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ARTÍCULO DE INVESTIGACIÓN

The Effectiveness of Brain-Based Learning Model on Studying and Reading Speed

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Abstract

The purpose of this study was to determine the effectiveness of the brain-based learning model on studying and reading Speed for the Persian literature lesson in the fifth-grade students of Mahmoudabad Town. In this study, non-random and semi-experimental sampling method was used. A preliminary and final test design with the control group was used without using random selection, which is one of the semi-experimental designs. The subjects were 30 students of the fifth-grade school where the researcher chose them and then placed them in two groups of 15 subjects. The teaching team teacher was given brain-based learning was given during five sessions and to their parents during one session. The learning environment was changed based on the components affecting the brain (light, nutrition, oxygen, color, music and water). Then, the teacher taught the Persian literature lesson based on the components and principles of brain-based learning in three months. For both groups (experiment and control), pre-test and post-test studying and reading speed by Moradi and Karami (2008) were performed. Findings indicate that the brain-based learning has increased the studying and reading speed of students and has had a significant impact on improving their learning quality.

Key words: brain, teaching, brain-based learning, study method, reading peed.

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Efectividad del Modelo Basado en el Cerebro para el Estudio y la Velocidad de Lectura

Resumen

El propósito de este estudio fue determinar la efectividad del modelo de aprendizaje basado en el cerebro para estudiar y leer la lección de Velocidad para la literatura persa en estudiantes de quinto grado de Mahmoudabad Town. En este estudio, se utilizó método de muestreo no aleatorio y semi-experimental. Se utilizó un diseño de prueba preliminar y final con el grupo de control sin utilizar la selección aleatoria, que es uno de los diseños semi-experimentales. Los sujetos fueron 30 estudiantes de la escuela de quinto grado donde el investigador los eligió y luego los colocó en dos grupos de 15 sujetos. El maestro del equipo de enseñanza recibió un aprendizaje basado en el cerebro durante cinco sesiones y a sus padres durante una sesión. El entorno de aprendizaje se modificó en función de los componentes que afectan al cerebro (luz, nutrición, oxígeno, color, música y agua). Luego, el maestro enseñó la lección de literatura persa basada en los componentes y principios del aprendizaje basado en el cerebro en tres meses. Para ambos grupos (experimento y control), se realizaron pruebas previas y posteriores a la prueba de velocidad y lectura de Moradi y Karami (2008). Los hallazgos indican que el aprendizaje basado en el cerebro ha aumentado la velocidad de estudio y lectura de los estudiantes y ha tenido un impacto significativo en la mejora de su calidad de aprendizaje.

Palabras clave: cerebro, enseñanza, aprendizaje basado en el cerebro, método de estudio, velocidad de lectura.

Introduction

Review of the evolution of the relationship between neuroscience and learning indicates that awareness of the nature and manner of learning of the brain and designing educational programs consistent with the learning manner of the brain of students have always been of the crucial concerns of many major neurologists and educators. In fact, it can be claimed that in every era, depending on the level of know ledge of the humankind on the brain function and how it learns, thinking and educational policy have also been affected, and consequently, the school programs have undergone alterations and modifications (Nouri, 2011). Since 1990, information on learning, light, and physiology has grown significantly, as in the United States, the last decade of the twentieth century was called the *Decade of the Brain*. This led to extensive studies on the structure of the human brain focusing on health, severe brain disorders, and the impact of drugs on the brain, however the international interests pushed research into learning and educational aspects. At the present, there is a global trend towards shared research on neuroscience and education. In Iran, the Department of Neuroscience and Curriculum has been established since 2012, moreover, the master's degree in Cognitive Science of Brain, Brain, and Education has been started in the Cognitive Science Research Institute in 2013. The position of types of learning as well as its level and significance to the brain, and all learning have been concentrated on this member. Brain-based learning (BBL) is the recognition of the rules and regulations of the brain for

meaningful learning and the organization of learning based on them. The BBLcan be implemented based on three components

(relaxing alertness, harmonious immersion, active processing) taking into account 12 principles. Regarding the above-mentioned issues, it becomes clear that given the elementary period and the new changes taken place in the curriculum and the evaluation procedure of the elementary schools, empowering students to read, understand, and write is of great importance. The brain-based learning is one of the effective strategies for empowering students in reading and its speed. In the present study, the viewpoints on the effectiveness of the BBL model on reading and reading speed of Farsi course will be investigated among the students of the elementary fifth grade in Mahmoudabad city, Iran (describing how to implement the brain-based model). Then the collected data will be analyzed and finally, in the fifth section, the conclusions, suggestions, and applications of the BBL model obtained from the study will be addressed.

Importance and necessity of the study

At present, there has been a global trend towards the research common between neuroscience and education; the relationship between neuroscience and education must be mutual, and educators must raise questions for neuroscience projects, and along with, extract educational data from neuroscience experiments. In fact, studies on learning link the fields of learning and neurology to each other (GOSEAMI, 2004). Learning and education can be considered a new discipline of natural sciences, the scope of which being the whole area of human life. Medical experts help to grow and maintain health through examining, studying, and making more knowledge on body organs including heart, brain, kidneys, digestive tract, etc. The human brain works like his heart without knowing its own structure and function, however human can organize his health and activities consciously based on information on the nature of these members. In other words, brain is the place of learning, both superficial and significant, and all learning is based on this member. The BBL is based on the fact that the brain is naturally planned for meaningful learning, and as any expert needs knowledge on the complex involved in that profession, teachers as learning professionals should also be aware of the brain learning process and apply the principles consistent with it so that basic and sustained learning is formed in the brain of the students; otherwise, teachers will be like doctors who practice medicine without knowledge of the body (Translated by Abolghasemi, 2004).

A review of the background of international studies did not reveal any evidence of research examining experimentally or quasi-experimentally the impact of BBL on reading and reading speed in the Persian language. On the other hand, the main objective of any type of education and learning activity and the most important activity of educational systems is to achieve the goal of "reading", and reading comprehension strategies are one of its most important skills. Generally, the basis of learning of materials and concepts is reading (comprehension) (Fedaik, 1919, quoting from Faryad and Rakhshan, 1991). Very less research has been carried out so far on BBL in Iran, however numerous studies have ad dressed metacognitive learning and its positive effects on reading comprehension and learning speed. Few studies have been performed on brain-based education so far. Therefore, taking into account the importance of reading in learning, this study was conducted to examine the effectiveness of the BBL model on reading and reading speed of Farsi language in the elementary fifth grade.

Research objectives

1. Determining the impact of BBL model on student reading.
2. Determining the impact of BBL model on student reading speed.

Research background

Nouri, Ali (2011) conducted a study entitled "Pattern of brain-adaptive curriculum design" and showed that brain-friendly design pattern based on the neuropsychological principles of curriculum assumes the learning as a process occurring in the brains of students; their brain learns best when learning materials and experiences are designed on the basis of their needs, abilities, and interests. Seifi, Somayeh, Ebrahimi Ghavam, Soghari, Farrokhi, Nourali (2009) carried out a study on "Examining the impact of BBL on reading comprehension and learning speed of the third-grade elementary students". The findings of this study suggested that the BBL has enhanced the reading comprehension and learning speed of students and has had a significant impact on improving their learning quality.

Talkhabi, Mahmoud (2008) presented a study as "Brain-based curriculum". The results of this study indicated that curriculum goals should be related to the students' real lives. In this program, the involvement of all parts of the brain is of particular importance, in addition to emphasizing the role of art and music. Moreover, this program evaluates the social life in the school and takes into account the differences in students' styles and preferences.

Rahimi, Mohammad (2011) presented a study on "Learning in your own brain style: your brain is different from others." The study results revealed that the brain-based learning and learning draw routes for educators who aim more targeted and informed learning. It also decreases the possibility of education based on guess (inaccurate learning) rather than accurate knowledge.

Asadian, Soroush (2011) performed a study entitled "What is a BBL?" The main objective in this study was to investigate the effect of BBL on student learning. The results indicated that teachers using the modern brain-based theories of learning, have expanded their classroom experiences to a high level. Most schools, however, ignore the results of the research and the issues of this theory, implying irreparable damages to their learning processes and student learning.

Daemi, Hamid Reza (2012) conducted a study as "Effectiveness of learning metacognitive strategies on improving reading, comprehension, and reading speed of students". The results showed that learning of metacognitive strategies improved the reading comprehension and reading speed, and reduced the number of mistakes in reading, in addition, the metacognitive learning could be exploited to improve the reading comprehension of students in other courses and education levels.

Kalhon, Christine (2012), performed a study on "Brain-based learning: Does it really work?" The findings in this study indicated that all parts of the brain participate in the learning process and increase the participation of students in the learning process and it is an active learner.

Willis, Judy (2015), presented a research as "Neuroscience behind stress and education (according to the theory of BBL)"; the findings in this study as well as the research on brain and neural network imaging suggested that impairment in brain learning circuits and neurotransmitters in the stressful learning environment had a negative effect on learning, in addition, qualitative improvement of the circuit involved in memory and performance that has been shown to have positive and interactive effect.

Wilson Donna (2015) in a study as "Brain-based learning" showed that the images which are created in the minds of the students, called *brain film*, can be more exciting and memorable than Hollywood movies and teachers can easily direct their students to their imagination, and the students can use it as an engaging and enjoyable way to enhance reading comprehension in the learning process.

Findings in a study conducted by Wilson Donna (2015) as "Attractive brains, learning children on neuroscience to raise their learning" revealed that learning of students as well as familiarity of the teachers with neuroscience can positively affect students' learning and their expectations and perception of their abilities that can lead to the most successful academic achievement.

Aifer (2013) conducted a studyas "Impact of types of text in reading and comprehension". The objective in this study was to determine the effect of various informative stories and texts on the level of reading and understanding of the concepts among the fourth and fifth grade elementary students. Results showed that students reading narrative texts had a better understanding of informative texts, in addition, there were significant differences between male and female students in terms of reading and reading comprehension.

Carty, Mc Christiane (2013) performed a study on the "Effect of artistic-visual integration on reading in elementary level, a literary perspective". The results showed that if the visual arts are considered in the student curriculum, and if teachers implement the BBL model in the classroom, the visual arts, the core curriculum, and the brain-based research results will be highly important in the learning of visual arts to children. In addition, the core curriculum is effective with the emphasis on visual arts and BBL in reading among children in the elementary period.

Research Methodology

This study is an applied study in terms of purpose and a field study and quasi-experimental method along with library studies in terms of research method. The research method in this study was quasi-experimental as, in the socio-natural situation of this study, the variables in the research field could not be completely controlled, in other words, in the present situation, the researcher was not able to study the experimental research properties such as what factors and when have been influenced by how many variables in the research field? Or, there is no chance for random selection. Therefore, the non-random and quasi-experimental sampling methods were exploited to study and assess the situation.

In quasi-experimental research plans, the researcher controls and monitors some of the factors existing in the research field which cause the internal and external invalidity of findings of the research. In fact, such designs are used when realistic experimental implementation is not possible. In cases where the random selection and division of subjects are not possible, the researcher can use the preliminary and final test design with the control group without using random selection, which is one of the quasi-experimental methods, for conducting an experimental study (Naraghi, Naderi, 2011).

Conceptual Definitions of Terms

Theoretical Definition

BBL: BBL is the recognition of the rules and regulations of the brain for meaningful learning and the organization of learning based on them (Jensen, Eric, 2012)

Reading: is a purposeful activity that requires regulation of extensive cognitive activities for decoding, understanding, and learning of the text (Hamid, Daemi, 2012)

Reading speed: is the length of studying of the course text.

Operational definition

BBL: The BBL was implemented based on 12 principles and three components of relaxing alertness, harmonious immersion, and active processing and expressing the environmental components affecting the brain (including light, oxygen, water, music) for teachers of the experimental group, parents of students, and students in five, one, and one session of one and half an hour, respectively.

Reading: In this study, a standard reading test proposed by Moradi and Karami (2008) was used for operational measuring of the reading variable, which was performed as pre-test and post-test forms in both groups.

Reading speed: In this study, to measure the speed of reading variable, the duration of the study of the test questions, reading of the comprehension text, and also the response time to the test questions were measured with a digital clock.

Research Scope

Time scope

The time period of the study has been considered as the time domain of the plan taking into account the contingency effects of various variables, especially environmental and genetic variables on the research subject

The time domain of the study was from December 2015 to June 2016.

Spatial scope

The spatial domain of the present study was Shahid Sheikh Fazlollah Nouri-Mirdeh elementary school in Mahmoudabad city.

Thematic domain

All topics related to neurology, brain, learning, program, reading Persian, and the suitable speed of reading Persian lesson are considered as the thematic domain of the present study.

Components and principles of the BBL

BBL includes three basic components that are effective in reducing the learning complexity:

Relaxing alertness: If the claim that 80% of the learning problems is related to stress is correct, then teachers are required to provide a quiet and stress-free learning environment for the students. Being far from mental stress provides the same condition for the learner, known as relaxing alertness. In general, it can be stated that if teachers want students to learn effectively, they must provide a relaxed learning environment for them. Based on personal experiences, everyone knows that the ability to think coherently may be under the influence of pressing positions, hence the individuals can divulge their capabilities. The principles of relaxing alertness (according to the 12 principles) include:

- Learning is enhanced through the challenge and reduced with threats.
- The brain is a social mind.
- Searching for meaning is intrinsic.
- Emotions play a determining role in modeling.

2. Harmonious immersion in the complex experiences: refers to a situation in which the learner is fully involved with the subject and the issue of learning. Several suggestions have been made for the learner to be deeply involved with the subject of learning. However, in general, it can be said that the subject of learning should be as accessible to the learner as possible. The deep engagement with the subject of learning is clearly related to the beliefsre garding the field and the acceptance, in addition, the

engagement with the subject of learning must be deep, growing, and controlled by the teacher. According to the 12 principles, the immersion principles are as follows:

- The brain is a parallel and simultaneous processor, and brain processing is both partial and generic.
- Learning requires the physiological involvement of brain.
- The search for meaning takes place through a pattern or searching for a pattern.
- Learning is evolutionary and developing.

3. Active processing: A very important principle that is related to the above-mentioned beliefs. In fact, there is a relationship between active processing and acceptance and perception. Active processing refers to the connection between experiences and prior knowledge with real life events. Active processing is associated with the principle of constructivism [according to the Fundamental Reform Document of Education (FRDE)], in which all new learning is based on previous knowledge and structurology. The deep engagement with the subject of learning and information processing are interacting with each other, helping the learner to gain a wider view towards learning. The principles of active processing include:

- Learning occurs when knowledge and skills come to natural memory space.
- Learning involves internal attention and external perception.
- Learning involves conscious and unconscious learning processes.
- The brain of each individual is organized in a unique way.

Learning Activities

What types of learning activities are recommended in a brain-based curriculum?

A better understanding of the brain hemispheres leads to the knowledge that they do not work separately. For instance, Robert Scano from the Montreal Neurological Institute and Hospital says: "I'm not in doubt, when we listen to a piece of music, our whole brain is involved." In any case, designed learning activities should exploit the whole brain. Hence, brain researchers raise the following issues:

Galin (1983) argues that a set of mental skills should be taken into account in the curriculum, including self-exploration, attention, concentration, visualization, mental-physical exercises, and art-enhanced visualization activities.

Patricia (2003) has proposed two activities for learning the whole brain:

1. **Involving students in solving real-life problems:** Many of our neural networks have been formed by the real experiences, so one can take the advantage of this natural desire through engaging students in solving real problems in school and society.
2. **Simulation:** Simulations provide a useful opportunity when dealing with real problems is not possible.

Features of Rich Learning Environment

1. **Feeling safe and removing threats**
2. **Variety of environmental stimuli:** In such an environment, the brain creates new communication in itself, which increases the capacity for learning.
3. **Providing challenging information:** This can be fulfilled through providing new learning opportunities, changing educational strategies, supporting the learning process.
4. **Providing feedback:** In fact, the brain acts according to feedbacks.

5. **Performing group activities:** Individuals feel valuable in the process of group interaction.
6. **Learning of reading:** This is very useful for stimulating the brain as the brain communication develops by increasing the vocabulary.
7. **Physical stimulation:** The brain grows through performing physical activities, therefore physical activity should be included in the program for specific motor stimulation.
8. **Learning to think and solve problems:** Solving challenging problems is the best way to grow the brain.
9. **Music learning:** Music is a stimulus that engages the whole brain and can be used in three roles: as a stimulus to change the learner's emotional state, as a carrier of the words, and eventually as a seasoning.
10. **Program flexibility:** Providing the right to the learners to choose content and learning method.

Keane and Keane (1991) noted that emotions and cognition cannot be separated, so the learning environment should reinforce positive attitudes among students and teachers. Emotions are very important in storing and remembering information, so students should be helped to be aware of their emotions and how emotional conditions impact their learning.

Time: Based on the brain-based curriculum, what time is suitable for learning? In this perspective, should the timing of the program be fixed or flexible?

Keane and Keane (1991) state that learning involves all body physiology, so physical growth, personal calm, and emotional states influence the learning ability. Therefore, it should be noted that the growth rate of children is not the same and the time age does not indicate their readiness for learning. For example, Eric Jensen (1996) notes that: Parents can start reading education from the six months of age of the children, and schools must provide the conditions so that the students encounter more and challenging words and learn foreign languages up to the age of 12.

Space and location: Does the brain-based curriculum focus on learning location or learning space? Is it limited to the classroom?

If we accept that each brain is unique, then the class cannot be the only place or space of learning. Therefore, the brain-based curriculum will support a variety of environments and will emphasize the compatibility of the environment with the brain (not brain compatibility with the environment as is being urged in schools today). Moreover, a brain-based curriculum is the supporter of learning within the environment. The brain can have a better learning performance when the learning is accomplished in the suitable environment, as separating learning from the real environment reduces brain function. In fact, the learning environment is a space where the brain carries out its own excellent work, i.e. the learning process. Hence, naturally, the brain-based curriculum will emphasize learning space rather than the learning location.

Grouping: How is the system of participation in the brain-based curriculum formed?

The brain-based curriculum system tries to help students find the application of information in their lives. For instance, learning the history course will help them understand the events happening in the today's world. However, since life is social in nature, this system makes learners to participate in their own learning activities and strive to reinforce each other's learning. Based on researches on brain, cooperative groups can be used in learning environments. These groups make members feel valuable in the process of internal interaction, and the brain make people enjoy their work through secretion of endorphins and dopamine.

Learning strategies: How is the learning process formed in the brain-based curriculum? What role do students and teachers play in?

As McCarthy (1990) points out, learning methods should take into account different learning styles of learners, so the learning method must be planned in such a way as to engage the whole brain and provide an opportunity for all learners in all age groups with different learning styles to take the advantage of that opportunity. Shon Carey (2005) argues that the brain of each individual is unique. According to him, this uniqueness implies that every individual requires a different educational experience. In this perspective, students take on the responsibility of learning, both receiving and processing information in that process.

In brain dominance theory, like McCarthy, Ned Herrman considers brain function in four quarters. According to him, learning methods should address all the brain in addition to respecting the brains of the learners. The basic point in the brain-based learning model is that teachers must gain high level of skills to apply different and multiple methods of learning.

McCarthy (1990) has presented the whole brain (quadrilateral) learning method, which involves four learning styles and is implemented in eight steps, linking the activity of the right and left hemispheres of the brain. The whole brain learning method provides a map of how to plan and provide education so that all learners in all age groups with different learning styles can benefit from. The role of the teacher changes in the learning steps in the entire brain learning method so that students take on the responsibility of learning. Studies indicate that this method increases motivation among students. Despite the presence of numerous learning methods, the four-part method is closer to the whole brain model due to dealing with both receiving and processing of information. Furthermore, according to studies in the field of neurology, the four-part approach considers the preferences of the learners' brain hemispheres.

According to the four-part method, two basic assumptions are:

1. Each student will maintain the learning style and processing preferences of their hemisphere.
2. Teachers will design learning strategies to address the student's tendencies as a systematic process.

The whole brain learning method can improve thinking and interpersonal skills. It also develops the concept of being a team member as a personal resource, while the whole brain method measures student engagement with learning activities, which often reflects their motivation, hence using the whole-brain approach, teachers can design learning manner in order to create the necessary merits of work and life environments among students.

McCarthy (1983) emphasizes that the whole-brain learning style helps teachers gain high skills in the use of multiple methods of learning. In other words, the whole brain learning method helps teachers gain a profound understanding of the educational materials and, hence, increase the effectiveness of their education.

In addition, Hart (2002) notes that BBL method is established based on the structure and functioning of the brain, however the traditional education often prevents the normal process of the brain and neglects it. Keane and Keane (1994) stated that the BBL method has influenced learning. Therefore, planners, managers, and teachers should consider how to use this method in curriculum, education, and assessment.

Eight steps of the whole brain learning approach are:

1. **Communication:** Activate the relationship between the left and right hemispheres of the brain. To do this, gain an experience or call previous experiences related to each other.

2. **Review:** This stage will give learners the chance to think about their experiences and clarify the meaning of some of the activities, by doing so, the left hemisphere is activated. (Students must participate in both of these activities; these two steps coincide the features for the first quarter and create the necessary motivation).
3. **Imagination:** This activates the right hemisphere of the brain. The third step is focused on integrating a thoughtful analysis in the concept which helps learners to imagine and understand the presented concept.
4. **Description:** This stage allows the teacher to explain the viewpoints and understanding of the experts regarding the concept and develop the necessary concepts and skills. By doing so, learners will learn concepts and skills. This step activates the left hemisphere of the brain. (Steps 3 and 4have been designed in line with the second quarter learners, thus teachers must expand the relationship between the concept and its relationships with the lives of students through objective activities).
5. **Test by applying:** This step also activates the left hemisphere of the brain and aims to provide students with opportunities to test their newly-gained knowledge in practice. At the end of the lesson, teachers can test students' perceptions of new material through questions or worksheets.
6. **Expanding:** At this stage, the learners are given the opportunity to develop their learning through applying them in more complex situations. This step has been designed to activate the right hemisphere of the brain (students must be active in both Steps5 and 6. In fact, these two steps are designed for third-quarter learners. Therefore, teachers should prepare practical activities to enable students to organize their learning in their own ways, and combine them together).
7. **Correction and refinement:** This step also activate the left hemisphere of the brain. This step helps learners analyze the application of their new learning for conceptualization, communication, effectiveness, and initiative. Teachers must make sure that students' analysis of the new information is accurate and correct it if necessary.
8. **Integration:** This step allows students to share their understanding and perception and integrate the new learning with their lives. This will activate the right hemisphere of the brain. All students should be active at this stage (steps 7 and 8 are designed in line with the characteristics of the fourth-quarter learners, therefore teachers must support students in learning and participating in classroom learning so that they all engage in learning and take on the learning responsibility).

This learning methodology has been established as an educational approach to apply the functions of left and right hemispheres of the brain in the learning. This method focuses on active learning and thinking as part of the learning methods connecting the left and right hemispheres. This approach also tries to enable learners to gain the ability to see the whole and full picture and identify patterns in the information provided.

Environmental issues and components affecting brain-based education

The importance of the learning environment cannot be ignored; the brain learns better in safe, healthy, creative, challenging, and adaptive environments. In designing schools, it should not be forgotten that the designed environment is an environment for brain development and learning of students and any omission can create irreparable damages.

Vilson (2015), believes that five main factors are necessary for creating a learning environment for BBL:

1. Creation of friendly classes and learning culture
2. Enrichment of the classroom environment
3. Collaboration
4. Logical thinking and student's freedom of choice
5. Achieving the mastery level and application of learning

Eric Jensen (2012) believes that the brain needs energy to learn; that is, a BBL environment should bea pleasant and stress-free environment; optimal learning takes place when the brain is properly challenged. When the learning activity is accompanied by threats and mental stress, the brain efficiency decreases.

In a school where brain development is challenged in non-threatening ways, learning thoughts, memory building, and a variety of arts are benefited from. Through visual and practical learning, the learner's brain creates fresher and more powerful communication. (Erik Jensen, 2012) considers music, architecture, painting, and other arts to be serious as a basis for effective learning. Architecture and facade of schools designed with appropriate principles and style are aesthetically stimulating. Such school environments are associated with brain development and lead to more brain activity.

Enriching brain through reading (What are the benefits of reading to the brain?)

As long as the child does not face new words, his auditory cortex cells do not grow so much to be able to distinguish different sounds. The best time to start reading among children is from the age of six months. In schools, especially the primary schools, teachers must provide the circumstances for students under the age of twelve to face more and more challenging words and learn foreign languages. Every passing year, eliminating nerve cells, and removing synapses makes it difficult to learn second language. The more vocabulary the students learn from their teacher, the more number of words remaining in their minds. If the teacher desires to supply more words to the students in a simple way, he can display those words and target their learning. Reading at a suitable speed is a great way to grow vocabulary domain, although it should not be imposed on students earlier than the proper time. The "normal" reading time for the brain of some learners is the age of three or four years old, and 8 years old for some others. In fact, the best reading time is from a few months to five years old (Jensen, Eric, 2013).

The brains of children with language impairment has an excessive balance, meaning that the sides of the brain are the same. In this case, the left hemisphere has lower power, despite the fact that the left hemisphere should be larger and more active than the right one. This makes the child hear intricate distinctions among voices, which makes distinguishing differences among the words and only a flow of meaningless voices not reach to the child's ear. According to Paulata, until the brain can learn the classification of words, new software programs distinguishing words from each other can be used. These programs have been successful in brain rehabilitation up to 80% (Jensen, Eric, 2013).

Reading steps

In general, the sequence of steps that a child naturally takes to acquire reading skills is as follows: (Daemi, Hamid, 2012)

1. **Developing reading preparedness:** This phase starts from birth and continues to the beginning steps of reading and includes the development of language, motor, hearing, and vision skills as well as the evolution of the cognitive thinking concept and the ability to accurately focus on performing activities.

2. **First stage of learning to read:** This is the beginning of the nominal reading program and traditionally takes place in the first year of elementary school.
3. **Rapid reading skills:** This step is usually performed in the second and third grades of the elementary school and is in fact the continuation of refinement and development of the previous stage.
4. **Broad reading:** Programs of late elementary school and early secondary school that focus on broad and continuous reading and enrichment of business and reading.
5. **Reading refinement:** Schools realize that reading development is not completed until the end of the elementary school even for the case of learners without a particular problem in reading.

Factors influencing reading preparedness

The following six factors have been considered as factors effective in reading preparedness: (Same reference)

1. Physical preparation
2. Perceptual preparation
3. Cognitive preparation
4. Linguistic preparation
5. Emotional preparation
6. Environmental-experimental preparation

According to the above mentioned issues, can one raise the question that is the education and learning able to make better brains?

The answer to this question is definitely yes. The knowledge of past generations can be passed on to us so that we can store and access more knowledge, learn more skills, and use them, hence we can be more aware of what affects our mental lives. Education can also correct the developing brain problems. How can we use our brain power more effectively? We certainly believe that the brain sciences will ultimately have an answer to this question. At least, this belief can strengthen our enthusiasm for learning and education. The education changes the brain and even the minds of students. Whenever students learn something new, whether a new face, a new word, or new song, something has changed in their minds. Education for the brain is like gardener for the garden. Not only education, but culture in a broader perspective also changes the brain.

Statistical analysis

In this study, t-test was used among the two independent groups to examine the effectiveness of brain-based learning model on reading speed. The output of the independent t-test for the two groups is shown in the following table:

Summarizing the results of independent T-test on the mean difference between the scores of post-test and pre-test (speed reading).

Brain-based learning		Numbers	Mean	Standard deviation	Standard deviation error
Reading the words	post-test	15	80.1333	24.39233	6.29805
	pre-test	15	106.2667	14.47888	3.73843
Chain of words	pre-test	15	81.1333	23.49733	6.06689
	pre-test	15	103.8667	16.32643	4.21574
Rhyme test	post-test	15	84.8667	19.52971	5.04255
	pre-test	15	113.6000	6.24271	1.61186
Naming images	post-test	15	76.6667	9.61893	2.48360
	pre-test	15	106.8000	9.89372	2.55455
Comprehension	post-test	15	75.4667	18.22818	4.70650
	pre-test	15	111.1333	7.22957	1.86667
Understanding the words	post-test	15	74.4667	18.83335	4.86275
	pre-test	15	103.6667	13.47308	3.47873
Remove the voices	post-test	15	72.4000	14.40635	3.71970
	pre-test	15	109.7333	8.84361	2.28341
Reading Nonsense words and quasi-words	post-test	15	71.4000	21.18895	5.47096
	pre-test	15	100.4000	14.92744	3.85425
Letter Symbols Test	post-test	15	69.2000	22.07196	5.69896
	pre-test	15	101.4000	7.88126	2.03493
Category tag test	post-test	15	34.4667	14.77868	3.81584
	pre-test	15	50.4000	8.00714	2.06743

Summarizing the independent T-test results for the mean difference between the post-test and pre-test scores

		Equality Test Lev Variance Equation Test		mean equation T-test							
		F	significance	t	Freedom degree	significance	mean difference	Standard error difference	%95 confidence level	t	Freedom degree
		high	low	high	low	high	low	high	high	high	low
Reading the words	equal variance hypothesis	5.912	0.022	3.568	28	0.001	26.13333	7.32402	11.13076	41.13591	5.912
	unequal variance hypothesis			3.568	22.776	0.002	26.13333	7.32402	10.97420	41.29247	
Chain of words	equal variance hypothesis	4.805	0.037	3.077	28	0.005	22.73333	7.38772	7.60027	37.86637	4.805
	unequal variance hypothesis			3.077	24.963	0.005	22.73333	7.38772	7.51688	37.94987	
Rhyme test	equal variance hypothesis	12.085	0.002	5.428	28	0.000	28.73333	5.29390	17.88927	39.57740	12.085
	unequal variance hypothesis			5.428	16.831	0.000	28.73333	5.29390	17.55565	39.91102	
Naming images	equal variance hypothesis	0.001	0.973	8.458	28	0.000	30.13333	3.56286	22.83515	37.43152	0.001
	unequal variance hypothesis			8.458	27.978	0.000	30.1333	3.56286	22.83489	37.43178	
Comprehension	equal variance hypothesis	10.049	0.004	7.044	28	0.000	35.66667	5.06316	25.29526	46.03807	10.049
	unequal variance hypothesis			7.044	18.289	0.000	35.66667	5.06316	25.04178	46.29155	
Understanding the words	equal variance hypothesis	1.637	0.221	4.884	28	0.000	29.20000	5.97896	16.95296	41.44734	1.637
	unequal variance hypothesis			4.884	25.356	0.000	29.20000	5.97896	16.89485	41.50515	
Remove the voices	equal variance hypothesis	3.170	0.086	8.554	28	0.000	37.33333	4.36465	28.39276	46.27391	3.170
	unequal variance hypothesis			8.554	23.239	0.000	37.33333	4.36465	28.30951	46.35715	
Reading Nonsense words and quasi-words	equal variance hypothesis	3.714	0.0649	4.333	28	0.000	290.00000	6.69228	15.29148	42.70852	3.714
	unequal variance hypothesis			4.333	25.150	0.000	290.00000	6.69228	15.22115	42.77885	
Letter Symbols Test	equal variance hypothesis	9.421	0.005	5.321	28	0.000	32.20000	6.05137	19.80434	44.59566	9.421
	unequal variance hypothesis			5.321	17.513	0.000	32.20000	6.05137	19.46115	44.93885	
Category tag test	equal variance hypothesis	2.787	0.106	3.671	28	0.001	15.93333	4.33992	7.04341	24.82326	2.787
	unequal variance hypothesis			3.671	21.567	0.001	15.93333	4.33992	6.92241	24.94496	

Summarizing the results of reading speed, sub-quests
The mean difference between the speed of post-test and pre-test

Indices	group	numbers	Mean of pre-test speed in minutes	Mean of post-test speed in minutes

Subtest of reading words	experiment	15	2	1:20
	control	15	2	2
chain of wordssubtest	experiment	15	2	1:20
	control	15	2	2
Rhyme subtest	experiment	15	2	9:10
	control	15	2	2
Subtest of Naming Images	experiment	15	2	1
	control	15	2	2
Subtest of comprehension	experiment	15	2	3
	control	15	2	5
Subtest of words comprehension	experiment	15	2	1
	control	15	2	2
Subtest of voice removal	experiment	15	2	1
	control	15	2	2
Subtest of reading the words and pseudo-words	experiment	15	2	1:20
	control	15	2	2
Subtest of Letter Symbols	experiment	15	2	1
	control	15	2	2
Subtests of category tags	experiment	15	1	1
	control	15	1	30 seconds

According to the data presented in the above tables, the statistical analysis of each of the sub-tests showed that the significance level of most of them was more than 5%, and at 95% confidence level, the learning-based learning test was effective on students' reading speed, i.e., there was a significant difference between students' reading speed in post-test and pre-test. Therefore, the BBL model has significantly influenced the reading speed among the students of the elementary fifth grade.

Conclusion

In the study by Nouri (2011) as "Brain-compatible curriculum design model", it was declared that the brain-compatible design model based on curriculum neuroscience fundamentals is a process that occurs in the brains of students and their brain learns best when learning materials and experiences are designed in accordance with their

needs, abilities, and interests. The results of this study are consistent with those of the present study. Based on the above findings, it is recommended to avoid lack of attention to students and their needs as well as emphasizing the outcome of learning and textbooks.

The results of a study conducted by Seifi, Ebrahimi Ghavam, Farokhi (2009) with the aim to examine the effect of BBL on reading comprehension and learning speed of elementary third-grade students indicated that the BBL has increased the reading comprehension level and learning speed among the students and has significantly improved their learning quality. This study is in agreement with the results of the present study regarding the finding that the BBL is effective in reading and reading speed.

In the study by Talakhabi (2008) on "Brain-based curriculum", it was indicated that the curriculum goals should be related to the students' real lives. In this program, the engagement of all parts of the brain is of particular importance, in addition, the role of art and music is emphasized. This finding is in line with the results of the present study and confirms them. Based on the above findings, it is recommended to avoid the traditional curriculum and passivity of students in the classroom as well as the lifeless and teacher-centered environment.

Asadian (2011) in a study on the BBL, suggested that the BBL method influences learning of the students; the findings of this study emphasize that in this strategy, teachers who teach based on the new brain-based learning theories, the students trained by these teachers act as self-activating and self-controlling. This study is consistent with and confirms the results of the present study.

Study recommendations

The concern in this study was whether the BBL model could have a significant effect on reading and reading speed of Persian language among students in the fifth grade. This study responded to this fundamental question in addition to examining the issue theoretically and statistically. Despite the fact that the issue was confirmed statistically, it is necessary to provide recommendations for theoretically and practically strengthening of the BBL for teachers in schools. Two sources have been used for presenting recommendations: theoretical source of the topic and the source based on the findings of the present study, hence the following suggestions have been presented for the better implementation of the BBL. In this study, the effectiveness of the BBL model on reading and reading speed was investigated. In addition, it was found that the effectiveness of reading and reading speed of students were a function of the BBL model in the classroom (of course, one of the factors is effective, not all of them). Accordingly, taking into account the confirmation of the research hypotheses, the Iranian Ministry of Education can use this finding to better implement the education and curriculum in line with the interests and needs of the students. Therefore, the main suggestion of the present study is presented in two steps:

Stepone: Prior to learning the textbook and starting the school year for teachers and parents

At this stage, before beginning the learning of textbooks and start of the school year, providing explanatory classes and participating in the learning course are recommended for teachers and parents of students for implementing the BBL method for them. At this stage, during a compact period of several months (2 or 3 months), the teacher applicants will undergo a learning course for implementing the BBL model and after learning and preparing learning environments according to the components and the principles of BBL, will be ready to begin learning the textbook.

Second step: the individuals or schools intended to use this model in the class have already been selected:

At this stage, the desired individuals and schools have already been selected to implement this method in their schools. It is necessary to first provide a preliminary explanatory course for recognizing the brain and the physiological structure of the brain and its principles and components, and how to prepare the learning environment for the teachers, in addition, one or two learning sessions must be held for the parents and students influenced by this method to enhance their awareness of how the brain learns as well as the brain functions.

Then, several sessions are suggested to be held for teachers involved in this method make them aware of the BBL model and how to prepare a curriculum plan and appropriate learning methods. It should be noted that the sessions should be held according to the school's conditions and after coordination with the management, so that the environmental components (in terms of color, music, light, water, oxygen) are prepared in the classroom.

Given the above issues, the following applied suggestions are presented:

- Taking into account the importance and role of the education system, especially in the economic, social, cultural, political, and educational dimensions of the society, it is necessary to undertake fundamental activities to improve the quality of these systems and prevent waste of the human and material capital.
- In-service learning and explanatory courses be provided for teachers and principals regarding recognition of the brain (neuroscience) and the relationship between neuroscience and curriculum, rather than traditional classes, as well as on how the brain learns and its impact on the learning process in all educational areas of the country, especially with regard to the changes in the Fundamental Reform Document of Education (FRDE) as one of the effective methods for learning textbooks.
- It is suggested that education officials familiarize the teachers and principals with new theories and neuroscience through holding in-service classes for them in accordance with the Fundamental Reform Document of Education (FRDE).
- The awareness of teachers and managers about the features and functions of the brain should be increased through organizing sessions and inviting educational experts and neuroscientists, in addition, measures must be taken to modify and

review learning and relearning programs for familiarizing teachers with neuroscience and its relation with the curriculum.

- According to research hypotheses, the BBL model is effective on reading and reading speed. The results indicated that the BBL model had a relationship with reading and reading speed of students. Therefore, according to the results, the following suggestions are made.

- School administrators and teachers should avoid hasty decisions and the mere goal of finishing textbooks and unilateral education in the field of performing various school functions and practices and implementing textbook learning.
- School administrators should cooperate with teachers through preparing the school and classes in accordance with the principles of BBL in implementing this method.
- Briefing classes should be held for students and their parents regarding the implementation of this method.
- The BBL model should be used as a new learning method by teachers and managers for better learning of the students.

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