Effectiveness of Brain-Based Learning Theory on Secondary Level Students of Urban Areas

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Abstract

The role of human brain in thinking (T), emotions (E) and memory (M) is vital. The innate faculties (I.F.) of brain trigger T, E and M. It is quite logical to examine the teaching learning process in context of I.F. So, the study was conducted to investigate effectiveness of the I.F. of human brain in the subject of mathematics. The Brain-based Learning theory consists of 12 principles related to I.F of brain. A pre-test, post-test control group design was followed. Three chapters from 9th grade textbook of mathematics were selected for teaching. The research tool of the study comprised 16 items. The selected 60 Ninth graders were randomly divided into experimental and control groups. The performance of students enhanced significantly by activation of the I.F. It was concluded that sharpening the I.F. of brain effects the academic achievement, positively.

Keywords: Brain-based Learning, Academic Achievement, Effectiveness

Introduction

Many teaching methods are in practice in the classrooms. The conventional teaching method is one of them. The conventional teaching method transfer only knowledge (Caine & Caine, 1995); promotes one-way communication (McIntosh, 1996); lacks in interaction between students and teachers (Munson, 1992); makes learners passive

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(Steinhorst and Keeler, 1995); works by presenting content formally (Vella, 1992); and orally (Ruyle, 1995). It is evident that in conventional teaching, learners' brains are inactively involved in the teaching learning process. In modern teaching methods, there is maximum involvement of brain faculties. The performance of the learners may also be observed if they are taught through a teaching method which is based on a maximum activation of innate faculties of the human brain.

The researchers found a teaching method, through a review of the relevant literature, which is based on natural functioning of human brain and maximum activation of innate faculties of human brain. This method is called Brain-Based Learning (BBL) teaching method based on BBL theory. This theory suggests that students should be provided a safe and threat-free environment whereby the meaningful presentation of contents prepares the learners' brains to store, process and retrieve the information in a soothing way.

Review of Literature
Contrary to conventional teaching method, BBL teaching method places its focus on the deep understanding of various concepts. The verbatim reproduction, coercive performance and threatening environment preclude the conventional teaching method. These traits fade away when students are taught through BBL teaching method.

The effectiveness of BBL teaching method was reported by many researchers (Cengelci, 2005; Avaci and Yagbasani, 2004; Waters, 2005; VanDevender, et al. 1984; and Duman, 2006) who tested its impact in the perspective of 12 principles in different subjects at different levels. Researchers like Tompkin (2007) and White (2004) developed brain-based learning acronymic models and promoted the concept of BBL theory.

The BBL theory works under 12 principles which were proposed by Caine and Caine (1991) in their research work. These twelve principles of brain-based learning theory are as follows:

- The brain is a parallel processor.
- Learning engages the entire physiology.
- The search for meaning is innate.
- The search for meaning occurs through "patterning".
- Emotions are critical to patterning.
- Every brain simultaneously perceives and creates parts and wholes.
- Learning involves both focused attention and peripheral perception.
- Learning always involves conscious and unconscious processes.

- We have (at least) two types of memory systems: spatial and rote learning.
- The brain understands and remembers best when facts and skills are embedded in natural spatial memory.
- Learning is enhanced by challenge and inhibited by threat.
- Every brain is unique.

In Pakistan, traditionally, the threatening environment, text-book, authoritative attitude of teachers and learning by cramming are hurdles in conceptual learning (Aly, 2007). The researchers, therefore, provided a threat-free environment and lessons developed on BBL teaching method to find out its impact and its comparison with the conventional teaching method in the subject of mathematics.

Statement of the Problem
The conventional teaching method is in practice even at the urban areas and the students reproduce different educational concepts given in their textbooks through rote-learning. The threatening environment of classrooms and verbatim reproduction by the students hamper the deep understanding of students. There is need for such teaching methods that promote conceptual understanding in students. The study investigates to find out the effectiveness of BBL teaching method on secondary level students of urban area.

Objectives of the Study
The objectives of the study were to compare the effectiveness of innate faculties of human brain, namely parallel processing; search for meaning; patterning; creation and perception through parts and wholes; and uniqueness of brain for the two groups of students who were taught the subject of mathematics through BBL and Conventional Teaching Methods.

Hypothesis of the Study
To test the effectiveness of the five innate faculties of human brain i.e. parallel processing; innate search of meaning; pattern formation; perception through creation of parts and wholes; and uniqueness, it was hypothesized that "There exists no significant difference in the academic achievements if students are taught through BBL teaching method or conventional teaching method".

Research Design
Pre-test, post-post test control group design was followed. The independent variable of the study was teaching methodology which was manipulated into brain based learning (BBL) teaching method and conventional teaching method whereas the dependent variable of academic achievement was divided into high, average and low achievers.

Population
Population consisted of all the students studying mathematics at 9th grade level in Secondary/ Higher Secondary Schools of Islamabad located in urban area.

Sample
A sample of 60 students was taken through normal distribution of the students on the 8th class annual examination aggregate scores. Two groups of 30 students having 10 high, 10 average and 10 low achievers were formulated. Randomly, one was taken as experimental and the other as control group.

Contents Selection and Development of Lesson Plans
Three chapters from 9th class mathematics textbook, Punjab Textbook Board, 2007 were selected to teach the selected students. The researcher developed 38 lesson plans based on BBL teaching method and 38 based on Conventional Teaching Method. The lesson plans were validated through pilot testing and experts' opinions.

Research Instrument
An academic achievement test was developed by the researchers through table of specification and for this purpose five in-built faculties of human brain were considered. The test was validated through experts' opinions and pilot testing. The item analysis was carried out to check difficulty level and discrimination power. A 16-items test was finalized stating five innate brain faculties, proportionately (in the ratios of 3:4:3:3:3 respectively). Split-half method was used to estimate the reliability of the test. The same tool was administered as pre-test in the start and post-test at the end of the 2-month treatment.

Teaching to Experimental and Control Groups
One researcher taught the students of experimental group whereas the other taught the control group. The principles of BBL theory were applied though enriched environment and cognitive practices as shown in the table below.

Table 1
Mode of Application of the principles of BBL theory

Principles of BBL theory	Teaching Learning Activities
Principle 1 (Parallel processing)	Diagrams, Figures, Re-corrections, Pinpointing mistakes, Filling blanks in the incomplete simplifications
Principle 2 (Learning engages the physiology)	Displaying balanced diet chart in the classroom, Encouraging students to bring water bottles with them, giving hygienic tips off and on
Principle 3 (search for meaning)	Familiarity and novelty in content, Innovative problems, Reflecting previous knowledge
Principle 4 (patterning)	Self-concept, location and generation of new patterns
Principle 5 (Emotions and patterning)	Creating cheerful environment through brain energizers and jokes; Using soothing colors (green, blue and brown), Playing soft tunes on few occasions, Reflecting students' interests in content and using praising words only for all the students
Principle 6 (parts and wholes)	Assembling parts into a meaningful whole, Dividing whole into small inter-related parts
Principle 7 (Learning and focused attention and peripheral perception)	Group discussions, Exploring similarities and differences between two mathematical concepts, Assuring students of having says in the classroom and solving problems related to real-life situations
Principle 8 Learning and conscious and unconscious processes	Giving pauses and adequate time during lessons to process information, Displaying group assignments in classrooms, Encouraging students for mutual question answer, Appreciating innovation and Acknowledging ambiguities
Principle 9 Spatial and Rote Learning Memory Principle 10 Building spatial memory	Generation of safe & friendly environment, presenting meaningful contents, fitting new ideas into existing ideas, encouraging students to form own patterns, acknowledging individual differences, encouraging smiles, laughter and promoting

	critical thinking
Principle 11 Challenge and threat	Physical activities, sarcasm free jokes, teacher's friendly attitude towards students, generation of a challenging atmosphere through exploration of ideas, unfolding riddles, exploring real life problems and appreciation of innovative thinking.
Principle 12 (Uniqueness of Brain)	Individual tasks, Free choices to perform

Data Analysis

The achievement scores (difference between pre-test and post-test scores) were tabulated and independent sample t test was applied with respect to each innate faculty. The effect size "r^2" was calculated through dividing t^2 by t^2+df. The results of each of the said faculty are given in the following tables.

Results

Following results of the study were obtained through independent sample t test.

Table 2

Application of Innate Faculties of Human Brain

Name of Innate Faculty of Brain	N	t	df	p-value	Effect Size "r^2"
Parallel Processing	60	3.533	58	.001	.18 (Between medium and large)
Innate Search of Meaning	60	2.223	58	.030	.08 (Medium)
Pattern Formation	60	1.889	58	.064	.06 {less than medium}
Creation of Parts and Wholes	60	2.623	58	.011	.11 (medium)
Uniqueness	60	2.913	58	.005	.13 (more than medium)

Table 2 indicates that the faculty of parallel processing of the brain was activated significantly as shown by t value 3.533 at α = .05 (p = .001). The students of experimental group used innate faculty of search of meaning more effectively at t value 2.223 at α = .05 (p=.030) shows. There was no significant difference of effectiveness of brain's learning

habit through pattern formation of students as the t value (1.889) at α = .05 (p=.064). The disintegration of a complex content into fragments or vice versa could work effectively for enhancement of academic achievement as shown by t value 2.623 at α = .05 (p = .011). The students perform significantly well when the faculty of uniqueness was activated by the teacher to enhance their academic achievement as t value 2.913 at α = .05 (p = .005). The null hypothesis "There exists no significant difference in the academic achievements if students are taught through BBL teaching method or conventional teaching method" was rejected for four faculties but was accepted for the faculty of pattern formation.

Conclusion and Discussion

It was concluded that students of experimental group performed better than the students of control group. This result verifies the studies conducted by Duman (2006); Waters (2005) and Ozden and Gultekin (2004). They found that BBL teaching enhances academic achievement. It was also concluded in this study that the four innate faculties of the brains of the learners i.e. parallel processing, innate search of meaning, creation of parts and wholes and uniqueness were activated through variety of teaching learning activities based on principles of BBL theory as the students taught through BBL teaching methods performed significantly better than the students taught through conventional methods. Possible reasons were: variety of tasks improves the performance of the students significantly for parallel processing; the aspects of familiarity and novelty satisfy the need of meaning search for the learning brains, the step-wise instruction can be effectively used as a tool of meaningful understanding of a complex idea improved the students' performance in creation of parts and whole and the better performance in uniqueness may be attributed to the typical learning activities like self-work habit, self-reliance, interacting with unseen mathematical problems and being unconscious of answers given in the textbook. But the performance of students of both experimental and control group was same in the faculty of pattern formation. This finding is contradictory to the study of Della Neve, Charmaine and Others (1994). They concluded in their study titled " Huge Learning Jumps Show Potency of Brain-Based Instruction" that "brain-compatible" learning, that Brain Based instruction can be applied to transform conventional, graded classrooms into "multi-teacher interactive learning units" that promotes thinking in terms of programs and patterns. Possible reason of this is that the pattern formation is also involved somewhere in the conventional methods as well.

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Appendix A

Analysis of Application of Innate Faculties of Human Brain (Urban Area Students)

	Innate faculty Of human brain	N	Mean	Std. Deviation	Std. Error Mean
Experimental Group	Parallel Processing	30	10.1000	3.9684	.7245
Control group		30	6.3667	4.2140	.7694
Experimental Group	Innate Search of Meaning	30	7.3333	3.7447	.6837
Control group		30	5.0000	4.3629	.7965
Experimental Group	Pattern Formation	30	7.8333	4.5188	.8250
Control group		30	5.5333	4.9041	.8954
Experimental Group	Creation of Parts and Wholes	30	9.9000	4.5361	.8282
Control group		30	6.5000	5.4630	.9974
Experimental Group	Uniqueness	30	10.6333	4.3588	.7958
Control group		30	7.4667	4.0576	.7408