



ENHANCING ACADEMIC ACHIEVEMENT OF STANDARD VII STUDENTS IN SCIENCE USING BRAIN BASED LEARNING (BBL) APPROACH

Kalpana M. More

Zeal Education Society's Dnyanganga College of Education, Sinhgad Road, Pune-411052.
India

Corresponding Author- Kalpana M. More

Email id: kalpamdev001@gmail.com

DOI- 10.5281/zenodo.7593633

Abstract

The present study deals with influence of Brain Based Learning (BBL) approach on academic achievement of Standard VII students in science. For the study true experimental design was used, by selecting two intact divisions of Standard VII from same school, each of 43 students. An intervention programme based on the BBL principles, fundamentals, and seven stage lesson plan was prepared. The data was analysed with descriptive and inferential statistics, using SPSS software. The results obtained herein imply that the BBL intervention programme leads to significant enhancement in student's achievement in science, which is attributed provision of interactive, challenging, and stress-free class environment. Moreover, the science teachers felt that BBL approach be adopted for other subjects and standards.

Key words: Brain Based Learning (BBL), Academic Achievement, Standard VII, Science

Introduction:

The prime aim of school education is holistic development of the students. In today's era of globalization characterized by rapidly changing scenario, prevailing teaching-learning approaches/methods offer limitations and thus need either timely modifications or introduction of new teaching-learning approaches. In this context, Brain Based Learning (BBL), a joint endeavour of neuroscientist and educationalist, has been recognized as a potential teaching-learning approach. BBL is based on structure and function of human brain. A comprehensive model of BBL was put forth by Renne Caine and Jeffry Caine

(1999), who consolidated the results of research studies, carried out by various neuroscientist and educationalist worldwide, in terms of twelve principles and three fundamentals. These BBL principles and fundamentals offer theoretical structure for effective teaching-learning process, seeking the best conditions ensuring learning takes place in the brain.

Amongst the various researchers who have put in efforts to develop BBL, the most noticeable contribution is due to Jensen Eric (2005, 2008). According to him "Brain based education is the purposeful engagement of strategies that apply to how the brain works in the context of education". Furthermore, he

has quoted "Brain Based Learning is a comprehensive approach to learning based on Neuroscience". In nutshell, BBL is an interdisciplinary answer to the question, "What is the most effective way of the brain's learning mechanism?"

Significance of BBL in teaching and learning of Science subject:

Amongst the different teaching-learning approaches, BBL is the most recent approach which is realized as an optimal one making learning more enjoyable and stress free. Since its initiation, many researchers have studied its effectiveness in the context of student's achievement in various subjects, class room environment, learning ability of special children, and so on. Davis, L. (2004) has studied use of BBL approach to increase grade IV student's academic achievement in science. It is observed that, with the implementation of BBL approach, the students displayed positive attitude towards learning leading to significant improvement in their achievement, and self-esteem. Dilek and Rahmi (2006) have studied impact of BBL approach on grade VII student's achievement and retention of knowledge about 'work energy' topic. This study was performed on 91 students consisting of 49 girls and 42 boys distributed as 30 in experimental group, 61 in two control groups, respectively. In this study pre-test post-test control grouped design was used. In addition, another measuring tool namely Brain Dominance Instrument (BDI) was used. The results of BDI indicated that 43.3% of the experimental group students have slight preference toward the left dominance, 26.7 %

have slight preference toward the right dominance, and 20% have moderate preference for the left. It was summarized that nearly ~ 66 and 30 % of the experimental group students use dominantly the left and right sections, respectively, and the BBL approach leads to significant increase in their achievement. An experimental study carried out by Ozden and Gultekin (2008) reported that the BBL approach is more effective than the traditional teaching procedures in science course facilitating enhancement in the retained knowledge. Similarly, S. Saleh (2012) has reported a study on effectiveness of the BBL approach in enhancing scientific understanding of Newtonian Physics.

Kawthar and Mohammed, (2016) have studied the impact of BBL teaching-learning program on the achievement of female students of grade IX in chemistry. The researchers have applied t-test for independent sample means, standard deviations and ANOVA. The results indicated statistically significant differences at the level ($\alpha \leq 0.05$) in contemporary and instructional achievement. The researchers recommended application of the BBL instructional methods in learning chemistry and science. Effectiveness of BBL strategy on student's academic achievement, attitude, motivation and knowledge retention in electrochemistry has been studied by Uzezi, J. G. and Jonah, K. J. (2017). Recently, A. Arun and G. Singaravelu, (2018) have investigated the effectiveness of BBL approach in enhancing physics learning among the students of standard VIII. Very

recently, a study on efficacy of BBL techniques in enhancing mathematical performance among preschool children has been carried out by A. M. Jazeel et.al.(2020).

Need of Study:

The literature survey reveals that rigorous research work on BBL approach and its significance has been mostly carried out overseas, and their results are interesting and encouraging. In Indian context, more research studies are anticipated, as results of these studies cannot be applied as it is. Therefore, systematic research work to reveal the effectiveness of BBL approach on academic achievement of students is the need of hour. For such research studies, an intervention programme based on the BBL principles and fundamentals compatible suitable to the Indian scenario has to be developed. Furthermore, due to misbeliefs and superstitions, there is significant lack of scientific attitude in peoples of developing countries, which can be overcome by imparting good science education at school level. Following this, science subject has been purposefully selected for the said research studies.

Operational Definitions:

Brain Based Learning: It is a learning approach that is aligned with how the human brain naturally learns best. It is an instructional approach in which conducive learning environment is created by the teacher with minimum threats and maximum challenges so as to make learning an enjoyable activity.

Achievement in science subject: In the present study, achievement in science subject

is measured in terms of difference between scores obtained by the student in pre-test and post-test (i. e. achievement test prepared by the researcher)

Objectives of the Study:

The present research study had following objectives.

1. To develop an intervention programme using the BBL principles and fundamentals, for some selected topics (Food and Nutrition Food and protection of food, Health and Disease.) of Standard VII General Science textbook.
2. To study influence of BBL intervention programme on academic achievement of Standard VII students.

Hypothesis:

Null Hypothesis

H1: There is significant difference in student's achievement of experimental and control groups.

H0: There is no significant difference in student's achievement of experimental and control groups.

Methodology:

The research study belongs to the category of applied research. For this study, 'pre test - post test equivalent group' design was selected. The pre test was administered before implementation of the BBL intervention programme, while the post test was conducted at the end of its application. Two groups were selected randomly as experimental and control group. For group equivalence, matching for mean and standard deviation of their pre test scores was used. The statistical analysis was carried out with the help of SPSS software.

The control variables (extraneous variables) that may influence the dependent variable (student's academic achievement) are school, class, medium of instruction, topic(s) to be taught, time of teaching (morning/noon session), and so on. As the study was carried out in one school and randomly selecting two divisions of the same school, it helped the researcher to control the aforesaid extraneous variables.

Table I: Statistical analysis for Group Equivalence

Pre test	No. of students	Mean	S.D	r	Df	t value	Level of Significance
Experiment Group	43	19.69	6.3865	0.93	42	0.259	0.01
Control Group	43	20.04	6.1835				

As seen from Table 1, the obtained t-value is 0.259 for the degrees of freedom (df) of 42.

The obtained t-value is less than 'Table t-value' of 2.71 at the significance level of 0.01. Therefore, it is concluded that both selected groups are equivalent, and do not differ in achievement in science subject.

Data Analysis:

i. Descriptive Statistical Analysis referring to Group Equalization:

The Table 1 depicts statistical analysis of the pre test scores of students of two divisions, selected as control and experimental groups. It is prerequisite to ensure 'equivalence' between the groups, so as to eliminate their influence, if any, on the final results of the research study.

ii. Descriptive Statistics of Pre-test and Post-test Scores:

The statistical analysis of the pre test and post test scores of the students of experimental and control groups is presented in Table 2.

Table II: Descriptive Statistics of the Pre test and Post test Scores

Variable	Group	Test	No. of students	Mean	Median	S.D	Skewness	Kurtosis
Achievement	Experimental	Pre	43	19.69	20	6.386	0.0730	-0.302
		Post	43	36.98	38	6.815	-0.6812	0.571
	Control	Pre	43	20.04	20	6.183	-0.3992	-0.704
		Post	43	26.67	28	7.456	-0.1246	-1.002

From the aforesaid statistical analysis, it is observed that;

a) At the outset, mean values of both the groups show enhancement implying gain in student's achievement. However, a careful observation reveals that the change in mean values is different for these groups. In the context of control group, the observed gain in achievement, (indicated by increase in the mean value from 20.04 to 26.67) can be considered to be 'natural', as these students were subjected to the traditional teaching.

The significant increase in mean value of the experimental group (from 19.64 to 36.98) is certainly due effect of the BBL intervention programme. Therefore, it is concluded that the BBL intervention programme has affirmative influence on student's achievement in science subject.

b) Skewness and Kurtosis are measures of distribution of students around the mean value. The '-ve' value of skewness indicates

more individuals in the group have higher scores than the mean value. Similarly, '-ve' value of Kurtosis indicates flatter distribution, whereas '+ve' Kurtosis refers to more peaked distribution. The flatter distribution indicates very few individuals near to the mean value, whereas in 'peaked' distribution, many individuals have scores near the mean value. In case of experimental group, Skewness values of pre-test and post-test exhibit change from '+ve' to '-ve'. This change clearly indicates that in post-test, more number of students have scores greater than the mean value, and there is gain in the achievement. In case of control group, the Skewness value of post-test exhibits slight positive shift with respect to the pre-test value, indicative of small rise in the number of students scoring more than the respective mean value. Thus the Skewness values clearly reveal that BBL intervention programme has affirmative influence on student's the achievement.

Similarly, in the context of experimental group, the pre-test and post-test Kurtosis values show change from '-ve' to '+ve', indicative of more number of students

having scores about the mean value in post test (peaked distribution). Thus, it clearly suggests gain in the achievement of experimental group students, which is attributed to positive effect of BBL intervention programme. In the case of control group, the values of pre test and post test Kurtosis are observed to be '-ve', (flatter distribution) indicative of no significant increase in students achievement.

iii. Inferential Statistical Analysis:

The inferential statistical analysis was performed to test following hypothesis.

H1: There is significant difference in student's achievement of experimental and control groups.

H0: There is no significant difference in student's achievement of experimental and control groups. 'Paired t-test' method was used for testing the hypothesis. The paired t-test explores the relationship between experimental and control groups, and one can statistically conclude whether or not the 'treatment' has improved the performance. The Tables 3 and 4 depict the relevant statistics of experimental and control group's achievement.

Table II: Paired Sample Statistics of Pre- and Post-test Scores

Group	Test	N	df	Mean	SD	Std. error mean	r	L.O.S
Experimental	Pre	43	42	19.69	6.3865	0.973	0.837	0.01
	Post	43		36.98	6.8155	1.039		
Control	Pre	43	42	20.04	6.1835	0.943	0.750	
	Post	43		26.67	7.4569	1.137		

Table IV: Paired Sample Test of Experimental and Control Groups

Pairs	Mean	SD	Std. Error Mean	99%Confidence interval of the Difference		t	Df	Significance (2-Tailed)
				Lower	Upper			
Experimenta 1 Post-Pre A	17.28	3.788	0.577	16.113	18.44	29.91	42	0.000

Control Post-Pre B	6.63	4.966	0.757	5.0993	8.156	8.751	42	0.000
-----------------------	------	-------	-------	--------	-------	-------	----	-------

In case of the experimental group, the obtained t-value of 29.91 is greater than the table t-value of 2.71 at 0.01 level of significance. Similarly, for control group the obtained t-value of 8.156 is greater than the table value 2.71 at 0.01 level of significance. This indicates that there is increase achievement of students of both the groups. However, from the 'Significance (2-Tailed)

value' being less than 0.5, it is inferred that there is statistically significant difference between the achievement of experimental and control groups (post- and pre tests). Therefore, in order to reveal the effect BBL intervention programme on student's achievement, gain score analysis was carried out and is presented in Table 5.

Table V: Statistics of Gain Scores of Experimental and Control Groups

Group	N	Gain score mean	SD	SE _D	Df	t ratio	L.O.S
Experimental	43	17.28	3.7880	0.5386	42	19.77	0.05
Control	43	6.63	4.967				

As seen from the table, there is significant difference in the gain scores of experimental and control groups. Interestingly, the gain score of experimental group is more than that of control group. Furthermore, the obtained t-value of 19.77 for achievement is greater than the table t-value 2.02 at 0.05 level of significance, indicating that gain score of experimental group is more than that of control group. Hence, the null hypothesis was rejected. Moreover, as the observed t-ratio of gain scores for achievement was found to be significant, ω^2 estimate was calculated.

$$\omega^2 = \frac{(t^2 - 1)}{N_1 + N_2 + (t^2 - 1)} = \frac{389.85}{475.85}$$

$$= 0.81927 \cong 0.82$$

The calculated values of ω^2 indicates 82% of the variance in achievement due to the BBL intervention programme.

Conclusions:

The results of descriptive statistical analysis in terms of mean, Skewness, and

Kurtosis indicate improvement in the achievement of students of both the groups. However, relatively more enhancement is observed in experimental group students as compared to the control group, supplemented by the inferential statistical analysis. The significant enhancement in achievement of experimental group students is attributed to affirmative effect of the BBL intervention programme. In nut shell, implementation of the BBL intervention programme leads to noticeable increase in the student's achievement in science.

References:

1. Arun A., and G. Singaravelu, (2018). Effectiveness of Brain Based Teaching Approach in Enhancing Physics Learning Among the Students of Standard VIII, Review of Research, 7(8), 1-6. <https://doi.org/10.9780/2249894X>.
2. Davis, L. (2004) "Use of Brain Based Learning to increase fourth grade

- students Academic achievement in Science”, (ERIC Document Reproduction Service No.ERIC#ED491477, Retrieved from, <http://eric.ed.gov/>)
3. Dilek E. A. and Rahmi Y. (2006-2007) “A Study on impact of Brain-Based Learning approach on Student’s Achievement and Retention of knowledge about Work Energy topic” (Retrieved from, <https://www.scribd.com/document/198979297/97-Erduran>)
 4. Jensen Eric. (2005) “Teaching with the Brain in Mind”, 2nd edition, ASCD Publication,
 5. Jensen Eric. (2008) “Brain-Based Learning: The New Paradigm of Teaching”, Corwin Press.
 6. Kawthar Shabatat and Mohammed Al-Tarawneh. (2016) “The Impact of a Teaching-Learning program based on a Brain-Based Learning on the Achievement of the Female students of 9th Grade in Chemistry”, Higher Education Studies; Vol. 6, No. 2, pages 162-173, 2016.
 7. Muhammet Ozden and Mehmet Gultekin. (2008) “The effects of Brain-Based Learning on Academic Achievement and Retention of knowledge in Science course”, Electronic Journal of Science Education, Vol. 12, No. 1, pages 1-17. (Southwestern University, retrieved from <http://ejse.southwestern.edu>)
 8. Rennate Caine and Geoffrey.Caine. (1999) “Brain-Based Process for Restructuring Schools and Renewing Education Mind shifts”, 2nd edition. Zephyr Press.
 9. Saleh Salmiza. (2012) “The effectiveness of the Brain Based Teaching approach in enhancing Scientific understanding of Newtonian Physics among form four Student”, International Journal of Environmental and Science Education, Vol. 7, No. 1, pages 107-122.
 10. Stephanie A. Clemons.(2005) “Brain-Based Learning: Possible Implications for Online Instruction”, International Journal of Instructional Technology and Distance Learning Vol. 2. No. 9, pages 25-33.
 11. Uzezi, J. G. and Jonah, K. J. (2017). Effectiveness of Brain-based Learning Strategy on Students’ Academic Achievement, Attitude, Motivation and Knowledge Retention in Electrochemistry. Journal of Education, Society and Behavioural Science, 1-13.