CHAPTER V
SUMMARY AND CONCLUSIONS

5.1 Introduction

Education aims in helping students to develop intellectual tools and learning strategies to be productive members in the society. It is high time to replace centre place of the teacher by the learner and make him responsible for learning. Learning is an active and dynamic process in which learners approach new tasks strategically, analyse task requirements, apply various mental processes appropriate to the task and reflect on the success of their attainments.

In the 21st century, one should understand how the human brain learns, what are the results of brain researches on learning principles derived from brain researches and what are the strategies to implement these brain researches in the classroom. An appropriate learning environment with brain friendly social and emotional atmosphere can be promoted through Brain-Based Learning.

The investigator envisaged that teaching Science subject through Brain-Based Learning Strategy at the secondary level could motivate the students to enhance their academic achievement and creativity. Also this would help to analyze the efficacy of Brain-Based Learning Strategy, hence the present investigation entitled “The Effect of Brain-Based Learning Strategy on Academic Achievement and Creativity among Secondary School Students” was undertaken with the following objectives:

5.2 Objectives of the Study

The major objectives of the study were:

1. Prepare Brain-Based Learning lesson transcripts for teaching the unit ‘Addiction and Healthy Lifestyle’ for the secondary school students.

2. Construct and validate an achievement test and test of creativity for the secondary school students.

3. Find out the effect of experimental group (Brain-Based Learning Strategy) and control group (Conventional Method) on academic achievement and creativity of secondary school students.
4. Compare the effect of experimental group and control group on academic achievement and creativity with respect to gender, locality and type of school.

5. Examine the relationship between the academic achievement and creativity of experimental group and control group.

6. Estimate the effect size of Brain-Based Learning Strategy on academic achievement and creativity.

5.3 Methodology

The investigator selected a sample of 156 students of standard IX from three types of schools namely, Government, Government aided and Corporation schools in Coimbatore by purposive sampling method. Among the 8 divisions selected, the sample was divided into two by stratified random sampling method one constituting the experimental group and the other, the control group. Due representation to gender, locality and type of school were considered while selecting the sample.

The content for the Brain-Based Learning Strategy was selected from the IX standard Tamilnadu State Board Science textbook. The content selected was a unit on ‘Addiction and Healthy Lifestyle’. Lessons were suitably prepared to teach the two groups of students for twenty hours of duration for each group. Each group comprising of 78 students, the experimental and the control group were taught using Brain-Based Learning Strategy and Conventional method of teaching respectively.

The investigator used achievement test and test of creativity (pre test and post test) as tools of evaluation. From the scores obtained by the students the effect of the Brain-Based Learning Strategy in relation to the variables was evaluated and the findings were enumerated.

5.4 Findings

1. The descriptive analysis of the pre test and the post test achievement scores of experimental and control groups showed that the post test mean was higher than pre test mean of experimental and control groups for the total sample and also with respect to gender, locality and type of school.

2. The analysis of the pre test achievement scores of experimental and control groups showed no significant difference for the total sample and also with respect to gender, locality and type of school.
3. The analysis of the post test achievement scores of experimental and control groups showed significant difference for the total sample and also with respect to gender, locality and type of school.

4. The analysis of the pre test and the post test achievement scores of experimental and control groups for the total sample showed significant differences in experimental group \( t = 14.185 \) and control group \( t = 2.885 \). The post test mean score was higher for the experimental group \( 25.68 \) than the control group \( 18.29 \). It was found that Brain-Based Learning Strategy enhances academic achievement.

5. The findings imply that the Brain-Based Learning Strategy was effective in case of boys of experimental group, which was revealed by significant ‘t’ value \( t = 13.207 \). Whereas, no significant difference was noted in the control group \( t = 1.448 \).

6. It was found that significant difference was noted between the pre test and post test achievement scores of girls in experimental group \( t = 9.417 \) and control group \( t = 2.899 \). The post test mean score was higher for the experimental group \( 21.56 \) than the control group \( 17.13 \).

7. The finding revealed that significant difference was found between the pre test and post test achievement scores of urban school students in experimental group having the highest t value \( t = 10.508 \). Whereas, no significant difference was noted for the control group \( t = 1.928 \).

8. Significant difference was noted between the pre test and post test achievement scores of rural school students in experimental group \( t = 9.473 \) and control group \( t = 2.155 \). The post test mean score was higher for the experimental group \( 25.62 \) than the control group \( 18.51 \) proving the experimental group scored better than control group.

9. The findings revealed that the experimental group showed significant result in the ‘t’ value being \( 8.974 \). Whereas, no significant difference was found between the pre test and post test achievement scores of the government school students in control group \( t = 0.890 \).

10. The findings indicated that significant difference was noted between the pre test and post test achievement scores of the government aided school students in the experimental group \( t = 7.406 \) whereas, no significant difference was noted between the pre test and post test scores of the government aided school students in control group \( t = 1.793 \).
11. The findings revealed that significant difference was found between the pre test and post test achievement scores of the corporation school students in the experimental group ($t=8.215$) and control group ($t=2.258$).

12. The F values 92.594 and 97.902 obtained out of the respective post test and adjusted post test mean achievement scores showed that significant difference existed among the total sample in experimental and control group. The adjusted post test mean score of the experimental group (25.48) proved that Brain-Based Learning Strategy was effective and the experimental group scored better than control group.

13. The analysis of the post test and the adjusted post test mean achievement scores of the experimental group showed that boys and girls differed significantly since the F values were 139.067 and 122.616 respectively. The F value of the post test achievement mean scores (5.813) indicated that significant difference existed among the control group. From, the highest mean score, it can be concluded that boys in experimental group (29.33) are high achievers than girls. The analysis of the adjusted post test mean achievement scores of the control group showed no significant difference with respect to gender.

14. The F value (152.567) obtained out of the adjusted post test mean achievement scores of boys in experimental and control group showed significant difference among the experimental and control groups.

15. The F values 26.464 and 28.576 obtained out of the respective post test and adjusted post test mean achievement scores showed that significant difference existed among the girls in experimental and control group. The adjusted post test mean score of the experimental group (21.38) proved that Brain-Based Learning Strategy was effective and the girls scored better in experimental group than control group.

16. No significant difference existed in the post test as well as in the adjusted post test achievement mean scores in the experimental group with respect to locality which was revealed by the F values 0.012 and 0.095 respectively. The same result was obtained in the case of control group for the post test and adjusted post test which was revealed by F values 0.189 and 0.095 respectively. Both in experimental group and control group, the mean score value was almost same with respect to locality.
17. The calculated post test and the adjusted post test achievement mean scores showed that significant difference existed among the urban school students which were revealed by their respective F values 50.757 and 50.806. The highest mean score of the experimental group (25.56) proved that Brain-Based Learning Strategy was effective and the urban school students scored better in experimental group than control group.

18. The F values (41.146 and 45.818) obtained out of the respective post test and adjusted post test mean achievement scores showed that significant difference existed among the rural school students in experimental and control group. The adjusted post test mean score of the experimental group (25.41) proved that Brain-Based Learning Strategy was effective and the urban school students scored better in experimental group than control group.

19. The analysis of the post test and the adjusted post test mean achievement scores of the experimental group showed no significant difference which was revealed by the respective F values 0.115 and 0.040. The same result was obtained in the case of control group which also revealed as not significant with F values for the post test and adjusted post test 0.37 and 0.466 respectively. Both in experimental group and control group, the mean score value is almost same with respect to type of school.

20. The F values (39.562 and 41.692) obtained out of the post test and the adjusted post test mean scores respectively showed that significant difference existed in the experimental and control group. From the adjusted post test mean achievement scores of experimental group (25.42) revealed that Brain-Based Learning Strategy can be taken as the effective method and the Government school students scored better in experimental group than control group.

21. Analysis of the achievement scores in Government aided school revealed significant difference in the experimental and control group since the F values 38.954 and 36.056 obtained out of the post test and adjusted post test mean scores respectively. From the high mean score of experimental group (25.91), it can be concluded that Brain-Based Learning Strategy as an effective method of teaching.

22. The F values 19.351 and 24.087 obtained out of the post test as well as adjusted post test mean scores respectively showed significant difference in the experimental and control group. From the high mean score of adjusted post test achievement scores of experimental group (25.21) revealed that Brain-Based Learning Strategy is proved to
be an effective method and the Corporation school students scored better in experimental group than the control group.

23. The descriptive analysis of the pre test and the post test creativity scores of experimental and control group showed that the post test mean is higher than pre test mean for the total sample and also with respect to gender, locality and type of school.

24. The analysis of the pre test creativity scores of experimental and control groups showed significant difference for the total sample and corporation school students. Whereas, no significant difference was seen with respect to boys and girls, rural and urban, Government and Government Aided students.

25. The analysis of the post test creativity scores of experimental and control groups showed significant difference for the total sample and also with respect to gender, locality and type of school.

26. The analysis of the pre test and the post test creativity scores for the total sample showed significant difference in experimental group (t =20.569) and control group (t =7.555). The post test mean score was higher for the experimental group (69.97) than the control group (54.12). It was found that the Brain Based Learning Strategy had helped in enhancing the creativity of the students.

27. The findings revealed significant difference between the pre test and post test creativity scores of the boys in experimental group (t=14.901) and control group (t =6.666). The post test mean score was higher for the experimental group (71.03) than the control group (55.59). The findings imply that the Brain-Based Learning Strategy was effective in case of boys of experimental group in enhancing creativity.

28. Significant difference was noted between the pre test and post test creativity scores of girls in experimental group (t =14.289) and control group (t =4.212). The post test mean score was higher for the experimental group (68.92) than the control group (52.64).

29. It was found that the significant difference was noted between the pre test and post test creativity scores of urban school students in experimental group (t =14.067) and control group (t =5.212). The post test mean score was higher for the experimental group (71.08) than the control group (54.44).
30. Significant difference was found between the pre test and post test creativity scores of rural school students in experimental group (t =15.126) and control group (t =5.449). The post test mean score was higher for the experimental group (68.87) than the control group (53.79).

31. The findings showed significant results, the ‘t’ value being 10.027 in the pre test and post test creativity scores of the government school students in experimental group and control group (t =4.131).

32. The findings revealed that significant difference was noted between the pre test and post test creativity scores of the government aided school students in the experimental group (t =14.127) and control group (t =2.961).

33. Significant difference was noted between the pre test and post test creativity scores of the corporation school students in the experimental group (t =12.207) and control group (t =6.479).

34. The F values 124.306 and 153.140 obtained out of the respective post test and adjusted post test mean creativity scores showed significant difference among the total sample in experimental and control group. The adjusted post test mean score of the experimental group (68.72) proved that Brain-Based Learning Strategy was effective and the experimental group scored better than control group.

35. The analysis of the post test and the adjusted post test mean creativity scores of the experimental group showed no significant difference which was revealed by the respective F values 0.912 and 1.750 with respect to gender. The same result was obtained in the case of control group for the post test, F value 2.736. Whereas, significant difference existed in the control group with respect to gender F value being 7.522 at the adjusted post test.

36. The F value (64.729) obtained out of the adjusted post test mean creativity scores of boys in experimental and control group showed significant difference among the experimental and control groups.

37. The F values 70.692 and 97.314 obtained out of the respective post test and adjusted post test mean creativity scores showed that significant difference existed among the girls in experimental and control group. The adjusted post test mean score of the experimental group (67.75) proved that Brain-Based Learning Strategy was effective and the girls scored better in experimental group than control group.
38. The analysis of the post test and the adjusted post test mean creativity scores of the experimental group showed that urban school students and rural school students showed no significant difference which was revealed by the F values 1.004 and 1.059 respectively. The same result was obtained in the case of control group, which was revealed as not significant with F values for the post test and adjusted post test 0.125 and 0.171 respectively. Both in experimental group and control group, no significant difference were noted with respect of the locality.

39. The analysis of the post test and the adjusted post test mean creativity scores of the urban school students showed that experimental and control group differed significantly since the respective F values (56.887 and 70.747). The highest mean score of the experimental group (69.69) proved that Brain-Based Learning Strategy was effective and the urban school students scored better in experimental group than control group.

40. The F values 69.679 and 83.404 obtained out of the respective post test and adjusted post test mean creativity scores showed that significant difference existed among the rural school students in experimental and control group. The adjusted post test mean score of the experimental group (67.77) proved that Brain-Based Learning Strategy was effective and the rural school students scored better in experimental group than control group.

41. The analysis of the post test and the adjusted post test mean creativity scores of the experimental group showed no significant difference since the respective F values (3.737 and 2.374). The same result was obtained in the case of control group also which showed no significant difference in the F values for the post test and adjusted post test 0.842 and 0.339 respectively. Both in experimental group and control group, no significant difference were noted with respect of the type of school.

42. The F values 33.703 and 43.586 obtained out of the post test as well as adjusted post test mean scores respectively showed that significant difference existed in the experimental and control groups. Based on the high adjusted post test mean creativity score of experimental group (67.91), it can be concluded that Brain-Based Learning Strategy can be considered as the effective method and the Government school students scored better in experimental group than control group.
43. Analysis of the creativity scores in Government aided school revealed that significant difference in the experimental and control group since the ‘F’ values 50.470 and 73.607 obtained out of the post test as well as adjusted post test mean scores respectively. From the high mean creativity scores of experimental group (72.90), it was revealed that Brain-Based Learning Strategy could be employed as an effective method of teaching.

44. The ‘F’ values 48.694 and 41.085 obtained out of the post test as well as adjusted post test mean scores respectively showed that significant difference existed in the experimental and control group. From the high adjusted post test mean creativity scores of experimental group (65.51), it was revealed that Brain-Based Learning Strategy can be considered as the effective method and can be concluded that the corporation school students scored better in experimental group than control group.

45. The correlation analysis of the experimental group showed significant positive correlation between academic achievement and creativity scores for girls and corporation school students. It was also found that very negative negligible correlation between academic achievement and creativity scores for boys and Government aided students.

46. It was found that the Brain-Based Learning Strategy had maximum effect in increasing academic achievement and creativity of secondary school students.

5.5 Educational Implications

5.5.1 Students

- The results of the study have proved that Brain-Based Learning Strategy was more effective than conventional method of teaching on the academic achievement and creativity of secondary school students. It is found that students enjoy learning through Brain-Based Learning Strategy so teachers should incorporate new strategy in terms of techniques, methods and materials in the teaching learning process.

- The Brain-Based Learning Strategy is found to be very effective in learning the concepts easily and meaningfully. The study revealed that Brain-Based Learning Strategy is effective in improving academic achievement and creativity.
From this study, it is clear that this is a self-learning style in which immediate reflection of the self is possible, which will motivate the students to regulate and manage their own learning styles, thereby creating an interest among the students as they are free to learn at their own pace. Brain-Based Learning Strategy is a combination of a variety of learning activities and learning materials. By adopting such an approach in the teaching-learning process, a teacher can make her student an expert learner.

The Brain-Based Learning Strategy motivates students to actively participate in outdoor activities like nature study, field study, environmental programme etc. The students are also motivated to read books and journals.

5.5.2 Teachers

The study revealed that Brain-Based Learning Strategy is effective in improving learning and performance outcomes. Hence, while commencing the learning task, with regard to its objectives, its nature and appropriate strategies are necessary to master it. For that, the budding teachers as well as the teachers in service should be sensitized to the need for incorporating new methods and strategies in their teaching.

Teachers should be given orientation as to how Brain-Based Learning Strategy can be developed by making use of the locally available resources to teach Science and other subjects. This will pave the way for the utilization of optimum human resource development.

By using this type of learning approach, teachers can improve the understanding and knowledge of students in any subject. Even in the absence of the teachers, these strategies can engage students and prevent wastage of their time.

Teachers should get opportunities to attend seminars, workshops, refresher courses etc. to equip them with the knowledge of Brain-Based Learning Strategy.
5.5.3 Heads of the Institutions

The present study would help the principals/ heads of institutions

- To understand the knowledge and application of Brain-Based Learning Strategy in school and inspire all teachers to be aware of the use of Brain-Based Learning Strategy in their classroom practices.

- The study recommends that the heads of institution should arrange activities like seminars, discussion and exchange programmes in the school making the school a brain-based learning community. Teachers and all students should be the active members.

- Pre-service and in-service teacher training programmes should focus on the importance of Brain-Based Learning Strategy in order to make our schools better institutions.

- Sufficient financial aid should be allotted to organise activities like nature club, field study etc. and sufficient audio visual aids should be made available in the schools for such activities.

- Heads of Institutions and teachers should be oriented with the effective use of different methods of teaching through short term courses, seminar, symposiums, conferences and refresher courses.

5.5.4 Government

- For the development of Brain-Based Learning Strategy, the NCERT and the SCERT can make use of the services of outstanding teachers at the national as well as the state level so that the expertise of the meritorious teachers can be made available even to the students in far flung areas.

- The curriculum planners and the authorities concerned at DIET, SCERT and NCERT should seriously look into this aspect-the need of the hour, in the teaching learning process.

- Keeping the results of the study in mind, the agencies responsible to improve the quality of education should take up the task of implementing Brain-Based Learning Strategy for all the subjects.
Necessary training should be given to teachers and students regarding the functioning.

The government should also take initiative to allot funds to the schools for organizing camps, workshops, seminars etc.

5.6 Suggestions for Further Research

It is hoped that the present study would- open avenues for further research in the following areas:

1. A study can be conducted to develop problem solving ability, critical thinking ability, language learning, multiple intelligence, metacognitive skills and reasoning skills using Brain-Based Learning.
2. The study can be replicated among specially challenged children and children with learning disabilities.
3. The effect of Brain-Based Learning Strategy was found to be effective in teaching the topic ‘Addiction and Healthy Lifestyle’. Further research can be conducted to find the effect in different subjects.
4. Similar studies on a wider sample including more content areas can be undertaken.
5. Learning package based on Brain-Based Learning Strategy can be prepared, and tested in other subjects and among various levels of students also.
6. Attitude of educational practitioners, administrators, curriculum framers, teachers and students towards the inclusion of more Brain-Based Learning Strategy in school and college curriculum may also be studied.
7. A survey can be conducted to identify the various Brain-Based Learning Strategy used at formal, informal and non-formal levels of education.
8. Similar study can be conducted for the, students of Arts and Science colleges and other Professional Institutions.
9. A comparative study can be undertaken to find out the best effective method by adopting more modern innovative strategies with modern technological equipments to teach subjects in schools and other educational institutions.
10. Studies can be conducted with different experimental designs to collect more reliable data.
5.7 Conclusion

Learning is not just an academic activity. In Brain-Based learning, the students become active participants in the learning process. Brain-Based Learning Strategy activates the innate faculties of the thinking brains of the learners. Proper implementation of brain-based learning strategies in the classroom enhances the students’ performance and also brings upon the learners the positive impact on social, emotional and cognitive levels.

As Albert Einstein said, “Knowledge is limited, but creativity encircles the world”. The teacher is the gardener who cultivates students’ potential to make them grow into creative adults. Teachers should ensure a creativity and intelligent friendly school environment. In order to teach creativity, one must teach creatively; that is, it will take a great deal of creative effort to bring out the most creative thinking in your classes. Learners are most creative when they are involved in meaningful, challenging and authentic activities; these are more likely to generate interest and engagement. Manifold thinking for creating, communicating, integrating, acting ethically on knowledge and critically evaluating its effects and impact on other humans and the society can offer a holistic educational practice.

The researches on Brain-based educational techniques support teachers to implement classroom techniques supporting students’ growth both socially and academically. This research has revealed how Brain-Based Learning Strategy enhances academic achievement and creativity of secondary school students. This study concludes that Brain-Based Learning Strategy would be helpful for the teachers to create a brain friendly classroom leading to effective learning. The glimpse of Brain-Based Learning will open up new vistas to discover the undiscovered facts, bringing a transition in the whole education system.

To conclude with words of John Holt, “What is essential is to realize the children learn independently, not in bunches; that they learn out of interest and curiosity, not to please or appease the adults in power; and that they ought to be in control of their own learning, deciding for themselves what they want to learn and how they want to learn it”. So let us learn with Brain-Based Learning. Brain Based Learning should lead to wellness of being and ‘human flourishing’, with teachers as mentors of learning, achievement and creativity.