



IMPACT OF BRAIN-BASED LEARNING ON 9TH STANDARD STUDENT'S BRAIN DOMINANCE

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Abstract

Learning is as natural as breathing. It can be inhibited or facilitated. New methods and approaches like constructivism, multiple intelligence, inquiry-based learning, etc. are adapted to minimize the limitations of the conventional way of teaching and to improve the quality of instruction. One of the upcoming approaches is Brain-Based Learning. In present research researcher has studied the impact of brain-based learning on 9th standard students Brain dominance. Researcher developed brain-based learning program on two units from 9th standard science text book. 64 (32 in Experimental group and 32 in controlled group) students were selected for the study. Pre-posttest nonequivalent group design was used. Brain-Based Learning Program found to be effective to develop Whole brain dominance.

Keywords: Brain-Based learning, Brain Dominance



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Introduction

Education in 21st century:

21st century is the age of science and technology. This technology-based world is changing rapidly. Education field is also not away from these changes. As social changes reflect in to education, it also changes rapidly.

While reviewing the education in last 50 years it is conclude that if education changes the human being then these changes should be take place in free and enrich environment. Today's conventional education system does not relish this technique. Apart from this it is observed that various efforts are taking place to improve conventional education system and to achieve the goal of all round development of students in coordination with (head- Heart-hand) Intelligence, kind-heartedness and hard work, which were expected by Mahatma Gandhi.

Learning is as natural as breathing. It can be inhibited or facilitated. New methods and approaches like constructivism, multiple intelligence, and inquiry based learning etc. are adapted to eradicate the limitations of conventional way of teaching and to improve the quality of instruction. One of the upcoming approaches is Brain-Based Learning.

Brain-Based Learning:

Findings of the researches in neuroscience are as follows

1. Learning be facilitate in an environment of total immersion.
2. Interactions of brain with its environment suggest that more enrich environment the more enrich brain.
3. An enriched environment can contribute up to 25% increase in the number of brain connections.

The concept of Brain-Based learning is developed on the basis of these principles.

• **Definition of Brain-Based Learning:**

1. Jenson 1998 –

Brain-Based Learning can be defined as an interdisciplinary answer to the question of “What is the most effective way of Brain’s learning mechanism.”

(<http://ejes.southwestern.edu>)

2. Caine & Caine (2002) -

Recognition of the brains codes for a meaningful learning and adjusting the teaching process in relation of these codes is called Brain-Based learning.

(<http://ejes.southwestern.edu>)

• **Principles of Brain-Based Learning:**

1. Brain is a parallel processor.
2. Learning engages the entire physiology.
3. Search for meaning is innate.
4. The search for meaning occurs through patterning
5. Emotions are critical to patterning
6. Every brain simultaneously perceives and creates part and wholes.
7. Learning involves both focused attention and peripheral perception.
8. Learning always involves conscious and unconscious processes.
9. We have at least two types of memory a spatial memory system and a set of system for rote learning.
10. The Brain understands and remembers best when facts and skills are embedded in natural spatial memory.
11. Learning is enhanced by challenge and inhibited by threat.
12. Each Brain is unique

Principles of Brain-Based learning suggest that real life experiences lead to effective learning. Implementation of these principles in teaching-learning process helps to enhance learning.

(<http://ejes.southwestern.edu>

www.cainelearners.com

<http://www.talkingpage.org/artic>)

Brain Dominance:

Human brain is not only the operator of the body but also intelligence, emotions and social behavior. By studying the structure and functions of brain researchers has been found that Human brain is divided in to three parts i.e. left brain, right brain and whole brain. Roger Sperry (1970) has discussed on right and left brain in his theory. According to him brain is divided in to two parts right and left. He considered it as hemisphere. Both hemispheres play an important role in information processing, thinking, and performing activities. Each hemisphere has its own characteristics and they functions differently. Left brain process information serially in analytical way while right brain process information intuitively as a whole. Levitsky (1968), Geschwid (1974), Witelson, Pallie (1975) functions of each brain are specific. Left brain responds to linguistic stimulus and right brain responds to challenges. Herbert Krugman (1972) recalling advertisement by reading is the function of left brain and recalling by watching is the function of right brain. Goldberg (1981) storing capacity of right brain is greater. Right brain matures earlier than left brain. Analyzing capacity of left brain is more. Above researches reflects that the functions of left and right brain are different.

Definition of Hemisphericity (Brain Dominance):

Hemisphericity is the dominance of individual in retaining and processing modes of information in his own style of learning and thinking. (Venketaraman1989)

From the functions of left and right brain it is observed that left brain is concerned with conscious mind. Individuals perform functions of conscious mind i.e. left brain whole brain is not used. When we will use right it will develop it enhances our efficiency and memory. Brain efficacy can be useful to overcome failure and get success.

Whole Brain Thinking: whole brain thinking is a capable framework which provides a lens for improved understanding and insight it acknowledges that different task requires different mental processes, and different people prefer different kinds of thinking.

(www.herrmann.com.au)

Review of Selected Literature

Some of the researches related to science and Brain-Based Learning are as follows.

Demirhan (2014), Vyas and Vashishtha (2014), Akyurek and Afacan (2013), Varghese and Pandya (2012), Inci and Erten (2009), Pociask and Settles (2007), Avci and Yagbasan (2005), Davis (2004), Ozden and Gultiken (2004) investigated the effectiveness of a Brain-Based learning on achievement of students in science at various level. They found that Brain-Based learning is effective for improving achievement. Demirhan (2014), found that Brain-Based learning approach is not effective for improving achievement.

Inci and Erten (2009), Avci and Yagbasan (2005), Ozden and Gultiken (2004), investigated the effectiveness of a Brain-Based learning on retention of knowledge. They found that Brain-Based learning is effective for improving retention of knowledge.

Varghese and Pandya (2012) tested the effect of Brain-Based Learning on study habits and found significant effect on study habits.

Varghese and Pandya (2012), Konecki and Schiller (2003) tested the effect of Brain-Based Learning on stress and found that Brain-Based learning is effective for managing stress.

Demirhan (2014) Akyurek and Afacan (2013) Inci and Erten (2009) studied effect of Brain-Based learning on scientific attitude at various level. They found that Brain-Based learning is effective for improving scientific attitude. Demirhan (2014) found that there was no significant effect of Brain-Based learning on attitude scores.

Demirhan (2014) studied effect of Brain-Based learning on critical thinking and found that Brain-Based learning is not effective in developing critical thinking.

Demirhan (2014) studied effect of Brain-Based learning on self-efficacy and found that Brain-Based learning is not effective in developing self-efficacy.

Pociask and Settles (2007), Davis (2004) studied effect of Brain-Based learning on self-esteem and found that Brain-Based learning is effective for developing self-esteem. Mansy (2014) implemented Brain-Based Learning (BBL) techniques in teaching science. He found that teachers' perceptions are positively correlated to their self-reported practices. Females, in general, and elementary teachers tend to practice brain-based learning strategies in teaching science significantly more than other subgroups.

Nuangchalerm and Charmsirattana (2010) attempted a Delphi study on Brain-Based instructional model in science. The findings showed that science instructional

model for brain-based learning consisted of five steps of learning organization (PRADA- Preparation, Relaxation, Action, Discussion, and Application) and provides teachers a framework to apply in science classroom and beyond to science education.

From the review of related research, it was concluded that very few researches are conducted in science based on Brain-Based learning. In science researchers studied effect of Brain-Based learning on variables like achievement, retention, scientific attitude, learning motivation etc. Most of them are conducted in abroad.

About Research

Title: A study of effectiveness of Brain-Based learning on 9th standard student's brain dominance.

Objectives:

1. To develop Brain-Based learning program on selected units.
2. To compare the effectiveness of conventional method and Brain-Based learning on 9th standard students brain dominance.
3. To study the effect of Brain-Based learning on brain dominance of 9th standard girls and boys.
4. To analyze the feedback of students regarding Brain-Based learning

Conceptual and Operational Definition of the terms.

• **Conceptual definitions:**

- **9th standard students:** 9th standard students at secondary level from Marathi medium school of Maharashtra state secondary and higher secondary board
- **Brain dominance:**

Conceptual definition: Hemisphericity is the dominance of individual in retaining and processing modes of information in his own style of learning and thinking. (Venketaraman1989)

• **Operational Definitions:**

- **Brain-Based learning program:** Program developed for increasing achievement and brain dominance of 9th standard students based on 12 Brain-Based principles, Jensen 7 stage plan and whole brain activities on the topics 'आरोग्या चा राजमार्ग' आणि 'पर्यावरण सेही व्यवस्थापन: घनकच-याचे'. The program was of 4 month duration.
- **9th standard students:** 9th standard students at secondary level from Dr, D.R. Nagarkar Marathi medium school of Maharashtra state secondary and higher secondary board in the year 2015-16

- **Brain dominance:** Brain dominance of the 9th standard students decided from the scores in Dr. D. R. Venkatraman's SOLAT test.

Delimits of the present research:

1. Present research was conducted on 9th standard student at secondary level in Dr. D. R. Nagarkar School in Pune city.
2. In this study Brain-Based learning program was developed on two topics 'आरोग्याचा राजमार्ग' आणि 'पर्यावरण स्नेही व्यवस्थापन: घनकच-याचे' from 9th standard Science and technology subject.
3. Brain-Based learning program was in Marathi.
4. Duration of Brain-Based learning program was near about 71 periods.
5. Present study was conducted in academic year 2015-16.

Limits of the present research:

1. Brain dominance of student was measured by using available brain dominance test
2. Validation of developed program was done by experts in the field.
3. Achievement test was developed by researcher; it was not standardized.
4. Effectiveness of the program has been calculated on the basis of responses given by students of experimental and control groups in pre-test and post-test.

Scope of the present research:

1. Scope of the research is 9th standard students of Marathi medium school in Maharashtra state.
2. Present study is concern with two topics 'आरोग्याचा राजमार्ग' आणि 'पर्यावरण स्नेही व्यवस्थापन□ घनकच-याचे' from 9th standard Science and technology subject.

Need of the present research:

Present education system of education undergoes tremendous changes and tries to meet diverse needs of the learners. For adapting these changes teaching learning methods has to be changed. Different strategies are adapted for making teaching learning process effective and to create enriched learning environment. A strategy based on structure and function of brain is Brain-Based learning. There is need of testing effectiveness of this Brain-Based learning strategy.

A well planned education system plays significant role in all round development of the students. National Curriculum Framework (2012) expects that teachers are encouraged to set up learning environments which appeal to children's interests, are relevant to their day-to-day experiences and can be explored in innovative and

challenging ways. It helps them to improved understanding, recall and the development of mental representations. Brain-Based learning approach supports to create enrich and free environment in the class which helps in all round development of the students. In such circumstances researcher feel a need to study effect of such environment on student's achievement and brain dominance

Significance of the study:

1. To create Enrich and free learning environment: In Brain-Based learning great importance is given to interaction of an individual with its surrounding. It is necessary to provide rich and free environment for effective interaction. Present study is important to provide such environment in teaching learning process.

2. Learning through real life experiences: Science is a subject related to day today life Brain-Based learning emphasis on real life experiences for meaningful learning. Present study is important to provide such experiences to the students.

3. To develop brain connections: Dual process of strengthening connections between used neuron cells and destroying unused cells takes place in the brain rapidly. An enriched environment can contribute up to 25% increase in the number of brain connections. The Brain-Based learning emphasis on creating enriched environment in learning Present study is significant to provide favorable environment for developing brain connections.

Assumptions:

1. Lecture method, questioning, experimental method, discussion and project methods etc. are used at school level for teaching science.
2. Brain-Based learning program is useful for increasing achievement.

Hypothesis:

Research hypothesis:

1. There will be a significant difference at 0.01 significance level between the effects of Brain-Based learning and conventional classroom teaching on brain dominance of the 9th standard students.
2. There will be a significant difference at 0. 01 significance level in the effect of Brain-Based learning on 9th standard boys and girl student's brain dominance.

Population:

Targeted population of present study is all Marathi medium 9th standard students of Maharashtra state from.

Variables:

Independent: 1. Brain-Based learning program
2. Conventional classroom teaching

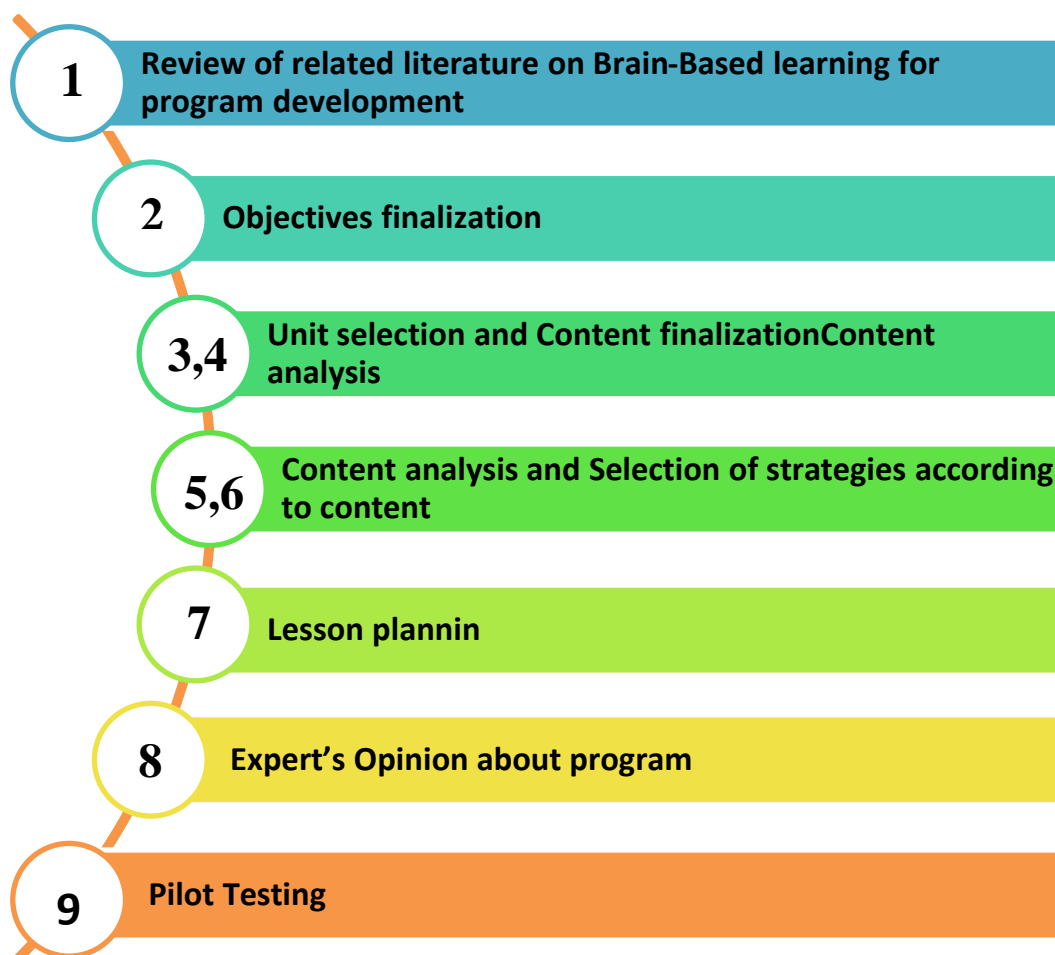
Dependent: 1. Brain dominance

Control: 1. Content and units
2. Teaching-learning duration
3. 9th standard students from one school
4. Teaching-learning medium.

Plan and Procedure of Present Research

Plan and procedure for objective 1:

Following steps were followed to develop Brain-Based learning Program



Plan and Procedure for Objective 2 And 3

Research Method: Experimental method was used.

- **Research design:** Non-equivalent control group design.

Sampling Design and Sample

Selection of school: Incidental

Selection of division: Randomization

Selection of groups: Randomization

Two groups were formed by pairing students on the basis of scores in pre achievement test. Number of boys and girl were equal in both groups. Experimental and control groups were choose by lottery method.

Sample of the present study

Sixty-four, 9th standard students were selected from Dr. D. R. Nagarkar Prashala, Pune Marathi medium school as respondents. 32 in experimental group and 32 in control group in which 21 were boys and 11 were girls in each group.

• Data Collection Tool

Brain Dominance test:

In present study Dr. D. Venkataraman's style of learning and thinking was used to test brain dominance of 9th standard students. Original test is in English. For present study it is translated in Marathi. Forward-backward method of translation was used. The reliability coefficient of correlation for right hemisphere is 0.89, for the left hemispheric function it is 0.65 and for integrated score it is 0.71.

Planning and procedure for objective 4

To analyze the feedback of students regarding Brain-Based learning.

Feedback forms were taken from students. Students' interviews were taken to analyze their opinion about Brain-Based learning program

- **Feedback Forms:** Feedback forms were taken from students at the end of every session. From these feedback forms student's opinion regarding Brain-Based learning program was analyzed.

Data Analysis and Interpretation

Analysis and interpretation of data for objective 2

Inferential Analysis:

Pretesting

Research Hypothesis 1. There will be a significant difference at 0.01 significance level between the effects of Brain-Based learning and conventional classroom teaching on brain dominance of the 9th standard students.

Two groups selected for studying objective 2 were not equivalent. Therefore researcher has compared Scores in pretesting and post testing by using two tailed 't' test.

For testing research hypothesis was converted in to null hypothesis.

Null hypothesis 1. There is no significant difference at 0.01 significance level between the mean scores of right, left and whole brain dominance of experimental and control group in pre testing.

Brain dominance	Right brain dominance (R)		Left brain dominance (L)		Whole brain dominance (W)	
	Experimental group (R1)	Control group (R2)	Experimental group (L1)	Control group (L2)	Experimental group (W1)	Control group (W2)
Total students	32	32	32	32	32	32
Mean	25.75	24.75	20.12	19.12	3.78	5.53
Standard deviation	5.45	5.72	4.33	5.77	4.30	6.66
Correlation	- 0.395		- 0.234		0.063	
Standard error of mean difference	1.39		1.27		1.40	
Degrees of freedom	62		62		62	
Obtained 't' value	0.715		0.784		1.248	
Table 't' value	2.65		2.65		2.65	

Table 1. Inferential statistics of experimental and control group in pretesting on brain dominance

Testing of null hypothesis 1:

For df 64 obtained 't' values of Right, left and whole brain dominance are respectively 0.715, 0.784 and 1.248 respectively, which are less than its table 't' value at 0.01 significance level that is 1.248. Therefore, the null hypothesis is accepted.

Interpretation: There is no significant difference at 0.01 significance level between the mean scores in right, left and whole brain dominance of experimental and control group in pre testing.

It can be concluded that experimental and control groups are equal on the basis of pre-test score in brain dominance test.

Post Testing

Null hypothesis 2. There is no significant difference at 0.01 significance level between the mean scores in right, left and whole brain dominance of experimental and control group in post testing.

Brain dominance	Right brain dominance (R)		Left brain dominance (L)		Whole brain dominance (W)	
	Experimental group (R1)	Control group (R2)	Experimental group (L1)	Control group (L2)	Experimental group (W1)	Control group (W2)
Total students	32	32	32	32	32	32
Mean	19.43	25.87	15.28	18.50	15	4.75
Standard deviation	4.03	6.72	3.42	5.41	3.84	4.13
Correlation	- 0.31		0.26		0.39	
Standard error of mean difference	1.38		1.15		0.997	
Degrees of freedom	62		62		62	
Obtained 't' value	4.643		2.798		10.271	
Table 't' value	2.65		2.65		2.65	

Table 2. Inferential statistics of experimental and control group in post testing on brain dominance

Testing of null hypothesis 2:

Observations: For df 64 obtained 't' value of right, left and whole brain are respectively 4.643, 2.798 and 10.271 which is greater than its table 't' value at 0.01 significance level that is 2.65. Therefore, the null hypothesis is rejected and alternative research hypothesis is accepted.

Interpretation: There is a significant difference at 0.01 significance level between the mean scores in right, left and whole brain dominance of experimental and control group in post testing.

Right and left brain dominance of control group is significantly greater than that of experimental group.

Explanation: Only one test was used to measure right, left and whole brain dominance. There were two options for each statement in Dr. D. Venkataraman's SOLAT test. Option 'A' shows use of right hemisphere, option 'B' shows use of left hemisphere. Both

options inclusively denote whole brain dominance. If right brain dominance scores are greater, then scores of remaining two decreases accordingly. Objective of Brain-Based learning program was to increase whole brain dominance. Whole brain dominance scores of experimental group were significantly greater. Therefore the right and left brain dominance of control group is significantly greater.

Whole brain dominance of experimental group is significantly greater than that of control group.

From the above observations, it can be concluded that Brain-Based learning program was significantly effective to increase whole brain dominance of 9th standard students as compare to the conventional classroom teaching.

Analysis and interpretation of data for objective 3

Inferential Analysis:

Research hypothesis 2. There will be a significant difference at 0. 01 significance level in the effect of Brain-Based learning on 9th standard boys and girl student’s brain dominance.

Null hypothesis 3. There is no significant difference at 0. 01 significance level in the effect of Brain-Based learning on 9th standard boys and girl student’s brain dominance in pre testing.

Null hypothesis 4. There is no significant difference at 0. 01 significance level in the effect of Brain-Based learning on 9th standard boys and girl student’s brain dominance in pre testing.

Brain dominance	Right brain dominance (R)		Left brain dominance (L)		Whole brain dominance (W)	
	Boys (R1)	Girls (R2)	Boys (L1)	Girls (L2)	Boys (W1)	Girls (W2)
Total students	21	11	21	11	21	11
Mean	25.85	25.54	21.42	19.45	4.38	2.63
Standard deviation	5.42	5.76	3.98	4.84	5.10	1.74
Standard error of mean difference	0.31		2.02		1.74	
Degrees of freedom	30		30		30	
Obtained ‘t’ value	0.151		1.269		1.093	
Table ‘t’ value	2.75		2.75		2.75	

Table 3. Inferential statistics of boys and girls of 9th standard in pre testing on brain dominance

Testing of null hypothesis 3:

Observations: For df 30 obtained 't' values of Right, left and whole brain dominance are respectively 0.151, 1.269 and 1.093 respectively, which are less than its table 't' value at 0.01 significance level (2.75). Therefore, the null hypothesis is accepted.

Interpretation: There is no significant difference at 0.01 significance level between the mean scores in right, left and whole brain dominance of boys and girls of 9th standard on pre testing.

It can be concluded that boys and girls of 9th standard are equal on the basis of pre-test score in brain dominance test.

Post Testing

Brain dominance	Right brain dominance (R)		Left brain dominance (L)		Whole brain dominance (W)	
	Boys (R1)	Girls (R2)	Boys (L1)	Girls (L2)	Boys (W1)	Girls (W2)
Total students	21	11	21	11	21	11
Mean	19.28	19.72	14.57	16.63	15.80	13.45
Standard deviation	4.67	2.57	3.90	2.65	4.19	2.58
Standard error of mean difference	1.28		1.16		1.20	
Degrees of freedom	30		30		30	
Obtained 't' value	0.345		1.766		1.961	
Table 't' value	2.75		2.75		2.75	

Table 4. Inferential statistics of boys and girl students of 9th standard in post testing on brain dominance

Testing of null hypothesis 4:

Observations : For df 30 obtained 't' values of Right, left and whole brain dominance are respectively 0.345, 1.766 and 1.961 respectively, which are less than its table 't' value at 0.01 significance level (2.75). Therefore, the null hypothesis is accepted and research hypothesis is rejected.

Interpretation: There is no significant difference at 0.01 significance level between the mean scores in right, left and whole brain dominance of boys and girls of 9th standard on post testing.

It can be concluded that effect of Brain-Based learning program on brain dominance of boys and girls of 9th standard is same.

Analysis and interpretation of data for objective 5

Feedback forms: Feedbacks of students about Brain-Based learning program were taken by using feedback forms. Conclusions drawn by analyzing feedback forms are as follows.

1. All 32 students liked Brain-Based learning program. Reasons for liking were as follows.
 - Program was activity based.
 - Students felt stress free while working in groups.
 - Student had participated in activities which they were not liked initially, after some period they feel liking towards that activities.
 - Confidence level was increased.
 - Program introduced new methods of teaching learning.
 - Program provides students an opportunity to participate freely in discussion.
2. Brain-Based learning will be helpful to develop following abilities in the students.
 - Innovative thinking
 - Reasoning
 - Communication
 - Integrated thinking
 - Problem solving
 - Emotional thinking
 - Information analysis
 - Holistic thinking
3. All 32 students liked all activities in Brain-Based learning program.
4. Students liked pair interview, role play, recycling of paper, graphic organizer etc. activities so much.
5. Students faced difficulties while performing various activities. But they overcame it by collecting information and discussing with peers and researcher.

Researcher's observations:

1. In the beginning students were not participating freely in the group work, discussion and written responses. Brain-Based activities were new for students so more time was required. After some periods students get familiar with activities, and because of practice required time was reduced.

2. In the beginning students were not serious about the program. After some days due to use of new thought-promoting methods, techniques, strategies, music, exercises, etc. students interest was increased and they attained activities carefully.
3. While performing activities like story writing, role play, experiment, poster presentation, interviews, gathering information while doing project, presenting information, performing group activities, shy students also started speaking confidently and freely.
4. Initially students were hesitated to express their thoughts freely in brain storming activities. Free and enrich environment helped them to share their views later.
5. Activities like Class-Yes, Teach-OK, Hands and Eyes, Mirror, Cross laterals and music meditation helped students in increasing attention and enthusiasm.
6. Spontaneous participation of students in activities based on right, left and whole brain and significant rise in whole brain scores of experimental group shows that Brain-Based learning program was effective for increasing whole brain dominance.

Main Findings of the Study

1. Brain-Based learning program was significantly effective to increase whole brain dominance of 9th standard students as compare to the conventional classroom teaching.
2. The effect of Brain-Based learning program on brain dominance of boys and girls of 9th standard is same.
3. It was noted in the feedback and interview that Brain-Based learning program was more effective for science teaching and learning as compare to Brain-Based learning.

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