Summary and Conclusions
CHAPTER V
SUMMARY AND CONCLUSIONS

5.1 INTRODUCTION
Since the time educational process has started, our teaching strategies have been improved in order to enhance the students' learning. In the era of globalization, everybody wants to leap ahead in all the areas to lead successful life. Parental expectations are so high that every parent wants their child to be a doctor or engineer. Such parental expectations have burdened the children to score good in their academic subjects. This has led to a paradigm shift in researches conducted in the field of education. Most of the educational researches now focus on the ways of teaching that can enhance the academic achievement of the students using the best available resources. Researches have been conducted to use a number of new teaching learning approaches in order to improve the performance of the learners. Learning as we know is a psychological phenomenon; no two learners in a class are alike. Every learner is distinct from another with respect to the physical and mental features, every one of those are having their own ways of learning styles. Classroom environment which is heterogeneous and contextual where students with different learning styles are found some of them are burdened with parental expectations and build low self-esteem which in turn results into faking student behavior. In such a scenario best of teaching practices cannot yield the desired output. There is a need to change the teaching strategies to improve student learning. Learning will become more enthusiastic when the learning is in their preferred style which therefore can improve the learners’ performance and improve the self-esteem of students. According to Jensen, an educator should expose learners to a variety of styles. He also indicates that to build a successful brain-based learning style approach one should: provide a variety of approaches; and offer choices. In brief, the framework of all learning styles and formats if available with teacher is the most valuable asset to help her determining whether her teaching approach/methodology covers all learners. Teacher has an important role in creating such classroom environment where she can link her teaching with learning experiences. The link should be so consistent that there appears a flow of knowledge and experiences in a constant manner. The flow must involve all the types of pupils. The classroom environment is heterogeneous. In order to cater to the needs of diverse learners and
improve their academic achievement, research today has shifted its focus from autocratic and teacher oriented instructional strategies to democratic teaching strategies wherein pupils are given due importance in putting their views in front of teacher. Apart from physical participation of students in the class, it is important to involve their minds and ideas into teaching. Teaching strategies must cater to the developmental needs of the students. Brain-based instructional strategies are pioneer in implementing such teaching in classroom that utilize the developmental principles of human brain and its needs.

**Brain based instructional strategies:** The brain based instructional process has its primary focus on understanding the learning process by synchronizing it with the brain’s functionality. These instructional strategies lays emphasis on what a learner is performing in the classroom and not on the kind of lecture prepared by the teacher. The learner and his learning process is the focus of brain based instructional strategies. In fact these strategies have been developed in a manner that all the developmental principles related to human brain are used practically. The key concept behind the brain based instructional strategies lies in providing challenging as well as supportive environment wherein the teacher act as facilitator and not as an autocratic administrator (Caine and Caine,).

Giving hands on interactive learning to students is found to be helpful in increasing retention. Prigge, 2002 has suggested some of the strategies which can actually improve the students' achievement. The strategies suggested are as follows:

- Teaching students about their brain
- Discussing about the Proper sleep hours required for better retention
- Telling importance of water and glucose for human brain.
- Making students aware about different learning styles.
- Establishing positive and interactive atmosphere.
- Integrating media in classroom teaching
- Encouraging students ideas about learning
- Using movement and music
- Utilizing first and last minutes of teaching involving students
Neuro-education has categorized brain-based instructional strategies into three domains which are as under:

1) Orchestrated Immersion

2) Relaxed Alertness

3) Active Processing

The main focus of orchestrated immersion is to make the gist of the subject meaningful and vivid in learners’ minds. If learners grasp the gist through various sense organs, retention level of the provided information will be increased. Immersion uses different strategies such as using music, visualization techniques etc for maximum involvement of the learners. It helps in establishing patterns and associations in pupils’ brains. (Matema, 2000).

The relaxed alertness implements such strategies that keep in mind the comfort level to be given to pupils for better learning. It focuses on the environment to be provided. The environment should be such that it is meaningful as well as challenging to the learners. However, challenge should be put forward in a way that students should not feel threatened. (Caine & Caine, 1995). Learners need to feel secure and relaxed so that they can take up risks to undertake that challenge. This domain is helpful in changing the thinking and learning styles of learners through establishing associations between the old and new knowledge (Pool, 1997).

Active processing is the theoretical organization and internalization of the meaningful information by learners (Caine & Caine, 2002), it include such teaching strategies that focus on memorizing the content by active and conscious involvement of the learner. Using mnemonics, chunking etc. are the best strategies. Apart from these, efforts made by learner in making creative aids for better learning are also part of active processing domain. As Matema (2000) states, the brain struggles to form meaningful patterns from experiences as it processes information.

Learners make associations to link newly encountered information with previous learning and storing it for the further use. Learning based on these techniques helps the brain to build new connections and consolidate new information. Brain-based instructions functions best with hands on interactive learning. BBIS provides academically a fear free environment resulting in superior understanding of the educational material. These strategies increase brain thickness, i.e. helps in
growing connections between axons and neurons leading to increased plasticity of brain. Thus, brain based instructional strategies stimulates students' continual interest in learning. The use of brain-based research would be most effective when combined with previously established frameworks for teaching and learning. BBIS strive to ensure that pupil receive the individualized education that will help them enhance their innate strengths and overcome difficulties they may encounter in school. We must acknowledge this emerging strategy for diversity of minds and usher in a new era of neuroeducational research. (Renate and Caine, 2004)

The theoretical principles of brain research can be put into practice by finding out the strategies meeting the needs of the human brain. Brain based principles can be applied in the educational field with the help of supporting material that can improve the teaching practices.

5.2 STATEMENT OF THE PROBLEM

EFFECT OF BRAIN BASED INSTRUCTIONAL STRATEGIES ON ACHIEVEMENT AND SELF ESTEEM OF SCIENCE STUDENTS IN RELATION TO THEIR LEARNING STYLES

5.3 DELIMITATIONS

1) The study was conducted on class VII science students only.

2) The BBIS was developed for few topics of science from prescribed syllabus of class VII of CBSE/NCERT

3) The experiment was limited to about two months of the academic session.

4) The study was confined to schools of Chandigarh territory.

5.4 OBJECTIVES

1. To develop instructional material based on brain-based instructional strategies (BBIS)

2. To study and compare the effect of BBIS and Conventional method on achievement of class VII students.

3. To study the interaction between instructional strategies, achievement in science and learning styles.

4. To study and compare the effect of BBIS and Conventional method on achievement in
5. To study and compare the effect of BBIS and Conventional method on achievement in science of students with Accommodation learning style (LS₁).
6. To study and compare the effect of BBIS and Conventional method on achievement in science of students with Assimilation learning style (LS₂).
7. To study and compare the effect of BBIS and Conventional method on achievement of in science of students with Convergent learning style (LS₃).
8. To study and compare the effect of BBIS and Conventional method on self-esteem of class VII students.
9. To study and compare the effect of BBIS on self-esteem of class VII students with respect to different learning styles.
10. To study the interaction between instructional strategies, self-esteem and learning styles.
11. To study and compare the effect of BBIS and Conventional method on self-esteem of students with Accommodation learning style (LS₁).
12. To study and compare the effect of BBIS and Conventional method on self-esteem of students with Assimilation learning style (LS₂).
13. To study and compare the effect of BBIS and Conventional method on self-esteem of students with Convergent learning style (LS₃).
14. To study and compare the effect of BBIS and Conventional method on self-esteem of students with Divergent learning style (LS₄).

5.5 HYPOTHESES

In the light of above objectives following hypotheses were framed.

HYPOTHESES FOR ACHIEVEMENT IN SCIENCE OF CLASS VII STUDENTS

H₁ The two instructional treatments will yield equal mean gain scores on achievement in science of class VII students.

H₂ The students with different learning styles will yield equal mean gain scores on achievement in science.
H3 There will be no significant interaction between instructional treatments and learning styles of science students with respect to achievement in science.

H4 There will be no significant difference in the achievement of students of experimental and control group with respect to Accommodation learning style (LS1).

H5 There will be no significant difference in the achievement of students of experimental and control group with respect to Assimilation learning style (LS2).

H6 There will be no significant difference in the achievement of students of experimental and control group with respect to Convergent learning style (LS3).

H7 There will be no significant difference in the achievement of students of experimental and control group with respect to Divergent learning style (LS4).

HYPOTHESES FOR SELF-ESTEEM OF CLASS VII SCIENCE STUDENTS

H8 The two instructional treatments will yield equal mean gain scores on self-esteem of class VII students.

H9 The students with different learning styles will yield equal mean gain scores on self-esteem.

H10 There is no significant interaction between instructional treatment and learning styles of science students with respect to self-esteem.

H11 There will be no significant difference in the self-esteem of students of experimental and control group with respect to Accommodation learning style (LS1)

H12 There will be no significant difference in the self-esteem of students of experimental and control group with respect to Assimilation learning style (LS2)

H13 There will be no significant difference in the self-esteem of students of experimental and control group with respect to Convergent learning style (LS3)

H14 There will be no significant difference in the self-esteem of students of experimental and control group with respect to Divergent learning style (LS4)
5.6 EXPERIMENTAL PROCEDURE

The study was conducted in following phases.

**Phase I:** During this phase the instructional strategies and achievement test was developed. A pilot study was also conducted to see the effect of these strategies on smaller sample.

**Phase II:** During this phase Pre-testing was done. The tests on achievement, self-esteem and learning styles were administered on the sample in accordance with the instructions given in the respective manuals by the concerned authors. This phase involved the administration of the following tests to the students of experimental and control group:

- Achievement test in science
- Self-esteem scale
- Learning style inventory

**Phase III: Instructional Treatment**

During this phase the sample was randomly assigned to experimental and control group by the investigator. The experimental group was exposed to the BBIS instructions and control group was exposed to Conventional instructions. Both the groups were taught similar topics, but were exposed to different instructional treatments. Teaching was carried out for six weeks taking up the morning and evening classes.

**Phase IV:** In this final phase after completion of instructional program comprising of six weeks with class duration of 30 minutes each. The post test was administered on the experimental and control groups. The tests were checked and scored by the investigator carefully. The scores were put to statistical analysis. Following tests were administered to both the experimental and control groups:

- Achievement test in science
- Self-esteem scale
- Learning style inventory
5.7 TOOLS USED

For the present study, the research required various data gathering tools which varied in their design, complexity, administration and interpretation. Every tool was appropriate for getting particular type of information from the chosen sample. For this study following tools were used to collect the data:

- Instructional material was prepared on 27 different topics of physics, chemistry and biology of class VII. The material was prepared on the basis of brain based instructional approach. It was validated by the subject experts and later on was implemented to the experimental group.
- An achievement test was constructed by the investigator for the local use in the present study as per the requirement. This test was used to measure the students’ achievement in science of VII grade, both before and after the treatment.
- Learning Style Inventory developed and standardized by Dangwal and Mitra (1997) was used to get the information of learning styles of students in both the groups i.e. experimental and control group.
- Self-esteem scale by Rosenberg (1965).

5.8 SAMPLE

In this study Sample of science students was taken from two intact classes of standard VII. The classes were chosen randomly for equating the group. Classes were equated on the basis of mean and SD on test scores of science achievement of previous class. The groups were randomly allocated to experimental and control groups. Each class comprised of 45 students. Therefore the final sample comprised of 90 students with 45 in each students group. Pre test was administered on both the groups. The tools employed for pre test included self-esteem scale, achievement in science and learning styles of class VII students. The scores of students on different learning styles, self esteem and achievement in science were obtained.

5.9 DESIGN OF THE STUDY

The experiment aimed at studying the effect of brain based instructional strategies on science achievement and self esteem among VII graders in relation to their learning styles. The
researcher used pre test post test control group design. The design of analysis was 2X2 factorial design for both achievement and self esteem. The independent variable was the mode of instructions i.e. brain based instructional strategies. Learning styles were the classifying variable in the present investigation whereas achievement in science and self esteem were the dependent variables.

1. The experimental method followed was based on 2x4 factorial design.
2. The reason why factorial design was used is that it permits one to evaluate the combined effect of two variables on third variable simultaneously.

5.10 STATISTICAL TECHNIQUES

Following statistical techniques were employed for analysis of data

- Mean, median, standard deviation was used to equate the groups in the selected sample.
- t-test was employed to see the difference in mean gain of two groups.
- Analysis of variance was employed to see the interaction of effect of two variables on the third.

5.11 MAJOR FINDINGS

1. The students of experimental group taught by BBIS scored more of achievement in science as compared to control group taught by Conventional method.

2. There was a significant gain on mean scores of achievement in science of students with accommodation, and divergent learning styles but not in convergent and assimilation in experimental group.

3. There was a significant interaction between instructional treatments and learning styles of science students with respect to achievement in science of experimental group.

4. There was a significant gain on mean scores of achievement in science of students belonging to Accommodation learning style of experimental group.

5. There was no significant gain on mean scores on achievement in science of students belonging to Assimilation learning style of experimental group and control groups.

6. There was no significant gain on mean scores of achievement in science of students belonging to Convergent learning style in experimental and control groups.
7. There was a significant gain on mean scores of achievement in science of students belonging to Divergent learning style of experimental group.

8. The students of experimental group taught by BBIS scored more on self-esteem as compared to control group taught by Conventional method.

9. There was significant mean gain on self-esteem of science students with accommodation, convergent and divergent learning styles but no significant gain was found in assimilation learning style of experimental group.

10. There was a significant interaction between instructional treatments and learning styles of science students with respect to self-esteem of experimental group.

11. There was a significant gain on mean scores of self-esteem of students belonging to Accommodation learning style of experimental group.

12. There was no significant gain on mean scores of self-esteem of students belonging to Assimilation learning style of experimental group and control groups.

13. There was a significant gain on mean scores of self-esteem of students belonging to Convergent learning style of experimental group and control groups.

14. There was a significant gain on mean scores of self-esteem of students belonging to Divergent learning style of experimental group.

5.12 CONCLUSIONS

1. The hypothesis $H_1$ stating “the two instructional treatments will yield equal mean gain score on achievement in science of class VII students” has not been accepted.

2. The hypothesis $H_2$ stating “the students with different learning styles will yield equal mean gain scores on achievement in science” has not been accepted.

3. The hypothesis $H_3$ stating “there will be no significant interaction between instructional treatments and learning styles of science students with respect to achievement in science” has not been accepted.

4. The hypothesis $H_4$ stating “there will be no significant difference in achievement of students of experimental and control group with respect to Accommodation learning style” has not been accepted.
5. The hypothesis H5 stating “there will be no significant difference in achievement of students of experimental and control group with respect to Assimilation learning style” has been accepted.

6. The hypothesis H6 “there will be no significant difference in achievement of students of experimental and control group with respect to convergent learning style” has been accepted.

7. The hypothesis H7 stating “there will be no significant difference in achievement of students of experimental and control group with respect to Divergent learning style” has not been accepted.

8. The hypothesis H8 stating “the two instructional treatments will yield equal mean gain score on self-esteem of class VII students” has not been accepted.

9. The hypothesis H9 stating “the students with different learning styles will yield equal mean gain scores on self-esteem” has not been accepted.

10. The hypothesis H10 stating “there will be no significant interaction between instructional treatments and learning styles of science students with respect to self-esteem” has not been accepted.

11. The hypothesis H11 stating “there will be no significant difference in self-esteem of students of experimental and control group with respect to Accommodation learning style” has not been accepted.

12. The hypothesis H12 stating “there will be no significant difference in self-esteem of students of experimental and control group with respect to Assimilation learning style” has been accepted.

13. The hypothesis H13 “there will be no significant difference in self-esteem of students of experimental and control group with respect to convergent learning style” has not been accepted.

14. The hypothesis H14 stating “there will be no significant difference in achievement of students of experimental and control group with respect to Divergent learning style” has not been accepted.
5.13 EDUCATIONAL IMPLICATIONS OF THE PRESENT STUDY

Brain based instructional strategy has been found to be a useful tool for enhancing the performance of the students in science subject. The researcher found the students motivated and persistent in their learning process.

Brain based instructional strategies are helpful in motivating students for bringing new ideas of learning in threat free environment. Students actively participate in the classroom either as a group leader, a performer or a learner.

Students themselves start taking initiatives when they are given freedom by altering classroom environment and building rapport. Here the threat free environment of BBL plays a vital role.

It is an effective teaching strategy that is found to be helpful in enhancing the level of self esteem of learners with different learning styles. The experiment at a government managed residential school with simple infrastructure and limited resources gave positive results in terms of enhancing learning through brain based learning strategies. Hence adequate amount of planning and participation by creative teachers with flexible attitude in classroom transaction can lead to enhancement of self esteem and achievement in Indian classrooms. The support of forward looking school administrators can change classroom environments for better science learning. Teacher education courses should also include this innovative approach for future classrooms.

5.14 SUGGESTIONS FOR FURTHER STUDIES

The present study was confined under certain delimited areas. However the study can be conducted upon a larger sample of students.

1. Effectiveness of BBIS modules of science teaching for primary school students with respect to scientific attitude.
2. Effectiveness of BBIS modules of science for secondary school adolescents with respect to scientific creativity.
3. Perception of science teacher trainees about science teaching methods in relation to awareness about BBIS.
4. Development of teacher training instructional material based on BBL principles.