.05 level.

Table 8
The Experimental and Control Group Means Comparison (Depression)

Groups		Mean Differences	Std.Error	Sig
Experimental	Control	-3.494	0.826	0.000
Control	Experimental	3.494	0.826	0.000

Accordingly, as the results show in Figure 3 and Tables 7 and 8, it can be concluded the treatment of the brain-based instruction has positive impacts on the participants' depression. The third hypothesis is then confirmed. The impact of the brain-based instruction through applying multiple pathway model was also investigated on the EFL learners' perceived supportive learning climate which was tested applying LCQ. The results of the covariance are shown in Table 9.

Table 9
The Results of Covariance Test of LCQ

Change sources	Square of changes	F	Sig	Eta	Df
Intercept	15350.77	83.587	0.001	0.595	1
Group	14025.98	76.374	0.001	0.573	1
Pretest	524.120	2.854	0.097	0.408	1
Error	10468.013				57
Sum	946356				60

The results in Table 9 indicate that there is a significant relationship between the variables. As the results depicts, the impact of the pretest of LCQ is significant (0.097), which reveals that the pretest of LCQ is significantly related to the posttest. The F estimate of the group (76.374) is significant (0.001) at the P value of 0.05. The eta estimate of 0.576 shows that 57.6% of the changes in the posttest is for the impact of the treatment. The means of the LCQ are also compared and the results are presented in Table 10.

Table 10
The Experimental and Control Group Means Comparison (LCQ)

Groups		Mean Differences	Std.Error	Sig
Experimental	Control	-30.608	3.502	0.000
Control	Experimental	30.608.	3.502	0.000

Therefore, based on the results shown in Figure 4, Table 9 and Table 10, it can be concluded that the treatment of the brain-based instruction has positive impacts on the participants' perceived supportive learning climate. The fourth hypothesis is then confirmed.

Discussion

The aim of the current study was to examine the impact of brain-based instruction on the Iranian EFL learners' stress, anxiety, depression and perceived supportive learning climate. To this aim, a quasi-experimental design with control group was employed and 30 EFL university students for the experimental and 30 for the control group, applying convenient sampling method, were selected. The experimental group received 10

sessions of brain-based instruction taking Zedina (2014)'s multiple pathway model. In each session, one pathway of the brain was addressed and the appropriate activities, involving the certain pathways, were assigned. The participants (both experimental and control groups) took the same pretest and posttest, which were the DASS 21 and LCQ, before and after the treatment. The collected data were statistically analyzed through appropriate nonparametric tests with SPSS 25. The results confirmed the hypotheses; in other words, the multiple pathway model, one of the brain-based instruction models, had a positive effect on the EFL learner's stress, anxiety, depression and perceived supportive learning climate.

Zedina (2014) believes that if classroom instruction is based on a pervasive learning style, which is usually explored using the Kolb Questionnaire, it will have positive effect although, for optimal learning, you have to focus on all brain pathways. She contends that considering only one pathway as a learner's learning style, for example, labeling that the person is visual or auditory (in the learning process) it is just a preference to the style used and is not very much effective in learning. She also maintains that classifying learners as visual, auditory, or sensory-motor is just labeling and prevents the learner from using his or her full brain potential. In this regard and the significance of the engaging brain pathways in learning, it is worth to refer to Makino, Hwang, Hedrick, and Komiyama (2017) who studied the mechanism of sensory-motor learning circuits, that is, the connection between the brain and the environment. They concluded that sensory-motor learning creates specialized circuits to produce neuronal activity and promote progression and behavior.

The impact of brain-based instruction was also studied by Meshkinmehr, PourMohamad, Noushi and Talkhabi (2019). They concluded that meaningful learning as result of brain-based activities in which learners are active and cooperative, makes learners feel more comfortable, self-confident and motivated in the classroom. In the same vein, Noureen, Awan, and Fatima (2017) investigated the effect of brain-based learning on academic achievement of the seventh graders mathematics. The results revealed that brain-based instruction presents better results and learning mathematics skills of the students might also develop in a better way by applying the principles of this method.

Given, the importance of learning climate, the impact of brain-based instruction on the learners' perception of supportive learning climate was also investigated in the current study (the fourth hypothesis). The results were meaningfully significant. The results were somehow in line with Nejati and Akbari (2017). They argue that effort and awareness are required for effective and active learning. They emphasize that teachers are to create passion for learning and understanding in their students, and such situations arise only in a calm and anxiety-free environment. They concluded that teachers should try to use new teaching methods and its positive effects to create appropriate educational environments. In such climates, the learners' psychological disorders can also be affected and the stress, anxiety and depression, are controlled. Then, according to Talkhabi (2008), a brain-based approach favors enriching the learning environment. He emphasizes that this approach seeks to manage learning by providing emotional security, providing a variety of stimuli, providing challenging information, providing feedback, and more. In the same vein, Duman (2010) pinpoints that in a brain-based learning approach, the best state of learning occurs by relying on a diverse set of activities such as the use of music, art, color, images, diagrams and metaphors. Also, diet, amount of sleep, oxygen, exercise, and amount of water drunk are all factors that affect the way our brain responds and learns.

Given the results of the current study, it can be concluded that several pathways are involved in the learning process. Zedina (2014) pinpoints that if more modalities are used to encode the incoming information for learning, the learning outcome will be more significant because of the created multisensory networks. Since learning a language and using a foreign language is very stressful for learners (Hashemi, 2011), it is significant to apply appropriate and effective methods to create peaceful atmosphere for learners. In other words, addressing all brain pathways of the students while teaching, will result in much more advantageous classrooms which improve emotional states and educational achievements.

Declaration of interest: none

References

Altiti, M. (2014). The impact of a brain-based teaching program on improving the achievement of 5th grade students in sciences. *Journal of Islamic University, 22* (1), 111-138.

Alizadeh Oghyanous, P. (2017). The effect of brain-based teaching on young EFL learners' self-efficacy. *English Language Teaching*; *10* (5), 158-167.

Biabangard, A. (1999). *Methods of preventing academic failure*. Tehran: Parents and Teachers Associations.

Bruer, J. T. (1998). Brain science, brain fiction. *Educational Leadership, 56*(3), 14-18.

Caine, R. N., & Caine, G. (1991). *Teaching and the human brain*. Alexandria: Association for Supervision and Curriculum Development.

Deci, E. L. (1975). *Intrinsic motivation*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (1995). Human autonomy: The basis for true self-esteem. In M. Kemis (Ed.), *Efficacy, agency, and self-esteem* (pp. 31-49). New York: Plenum

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.

Deci, E. L., & Ryan, R. M. (2002). *Handbook of self-determination research*. Rochester, USA: The University of Rochester Press

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), 2077-2103.

Fleming, N. D., & Mills, C. (1992). Not another inventory, rather a catalyst for reflection. Retrieved from: https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1245&context=podimproveacad.

Gewirtz, J. C., & Radke, A. K. (2010). Effects of stress on learning and memory. *Encyclopedia of Behavioral Neuroscience, 1,* 461–468.

Gläser-Zikuda, M., Stuchlíková, I., & Janík, T. (2013). Emotional aspects of learning and teaching: Reviewing the field-discussing the issues. *Theoretical and Research Papers, 7* (2), 7−22

Gözüyeşil, E., & Dikic, A. (2014). The effect of brain based learning on academic achievement: A meta-analytical study. *Educational Sciences: Theory & Practice, 14* (2), 642-648.

Halloun, I. (2017). Mind, brain, and education: A systemic perspective. Retrievedfrom:https://www.researchgate.net/publication/312576567_Mind_Brain_and_Education_A_Systemic_Perspective

Handayani, B. S., & Corebima, A.D. (2017). Model brain based learning (BBL) and whole brain teaching (WBT) in learning. *International Journal of Science and Applied Science, 1* (2), 153-161.

Hasani, M., Dastjerdy, R., &, Pakdaman, M. (2015). The effect of brain-based learning on attitude and academic achievement of students in mathematics. *Research in Curriculum Planning, 12* (2), 61-73.

Hashemi, M. (2011). Language stress and anxiety among the English language learners. *Procedia - Social and Behavioral Sciences, 30,* 1811 – 1816.

Herson, L. A. (2006). *Brain-compatible research: using brain-based techniques to positively impact student learning*. (Unpublished master's thesis). University of South Florida, Florida, USA.

Jensen, E. (2011). *Brain based learning paradigm of teaching*. Jakarta: Indeks

Jensen, E. (2000). *Brain-Based Learning*. CA: Brain Store Inc.

Legault, L. (2017). Self-determination theory. Retrieved from https://www.researchgate.net/publication/317690916_SelfDetermination_Theory

Lewin, K. (2007). Depression assessment. *Practice Nurse Journal, 33* (12), 43-45.

Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the depression anxiety stress scales (DASS)*. New South Wales: Psychology Foundation Monograph.

Makino, H., Hwang, E., J., Hedrick, N. G., & Komiyama. (2017). Circuit mechanisms of sensorimotor learning, *HHS, 92* (4), 705–721.

Meshkin Mehr, A. R., Pourmohamah, M., Noushi, M., & Talkhabi, M. (2019). Investigating the effect of applying brain-based learning principles on the learning and retention of vocabulary by EFL Learners. *Critical Language and Literary Studies, 16* (32), 239-270.

Nejati, M., & Akbari, S. (2017). The impact of depression on learning. *Journal of Humanities and Islamic Strategic Studies, 1* (5), 85-99.

Noorbala, A. (2011). Psychosocial health and strategies for improvement. *Iranian Journal of Psychiatry and Clinical Psychology 17* (2), 151-156.

Noureen, G., Awan, R. N., & Fatima, H. (2017). Effect of brain-based learning on academic achievement of VII graders in mathematics. *Journal of Elementary Education, 27* (2), 85-97.

Ozden, M., & Gultekin, M. (2008). The effects of brain-based learning on academic achievement and retention of knowledge in science course, Electronic Journal of Science Education 12 (1), 3-19.

Ofoghi, N., Sadeghi, A., & Babaei, M (2016). Impact of class atmosphere on the quality of learning. *Psychology, 7*, 1645-1657.

Ramakrishnan, J. (2013). Brain based strategies. *International Journal of Innovative Research and Studies, 2* (5), 235+244.

Ryan, R.M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55(1), 68-78.

Ryan, R. M., Kuhl, J., & Deci, E. L. (1997). Nature and autonomy: Organizational view of social and neurobiological aspects of self-regulation in behavior and development. *Development and Psychopathology, 9*, 701-728.

Roohi, A. (2013). Theoretical and practical approaches to anxiety disorders in children. *Exceptional Education 3* (125), 42-59.

Shabatat,K., & Al-Tarawneh, M. (2016). The impact of a teaching-learning program based on a brain-based learning on the achievement of the female students of 9th grade in chemistry. *Higher Education Studies, 6* (2), 162-174.

Talkhabi. M. (2008). Brain-based syllabus .*Quarterly Journal of Educational Innovations, 7* (26), 127-150.

Tobias, S. (1983). *Anxiety and cognitive processing of instruction*. Retrievedfromfile:///C:/Users/Jila/Downloads/Anxiety_and_Cognitive_Processing_of_Instruction.pdf

Tüfekçia, S., & Demirel, M. (2009). The effect of brain based learning on achievement, retention, attitude and learning process. *World Conference on Educational Sciences*, 1, 1782-1791.

Vanin, J. R. (2008). Overview of anxiety and the anxiety disorders anxiety disorder. *Anxiety Disorders, 3*, 1-18.

Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and Social Psychology*, *70*, 767– 779

Zedina, J. (2014). *Multiple pathways to the student's brain: Energizing and enhancing instruction.* San Francisco: Jossey-Bass, A Wiley Brand.

Appendix A

DASS-21 پرسشنامه استرس- اضطراب- افسردگی

خواهشمند است هر یک از جملات زیر را به دقت بخوانیدو با علامت * مشخص کنید که هر جمله تا چه اندازه در مورد شما صدق می کند توجه داشته باشید که جمله درست و غلطی وجود ندارد.

	جملات	اصلاً	کم	متوسط	زیاد
۱	برایم مشکل است آرام بگیرم				
۲	متوجه شدم دهانم خشک می شود				
۳	فکرنمی کنم بتوانم هیچ نوع احساس خوبی را تجربه کنم				
۴	تنفس کردن برایم مشکل است				
۵	برایم سخت است در انجام کار پیشقدم شوم				
۶	به موقعیتهایم به طور افراطی واکنش نشان می دهم				
۷	در بدنم احساس لرزش می کنم				
۸	احساس می کنم انرژی روانی زیادی مصرف می کنم				
۹	نگرانم که مبادا در بعضی موقعیت ها دچار ترس شوم یا به کار احمقانه ای دست بزنم				
۱۰	احساس می کنم چیزی ندارم که منتظرش باشم				
۱۱	خودم را پریشان و سردرگم احساس می کنم				
۱۲	آرام بودن و در آرامش به سربردن برایم مشکل است				
۱۳	احساس دلمردگی و دل شکستگی دارم				
۱۴	نسبت به هرچیزی که مرا از کار بازدارد بی تحمل و نابردبارم (صبرو تحمل ندارم)				
۱۵	احساس می کنم که در هر لحظه ممکن است دچار ترس و وحشت شوم				
۱۶	قادر نیستم درباره خیلی چیزها شور و شوق از خود نشان دهم				
۱۷	احساس می کنم به عنوان یک فرد ارزش زیادی ندارم				
۱۸	فکر می کنم بسیار حساس و زودرنج هستم				
۱۹	بدون اینکه هیچ گونه فعالیت بدنی انجام دهم متوجه شده ام که قلبم غیرعادی کار می کند (مثلاً ضربان شدید قلب یا از کار افتادن آن برای چند لحظه)				
۲۰	بدون هیچ دلیل موجهی احساس ترس می کنم				
۲۱	احساس می کنم زندگی بی معناست				

Appendix B

پرسشنامه فضای یادگیری

***توجه* ذکر نام دانشجویان فقط جهت انجام تحلیل های آماری است و اطمینان داشته باشید که پاسخ های شما محرمانه خواهد بود.**

این پرسشنامه برای سنجش درک دانشجویان از نیازهای خود : نیاز خودمختاری، شایستگی و مرتبط بودن طراحی شده است. با توجه به مقیاس های مطابق با خود یکی از هفت مقیاس را برای هر سوال با انتخاب بفرمایید. در نظر داشته پاسخ های صادقانه دانشجویان در به تحقق رسیدن اهداف تحقیق بسیار موثر خواهد بود.

سوالات	خیلی زیاد مخالفم	خیلی مخالفم	مخالفم	نظری ندارم	موافقم	خیلی موافقم	خیلی زیاد موافقم
الف: حمایت از خودمختاری							
۱. احساس میکنم که در کلاس به ما حق انتخاب داده میشد.							
۲. احساس میکنم که در کلاس درک میشدیم.							
۳. میتوانستیم در کلاس در طول دوره با استادمان راحت باشیم.							
۴. درمورد توانائی هایمان در خوب انجام دادن کارها به ما اعتماد به نفس داده میشد.							
۵. حس میکردیم استادمان مارا پذیرفته است.							
۶. در کلاس به ما کمک میشد که اهداف دروس هر جلسه و لزوم انجام کارها را درک کنیم.							
۷. به سوال پرسیدن در کلاس تشویق میشدیم.							
۸. احساس میکردیم اطمینان زیادی به استادمان داشتیم.							
۹. سوالاتمان در کلاس، به دقت و کامل پاسخ داده میشدند.							
۱۰. احساسات و عواطفم در کلاس،خوب کنترل و هدایت میشدند.							
۱۱در کلاس به ما، مانند دیگر افراد جامعه اهمییت داده میشد.							
۱۲. احساس خوبی نسبت به طرز صحبت کردن استاد با ما، نداشتیم.							
۱۳. قبل از اینکه روشهای جدیدی برای انجام فعالیت های کلاسی، شرایط دانشجویان سنجیده میشد.							
۱۴به راحتی میتوانستیم احساساتمان را در کلاس با استادمان تقسیم کنییم.							
۱۵. به نظراتمان درمورد چگونگی انجام فعالیت های کلاسی ارزش داده میشد.							
ب. حمایت از شایستگی							
۱۶. در کلاس، برای پیشرفتمان به ما کمک میشد.							
۱۷.در کلاس درس به ما کمک میشد حس کنیم وضعیت جسمانی ما خوب است.							
۱۸. احساس میکردیم ، اهمیت خیلی زیادی دارد که ما فعالیت های کلاسی را، درست انجام دهیم.							
۱۹. احساس میکردیم، استاد کاری میکند که حس کنیم میتوانیم کارها را انجام دهیم.							
ج. حمایت از ارتباط							
۲۰. در کلاس حمایت میشدیم.							
۲۱. تشویق میشدیم که تا کارها را باهم انجام دهیم.							
۲۲. به ما احترم گذاشته میشد.							
۲۳. احساس میکردیم، استادمان به ما علاقه دارد.							
۲۴. احساس میکردیم، که استادمان با ما مهربان است.							

Biodata

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