CHAPTER 5
SUMMARY AND CONCLUSIONS

5.1 INTRODUCTION

Education is a life-long process and continues in various forms throughout life. The main objective of education is all round development of an individual, including cognitive, affective and psychomotor domain. To develop these three domains of learning, the individual needs to be provided with the right kind of learning environment. The appropriate environment and the foundation for learning is formally provided by the schools, where individual are prepared for life. But, the present system of education somehow is not able to provide the right learning environment. Inspite of ICT in education, large number of trained teachers, good schools and government initiatives there is waning interest in learning of science. This demands teacher to use innovative strategies in their classrooms for improving learning. The uniqueness of every individual demands the variation in teaching learning process to make the teaching learning process more effective. There is need to understand the learning cannot be one size fits all. The researches in the field of science have revolutionized teaching learning process by using brain research in education as it has allowed researchers to understand the functioning of brain and how that can affect the learning. It has opened the avenues to understand how the human brain learns. The researches in the field of neuroscience and its application in the field of education have given rise to brain based learning. Various researches have shown that the application of strategies based on the principles of brain based learning have positive impact on student learning and achievement.

Various researches have been undertaken by educators and neuroscientists to understand the teaching learning process through brain based research (Sousa, 2006). The use of brain based imaging technology like computerized tomography, magnetic resonance imaging, functional magnetic resonance imaging, electroencephalography and positron emission tomography scans has helped researchers to study the functioning of brain like how the memory, recall, emotion, attention, pattern, context, speech, language, thinking, reasoning, speaking, reading, learning, etc. are processed (Weiss, 2000; Hari & Lounasmaa, 2000; Posner & Raichle, 1994). The advancement in neuroscience and its congruence with psychology and science of education has
allowed the researcher to study the various areas of brain that gets activated during learning of a concept or skill and understand how brain physically changes when it learns, opening varied avenues to education (Goswami, 2008). The understanding of the functioning of brain and its application in the field of education has given rise to the concept of brain based learning (Clemons, 2005). Brain based learning is “learning in accordance with the way the brain is naturally designed to learn” (Jensen, 2000, p.6). It is defined as any teaching technique or strategy that utilizes information about the human brain to organize how lessons are constructed and facilitated with emphasis placed on how the brain learns naturally” (Slavkin, 2004). It is an extensive approach that applies the findings of neuroscience in education (Jensen, 2008) to improve the teaching learning process. The understanding of the development of brain and its functioning and its emergence with education and psychology has allowed to develop the classrooms for the students, where not only the brain is understood but the psychology of students and how they learn is also taken into account thus making learning meaningful for the brain and developing teaching methods in accordance with rules of the brain (Jensen, 2005).

The brain based learning utilizes the strategies that tries to exploit the maximum potential of brain by providing student centered approach where the brain is provided maximum opportunity to learn by understanding the fact that during the learning process the structure and function of brain undergoes changes that helps learning. It is based on the theory that each brain continues to learn till it is not restricted from undergoing its routine processes (Caine & Caine, 1991; Jensen, 1996; Caine et al., 2005).

“The brain based teaching approach is believed to boost learning due to its holistic approach towards the learners” (Saleh 2011(b)). It is a student centred approach that exploits cognitive endowment of students to ensure the learning is more efficacious and deep-rooted. Being rooted in the disciplines of neuroscience, pedagogy and psychology it integrates emotions, nutrition, enriched environments, music, movement, meaningfulness, threat free environment for optimal learning of the students (Sousa, 2004). Neuroscience in education affirms that “learning experiences do help the brain grow, emotional safety does influence learning, and making lessons
relevant can help information to stick” (Bernard, 2010). Following are the principles of brain based learning:

1. All learning engages the whole physiology
2. The brain/mind is social.
3. The search for meaning is innate.
4. The search for meaning occurs through patterning.
5. Emotions are critical to patterning.
6. The brain/mind processes parts and wholes simultaneously.
7. Learning involves both focused attention and peripheral perceptions.
8. Learning always involves conscious and unconscious processes.
9. There are at least two approaches to memory: contextual and rote.
10. Learning is developmental.
11. Learning is enhanced by challenge and inhibited by threat.
12. Each brain is uniquely organised.

The interactive teaching elements of brain based learning are as follows:

1. Relaxed alertness
2. Orchestrated immersion
3. Active processing

The brain based learning can be best described as engagement of students in classroom using various strategies and resources based on principles of brain based learning. Emotional engagement, physical involvement, breaks, threat free environment, social interconnectedness, etc. must be included in a classroom to enhance leaning. The researches in neuroscience and education have proven that use of strategies based on brain based learning effects learning and improves achievement.

Achievement is a measure for effectiveness of education. It gives direction to all educational improvement efforts, provides the foundation for education accountability programs and serves as the primary outcome variable in most educational research studies. The interaction of teacher and learner during the teaching learning process is focused to help students acquire knowledge and develop understanding and skills. Achievement is a multifaceted construct, therefore it is necessary to define
achievement clearly in terms of instructional objectives and activities that students are expected to achieve.

Achievement is defined by learning goals and these learning goals in education have been classified in three domains: cognitive, affective, and psychomotor. Cognitive domain (Bloom, Englehart, Furst, Hill & Krathwohl, 1956) forms the basis for most of academic achievement during the formal education system. Affective domain of learning goals (Krathwohl, Bloom & Masia, 1964) refers to students' attitudes, interests, feelings, beliefs and dispositions. Psychomotor domain of learning goals for achievement (Simpson, 1966) typically requires student performances or demonstration of specific skills or behaviours. These three domains are interrelated and some researchers consider affective and psychomotor goals to be “enabling” traits or behaviours that facilitate student achievement of cognitive outcomes (McMillan, 2001). The other researchers are with the view that cognitive results elicit affective and psychomotor responses. The measures of student achievement in these three domains tend to be moderately related, and those relations appear to be reciprocal.

Garrison, Kingston and McDonald (1955-1964) defined achievement as the progress pupils make toward the goals and objectives of the curriculum, they then assert further about the definition that achievement may be the one’s ability or the extent of his/her knowledge in a specific content area. According to Cunningham (2012) the achievement of students is measured in terms of their performance in various academic areas and measured by achievement tests.

Thus, achievement is the determination of a student's academic competencies in related content areas; abilities necessary to succeed in school and real-world contexts (Hattie & Anderman, 2013). Increase in achievement helps to improve the self esteem of the learners.

Self esteem refers to a person's sense of own worth, or the degree to which a person values, approves of, appreciates, prizes, or oneself (Blascovich & Tomaka, 1991). Self esteem is described in terms of three general levels. First is global self that is a stable quality within an individual and is an evaluation of his own worth. Second is specific self esteem or situational self esteem including assessment of individual in his/her own capabilities in certain specific situations. Third is task self esteem including particular activities in specific situations (Brown, 2007). In border sense
Self esteem refers to a global sense of self-worth and in narrower concept it implies a sense of self esteem in specific domains.

Self esteem is the process of evaluating own performance, capacities and attributes in accordance with the personal standards and values that individual have incorporated in self from society and significant others. These self-evaluations lead to behaviour in consonance with knowledge about self (Moody 1984). Rosenberg (1965) said that self esteem is the attitude of an individual toward himself. He defined self esteem as a “favourable or unfavourable attitude toward the self”. Coopersmith (1967) said “by self esteem we refer to the evaluation which an individual makes and customarily maintains with regard to himself; it expresses an attitude of approval or disapproval, and indicates the extent to which an individual believes himself to be capable, significant, successful and worthy.” Therefore, self esteem is an evaluation of self-worth expressed through attitudes of an individual toward himself. The positive self esteem “effects the immune system of consciousness, providing resistance, strength and a capacity for regeneration” (Braden, 1995). To develop positive self esteem congenial classroom environment play very important role.

Classroom environment include the classroom conditions that facilitate teaching learning process. The classroom provides the environment where interaction occurs among teachers, learners and learning takes place. Hoy and Miskel (1987) believes that classroom climate consists of a set of internal characteristics that distinguish one school from another and influences the behaviour of the people in it.

Psychological perceptions of classroom environment have important influence on students’ achievement, performance and self concept as well as on other valuable educational outcomes. Learning environment needs to be constructivist and it consists of teacher support, teaching material, task orientation, clique, study habits, involvement, empathy, friction, disengagement etc. Good (1973) defined the classroom environment includes the physical, social and psychological dimensions. According to him climate includes heat, light, individual differences among the members, the teachers’ personality and teacher-student relationship. Brighton, Hertberg, Moon, Tomlinson and Callahan (2005) stated “classroom environment is the process of organizing and conducting a class, so that it results in maximum students learning, preventing distractions and disturbances.” Classroom environment can be defined as the interaction that takes place in classroom between teacher and
pupil and among pupils. It includes the physical environment and the classroom rules and procedure. Having an environment where students feel safe, nurtured and intellectually stimulated is must for students to learn to their potential. The classroom environment includes the physical, social and psychological dimensions. These include physical elements such as wall art, arrangement of desks, and other learning resources. Also, there are non-physical elements such as the classroom regulations and rules, or even the sounds and light within the room.

Effective teachers create a leaning environment which is inviting and cheerful, and in which pupils feels safe. Pupils feel able to take risks and make mistakes without fear of ridicule. Classroom climate encompasses all dimensions of classroom life (Wang, Haertel, & Walberg, 1993). The physical arrangement of furniture, availability of resource materials, length of class period (Chapin & Eastman, 1996), level of task difficulty, type and pace of instruction (Wang et al., 1993), predictability of the environment (Anderson, Stevens, Prawat, & Nickerson, 1987), and the value placed on interpersonal relationships (Gottfredson & Gottfredson, 1989) influence classroom climate. Positive classroom climates are safe and supportive and provide ample opportunities for exploration, experimentation and learning.

Science as a subject forms an inseparable part of education system and has utilitarian value in the day-to-day life. As per the recommendations of Indian Education Commission (1964-66) science education and research plays a pivotal role in the development of the economy of a nation. Subjects such as science and mathematics must be an indispensable part of education till the culmination of schooling for each and every child. In NCF (2005) science has been defined as “a dynamic, expanding body of knowledge, covering ever-new domains of experience… science can play a truly liberating role, helping people escape from the vicious cycle of poverty, ignorance and superstition”. But, the poor results in science as a subject raise a lot of questions regarding the present education system in our country and process of imparting science education in schools. In reports by Trends in International Mathematics and Science Study in 2003 India ranked 46 among 51 countries and in PISA (2009) India was second last among 73 countries on assessment of knowledge of students in mathematics and science (Anirudh Sethi Report, 2011) indicating poor performance of students. Not only globally the national education reports also show
poor performance of students. The ASER report for the year 2007 showed that only 35.3% students in age group of 11-14 years could comprehend and solve problems based on class second text and ASER 2016 report claimed that 27% of students studying in class 8th could not read text of class 2nd and 57% students could not solve problems of simple division of class 4th level. The ASER reports shows the condition have not changed much and such poor levels of reading and writing ability negatively impacted understanding in other subject areas such as science and mathematics. This demands change in teaching learning process which could impact the achievement of students.

NCF (2005) advocates that at elementary level the learner should be taught science through real life experiences by providing hands on experiences through experiments and explorative activities. Actively participating in group tasks, brainstorming on issues, collecting and organizing data and thereafter displaying it, must be an integral part of the teaching learning processes. It should be understood that the brain is always looking for meaning and it learns best when it can relate things in a natural way. Teaching science using brain based learning could be very fruitful in successfully implementing the principles of science teaching in our classrooms, so that each and every child could learn and understand science by doing and not by merely memorizing it (Mangan, 1998).

It has been found in various researches that brain based learning effects the learning. These brain friendly instructional strategies provide an emotionally supportive environment where learners can have total immersion in the challenging but threat free environment. The learners are believed to be unique in brain friendly classrooms and it is felt that the basis for new knowledge lies in the previous knowledge (Fogarty, 2002). In such classrooms, activities those have challenges, novelty, critical and deep thinking and multitasking are adopted and are seen to be favourable for the functioning of the brain.

It has also been found that positive self esteem effects learning but many contradictory studies have also been reported where higher self esteem do not relate with or predict better achievement. The researches in field of brain based learning has also been found to improve the self esteem, self confidence, self efficacy of the learners.
Also the classroom environment has been found to play an important role in improving the achievement and self esteem of learners. The researches shows that positive classroom environment is an important aspect of brain based learning and positively impacts the achievement. But certain studied have reported classroom environment does not affect achievement. These relationships and inconsistencies in findings of various researches have been identified and also it was found that not much work has been done in field of brain based learning in India. Hence, the researcher decided to design interventions in subject of science based on the principles of brain based learning to find out the effect on achievement and self esteem of learners in relation to how the learners perceive their classroom environment. Hence the statement of problem was formulated as:

**EFFECT OF BRAIN BASED INSTRUCTIONAL STRATEGIES ON ACHIEVEMENT AND SELF ESTEEM IN RELATION TO PERCEPTION OF CLASSROOM ENVIRONMENT AMONG ELEMENTARY SCHOOL SCIENCE STUDENTS**

Operational definitions for the study are:

*Brain Based Instructional Strategies* are the teaching and learning strategies based on principles of brain based learning.

*Achievement* is scores obtained by students on self constructed achievement test based on the CBSE/NCERT prescribed syllabus of Science for class VII.

*Self Esteem* is taken as the score obtained by students on self esteem scale (Rosenberg, 1965). It is the value ascribed by individual to himself and the quality of the ways in which he views himself.

*Perception of Classroom Environment* is assessed as the score obtained by students on scale for perception of classroom environment (Sharma and Kaur, 2013). It is in terms of classroom infrastructure, teacher behaviour and characteristics, student behaviour and characteristics, discipline, teaching and evaluation.

The present study was delimited to class VII science students studying in a residential school in Chandigarh. 30 lesson plans were executed in duration of three months.
the effect of instructional treatments on self esteem of class VII students

5.2

OBJECTIVES OF THE STUDY

The following objectives were formulated:
1. To compare the effect of instructional treatments on achievement in science of class VII students.
2. To compare the achievement in science of class VII students with differing perception of classroom environment.
3. To compare the effect of instructional treatments on achievement in science of class VII students with differing perception of classroom environment.
4. To compare the effect of instructional treatments on self esteem of class VII students.
5. To compare the self esteem of class VII students with differing perception of classroom environment.
6. To compare with differing perception of classroom environment.

5.3 HYPOTHESES

Hypotheses related to achievement in science

$H_{01}$) There exists no significant difference in the scores of achievement in science between control and experimental groups of elementary school students.

$H_{A1}$) The elementary school students in experimental group score better on achievement in science than the students in control group.

$H_{02}$) There exists no significant difference in scores of achievement in science between elementary school students with favourable and unfavourable perception of classroom environment.

$H_{A2}$) The elementary school students with favourable perception of classroom environment score better on achievement in science than the students with unfavourable perception of classroom environment.

$H_{03}$) There exists no significant interaction effect between instructional treatments and perception of classroom environment on scores of achievement in science of elementary school students.
There exists significant interaction effect between instructional treatments and perception of classroom environment on scores of achievement in science of elementary school students.

**Hypotheses related to self-esteem**

**H\textsubscript{04}** There exists no significant difference in the scores of self esteem between control and experimental groups of elementary school students.

**H\textsubscript{A4}** The elementary school students in experimental group score better on self esteem than the students in control group.

**H\textsubscript{05}** There exists no significant difference in scores of self esteem between elementary school students with favourable and unfavourable perception of classroom environment.

**H\textsubscript{A5}** The elementary school students with favourable perception of classroom environment score better on self esteem than the students with unfavourable perception of classroom environment.

**H\textsubscript{06}** There exists no significant interaction effect between instructional treatments and perception of classroom environment on scores of self esteem of elementary school students.

**H\textsubscript{A6}** There exists significant interaction effect between instructional treatments and perception of classroom environment on scores of self esteem of elementary school students.

### 5.4 METHOD AND PROCEDURE

The present study was experimental in nature using quasi-experimental design. Non-equivalent pre-test and post-test control group design was selected for the study. The instructional strategies were used as independent variable including Brain based instructional strategies and Conventional teaching strategy, perception of classroom environment was used as moderating variable and achievement in science and self esteem were the dependent variables used in the study. The study used two 2x2 factorial design to find out the interaction effect of instructional strategies and perception of classroom environment on achievement in science and self esteem.

All the students of class VII studying in one of the CBSE affiliated residential school was selected for conducting the experiment after getting the permission from the concerned authorities. The two sections of class VII were randomly assigned as
control and experimental group. The school had evening classes along with the regular classes. Both sections of the class VII were equated on the score in achievement test for science and were found to be similar on achievement in science. The total sample consisted of 76 students including 37 students in control group and 39 students in experimental group.

Achievement test in science (developed and standardized by the researcher), Rosenberg’s self esteem scale (Rosenberg, 1965) and Scale for perception of classroom environment (Kaur & Sharma, 2013) were used for collecting data from students of control and experimental group.

The procedure was conducted in three phases. Phase 1 included the administration of Achievement test in science, Self Esteem scale and Scale for Perception of Classroom Environment on the students of experimental and control group. Phase 2 included actual conduct of experiment. Actual conduct of the experiment included teaching the control group through conventional teaching strategy and experimental group through brain based learning. Lesson plans were formulated based on science syllabus prescribed by CBSE/NCERT for class VII science. The lesson plans were formulated based on brain based instructional strategies and conventional teaching strategy. The experiment was conducted for three months and both groups were taught for period of three months during the academic session 2015-16 in months of October to December. The lesson plans were executed for 30 sessions, each session of 1 hour and 15 minutes. The lesson plans based on brain based instructional strategies included different activities like use of videos, experiments, visits, stories, meditation, real life examples, collaborative tasks etc. while the conventional teaching strategy utilized only chalk and talk method of teaching and phase 3 included administration of Achievement test in science and Self Esteem scale on the students of experimental and control group after completion of intervention.

Then the scoring of tests and scales was done personally by hand by the researcher. The scores were methodically tabulated for analysis using SPSS (version 16.0) and results were interpreted at .05 level of significance. Mean, median, mode, SD, SEM, skewness and kurtosis were calculated for establishing normality of the data. 2x2 ANCOVA was used to find out the difference and interaction effect between the groups and classroom environment for achievement in science and self esteem and
effect size (eta squared) was calculated to estimate how much difference the results make.

5.5 FINDINGS OF THE STUDY

The descriptive analysis of scores obtained by students on achievement test in science revealed that for total sample it increased from mean score of 21 to 35, for control group means increased from score of 20 to 33, for experimental group means increased from score of 22 to 38, for favourable perception of classroom environment group means score increased from 22 to 36 and for unfavourable perception of classroom environment group it increased from means score of 20 to 34.

The descriptive analysis of scores obtained by students on self esteem revealed that for total sample it increased from mean score of 29 to 32, for control group means increased from score of 31 to 32, for experimental group means increased from score of 27 to 33, for favourable perception of classroom environment group means score increased from 30 to 32 and for unfavourable perception of classroom environment group it increased from means score of 29 to 33.

The statistical analysis of study had revealed statistically significant improvement in achievement in science and self esteem of students due to brain based instructional strategies.

The qualitative analysis was done using response of students on feedback forms. It revealed use of brain based instructional strategies like activities, videos, pictures, experimentation, working in groups; meditation was liked by the students.

Results related to Achievement in Science

1. There was statistically significant difference in scores of achievement in sciences of experimental and control group of elementary school students. The mean of experimental group was found more than control group and 11.7% of total variance of achievement in science was explained by the main effect of instructional strategies. Hence, the brain based instructional strategies were effective in improving the achievement in science in comparison to conventional teaching strategy.

2. There was difference in scores of achievement in science between groups with favourable and unfavourable perception of classroom environment of elementary
school students. But the difference between the two groups was not statistically significant and also only 3.2% of total variance of achievement in science was explained by the main effect of perception of classroom environment. Hence, perception of classroom environment did not have significant effect in improving the achievement in science.

3. There was difference in scores of achievement in science of experimental and control group with favourable and unfavourable perception of classroom environment of elementary school students. But the differences among these groups were not statistically significant and only 0.7% of total variance of achievement in science was explained by the interaction effect of instructional strategies and perception of classroom environment. Hence, interaction effect of instructional strategies and perception of classroom environment did not have significant effect in improving the achievement in science.

**Results related to Self Esteem**

1. There was statistically significant difference in scores of self esteem of experimental and control group of elementary school students. The mean of experimental group was found more than control group and 5.7 % of total variance of self esteem was explained by the main effect of instructional strategies. Hence, the brain based instructional strategies were effective in improving the self esteem of students in comparison to conventional teaching strategy.

2. There was difference in scores of self esteem between groups with favourable and unfavourable perception of classroom environment of elementary school students. But the difference between the two groups was not statistically significant and also only 0.2% of total variance of self esteem was explained by the main effect of perception of classroom environment. Hence, perception of classroom environment did not have significant effect in improving the self esteem of students.

3. There was difference in scores of self esteem of experimental and control group with favourable and unfavourable perception of classroom environment of elementary school students. But the differences among these groups were not statistically significant and only 0.8% of total variance of self esteem is explained
by the interaction effect of instructional strategies and perception of classroom environment. Hence, interaction effect of instructional strategies and perception of classroom environment did not have significant effect in improving the self esteem of students.

5.6 CONCLUSIONS

1. The hypothesis $H_{01}$ stating “There exists no significant difference in the scores of achievement in science between control and experimental groups of elementary school students” was rejected and alternate hypothesis $H_{A1}$ “The elementary school students in experimental group score better on achievement in science than the students in control group”, was not rejected.

2. The hypothesis $H_{02}$ stating “There exists no significant difference in scores of achievement in science between elementary school students with favourable and unfavourable perception of classroom environment” was not rejected and alternate hypothesis $H_{A2}$ “The elementary school students with favourable perception of classroom environment score better on achievement in science than the students with unfavourable perception of classroom environment”, was rejected.

3. The hypothesis $H_{03}$ stating “There exists no significant interaction effect between instructional treatments and perception of classroom environment on scores of achievement in science of elementary school students” was not rejected and alternate hypothesis $H_{A3}$ “There exists significant interaction effect between instructional treatments and perception of classroom environment on scores of achievement in science of elementary school students”, was rejected.

4. The hypothesis $H_{04}$ stating “There exists no significant difference in the scores of self esteem between control and experimental groups of elementary school students” was rejected and alternate hypothesis $H_{A4}$ “The elementary school students in experimental group score better on self esteem than the students in control group”, was not rejected.

5. The hypothesis $H_{05}$ stating “There exists no significant difference in scores of self esteem between elementary school students with favourable and unfavourable perception of classroom environment” was not rejected and alternate hypothesis $H_{A5}$ “The elementary school students with favourable perception of classroom
environment score better on self esteem than the students with unfavourable perception of classroom environment”, was rejected.

6. The hypothesis $H_{06}$ stating “There exists no significant interaction effect between instructional treatments and perception of classroom environment on scores of self esteem of elementary school students” was not rejected and alternate hypothesis $H_{A6}$ “There exists significant interaction effect between instructional treatments and perception of classroom environment on scores of self esteem of elementary school students”, was rejected.

5.7 EDUCATIONAL IMPLICATIONS

Brain based learning is based on interactive elements and principles of brain based leaning that are formulated on way the brain is naturally designed to learn. Knowledge and understanding of these is being applied to the classrooms to improve the learning experiences of students. Some of the implications based on the present study are discussed below:

The researcher observed that involvement of physiology in classroom helped to break the monotony in class, keep students interested and also caters to individual differences by involving various senses in the classroom. The teachers must include such activities during the teaching learning process that involves various senses and movement as it caters to multiple intelligence.

Teachers must provide breaks at regular time interval so the students can assimilate the provided information. Breaks for water should also be provided as it helps to energise the brain. Hence, these breaks should not be seen as interruption to learning.

During experiment it was found that students learnt things quickly when they worked in groups and shared their experiences. The teachers need to plan lessons which utilises various teaching methodologies like collaborative learning, team teaching, role plays, etc. as this helps to develop the social skills among students.

The results also showed that students learn by identifying the interrelatedness between new knowledge with the previous knowledge. The use of humour, freedom of expression in threat free environment, sharing of real life experiences, etc. involve students emotionally in learning. The involvement of students and application of the knowledge gained in their classroom to real life situations play a crucial role in
learning. The use of real life experiences, role plays, stories, music, humour, art and drawing, etc. by the teachers would help to engage the students in emotionally safe and secure environment. Teachers need to provide conducive classroom environment by following strategies that allow students to observe, analyse and interpret the context of the content taught by using their decision making ability and thereby developing an in-depth understanding of the content taught.

It was observed during the experiment that the information when presented in part was easy to be understood and students could find the relation between the parts and whole. So, it is suggested that the teacher teaches the whole concept in smaller parts. These smaller parts should be so presented during the teaching learning process that they represent the content as whole. Providing information in smaller parts allow time to the students for incubation of information thereby facilitating the brain in information processing.

The students reported that the use of meditation and relaxation activities helped them to relax and to be more focused in class. Such techniques need to be taught to students to improve their concentration and attention during the teaching learning process. This also demands that in-service and prospective teachers must also be trained in the same.

Students need to be provided with threat free and challenging environment. Prevalence of threat in any form causes decrease students’ learning ability. Instead of autocratic discipline teachers should emphasise on democratic discipline with emphasis on zero tolerance for teasing, humiliation, put downs. Provided with this kind of environment students feel both physically and emotionally secure and develop healthy relationship with teachers and fellow students. It also develops confidence among student to ask questions, share their ideas, and try out various activities without fear of being judged or humiliated.

The school authorities need to understand the difference between noise and active classrooms. School authorities need to understand, provide and encourage environment for healthy discussions, interactions and brain storming in classrooms as sharing of ideas and discussions not only increase the confidence level of participants but also provide opportunities to practice positive assertion and develop interpersonal skills. It is important that each and every student is provided opportunities to express their point of view as these skills cannot be developed in autocratic environment.
For teacher to implement various principles of brain based learning in their classroom it is important that they are provided knowledge about structure and function of brain and strategies through in-service training programmes, seminars and workshops, etc. Effort must be taken by government, school administrators and curriculum planners to incorporate brain based learning methodologies and interventions as part of school and teacher education curriculum.

5.8 SUGGESTIONS FOR FURTHER STUDIES

1. The study should be replicated to estimate the variability of the results and to increase the accuracy of the estimate.

2. The researches done in field of neuroscience in education have been very limited in number in India, therefore, there is need to conduct further researches in this field to find its effectiveness in Indian context for various age groups considering the development of brain at the particular age and also for different subjects.

3. The present study aimed to find effect of brain based instructional strategies on achievement and self esteem only. But during the experiment researcher observed the changes in motivation, interest, attitude towards science, thus, these may be further studied.

4. Further researches can be done to develop modules for various subjects and classes based on brain based instructional strategies.

5. Qualitative and longitudinal studies can also be done to assess the effectiveness and perception towards brain based instructional strategies.

6. The studies can be done to study the perception of science teachers and teacher trainees about teaching methods in relation to awareness about brain based instructional strategies.

7. Studies can be taken up where neuroscientists and educators can work in collaboration to assess the changes in brain while implementing various brain-based instructional strategies.