Journal of Positive School Psychology http://journalppw.com
2022, Vol. 6, No. 8, 10356-10364

The Effectiveness Of A Brain-Based Instructional Package On Academic Achievement Among Upper Primary School Students With Varying Levels Of Achievement

Christopher Christudas Sujatha*

**Assistant Professor, Sree Narayana Guru Kripa B.Ed. College. Pothencode, Trivandrum, Kerala, India.*

*Corresponding Author: Christopher Christudas Sujatha

Abstract

The conventional educational system promotes memorization over cognitive development. A well-planned and implemented educational system is crucial for a child's holistic development. An effective learning approach is required to strengthen students' innate thinking abilities. Brain-based learning creates a safe, threat-free environment where meaningful content presentation prepares learners' brains to store, process, and retrieve information appropriately (Aziz-ur-Rehman et al., 2012). The researcher was confident that teachers can boost students' performance by maximising the brain's innate abilities.

The researcher used the quasi-experimental experimental design for this investigation. The researcher used a "Pre-test Post-test Non-equivalent group design" From quantitative data, the researcher determined that $p>0.05$. "There is no significant difference between the experimental group and the control group in pre-test achievement scores" was accepted. "There is no significant difference between the experimental group and the control group in terms of post-test achievement scores" was rejected at the 0.01 level. The experimental group received more excellent post-test scores than the control group. The Brain-Based Learning Strategy was more effective in boosting achievement across all levels. In the post-test, a significant difference was detected between the experimental and control groups, as indicated by the F value (92.594) at the 1% level. Total sample adjusted post-test means differed at the 1% level ($F = 97.902$). Thus, there exists a significant difference between the experimental and control groups in terms of post-test achievement scores for the overall sample.

Keywords: *Academic Achievement, Average Achievers, Brain-Based Instructional strategies, below Average Achievers, High Achievers.*

I. BACKGROUND OF THE STUDY

The conventional approach to education does not use an interactive learning style that is physically active and mentally beneficial between a student and his or her teacher. Most students who have little interaction with their teachers think that the normal teaching technique is quite disappointing as it does not comply with the natural learning process that occurs in their brains. The vast majority of educators make the all-too-common error of presuming that their job entails nothing more than stuffing students' heads with random titbits of information rather than facilitating a learning process that assists children in acquiring, assimilating, and processing knowledge across a variety of topics. It frequently entails the teacher taking complete control of the entire process of teaching and learning, which suppresses the student's capacity for intellectual growth. An ideal educational environment for a child should strive to bring about a student's balanced and comprehensive development. This can be accomplished by placing a particular emphasis on a child's ability to develop his or her self-analytical skills and interactive-learning skills by working together with people such as parents, teachers, siblings, in pairs, and in groups. Students should be active participants in the learning process, and the classroom should be organized to encourage such facilitation on a small scale and with a small set of students. The International Commission for the Twenty-first Century submitted a report. (Delors, 1996) to UNESCO, 'Learning: The Treasure Within' reflects on the four pillars of learning as 1. 'Learning to know' (which develops one's thinking skills, arouses one's curiosity, and experiences the pleasures of research and discovery), 2. 'Learning to do' (which involves acquiring practical skills and equipping one to do the different types of work), 3. 'Learning to be' (enables one to solve one's problems critically, analyze and make decisions, and act responsibly. 4. 'Learning to live together.'(which develops an understanding of self and others through dialogue and interactions, appreciating human diversity as well as similarities and existing interdependently).

Neuro-Educationalists have compared brain-based learning to a fusion of neurology and

common sense. The brain is "the organ of learning," as Hart (1983) put it. Learning that considers the latest neuroscience findings about how the human brain learns on its own is called "brain-based learning." This approach to education explains the reoccurring learning behaviours it identifies and a physiologically motivated framework for teaching and learning. It is a broad idea that encompasses many different approaches. Educators can now relate classroom content to students' everyday lives using these methods. Mastery learning, learning styles, multiple intelligences, cooperative learning, practical simulations, experiential learning, problem-based learning, movement education, etc., are all included in this approach to education. We can use this idea's framework to consider how our brains are wired during the deliberation process. Our brain's expertise allows us to make better decisions, allowing us to help many more pupils. The term "Brain-Based Learning" refers, in a nutshell, to the process of acquiring knowledge via employing one's cerebral cortex (Jensen, 2000).

II. NEED AND SIGNIFICANCE OF THE STUDY.

Learning is undeniably a neurological process, i.e., Brain-based. Everyone's brain is unique. The stress and strain of modern life, along with the massive amount of knowledge that must be recalled, exerts substantial pressure on the brain. This results in the poor recall, tension, and eventual failure. If the brain receives information viewed as physically and psychologically harmful, the rational/logical thinking process is shut down, and in situations of war or flight, the hypothalamus and pituitary glands work together to generate adrenaline. This first spontaneous response is advantageous for evading danger but hinders learning (Dwyer, 2002; Duman, 2006).

The conventional educational system emphasizes memorization over thinking instead of developing students' cognitive abilities and thinking capacity. This method produces only surface knowledge, requires rote memorization of facts, promotes one-way communication, lacks interaction between students and teachers, and makes learners passive. A well-planned and properly implemented educational system is essential in establishing a solid foundation for the child's holistic development. An appropriate learning strategy is required to gear up and develop students' thinking abilities based on the innate faculties of the human brain. The Brain-Based Learning Strategy creates a safe and threat-free environment in which meaningful content presentation prepares learners' brains to store, process, and retrieve information gently (Aziz-ur-Rehman et al., 2012).

While working as a teacher in a school, the investigator realized that the conventional learning strategies were more focused on getting good grades in exams. This leads to the lack of cognitive-enhancing skills to process information correctly; the students find learning difficult leading to poor performance in the classroom. Using a single instructional strategy to reach every student in the classroom is impossible (Eggen and Kauchak, 2001). The investigator was convinced that understanding modern instructional strategies is critical for student development. Learners' performance can be improved if teachers use a method that maximizes the activation of the human brain's innate faculties. As a result, a holistic and multidisciplinary approach will maximize each child's learning potential.

III. RESEARCH QUESTION

RQ_1. Whether the teachers are aware of brain-based learning?
RQ_2. Whether the students are aware of brain-based learning?
RQ_3. Can brain-based learning help the students to increase interest in teaching-learning process?
RQ_4. Whether brain-based learning strategies capable enough to improve students' academic achievement?

IV. OBJECTIVES OF THE STUDY

OB_1.Prepare Brain-Based Learning lesson transcripts for teaching the unit ‘A Glimpse of India’ for class seven.
OB_2. Construct and validate an achievement test
OB_3. Find out the effect of the experimental group (Brain-Based Learning Strategy) and control group (Conventional Method) on the academic achievement of upper primary school students.
OB_4. Compare the effect of experimental group and control group on academic achievement with respect to different levels of achievers (High Achievers, Average Achievers, Below Average Achievers).

V. HYPOTHESIS OF THE STUDY

HY_1: There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample and also with respect to different levels of achievers at the pre-test level.

HY_2: There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample and also with respect to different levels of achievers at the post-test level.

HY_3: There is no significant difference between the pre-test and the post-test of the experimental and control groups in terms of achievement scores for the total sample.

HY_4: There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample at the adjusted post-test level.

HY_5: There is no significant difference between the experimental and control groups in terms of achievement scores with respect to different levels of achievers at the adjusted post-test level.

VI. METHODOLOGY IN BRIEF

VI. A. Type of Study:

For this study, the researcher adopted the Experimental type of research.

VI. B. Research Design

In Educational research, it is challenging to establish equivalent experimental and control groups and obtain identical groups. As real-life conditions are dynamic and complex; a true experimental design is seldom possible with humans. It is possible to acquire a reasonable level of validity by employing suitable methods (Krishnaswamy and Renganathan, 2006). Based on the above explanation, the researcher is working to implement a Brain-Based Learning Strategy using a **quasi-experimental approach**.

In this investigation, the researcher has adopted the "**Pre-test Post-test Non-equivalent group design**." This design is employed in the classroom when the experimental and control groups are naturally assembled classes that may be identical (Best and Kahn, 2006). In order to avoid interrupting the natural environment of the classroom, non-equal intact class groupings were chosen for the investigation. In the present investigation, the researcher utilized two non-identical intact classroom groups, an experimental group, and a control group. In a school setting, it is almost impossible to disrupt class schedules, collect a sufficiently high sample size, or reorganize classes in order to utilize a randomization technique to create comparable experimental and control groups. The researcher has utilized Analysis of Co-variance (ANCOVA) to account for the absence of equality between the two groups. An initial pre-test was conducted on both groups. The treatments were then randomly assigned to these groups. The experimental group was taught using Brain-Based Learning Strategies, while the control group was instructed using a conventional manner. The post-test was then administered to both groups. The discrepancies between pre-test and post-test scores were analysed using proper statistical approaches to determine the relative effectiveness of the Brain-Based Learning Strategies and Conventional teaching methods.

VI. C. Sampling and Sample:

Sampling Technique: Stratified Random Sampling
Population: Upper Primary Students studying in schools
Sample: Students of class VII
Sample Size: 90 students; 45 students from Class 7 H & 45 students from Class 7 N
Location: St. Mary's Pattom in Trivandrum district of Kerala

VI.D. Variables

Independent Variable: Brain-Based Learning Strategies
Dependent Variable: Academic Achievement

VI.E. Tools adopted for the study

1. Lesson transcripts; based on Brain-Based Learning Strategies (prepared and validated by the researcher under the supervision of the guide).
2. Achievement Test (prepared and standardized by the researcher under the supervision of the guide).

VI.F. Statistical Techniques to be used

1. Mean
2. Median
3. Standard deviation
4. Test of significance
5. Analysis of Covariance

VII. ANALYSIS AND INTERPRETATION

The findings of the ongoing investigation are meticulously discussed in terms of descriptive and inferential analysis. The outcomes are presented and interpreted in Tables VII.1 to VII.6.

VII.A. Descriptive Analysis

Descriptive analysis is a type of data analysis that helps describe and summarise data points. It provides researchers with a conclusion about the distribution of their data, aids in detecting typos and outliers, and allows them to identify similarities between variables.

Table VII.1 Descriptive Analysis of the Pre-Test and Post-Test Achievement Scores of Experimental (Brain Based) and Control (Conventional) Groups.

	Variables	Groups	N	Test	Mean	Median	Mode	SD
	Total	Brain-based	45	Pre	17.49	17	16	5.13
				Post	25.68	26	28	5.15
		Conventional	45	Pre	16.48	17	14	4.51
				Post	18.29	18	19	4.51
Achievers	High	Brain-based	15	Pre	17.85	17	16	4.83
				Post	25.65	26	28	5.28
		Conventional	15	Pre	16.77	17	14	4.35
				Post	17.69	18	17	3.72
	Average	Brain-based	15	Pre	18.12	17.5	16	4.56
				Post	26.04	26.5	28	4.76
		Conventional	15	Pre	16.77	18.5	19	4.11
				Post	18.69	18	19	3.65
	Below Average	Brain-based	15	Pre	16.58	16	112	5.96
				Post	25.35	26	28	5.56
		Conventional	15	Pre	16.08	15.5	14	5.14
				Post	18.5	17.5	16	5.66

Table VII.1. reveals that the measures of central tendency and variability of pre-test and post-test achievement scores for the experimental and control groups and the different levels of achievers for the entire sample (High, Average, Below Average).

The experimental and control groups received pre-test scores of 17.49 and 16.48, respectively. The difference in mean scores between the experimental and control groups is 1.01; the median value is 17, and the mode values are 16 and 14, respectively. These results show that the ***pre-test scores of the brain-based and conventional groups diverged slightly***. The standard deviations for the experimental and control groups are 5.13 and 4.51, respectively. In other words, the ***pre-test scores of both the brain-based and conventional groups are very close to the mean***.

The experimental groups' mean, median, and mode post-test values are 25.68, 26.8, and 28, respectively, while the control groups' values are 18.29, 18, and 19. These figures proved that ***Brain-Based Learning Strategies significantly impacted post-test achievement***. The experimental and control groups' standard deviation values of 5.15 and 4.41, respectively, indicated that the scores did not deviate significantly from the mean for the experimental and control groups' total samples and the different levels of achievers; the post-test mean is greater than the pre-test means. The findings confirm that ***when educated using brain-based learning strategies, the experimental group significantly outperforms the control group***.

HY_1: There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample and also with respect to different levels of achievers at the pre-test level.

Table VII.2. The Pre-Test Analysis of Achievement Scores between the Experimental and Control Groups for the Total Sample and also with respect to Different Levels of Achievers.

	Variables	Groups	N	Mean	SD	SEM	df	t
	Total	Brain-based	45	17.51	5.13	0.58	154	1.26^{NS}
		Conventional	45	16.54	4.51	0.51		
Achievers	High	Brain-based	15	17.85	4.83	0.94	50	0.845 NS
		Conventional	15	16.77	4.35	0.85		
	Average	Brain-based	15	18.12	4.56	0.89	50	0.324 NS
		Conventional	15	16.77	4.11	0.80		
	Below Average	Brain-based	15	16.58	5.96	1.16	50	1.117^{NS}
		Conventional	15	16.08	5.14	1.00		

NS: Not Significant, df: Degrees of freedom, (Table value for 0.05 level for df 154=1.97; df 50=2.00)

As shown in table VII.2, the p-value was more significant than 0.05. Hence the hypothesis "There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample at the pre-test level" was accepted. It means that the difference between the experimental and control groups in their achievement was not statistically significant. Hence, both groups were similar in their achievement at the pre-test level. Similarly, the p values for different levels of achievers were more significant than 0.05. Hence the hypothesis (**HY_1**) ***"There is no significant difference between the experimental group and the control group in terms of achievement scores concerning different levels of achievers at the pre-test level" was accepted.***

HY_2: There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample and also with respect to different levels of achievers at the post-test level.

Table VII.3. The Post-Test Analysis of Achievement Scores between the Experimental and Control Groups for the Total Sample and also with respect to Different Levels of Achievers.

Variables		Groups	N	Mean	SD	SEM	df	t
Total		Brain-based	45	17.51	5.13	0.58	154	1.26^{NS}
		Conventional	45	16.54	4.51	0.51		
Achievers	High	Brain-based	15	17.85	4.83	0.94	50	0.845 NS
		Conventional	15	16.77	4.35	0.85		
	Average	Brain-based	15	18.12	4.56	0.89	50	0.324 NS
		Conventional	15	16.77	4.11	0.80		
	Below Average	Brain-based	15	16.58	5.96	1.16	50	1.117^{NS}
		Conventional	15	16.08	5.14	1.00		

Si: Significant at 0.01 level, df: Degrees of freedom, (Table value for 0.01 level for df 154=2.608; df 50=2.677)

As shown in table VII.3, the p-value was less than 0.01. Hence the hypothesis (**HY_2**) ***"There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample and concerning different levels of achievers at the post-test level" was rejected*** at 0.01 level. It indicates that the Brain-Based Learning Strategy was more effective in developing achievement among the upper primary school students.

From the post-test scores, it was inferred that the experimental group students had higher achievement scores than the control group. Hence, it can be concluded that the Brain-Based Learning Strategy was more effective in developing achievement among different levels of achievers.

HY_3: There is no significant difference between the pre-test and the post-test of the experimental and control groups in terms of achievement scores for the total sample.

Table VII.4. The Post-Test Analysis of Achievement Scores between the Experimental and Control Groups for the Total Sample and also with respect to Different Levels of Achievers.

Groups	Test	N	Mean	SD	SEM	df	t
Brain-based	Pre	45	17.51	5.13	0.58	77	14.185^{Si}
	Post	45	25.68	5.13	0.58		
Conventional	Pre	45	16.54	4.51	0.50	77	2.885^{Si}
	Post	45	18.29	4.41	0.51		

Si: Significant at 0.01 level, df: Degrees of freedom, (Table value for 0.01 level for df 77=2.641)

From Table VII.4, one can infer that 't' values indicate a significant difference between the pre-test and post-test scores of the students in the experimental group (t = 14.185). Similarly, a significant difference (P<0.01) was seen between the pre-test and post-test scores of the students in the control group (t =2.885). The post-test mean score was significantly higher for the experimental group (25.68) than for the control group (18.29). Hence, the hypothesis(**HY_3**) ***"There is no significant difference between the pre-test and the post-test of the experimental and control groups in terms of achievement scores for the total sample" was rejected.*** This means that while the content was explained through the Brain-Based Learning Strategy, the experimental group students achieved more than those in the control group taught through the conventional teaching method. The Brain-Based Learning Strategy was found to be more effective than the conventional method in the present study.

VII.B. inferential Analysis.

Analysis of covariance (ANCOVA)

The differences in pre-test and post-test scores of various groups were investigated. However, the significant differences between the experimental and control group's mean scores must be compared to determine the true impact of the group chosen for the study. In this section, such a comparison is made using covariance analysis.

HY_4: There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample at the adjusted post-test level.

Table VII.5. Analysis of Covariance of Achievement Scores of Total Sample in Experimental and Control Groups

	Experimental group	Control Group	Source of Variance	Sum of squares	df	Mean Squares	F
Pre Test Means	17.51	16.54	BG	37.026	1	37.026	1.588^{NS}
			WG	3590.872	154	23.317	
Post Test Means	25.68	18.29	BG	2126.769	1	2126.769	92.594^{Si}
			WG	3537.203	154	22.969	
Adjusted Post Test Means	25.48	18.49	BG	1885.930	1	1885.930	97.902^{Si}
			WG	2947.294	153	19.263	

NS: Not significant, Si: Significant at 0.01 level, BG: Between Group, WG: Within Group, df: Degrees of freedom, (Table value for 0.01 level for df 1 & 154=6.80)

Table VII.5. indicates that there is no significant difference in the pre-test scores of total sample under experimental and control groups.

However, in the post-test, a significant difference was found among the total sample under experimental and control groups, which was revealed by the significant F value (92.594) at the one percent level. It was found that the total sample differed in the adjusted post-test means as the F value (97.902) was significant at the one percent level. Hence the hypothesis(**HY_4**) ***"There is no significant difference between the experimental and control groups in terms of achievement scores for the total sample at the adjusted post test level" was rejected.***

HY_5: There is no significant difference between the experimental and control groups in terms of achievement scores with respect to different levels of achievers at the adjusted post-test level.

Table VII.6. Analysis of Covariance of Achievement Scores of Experimental and Control Groups Based on Different Levels of Achievers.

Group		High Achievers	Average Achievers	Below Average Achievers	Source of Variance	Sum of squares	df	Mean Squares	F
Brain-based Group	Pre Test Means	17.85	16.58	18.12	BG	35.103	2	17.551	0.661 NS
					WG	1992.385	75	26.565	
	Post Test Means	25.65	25.35	26.04	BG	6.256	2	3.128	0.115 NS
					WG	2036.731	75	27.156	
	Adjusted Post Test Means	25.48	25.83	25.73	BG	1.693	2	0.820	0.040 NS
					WG	1508.064	74	20.379	
Conventional Group	Pre Test Means	16.08	16.76	16.77	BG	8.308	2	4.154	0.200 NS
					WG	1555.077	75	20.734	
	Post Test Means	18.50	18.69	17.69	BG	14.641	2	7.321	0.37 NS
					WG	1479.577	75	19.728	
	Adjusted Post Test Means	17.63	18.62	18.63	BG	17.214	2	8.607	0.466 NS
					WG	1366.516	74	18.466	

NS: Not significant, BG: Between Group, WG: Within Group, df: Degrees of freedom, (Table value for 0.05 level for df 2 & 75=3.119)

It was clear from table VII.6 that the F value for the pre-test scores achieved (0.661) was less than the F value necessary for significance at the 5% level. This shows no significant difference between the experimental group and different levels of achievers. Similar to the pre-test scores, neither the post-test scores nor the adjusted post-test scores revealed any significant differences between the students in the experimental group in terms of different levels of achievers. In the control group, the F value achieved for pre-test scores (0.200) was less than the F value required at the 5% significance level. This demonstrated no significant difference in the different levels of achievers in the control group. Similarly, neither the post-test nor the modified post-test scores revealed any significant differences between the different levels of achievers in the control group. Based on the data in Table VII.6, it is possible to conclude that the experimental and control groups of children achieved nearly identical results for the different levels of achievers. Therefore, the hypothesis (**HY_5**) ***"There is no significant difference between the experimental and control groups in terms of post-test achievement scores based on different levels of achievers" was accepted.***

VIII. Discussion of the Result

The study found that when compared to the conventional approach to teaching, the Brain-Based Learning Strategy significantly improved the academic performance of upper primary school students. According to the research, using a Brain-Based Learning Strategy makes learning more engaging for students. This finding suggests that educators should adopt this approach by adopting new tactics, methods, and materials. Substantial evidence is that the Brain-Based Learning Strategy facilitates profound and lasting conceptual understanding. The study results showed that using the Brain-Based Learning Strategy helped students improve their grades. Learning and performance results can be enhanced using a Brain-Based Learning Strategy. Therefore, it is essential to consider the task's goals, nature, and relevant strategies before beginning the learning process. To achieve this goal, it is essential to raise awareness among aspiring and practicing educators about the importance of using brain-based strategies and techniques in the classroom.

Bibliography

[1]. Agnes, M. (2003). Webster's New World Dictionary. New York: Wiley Publishing, Inc.
[2]. Anderson, L.W., David, R., & Karthwohl, D.R. (2000). A taxonomy of learning, teaching and assessing; A revision of Bloom's taxonomy of educational objectives. Boston.M.A: Allyn & Bacon.
[3]. Bean, K. L. (1953). Construction of educational and personnel tests. New York: McGraw- Hill Book Co.
[4]. Best, J. W., & Kahn, J. V. (2006). Research in education (10th ed.). New Delhi: Prentice Hall of India Private Limited.
[5]. Biller, L. (2003). Creating brain-friendly classrooms: Practical instructional strategies for educators. Lanham, Md: Scarecrow Press.

[6]. Borg, R. W., & Gall, M. D. (1989). Educational research: An introduction (5th ed.). New York: Longman.
[7]. Brown, A. L., & Palincsar, A. S. (1986). Guided, cooperative learning and individual knowledge acquisition. Champaign, Ill: University of Illinois at Urbana Champaign.
[8]. Caine, R. N. (2005). 12 Brain/mind learning principles in action: The field book for making connections, teaching, and the human brain. Thousand Oaks, Calif: Corwin Press.
[9]. Caine, R.N., & Caine, G. (1997). Unleashing the power of perceptual change: The potential of brain-based teaching. Alexandria, VA: Association for Supervision and Curriculum Development.
[10]. Caine, G., & Caine, R. N. (1997). Education on the edge of possibility. Alexandria, VA: ASCD.
[11]. Caine, G., & Caine, R. N. (1994). Making connections: Teaching and the human brain. Menlo Park, CA: Addison-Wesley.
[12]. Caine, G., Caine, R. N., & Crowell, S. (1999). Mindshifts: A brain-based process for restructuring schools and renewing education (2nd ed.). Tucson, AZ: Zephyr Press.
[13]. Krishnaswami, O. R., & Ranganathan, M. (2006). Methodology of research in Social Sciences (2 nd ed.). Mumbai: Himalaya Publishing House.
[14]. McCarthy, B., & McCarthy, D. (2006). Teaching around the 4MAT cycle: Designing instruction for diverse learners with diverse learning styles. Thousand Oaks, Calif: Crowin Press.
[15]. Sarsani, M.R. (2005). Creativity in Education. New Delhi: Sarup & Sons.
[16]. Seltzer, K., & Bentley, T. (1999). The creative age: Knowledge and skills for the new economy. London: Demos.
[17]. Sousa, D. A. (2015). How the brain learns (4th ed.). Thousand Oaks, California: Corwin press, Inc.
[18]. Banchonhattakit, P., Duangsong, R., Muangsom, N., Kamsong, T., & Phangwan, K. (2015). Effectiveness of brain-based learning and animated cartoons for enhancing healthy habits among school children in Khon Kaen, Thailand. AsiaPacific Journal of Public Health, 27 (2), NP2028-NP2039.
[19]. Bas, G. (2010). Effects of brain-based learning on students' achievement levels and attitudes towards English lesson. Elementary education online, 9 (2), 488-507.
[20]. Bawaneh, A. K., Zain, A. N., Saleh, S., & Abdullah, A. G. (2012). The Effect of a brain-based teaching method on conceptual change in students' understanding of electricity. Eurasian Journal of Physics and Chemistry Education, 4(2), 79-96.
[21]. Becktold, T. H. (2001). Brain based instruction in correctional settings: Strategies for teachers. Journal of Correctional Education, 95-97.
[22]. Bellah, K. A., Akers, C., Robinson, J. S., Kaufman, E. K., Haase-Wittler, P., & Martindale, L. (2008). Brain-based Learning: A Synthesis of Research. NACTA Journal, 15-22.
[23]. Bellah, K. A., Robinson, J. S., Kaufman, E. K., Akers, C., Haase-Wittler, P., & Martindale, L. (2008). Engaging Students with Brain-Based Learning. Techniques, 50-55.
[24]. Binulal, K. R., & Aravind, A. (2013). Brain Based Learning–Feel the difference in meaningful learning. Asian Journal of Research in Social Sciences and Humanities, 3 (9), 228-232.
[25]. Brown, N. (2005). Meeteth Thy match: Sensory activities to support Brain-Based Learning. School Library Media Activities Monthly, 21 (8), 17-19.
[26]. Caine, R.N. (2000). Building the bridge from research to classroom. Educational Leadership, 58(3), 59-65.
[27]. Caine, R.N., & Caine, H. (1998). Building a bridge between the neurosciences and education: Cautions and possibilities. NASSP Bulletin, 82(598), 1-8.
[28]. Caine, R.M., & Caine, G. (1995). Reinventing schools through brain-based learning. Educational Leadership, 52(7), 43-47.
[29]. Caine, R.N., & Caine, G. (1990). Understanding a brain-based approach to learning and teaching. Educational Leadership, 48(2), 66-70.
[30]. Canbulat, T., & Kucukkaragoz, H. (2014). The effects of the brain based learning approach on 5th grade students academic achievement and academic selfesteem in Social Studies. Batı Anadolu Egitim Bilimleri Dergisi, , 5 (9), 13-45.
[31]. Diakidoy, N., & Constantinou, P. (2001). Creativity in Physics: Response fluency and task specificity. Creativity Research Journal, 13(3), 401-410. doi:10.1207/S15326934CRJ1334_17.
[32]. Duman, B. (2010). The effects of brain-based learning on the academic achievement of students with different learning styles. Educational Sciences: Theory and Practice, 10 (4), 2077-2103.

[33].Gangadharrao, K. M. (2012). A comparative study of creativity level of students from Marathi and English medium students. Indian Streams Research Journal, 2 (3), DOI: 10.9780/22307850, http://isrj.org/UploadedData/1291.pdf.

[34].Garg, M., & Agarwal, J. (2008). Psycho-social home environment and its relation to adolescents creative thinking. Asian Journal of Home Science, 3 (2), 171-173.

[35].Hurby, G. G. (2011). Minding the brain. Journal of Adolescent & Adult Literacy , 54 (5), 316-321.

[36].Jausovec, N., & Jausovec, K. (2011). Brain, creativity and education. The Open Education Journal , 4, 50-57.

[37].Jensen, E. (2000). Brain-based learning: a reality check. Educational Leadership , 7,

[38].Nami, Y., Marsooli, H., & Ashouri, M. (2014). The relationship between creativity and academic achievement. Procedia-Social and Behavioral Sciences, 114, 36-39.

[39].Paltasingh, S. (2008). Relationship among creativity, intelligence and achievement scores of secondary school students. Journal of Teacher Education and Research, 3 (2), 54-60.

[40].Pathak, N. (2013). A comparative study of creativity among undergraduate Mathematical gifted boys and girls. Indian Journal of Applied Research, 3 (5).

[41].Prigge, D. J. (2002). 20 Ways to promote brain-based teaching and learning. Intervention in School and Clinic, 237 (5).

[42].Reid, R., & Niekerk, J. v. (2014). Brain-compatible, web-based information security education: A statistical study. Information Management & Computer Security,

[43].Vyas, K., & Vashishtha, K. C. (2013). Effectiveness of teaching based on Brain research with reference to academic achievement of secondary school students. International Journal of Students Research in Technology & Management, 1 (04), 383-397.

[44].Kiedinger, R. S. (2011). Brain-based Learning and its effects on student outcome in elementary aged students (Doctoral dissertation, University of WisconsinStout). Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.389.6207&rep=rep1&type=pdf

[45].Mansy, D. L. (2014). Brain based learning: K-12 teachers' preferred methods of science instruction (Doctoral dissertation, East Tennessee State University). Retrieved from http://dc.etsu.edu/etd/2436/

[46].Margolis, C. (2012). Teaching to the right side of the brain to achieve whole-brain learning: Its effect on language learning with low-level, low-literate adult ESL students (Master's Thesis, Hamline University, Saint Paul, Minnesota).

[47].McNamee, M. M. (2011). The impact of brain-based instruction on reading achievement in a second-grade classroom. Retrieved from ERIC database (ED525320).

[48].Nussbaum, S. S. (2010). The effects of Brain Gym as a general education intervention: Improving academic performance and behaviors (Doctoral dissertation, North central University). Retrieved from ERIC database (ED517276).

[49].Panse, S. (2013). Development of brain-based program for enrichment of oral communication of 1st Std deprived students (Doctoral dissertation,

[50].SNDT Women's University, Mumbai). Retrieved from http://shodhganga.inflibnet.ac.in/handle/10603/7215

[51].Singh, B. (2006). Academic achievement of college students in fine arts in relation to emotional intelligence, creativity, learning and thinking styles (Doctoral dissertation, Punjab University, Chandigarh).

[52].Smolinski, K. (2010). Original Science-based music and student learning (Doctoral dissertation, Walden University). Retrieved from ERIC database (ED516912).

[53].Delors, J. (1996). Learning: The treasure within: Report to UNESCO of the International Commission on Education for the Twenty-first Century, Paris: UNESCO.

[54].Duman, B. (2006). The effect of brain-based instruction to improve on students' academic achievement in social studies instruction. 9th International Conference on Engineering Education, (pp. 17-25).

[55].Inci, N., & Erten, H. (2009). The Effect of Brain Based Learning on Academic Success, Attitude and Retrieval of Information in Science and Technology Classes. In ESERA conference, Lyon, (pp. 5-9).

[56].Parker Jr, W. S., Director, P. E., & Sedona, A. Z. (2007). Brain Education for Enhanced Learning: The Next Frontier in Education Paper Presented at the 3rd International Brain Education Conference August 10-12, 2007, Best 5 Resort Ellenville. New York.

[57].Soonthornrojana, W. (2007). A Teaching model development for reading comprehension by brain-based learning activities. (The 1st International Conference on Educational

Reform Mahasarakham University, Thailand,
310-319).

*****