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The Study of the Effectiveness of Brain-Based Learning on Self-Regulated Learning among Girl Students of First Grade in High School of Yazd

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ABSTRACT: The perspective of this research is determining the effectiveness of brain-based learning on self-regulated learning of students. This study was executed as a trial method and by design of pretest-posttest. The sample size consisted of 40 first year students who were selected randomly among the multiple regions and were placed in two groups of control and experiment (each group, 20 case). The teachers of experiment group trained their lessons based on the principles of brain-based learning in three month. The self-regulated learning scale of Bouffard was used for collecting the data. The research data were analyzed by covariance analysis test and t test. The results of covariance analysis test showed that the brain-based learning has effect on self-regulated learning and this impact lasts for 3 month. According to the research, Brain-based Learning can be used as a intervention to increasing self-regulation student learning.

Key words: learning, brain based learning, self-regulated learning

INTRODUCTION

Learning is one of the most important areas and matters in psychology which has been considered and studied from the beginning of formation of scientific psychology. The experts and researchers of learning area have studied the basic process of learning from different aspects. These paradigms are: Functionalism, Institutionalism, Cognitive, (Nuri Emamzedeie, 2010).

Great progress which has appeared in fields such as molecular biology, neurology, medicine, imaging, genetics and many field of known neuroscience let us to look more carefully to chemical, structural and functional dimensions of what happens in the brain during learning (Taraj, 2012).

The neurobiological explanation that began anonymously in peak period of behaviorist movement nowadays is considered as one of the known learning approaches. This can be seen well in tendency to study the neural networks and new connectionism (Nuri Emamzedeie, 2010).

The human brain has many parts but the current educational system has pointed a small percentage of that. Presently the school learning concentrates on a narrow part of brain which is placed in left side of cerebral cortex and isolation of specific parts of the brain, has eliminated its systematic cohesion and correlation (Kerry, 2010).

Frederick Goodwin, president of the National Institute of Mental Health says:" Previously, it was thought that our brain nerves are unalterable but in fact positive environments can create physical change in growing brain (Hoseini Iraj, 2010).

Despite the variety of teaching methods in the educational system, less teaching methods have focused on structure and function of brain. The human brain is a complex system that is still used in school as a simple device to store and retrieve the information (Hoiland, 2005).

The brain-based learning is a learner-based process that uses whole brain and all students self-actively build their knowledge in various fields of learning (Weiss, 2005). The brain-based learning is recognition of brain rules for meaningful learning and organizing the training according to them.

The basis of brain-based learning is that the brain is naturally programmed for meaningful learning and exactly as each expert requires the understanding of the factors of his expertise for his optimal performance, the teachers also as learning experts should be aware of ways of brain learning (Abolghasemi, 2001).

According to brain based education, many common elements of educational system should be revised. According to Jensen "we are placed in transformation phase", a transformation which changes many things such as start time of schools, disciplinary policies, assessment methods, teaching strategies, budget priorities, classroom environments, technology application and even the way we think about art and education (Jensen, 2000).

However learning is the primary goal of any educational activity. Purpose of any teaching method is to improve learning of learners and their educational improvement. In brain based learning by emphasizing on structure and function of brain for its most important activity (learning) a series of educational actions have been implemented based on compatible principles with brain learning. The learning environment in terms of light, oxygen, water, food, music, color and sleeping is prepared and the effects of these factors on students' self-regulated learning has been studied. Hart (2002), points out that the brain-based learning is built based on the construction and function of the brain but the traditional education often prevents the natural process of brain and neglect it. Hart in other place points out that the brain is an extremely reckless system; as if it is motivated to learn like heart is for blood pumping. He believes the brain is not compatible with the schools, so if you really want to achieve learning position in line with national needs, schools have to change for compatibility with the brain that we know today. Hsieh, Hsiu-Chin (2003) mentions that many researches like Galyean researches (1983), Leslie Hart (1983), McCarthy (1990) and Caine (1994) have increased our knowledge about brain. So it would not be wise if we ignore this information.

Students may get un motivated in facing with occasions such as in appropriate styles of learning, lack of resources, lingual barriers, lack of right to choose, cultural taboos, fear of embarrassment, lack of feedback, malnutrition, bias, poor lighting, inappropriate location for sitting, fear of failure, dishonor, irrelevant content, etc…(Hoseini Iraj, 2010).

The major focus of researches in the field of educational psychology is self-regulated learning (Pintrich, 2000, Montalvo and Torres, 2004). In recent years an excessive interest is shown to self-regulate learning. Self-regulated learning is considered as a basic skill for learning during the lifetime which is seen as an important preparation for life in a postmodern society (Kauffman, 2004).

Research on scientific self-regulation learning was proposed in mid-1980s in response to the question of "how the students become dominant on their learning processes?"Self-regulation is a self-guided process through which the learners convert their mental abilities to scientific skills relevant to task (Zimmerman, 2001). According to Fetterman (Fetterman, 2001), self-regulation and self-control are among the important psychological processes which results in self-efficiency and empowerment of learner. Self-regulation refers to a process in which the learners systematically conduct their thoughts, feelings and behaviors (Pintrich, 2000, Schunk and Zimmerman, 2008).

In fact the self-regulation has ability to control of shocks, movements and actions in a manner that enables a person to stop doing something or in contrary makes him to do an activity (Bodrova and Loeng, 2005). Zimmerman (2005) has described the self-regulation as an active met cognitive, motivational and behavioral participation of learners in learning process.

Self-regulation strategies, including self-instruction, self-questioning, self-monitoring, self-reinforce will help the learners to facilitate their learning by using cognitive processes (Montague, 2003).

Regarding the importance of self-regulation learning, various models such as model of Bouffard, Vezeau, Bordeleau & Larvchrh (Jokar, 2006) has been proposed. According to this model, self-regulation includes components of meta-cognition, cognition and motivation. The meta-cognition components includes the plans and programs of students in time of reading such as applying strategies to schedule for studding, summarizing the study, organizing and supervising the study. The cognitive component includes strategies that will help the students to better understanding of lessons and component of motivation includes the extent of interest, continuity and persistence of student for lessons.

The study of abroad researches dint show any sign of experimental or semi-experimental research that have examined the effect of brain-based learning on self-regulated learning. On the other hand one of the most important internal factors that will pave the path to academic achievement is self-regulation; the learners make their behavior regulated and facilitate the learning (Talebzade Nobaryan *et al.*, 2011).

Sunger & Tekkaya (2006), in their research studied the effect of question-based learning and traditional learning on self-regulated learning of 61 students in second grade of high school. The results showed that the student which have trained by question-based learning method, have reached a higher levels of ability for determination of goal, assessment of the duty, use of complicated strategies of learning, creative thinking, met cognitive self-regulation and regulation of attempts.

Doris showed in his research that the brain-based learning will help to increase the math scores of students (Doris, 2007). Wills in a study entitled brain-based teaching strategies for improving students' learning and memory showed that this strategy has effect on improvement of learning and memory of students (Wills, 2007).

The brain-based learning and self-regulated learning has not been studied in Iran so far. Saifi *et al.* in a research entitled "studying the effect of brain-based learning on the comprehension and learning speed of students" concluded that the brain-based learning will increase the level of comprehension and learning speed of students and enhance the quality of their learning (Saifi *et al.*, 2010).

Talkhabi, in his research entitled "brain-based curriculum" showed that the aims of curriculum must be related to real life of students. In this regard it is emphasized to involve all parts of brain, the role of art and music, self-evaluation, emotional environment, social programs and enrichment of learning environment (Talkhabi, 2008) .

Regarding the lack of research in the field of this research and with aim to create infrastructure for application and develop the use of brain-based learning approach and also due to the importance of self-regulated learning, the present research has focused on this issue that does the brain-based learning affect on self-regulated learning of students?

METHODOLOGY

This research in terms of purpose is applied. In addition in terms of research design it is experimental research including an experimental group and a control group with pretest and posttest design and random arrangement. Each of two groups of subjects were measured. One of them was exposed to an independent variable (brain-based learning) and no intervention applied in control group.

In this study, 40 students were selected by multi-stage cluster random method from students of the first grade of a girlish high school and placed in experimental group and control group. Independent variable was the brain-based learning. The brain-based learning discussions are physiological structure of brain, the effect of stress on the brain and learning, elements and principals of brain-based learning and effect of environmental components on brain and learning. The topics of brain and learning were trained to teachers of experimental group for 45 minute in 3 sessions, their parents for 60 minute in 2 sessions and students of experiment group for 90 minute in 1 session.

The basic components of learning included consciousness along with relaxation (creating a exiting and pleasant environment for brain and learning), harmonious dipping in complex experiences (creating the pleasant, optimal and rich opportunities for learning) and active process of information (creating the optimal and rich opportunities for learning). Caine and Caine, designed 12 principles for brain-based learning based on these components (Caine and Caine, 1985).

Principle 1: The learning increases by challenge and remains fruitless by threat.
Principle 2: Mind and brain are social
Principle 3: The search for meaning is inherent.
Principle 4: Excitements have a crucial role in model making.
Principle 5: The brain is a parallel and simultaneous processor and brain processes are both partial and general
Principle 6: Learning requires the brain engaging physiologically.
Principle 7: The search for meaning construction is happening by taking model in the brain occurs.
Principle 8: Learning is the evolutionary and developmental.
Principle 9: Good understanding and desirable memorization occurs when the knowledge and skills comes to natural or spatial memory.
Principle 10: Learning requires emphatic attention and environmental perception.
Principle 11: Learning involves conscious and non-conscious processes.
Principle 12: Every person has an unique brain.

The learning sessions is summarized in Table 1 and 2.

Table 1: Summary of teacher training sessions.

	Sessions	Session's topic	Summary
1	Session1	Structure and function of brain	Short-term and comprehensive acquaintance of teachers with the structures of brain and chemical messengers and its relation with learning
2	Session2	Basic components and principles of brain-based learning	acquaintance of teachers with three basic consciousness components along with relaxation, harmonious dipping in complex experiences, and active process of information an 12 principles of brain-based learning and training aspects of these principles
3	Session3	Applying the brain based learning and training in class	acquaintance of teachers with teaching strategies of brain-based learning (various kinds of teaching method based on this approach, preferences of learning, creating a positive atmosphere, mobility and movement, engaging the emotions, the manner of eating, sleeping and drinking and etc.)

Table 2: Summary of 2 sessions of parents training.

	Sessions	Session's topic	Summary
1	Session1	Basic components and principles of brain-based learning	acquaintance of teachers with three basic consciousness components along with relaxation, harmonious dipping in complex experiences, and active process of information an 12 principles of brain-based learning and training aspects of these
2	Session2	Management of learning environment	Training of parents in order to create an environment and condition of brain-based learning (sleep, nutrition, exercise, music, relaxation, positive emotions and etc.)

Table 3: Summary of 2 sessions of students training.

	Sessions	Session's topic	Summary
1	Session1	Brain-based learning principles	Acquaintance of students with functionally with 12 principles of brain-based learning in order to improve the learning process
2	Session2	Management of learning situation	Scientific justification of students in changing the situation and environment of learning (he influence of light, oxygen, food, music, stress and sleep on learning

Also the teachers performed the trainings practically for 3 month by supervision of researcher.

The following changes were applied to change the traditional learning environment to brain-based learning environment:

Light: due to negative effects of fluorescent light on brain (creating stress), the yellow light was used in the class.

Water: due to essential need of brain to water and negative effects of water shortage on brain and learning, the water bottles was given to students to easy access to water.

Nutrition: due to influence of nutrition on the brain and learning, the useful and good food such as four nut (walnuts, almonds, pistachios and hazelnuts), fruit and milk were given to students as snacks.

Oxygen: the brain is consumer of one fifth of body oxygen so to improve the function of brain and learning, four natural flower pots was placed in a class.

Color: due to effects of colors on creating the positive exciting environment, the effective colors on brain were applied (yellow and orange and blue for ceiling).

Music: music has impact on many different parts of brain so music was played in time of problem solving and breaks time of students (Saif, 2010).

The dependent variable was self-regulated learning which was performed as pre-test and post-test in both groups after determining its validity and reliability. The research design of present study was the pre-test - post-test design with control group. Its properties graph based on shape (1) is as follows:

Two groups of experiment and control were evaluated by a self-regulated test (1T) simultaneously.

By designing the learning environment compatible with brain-based learning as independent variable (X), the brain-based learning was given to experimental group and control group weren't trained in this field.

Both groups after simultaneous performance of test in equal situation, were evaluated by a common test (2T).

The diagram of design is as follows:

E R T1 X1 T2

C R T1 - T2

The statistical population and sample size

The statistical population of the study was the first year students in public high schools in city of Yazd in 92-93. The sample size consisted of 40 students who were selected by multi-stage cluster random method and divided to two groups of control and experiment (each group, 20 case). Due to conduct the research, at the beginning one zone from two zones of education organization was selected.

In the next phase one high school was selected randomly among the lists of first grade high school. Then the students of one class of first grade placed randomly in experimental group and students of another class placed in control group. The intervening variable was pretest marks for self-regulated which its effect on subjects was controlled and the variance analysis was used for control of its effect.

Research Instruments

Bouffard self - regulation questionnaire: this questionnaire includes 14 questions designed by Bouffard *et al.* (1998) and is standardized by Kadivar (2001). In this test, each question has five options including: completely agree, agree no opinion, disagree, and completely disagree, and have points from 1 to 5 respectively.

The general reliability coefficient of the questionnaire based on Cronbach's Alfa was 0.71. The reliability of subscales of cognitive strategies was 0.70 and a meta-cognitive subscale was 0.68. The results of factor analysis showed that the correlation coefficient among the questions was right and instruments are composed of two factors. The value of factors was acceptable and this instrument is able to explain the variance of 0.52 for self-regulation. The validity of its structure is satisfactory (Kadivar, 2001). In research of Talebzade Nobaryan *et al*, its reliability was obtained 0.76 through performing test on 30 students and by using Cronbach's alpha (Talkhabi, 2008). In research of Atarodi and Karshki, the general reliability coefficient of questionnaire by method of Cronbach's alpha was 0.72 (Atarodi and Karashki, 2013). The reliability of this study was obtained 0.76 through performing test on 30 students and by using Cronbach's alpha.

FINDINGS

A. Descriptive findings

According to Table 4, the averages of experimental and control groups in pretest are not very different (45.15 against 45.80).

There is difference between marks of posttest against pretest in experimental and control group (55.90 against 46.20) and this difference is indicating the effect of brain-based learning.

B. Analytical Findings

First hypothesis: brain-based learning has effect on self-regulated learning of girl students of first grade in high school.

Based on the test results of Table 5, the Levin in level of $p<0.05$ is not meaningful. Therefore the assumption of homogeneity of variances is confirmed. The test of the meaningfully of covariance f in level of $p<0.05$ indicates that there is a meaningful difference between average of experimental group and control group. The result is that the hypothesis of research is conformed. It means that the self-regulated learning is changing by brain-based learning. In other words, the brain-based learning has affected on self-regulated learning.

The second hypothesis: the brain-based learning has effect on self-regulated learning and this impact lasts for 3 month.

Table 4: Average, standard deviation scores of self-regulated learning in the experimental and control group in stages of pretest – posttest.

Statistic / Group		Average	Standard deviation	Number of people
Experiment	Pretest	45.15	6.45	20
	Posttest	55.90	5.39	
Control	Pretest	45.80	5.49	20
	Posttest	46.20	5.32	

Table 5: Covariance analysis tests comparing the average marks of posttest of experimental and control group in self-regulated learning.

Sig	F covariance	Homogeneity of slopes		Homogeneity of variance	
0.001	13.76	Sig	F	sig	Loin
		0.000	36.19	0.85	0.36

Table 6: The summary of information of paired t test due to comparing the average of overall marks of student's questionnaire against the self-regulated learning in 2 states (immediately after training and 3 month after training.

Sig	df	t	S	The average difference	S	X	Groups
0.428	19	0.809	0.55	0.1	5.39	55.90	Immediately after learning
					5.62	55.80	3month after learning

Based on above results, we can conclude that there is no difference in level of error of 0.05 between student's marks of the experimental group in mentioned phases (Sig=0.428) (Table 6).

Thus, hypothesis (2) in general is confirmed, it means that the applying test variable (in period of training), has stable results among students for 3 months.

DISCUSSION AND CONCLUSIONS

The purpose of this study is to provide context for developing application of brain-based learning among students. This is expected to enhance the self-regulated learning by brain-based learning. The findings obtained from the Tables 2 and 3 show that the applying independent variable (brain-based learning) has positive and meaningful effect on increasing the self-regulated learning. Therefore, we can conclude that the awareness of students and teachers and parents from brain based learning and applying them in learning and studding is effective on self-regulation of students.

About the effects of brain-based learning on self-regulated learning we can say that because of not doing any research in this area and because the self-regulated learning increases the academic achievement and learning speed, so this research is indirectly compatible with researches that studied the effect of brain-based learning on students' academic achievement (Caine and Caine, 1994).

Also it is indirectly compatible with research of Saifi, which has confirmed the impact of brain-based learning on comprehension and learning speed of third grade students in primary school (Saifi *et al.*, 2010). Research findings are indirectly in line with research findings of Pociask and Settles and Doris (Pociask and Settles, 2007, Doris, 2007). The researcher found that the brain-based learning regarding the carried activities, based on three variables of brain-based learning in teaching (consciousness along with relaxation, harmonious dipping in complex experiences, and active process of information) leads to increase of cognitive and Meta cognitive processes in self-regulation learning. It seems that relation between three groups of students, parents and teachers and having aligned information and attitudes about learning principles in these three groups will facilitate the learning situation for students and students without any anxiety and unhealthy competition, regulate their learning.

Among the existing reasons for explaining this findings are the ability of being teachable for strategies of brain-based learning, the possibility of changing the environmental conditions and as well as ability to learn strategies in context of education.

In this research teachers by awareness of brain structure and also optimal use of brain and by considering the positive and negative effective variables provides the suitable method and also design for brain-based lessons in this study. In addition, teachers and students and parents aware of the impact of stress on the brain and learning, were very effective in creating a pleasant learning environment without the stress and omitting the causative factors of stress and psychological pressure. Learning environment without stress strengthened the feelings of self-efficacy, resilience and self-regulation of students. The researches of neuroscience shows that learning is happening in the process of changes in functional organization of brain therefore teaching is an art of changing the brain that creates the new linking between stimulus, experiences and comprehensive behavior (Hall, 2011). Brain flexibility which is necessary to adapt the brain to changing conditions makes it possible to create such links (Firth, 2005). Therefore, the most important link of neuroscience and education research is study of nature of learning and memory formation (Jones, 2011). Caine and Caine (1991), say that the emotions and cognitions cannot be separated. Thus, the learning environment should reinforce positive attitudes among students and teachers. Emotions are very important in storage and recall of information, therefore, students should be helped to be aware of their emotions and be aware of effect of emotional conditions on their learning.

Having consideration to enough sleep and proper time for teaching and rest make it possible the transformation of information from short-term memory to long term-memory also it provided the required time for processing the information and concepts. Also more storage of learning staff in the brain and relation of lessons with learning for its more meaningfully led to increase of persistence of lesions and self-regulation learning of students.

Appropriate evaluation methods emphasized on providing the feedback and self-assessment and use of productive resources and tools increased self-regulated learning which is in line with the study of Talkhabi (2008). Talkhabi in his research showed that the students' curriculum goals should be related to their real life. Evaluation is related to the process of learning and self-assessment gives the learners values. Brain-based program emphasizes on enrichment of the learning environment and emphasizes on proper emotional atmosphere. Also this program supports the social life in school and considers the difference of styles and preferences of students and this it effects on self-assessment of students and reinforced the power of cognition and meta-cognition on students.

Consideration to nutrition, water and exercise in brain-based learning helped to improve brain-based learning, due to the fundamental need of brain to them. Therefore it had a positive effect on brain. Adult human brain is approximately 1300 to 1400 grams. The brain is 78 percent water, 10 percent fat and 8 percent protein and it consume about 20% of the oxygen your body (Talkhabi, 2008).

Using the music in time of doing during homework and rest has a considerable role in recording and remembering information and the on-time ordering and remembering of information facilitated the self-regulation learning. According to Martin (2006), quoted by Saifi (2010), music by relaxation of nervous system increases learning, memory, and creativity. Almerud believes that music influences the brain and by stimulating alpha brain waves results in release of endorphins and creates relaxation, reduces anxiety (Almerud and Peterson, 2003). Reduction of stress is considered as an important factor in registration and recall of information.

Based on the results of paired t-test, we can conclude that there is not a meaningful difference in error level of 0.05 between student's marks of the experimental group in two stages of immediately after learning and three month after learning (Sig=0.428). It means that applying the intervention has stable results among students for three month.

Therefore brain-based learning could also be effective on students' self-regulated learning, and leave lasting effects on self-regulated learning. In general these results indicate that by brain-based learning we can s enhanced self-regulation learning of students. Regarding that one of the basic concerns of authorities and researchers of education in the last decades have been reform and innovation of teaching method, this research results has emphasized the role of learning brain-based in the self-regulation of student. But this important will not happen unless the teachers firstly have the internal belief to its importance for use of brain-based strategies. So it is proposed that the education system or in other words, the system of training the human forces in education system and universities place the brain-based learning among their objectives in training the teacher. Also it is recommended that parents and teachers association in the education system place the awareness of parents in their priority. Also its proposed that academic advisers in high school by equipping their working programs to brain-based learning, transform their scientific information through booklets and brochures to students. Also it is recommended that evaluation of students must be descriptive and do not use scores as much as possible. The ultra-organization connection between education and university of medical science due to applying of cognitive neuroscience at the education and training science is another proposal.

The most important limitation of this study is the lack of adequate literature research on brain-based teaching and learning and self-regulated learning in Iran, so it is suggested other researchers in addition to studied variables (comprehension, speed of learning and self-regulation learning), study other variables.

Also it is proposed that other researchers study the brain-based learning and training in elementary school and university.

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