Effectiveness of Brain Based Learning Strategies on Scientific Creativity among the Students of Standard IX

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***Abstract*— The present study aims to find out the effectiveness of brain based learning strategies on scientific creativity among the students of standard IX. The investigator has adopted experimental method with pretest –posttest nonequivalent group design. Random sampling technique was used for sample selection. Two hundred standard IX students from two districts of Kerala state were selected for the experimental study. Verbal test of scientific creativity (developed by V. P. Sharma & J.P. Shukla) and lesson transcripts based on Brain Based learning strategies developed by the investigator were the tools used in the study. The verbal test of scientific creativity was used as both pre-test and post-test to measure the scientific creativity of standard IX students before and after the experiment. The experimental group was taught through BBL strategies on the basis of lesson transcripts prepared by the investigator and the control group was taught through activity oriented method. At the end of the instructional phase, the post-test was administered to the two groups. Statistical techniques employed for data analysis were t-test and ANCOVA. Major finding of the study is that brain based learning strategies is effective in enhancing scientific creativity among the students of standard IX.**

***Keywords* — Brain Based Learning, Scientific creativity. Brain/mind learning principles, effectiveness, standard IX students**

I INTRODUCTION

Science plays a substantial part in the lives of human beings. Science education makes the individuals adept to assess and comprehend scientific information and make proper decisions. There is a close association between creativity and science learning. Scientific creativity is creativity in the field of science. Problem solving, forming hypotheses, designing experiments and technical innovation require scientific creativity [1].Scientific creativity is defined as, a kind of intellectual trait or ability producing or potentially producing a certain product that is original and has social or personal value, designed with a certain purpose in mind, using given information [2]. It deals with the unusual and original excellence in the field of science or scientific productivity [3] .In order to nurture creative thinking in students, they should be involved in meaningful and challenging learning activities in a caring and encouraging learning environment.

Brain Based Learning (BBL) is a learner centred and teacher facilitated strategy that utilizes learners cognitive endowments [4].BBL is based on brain/mind learning principles [5].They are:a) Brain is a parallel processor b) Learning engages the entire physiology c) Search for meaning is innate d)Search for meaning occurs through patterning e)Emotions are critical to patterning f) Brain simultaneously perceives and creates parts and wholes g) Learning involves both focused and peripheral attention h) Learning involves conscious and unconscious processes. i) Brain has two types of memory- a spatial memory system and rote learning system. j) The brain understands and remembers best when facts and skills are embedded in natural spatial memory. k) Learning is enhanced by challenge and inhibited by threats. l) Each brain is unique.

Grounded on these principles, [6] have advocated three central components, for successful teaching: They are a) Relaxed Alertness: a state of mind that caters brains preference for challenge and its search for meaning. If learners are to be in a state of relaxed alertness teachers should provide an atmosphere with low threat and significant challenge b) Orchestrated Immersion: learners should be immersed in appropriate learning experiences c) Active Processing: Creating optimal ways to consolidate learning.

Maximum learner participation and achievement require the incorporation of the engagement of emotions, nutrition, enriched environment, music, movement, meaning making and the absence of threat. BBL method takes in to account how the brain naturally learns best, what is natural to our brain and how circumstances and experiences impact brain. Brain based learning involves engagement in strategies based on principles derived from understanding of brain [7]. All learning is connected to brain in some way. But brain based approach is learning in accordance with how the brain is naturally designed to learn [8]. Teaching without an awareness of how the brain learns is like designing a glove with no sense of what a hand looks like- Its shape, how it moves [9].

II NEED AND SIGNIFICANCE OF THE STUDY

Students' creativity in learning science is important as they are future scientists and potential resource of any nation [10]. It is important to stimulate creative thinking right from the early years of life. Creative scientists are appreciated because of the uniqueness in their ideas and innovations. The society, being technical and scientific needs a good number of scientifically tempered and skilled persons who may effectively contribute to its development [11]. Science education in India, even at its best develops competence but does not encourage inventiveness and creativity [12]. Current methods of teaching in science education should undergo a shift so that inventiveness and creativity is encouraged. Brain Based Learning is a method that can bring novelty into the classrooms to accomplish this goal. So this study attempts to find out whether brain based learning strategy, an approach that is based on the natural learning of the brain, is effective in enhancing scientific creativity among students.

III OBJECTIVE OF THE STUDY

To compare the effectiveness of brain based learning strategies and activity oriented method on scientific creativity between experimental and control group.

IV HYPOTHESES OF THE STUDY

1. There is no significant difference between the mean pre test scores of scientific creativity between experimental and control group students.
2. There is significant difference between the mean post test scores of scientific creativity between experimental and control group students.
3. Brain based learning strategies is more effective than activity oriented method in enhancing scientific creativity among standard IX students.

V METHODOLOGY

For conducting the present study, the investigator adopted experimental method and used pre test- post test non equivalent group design.200 standard IX students from three secondary schools of Kerala state constituted the sample of the study. Sample was selected through simple random sampling technique. The verbal test of scientific creativity (developed by V. P. Sharma & J.P. Shukla) was used as both pre-test and post-test to measure the scientific creativity of standard IX students

before and after the experiment. The experimental group was taught through lesson transcripts prepared by the investigator based on BBL strategies and the control group was taught through activity oriented method. At the end of the instructional phase, the post-test was administered to the two groups. The scores thus obtained were then analyzed by using statistical techniques and the comparison of the groups was done to determine the comparative effectiveness of BBL strategies and activity oriented method.

VI TOOLS USED IN THE STUDY

1. Verbal test of scientific creativity (developed by V. P. Sharma & J.P. Shukla)
2. Lesson transcripts and learning materials on the basis of BBL (Developed by the investigator).

VII STATISTICAL TECHNIQUES USED

Both descriptive and inferential statistical procedures such as Mean, Standard deviation, t-test, ANCOVA were employed to analyze the data.

VIII ANALYSIS OF DATA AND INTERPRETATION

A. Comparison of Means of the Pre-Test scientific Creativity Scores of the Experimental Group and Control Group

Hypothesis 1: There is no significant difference between mean pre-test scientific creativity scores of students in the experimental and control group

To find out whether there is any significant difference between the experimental group and the control group in their pre-test scores, the mean and standard deviation of the pre-test scores of students in the two groups were obtained and the t-value was found out. The data and results of the test of significance of difference between means are given in Table I

TABLE I

DATA AND RESULT OF THE TEST OF SIGNIFICANCE OF THE PRE-TEST CREATIVITY SCORES OF STUDENTS IN THE EXPERIMENTAL AND CONTROL GROUPS

Group	**No. of students**	**Mean**	**Standard Deviation**	**t-value**
Control	100	63.61	11.21	1.82
Experimental	100	60.97	9.14	

Table I shows that the t-value is 1.82 which is not significant at 0.01 level. This shows that there is no significant difference between the means of the pre-test scores of the students in the experimental and control groups. That means the two groups do not differ significantly with respect to their scientific creativity scores. Hence the hypothesis, there is no significant difference between mean pre-test scientific creativity scores of students in the experimental and control group is accepted.

B. Comparison of Means of Post-test Scientific Creativity Scores of the Experimental and Control Groups

Hypothesis 2: There is significant difference between mean post-test scientific creativity scores of students in the experimental and control group

The mean and standard deviation of the post-test scores of the students in the experimental group and the control group were obtained and t value was found out. The data and results of the test of significance are given in Table II.

TABLE II

DATA AND RESULT OF THE TEST OF SIGNIFICANCE OF THE DIFFERENCE BETWEEN THE MEAN POSTSTEST SCORES OF THE STUDENTS IN EXPERIMENTAL AND CONTROL GROUP

Group	**No. of students**	**Mean**	**Standard Deviation**	**t-value**
Control	100	75.67	11.42	24.99*
Experimental	100	121.70	14.46	

**Significant at 0.01 level*

The t-value obtained is 24.99 which is significant at 0.01 level, indicating that there is significant difference between the means of the post-test scores of the students in experimental and control groups. This means that the two groups differ significantly in the post-test. Since the mean score of the experimental group is higher than that of the control group, the experimental group is considered superior to the control group. Hence the hypothesis, there is significant difference between the mean post test scores of scientific creativity between experimental and control group students is accepted.

C. Comparison of the Effectiveness of BBL Strategies and Activity Oriented Method on the Scientific Creativity of Experimental and Control Group Students (using ANCOVA)

After administering the Brain Based Learning strategies to the experimental group and administering the activity oriented method to the control group, it was found in the comparison of the post-test scores that, the experimental group was better than the control group in their scientific creativity scores. Hence, it can be summarized that the Brain Based Learning strategies is more effective than the activity oriented method of teaching.

But it cannot be conclusively said that both the groups differ significantly by simply comparing the post-test scores of the groups. So it became necessary that the scores be analysed using the technique of Analysis of Covariance (ANCOVA) to determine the effectiveness of the Brain Based Learning strategies over the activity oriented method for enhancing the scientific creativity of the students.

Hypothesis 3 - Brain based learning strategies is more effective than activity oriented method in enhancing scientific creativity among standard IX students

The scores of scientific creativity of students of the experimental group and the control group were subjected to Analysis of Covariance. The sum squares, mean square variances and F ratios for the pre-test and post-test scores of the experimental group and the control group were computed and Table III presents the details of the analysis.

TABLE III

SUMMARY OF ANOVA OF PRE-TEST AND POST-TEST SCORES OF STUDENTS IN THE EXPERIMENTAL AND CONTROL GROUPS

Source of Variation	**df**	**SSx**	**SSy**	**MSx**	**Msy**
Among Means	1	348.48	105938.05	348.84	105938.05
Within Groups	198	20710.70	33599.11	104.60	169.7
Total	199	21059.18	139537.16		

Fx = 3.33 From table F for df 1/198

Fy = 624.29

F at 0.05 level =3.90

F at 0.01 level = 6.81

The F ratios for the two sets of scores were tested for significance. Since the table value of F for df 1/198 is 3.90 at 0.05 level and 6.81 at 0.01 level, the obtained Fx (Fx = 3.33) value is not significant. The obtained Fx value shows that the random assignment of subjects to the two groups was quite successful. The Fy obtained (Fy = 624.49) is significant at 0.01 level as it is above the table value at 0.01 level. The analysis of variance of the 'y' means indicate that there exists significant difference between experimental group and control group.

For correcting the final y-scores for the difference in the pre-test scores, the adjusted sum of squares and adjusted mean square variances for post-test scores were computed and F ratio was calculated and given in Table IV.

TABLE IV

ANALYSIS OF CO-VARIANCE (ANCOVA) OF THE PRE-TEST AND POST-TEST SCORES OF STUDENTS IN THE EXPERIMENTAL AND CONTROL GROUPS

Source of Variation	**df**	**SSx**	**SSy**	**SSxy**	**SSyx**	**MSyx**	**SDyx**
Among Means	1	348.48	105938.05	-6075.96	112914.73	112914.73	10.80
Within Groups	197	20710.70	33599.11	14824.23	22988.28	116.69	
Total	198	21059.18	139537.16	8748.27	135903.00		

Fy.x = 967.63

From Table F for df 1/197

F at 0.05 level = 3.90 F at 0.01 level = 6.81

Since the obtained F ratio (Fy.x = 967.63) is higher than Table value at 0.01 level, it is significant at 0.01 level. The significant F ratio for the adjusted post-test scores shows that the two final mean scores of the experimental and control group differ significantly after they have been adjusted for differences in the pre-test scores. The adjusted means for the post-test scores of students in the experimental and control groups were computed using correlation and regression and given in Table V.

TABLE V

ADJUSTED MEANS FOR THE POST-TEST SCORES OF STUDENTS IN THE EXPERIMENTAL AND CONTROL GROUPS

Groups	**N**	**Mx**	**My**	**My.x (adjusted)**
Experimental Group	100	60.97	121.70	122.64
Control Group	100	63.61	75.67	74.73
General Means		62.29	98.69	98.69

t = 31.37

From Table D, for df 197

t at 0.05 level = 1.98

t at 0.01 level = 2.61

Adjusted means for the post-test scores were tested for significance for df 197. The‘t’ value obtained is 31.37. The ‘t’ value for df 197 is 1.98 at 0.05 level and 2.61 at 0.01 level. The obtained ‘t’ value is significant (t = 31.37, $p<0.01$) since it is greater than the table value at 0.01 level.

The ‘t’ value shows that the two means differ significantly. It means that the experimental group and control group differ significantly. As the adjusted mean score for the experimental group is higher than that of the control group, the experimental group can be said to be superior to control group. So the hypothesis, Brain Based Learning strategies is more effective than activity oriented method in enhancing scientific creativity among standard IX students is accepted. Thus, it can be concluded that Brain Based Learning Strategies is more effective in enhancing the scientific creativity of standard IX students compared to activity oriented method.

IX. MAJOR FINDING OF THE STUDY

Brain based learning strategies is effective in enhancing scientific creativity among the standard IX students.

X. CONCLUSION

It can be concluded from the study that BBL approach, which is based on the natural learning of brain, is advantageous in enhancing the scientific creativity of standard IX students. It is evident that creating a friendly, safe, stress-free and caring classroom is vital for a successful learning experience. Typical teaching methods followed in our schools neglect suggestions given by neuroscience researchers about brain’s natural learning techniques. Any committed and resourceful teacher can convert

the classroom in to a brain based setting. By the acquisition of an improved perception of this practice, teachers can employ the findings to set up classrooms that will involve the minds of students, bettering their scientific creativity. Teachers must do thoughtful research and become contented with the format to be successful. When brain based learning is effectively executed in the classroom every child is gained.

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