CHAPTER 2

REVIEW OF THE RELATED LITERATURE

Research exploits the knowledge which has been gathered in past with the constant efforts of various researchers. No research can be done in exclusion of the researches done in past which may directly or indirectly relate with the work taken up for the study. The review of related literature gives a theoretical foundation and an insight of the work done in the related area of study. A careful review of related literature include journal, articles, abstracts, unpublished thesis and dissertations, books, internet, etc provides information related with the study undertaken.

For the present study, the researcher explored various sources like thesis, dissertation, journals, research papers and books for collection of information about the work by various researchers on Brain based Learning. The related literature has been presented under following major heads:

2.1 Studies related to Brain Based Learning and Achievement  
2.2 Studies related to Brain Based Learning and Self Esteem  
2.3 Studies related to Classroom Environment and Achievement  
2.4 Studies related to Classroom Environment and Self Esteem  
2.5 Studies related to Brain Based Learning and Classroom Environment

2.1 STUDIES RELATED TO BRAIN BASED LEARNING AND ACHIEVEMENT

Williams (1999) studied the effects of a brain based learning strategy, mind mapping, on achievement of adults in a training environment with consideration to learning styles and brain hemisphericity. The pre-test post-test control group design of experimental method of research was used. Participants included the volunteers in mind mapping training class. The experimental group was given training in mind mapping based on brain based learning strategy and the control group were taught through traditional note taking method. The two groups were compared using analysis of variance. It was found that learners taught using mind mapping based on brain based learning and traditional note taking method showed similar performance.

Agin (2001) studied the effectiveness of using brain based strategies in classroom instruction to enhance student learning. Quasi experimental design was employed in
the study. The sample included two sections of 5th class with 42 students; 21 students in each experimental and control group respectively. There were five special students in each group. Screws vocabulary test and test at the end of the chapter were used to collect data on knowledge. The percentages were used for analysis and it was reported that students who received brain based instruction performed significantly better on content part of the test, but on vocabulary part of test the students who received direct instruction performed significantly better than the experimental group.

Getz (2003) conducted a case study to examine the effect of application of brain based learning theory for community college developmental English students. The mixed method approach was used in the study with both quantitative and qualitative method. The sample included students of community college studying in seven developmental English classes. Students of three classes were taught through brain based learning theory and four classes were taught through non brain based methodologies. Scores were taken as gain scores on a writing sample, a survey of attitude towards writing, and a survey of comfort with the writing situation, and these scores were compared for both the groups. All seven classes had significant increase in scores but the difference was not significant for the groups and one of the reasons attributed for such results was that college composition classes were naturally using strategies consistent with brain based theory.

Siar (2005) investigated the effects of super brain yoga in improving academic and behavioural performances in adolescents. The study was experimental in nature with 37 students in experimental group and 19 students in control group who were studying in a middle school in Norristown, Pennsylvania. The super brain yoga was practiced two times in a week before tests, and when the students were found to be visibly tired or required to assimilate academic information. Gates MacGinitie reading inventory was used to collect data which was analysed and it was found that the scores of students in experimental group increased significantly and also their participation increased immensely in curricular and co-curricular activities.

Duman (2006) conducted a study on the effect of brain based instruction to improve students’ academic achievement in social studies. The study was designed as an experimental research. Sample included randomly selected students of class 6th from two separate classes of Turdu primary school in Mugla. Academic Achievement Test of Social Studies and Interview were used for collecting data. Analysis of covariance
and t-test were used for analysing the data. The findings of the study revealed that brain based instructions were more effective than teacher centred method to improve the academic achievement of students in social studies.

Bello (2007) investigated the effect of brain based learning with teacher training in division and fractions in 5th grade students of a private school. The study was taken up to enhance the achievement in mathematics. The study included 58 students and 23 teachers of class 5th English medium private school in Puerto Rico. The results indicated that the teacher trained in brain based learning when taught through same, assisted the students to achieve better in mathematics.

Cengelci (2007) investigated the effect of brain based learning on academic success and retention in social studies. The experiment was conducted during academic year 2004-2005 with 40 students studying in an elementary school in Esksehir. Pre-test post-test control group design of experimental method was used with both qualitative and quantitative method of research. The experimental and control group had 20 students each. Independent sample t-test was used for analysis and results showed a significant increase in academic success and retention of students, when the students were taught through brain based instructional strategies.

Dilek and Rahmi (2007) researched on impact of brain based learning approach on students’ achievement and retention of knowledge about “work-energy” topic. The research was conducted in the academic session 2005-06 in an elementary school in Ankara, Turkey. The experimental method of research was utilized with pre-test post-test control group design with one experimental group and two control groups. Total sample included 91 students studying in class 7th; 30 in experimental group, 30 in one control group and 31 in another control group. The experimental group was taught through brain based learning, one control was taught by the researcher using traditional method and another control group by the science teacher using traditional method for 8 weeks. Scores were obtained on work-energy achievement test and the attitude and perception inquiry. The achievement test was administered again after 6 months for scores on retention. The scores were analysed using analysis of variance and statistically significant differences were found on achievement and retention between experimental and control groups favouring brain based instructional strategies.
Siar (2007) studied the effect of super brain yoga in improving academic and behavioural performance in students for three years from 2003. The experimental group had 37 students in first year, 28 students in second year and 36 students in third year in the age group of 13-15 years studying in a urban school of Pennsylvania. Through quantitative and qualitative analysis it was found that the students doing super brain yoga performed better academically as well as behaviourally.

Ozden and Gultekin (2008) conducted a research to find the effects of brain based learning on academic achievement and retention of knowledge in science course. They conducted the study in 2004-2005 academic year at Kutahya Abdurrahman Pasa Primary School in Kutahya, Turkey on 44 students studying in 5th class. They used pre-test post-test control group design. The experiment was done for 11 days for 18 class hours. The experimental group was taught through brain based learning approach and the control group was taught through traditional teaching approach. Data for achievement and retention was collected by using Achievement test of the unit ‘Movement and Power’ developed by the researcher. Basic learning test and attitude scale (constructed by the researcher) and semi structure interviews were used to collect data. Independent sample t-test was used for the analysis of the data and it revealed significant difference due to brain based learning.

Tufekci and Demirel (2009) investigated the effect of brain based learning on achievement, retention, attitude and learning process. Researcher used both qualitative and quantitative methods of research. The control group pre-test post-test experimental design was used. Third year students studying at Gazi University were the sample of the study. The results showed that for basic level learning achievements and basic level retention of both experimental and control group showed similar performance, but students taught through brain based learning showed a positive effect on higher level learning achievements, higher level retention and attitude of students.

Ali, Ghazi, Shahzad and Khan (2010) researched the impact of brain based learning on students’ academic achievement. This experimental study included 50 students studying in class 10th in a government high school at Sikander Khel Bala, Khyber-Pakhtunkhwa in Pakistan. The 25 students in experimental group were given instructions based on brain based learning and the 25 students in control group were given instructions with traditional method. Self-prepared achievement test of physics
was used by the researcher to gather data and analysis was done by using t-test and coefficient of variation. The results revealed that brain based learning have statistically significant result on achievement in comparison to traditional method of teaching.

Duman (2010) investigated the effects of brain based learning on the academic achievement of students with different learning styles. The sample consisted of 68 third-year Social Sciences Teacher Education students (2006-2007) of Faculty of Education of Mugla University. The experimental method was used with pre-test-post-test control group design. Data was collected by using academic achievement test developed by the researcher and learning style scale by Kolb. Mann Whitney U-test and Kruskal-Wallis H-test were used for the analysis of data and it was found that brain based learning approach was significantly better than the traditional approach for improving academic achievement of students but no significant differences on academic achievement was observed among students of experimental group having different learning styles.

Inci (2010) studied the effect of brain based learning on academic success, attitude and retrieval of information in science and technology classes. The experiment was conducted using pre-test post-test control group design in academic year 2008-09 with 30 students studying in 8th class. Experimental group was instructed using brain based learning approach and the control group was given instructions using traditional method. The scored data was analysed using Mann Whitney U Test, Friedman Test and Wilcoxon Sign Rank Test and the findings revealed that brain based learning approach had statistically significant effect in improving achievement, attitude and retention of students.

Pennington (2010) investigated brain based learning theory by the incorporation of movement to increase the learning of grammar by high school students. Sample included randomly selected 277 students of class 9th to 11th studying in college prep English courses. The experimental group was taught by including kinesthetic movements as a part of brain based learning and control group received instruction through traditional grammar practice method. 15 lesson plans were taught to both the groups during period of five weeks. Elements of Writing: Language Skills by Holt, Rinehart and Winston was used to collect data on pre-test and post-test. On analysing
the data by using t-test no significant difference was found between experimental and control group but teachers reported meaningful effect on students.

Awolola (2011) carried out research to study the effect of brain based learning strategy on students’ achievement in senior secondary school Mathematics in Oyo State, Nigeria. The study included 522 senior secondary school students of Mathematics. Achievement Test in Mathematics developed by the researcher and Cognitive Style Test (modified version) by Awolola (2002) were used to collect data. Using cognitive style as covariate, analysis of covariance was used for the analysis. The results showed that brain based instructional strategy was more effective in increasing the achievement in mathematics in comparison to conventional lecture method. Interaction of brain based instructional strategy and cognitive style also showed favourable results in comparison to interaction of conventional lecture method and cognitive style.

Kiedinger (2011) studied the effect of brain based learning on reading outcome in elementary aged students. The study was descriptive survey in nature. Two elementary schools, an urban and a rural, were selected for the study from De Soto district of Wisconsin. The research was conducted for academic sessions 2009-2010 and 2010-2011. The sample included six teachers from two elementary schools, 105 students from the academic session 2009-2010 and 95 students from the academic session 2010-2011 from classes 3rd, 4th and 5th. The data was collected by using Wisconsin Knowledge and Concepts Examination scores on reading. The findings of the study revealed that brain based learning helped the students to perform better, especially the low performing students.

McNamee (2011) conducted research to study the impact of brain based instruction on reading achievement in a second grade classroom. The study was experimental in nature and used pre-test post-test control group design. The sample of the study comprised students of 2nd class; 25 in experimental group and 19 in control group. The intervention was implemented for 12-weeks, where experimental group was taught through brain based instructional strategies and control group was taught the same content through traditional reading instruction. The data was collected before and after the execution of the lesson plans using Sunshine State Standards Reading Diagnostic Assessment and was analysed by using independent sample t-test. The findings of the study reported that experimental and control group do not differ
significantly on reading achievement but the teaching learning through brain based learning allows innovative methods of teaching to improve learning.

Saleh (2011) studied the effectiveness of the brain based teaching approach in generating students’ learning motivation towards the subject of physics. The sample of the study consisted of 100 form four science students from two secondary schools in Malaysia. The data was collected by using the questionnaires on Physics learning motivation, learning style of students, journal documentations and interview of students. Qualitative approach was used in the present study by analyzing the achievement of students in control and experimental group. The analysis was done by using the progressive focus technique and triangulation. The results showed that the brain based teaching approach was more effective in improving physics learning motivation in comparison to conventional teaching method.

Aziz-Ur-Rehman, Malik, Hussain, Iqbal and Rauf (2012) studied the effectiveness of brain based learning theory on secondary level students of urban areas. The present study examined the effect of brain based learning theory focusing on innate faculties i.e. thinking, emotions and memory on mathematics. The experimental method was used following pre-test post-test control group design. The sample of the study consisted of 60 students of class 9th who were divided in experimental and control groups randomly. During the experiment three chapters were taught through brain based learning theory by formulating 38 lesson plans from the mathematics textbook. The academic achievement test was used to collect the data which was constructed by the researchers. The analysis of data was done by using independent sample t-test. The results showed teaching through brain based learning improved the academic achievement of students.

Bawaneh, Nurulazam, Saleh and Kanesan (2012) studied the effect of a brain-based teaching method on conceptual change in students' understanding of electricity. The quasi-experimental factorial design was used for the study for 357 8th class students from the Bani Kenanah Directorate of Education in Jordan. The experimental group included 183 students and the control group had 174 students. The experimental group was taught using brain-based teaching method and the control group was taught using conventional teaching method. Conceptual test and inventory of learning process were used for the data collection pre and post intervention. The score obtained were analysed using two way analysis of covariance. The results of the study showed
that using brain-based teaching method helped to correct the misconceptions and changing students’ concepts of electricity.

Haghighi (2012) conducted study to investigate the effect of brain-based learning on Iranian EFL achievement and retention. The quasi experimental method was used with pre-test and post-test control group design. The sample of the study included 50 male students pursuing BA at Civil Aviation Technology College in Tehran, Iran. Achievement test was used to collect the data on achievement and retention. Of the two intact classes, one was taught through brain based learning approach and the control group was taught through traditional teaching approach. Analysis was done on the post-test scores of achievement and retention tests by using independent t-test. The findings show that there is a significant difference between the experimental and control group, where students performed better when taught through brain based learning.

Lago and Seepho (2012) studied brain compatible activities for EFL (English as foreign language) vocabulary learning and retention. The study utilized both qualitative and quantitative methods for research. The sample included 31 third year undergraduate students studying English for tourism. Data was collected using pre-test, immediate post-test, delayed post-test and semi-structured interview. The results indicated significant learned target words when taught using brain compatible activities.

Panse (2012) conducted study on development of brain based program for enrichment of oral communication of 1st standard deprived students. The study was an experimental research using pre-test post-test control group design. The sample included two government schools in Pune and students studying in the class 1st and attending school in morning shift in these school comprised the sample including 82 students, 41 students from each school. One of the two school was assigned as control group and the other as experimental group. The data was collected using test on oral communication prepared by the researcher and through observation. Two parallel forms of oral communication test were prepared by researcher to be used as pre-test and post-test. The intervention module was executed with experimental group for one complete academic year preceded by pre-test and followed by post-test. The data was analysed using t-test and findings showed statistically significant improvement in oral communication skills of students taught using brain based learning.
Saleh (2012) conducted a study to assess the effectiveness of brain based teaching approach in enhancing students’ scientific understanding of Newtonian Physics in the context of form four Physics instruction. Quasi-experimental design was used with a sample of 100 students randomly selected from two secondary schools of Malaysia. Data was collected using subjective test of Newtonian Physics. Data was analysed qualitatively and it was concluded that brain based teaching approach was more effective in improving the conceptual understanding of Newtonian Physics than conventional teaching method.

Seyihoglu and Kaptan (2012) studied the effect of brain based learning approach to elementary teacher candidates’ attitude and achievement in geography lesson. The sample consisted of 131 first-year students of academic session 2008-2009 at Rize University studying in Department of Primary School Teaching in Faculty of Education. The experiment was conducted for six weeks with three hours per week. The data was collected by using attitude scale, self-evaluation and open-ended questions. Data analysis was done by using t-test and content analysis. It was concluded from the study that brain based learning approach helped to improve the students’ attitude and achievement in geography.

Akyurek and Afacan (2013) investigated the effects of brain based learning approach on students’ motivation and attitude levels in science class. The experiment was conducted in Kirsehir in the academic year 2011-2012. 57 students from class 8th (19 students in experimental group and 19 students in the two control groups) were taken as sample for the study. The experimental method used pre-test post-test control group design. The brain based learning approach was used to teach cell division and heredity. The data was collected by using the scales on attitudes toward science learning (Nuhoglu, 2008) and students’ motivation toward science learning (Tuan, Chin and Shieh, 2005). Mann Whitney U-test and One-way Analysis of Variance were used for the analysis of the data. The results revealed that experimental group taught through brain based learning approach was significantly better than the control groups.

Binulal and Aravind (2013) studied the review of related literature on brain based learning. The researchers reviewed the literature of previous five year for the researches relating with brain based learning. On the basis of the review of literature they concluded that teaching learning process when included brain based learning it helped to increase acquisition and retention of information.
Iscen and Yucel (2013) examined the effect of a brain based learning approach on 8th grade student achievement, attitudes and retention of knowledge in a science and technology lesson. The experiment was conducted in the academic session 2009-10 during first semester in a primary school with 29 students in experimental group and control group. The lesson plans framed on the basis of brain based learning approach was executed with experimental group and constructivist approach was executed with control group. After the execution of 24 lesson plans for 6 weeks, tests for achievement, retention, attitude and perception survey were administered and the scores were subjected to statistical analysis using t-test. The findings revealed statistically significant differences on achievement and retention in favour of brain based instructional strategies.

Khattab (2013) conducted a research to study the impact of using brain based learning theory in mathematics teaching on developing the skills of mathematical communication and mental arithmetic by the students of primary (basic) stage. The study was experimental in nature and included 63 students of class three in Alfayoom, Egypt. The results showed no significant differences in mathematical communication and mind arithmetic among the students of the experimental group.

Nafa (2013) investigated the Arabic speaking learners to study effect of brain based approach for teaching English language vocabulary to English as second language learners. The study was conducted in a public school in Dubai with students studying in class 12th. Mixed method was used in the study and the findings showed that teaching through brain based learning is more effective in solving problems of vocabulary.

Sumamol (2013) conducted a study to develop certain strategies for better teacher accountability and reflective teaching among secondary school teachers in Kerala. The experimental study used multiple group design with one pre-test and one post-test design. Teacher accountability analysis scale, reflective teaching analysis scale, lesson designs based on SWOT analysis, SCAMPER technique, brain based learning, mind mapping, prevailing activity oriented approach, pre-test and post-test on achievement in social science and participant observation schedule based on select strategies were developed and standardised by the researcher. The sample included 50 teachers and 1500 students from secondary schools of Kannur, Kasargod, Kozhikode, Kottayam and Ernakulam districts of Kerala. The study included four experimental groups
taught using SWOT analysis, SCAMPER technique, brain based learning, mind mapping respectively and the control group was taught using prevailing activity oriented approach. After intervention the analysis of data using t-test showed that there was no significant difference among the students of experimental group taught through brain based learning and the students in control group while the other three experimental groups performed significantly better.

Vyas and Vashishtha (2013) conducted study on effectiveness of teaching based on brain research with reference to academic achievement of secondary school students. The study employed quasi experimental design with comparable matched groups. The pre-test-post-test design was used with a control group and an experimental group. The sample included 65 students studying biology in class 8th in CBSE affiliated school in Agra. The study included 33 students in experimental group and 32 students in control group. The two groups were taught for 10 lectures for 40 minutes each. The scores on post achievement test were then analysed using Mann Whitney U test. The findings of the study revealed that using brain based instructional strategies resulted in significant increase in academic achievement in biology.

Yavuz and Yagli (2013) conducted a study to find effectiveness of brain based learning approach to academic achievement and attitude in English course. The study used Solomon research model and included sample of 78 students studying at Vocational High School in class 10th during the academic session 2007-08. The experimental group had 37 students taught through brain based learning approach and control group had 41 students taught using traditional method. An achievement test, attitude questionnaire and interview were used to collect data. The scores obtained on achievement test and attitude scale were analysed using independent sample t-test, paired sample t-test and one way analysis of variance. The results indicated significant improvement in attitude among students in experimental group and no significant difference was observed for achievement between the two groups.

Alfilimbani (2014) conducted research to study the impact of brain based learning training program and level of mastering on the development of skills of para learning and academic achievement in Saudi Arabia. The sample included randomly selected 68 students from Cairo University. The findings of the study showed that the training program based on brain based learning had significant impact on the academic achievement and motivation towards mastering the development skills of para learning.
Altiti (2014) in the study explored the impact of brain based teaching program on the achievement of the 5th grade students in the science curriculum in Jordan. The sample had 128 students and the results showed that teaching through brain based teaching program showed increased achievement scores in favour of experimental group. But no such significant improvement was found for the gender or for interaction of gender and methods of teaching.

Demirhan, Onder and Besoluk (2014) investigated the effectiveness of brain based biology teaching on cognitive and affective features and opinions of science teacher trainees. The study employed mixed method approach for research. Sample of the study included 65 sophomore elementary science teacher trainees studying in general biology class enrolled for elementary science teacher education programme at Sakarya University, Turkey. The experimental group had 30 students and the control group had 35 students. Tools used to collect data included Kolb learning style inventory III and revised two factor study process questionnaire as pre-test and Biology achievement test, Attitude scale towards biology, California critical thinking disposition inventory and Biology self-efficacy scale were administered both for pre-test and post-test. Experimental group was taught through instructional strategies based on brain based learning and control group was taught using conventional teaching method. The scores obtained after intervention were analysed using one way analysis of covariance. The findings showed no statistically significant difference in achievement, critical thinking disposition and self-efficacy.

Ebere et al. (2014) investigated the effect of brain based adaptive learning strategy on academic competence of students with learning disability. The quasi experimental method was used employing non-equivalent control group pre-test-post-test design. The sample consisted of 86 students, with 41 male students and 45 female students from two public senior secondary schools in Enugu State, Nigeria. The sample was selected purposively to select the dyslexic students. The tools used for collecting data were Academic Competence Evaluation Scale adapted from Di Perna and Elliott (2000) and Brain based Learning Strategy Test developed by the researcher. The data was analysed by using analysis of covariance. It was found in the study that the brain based adaptive learning strategy proved better to improve the academic competence of dyslexic students.
Gozuyesil and Dikiciib (2014) conducted a study to measure the effect sizes of the quantitative studies that had been previously done to find out effectiveness of brain based learning on students’ academic achievement. Meta-analytical method was employed to find if there exist any significant difference in effect in terms of the factors chosen for the study i.e. education level, subject matter, sampling size, and the countries where the studies were carried out to find out the effectiveness of brain based learning on students’ academic achievement between the years 1999-2011. This meta-analytical research included the 42 studies reported in English and Turkish. Out of 46 researches in 35 studies positive effect sizes had been found. The findings of the study also showed that studies done to find effectiveness of brain based learning had a positive and medium effect size with value of $d = .640$ on academic achievement of students.

Francis (2014) conducted research to find out the effectiveness of brain based learning strategy on emotional regulation and critical thinking of higher secondary school students. The quasi experimental research method was used employing the pre-test-post-test non-equivalent group design. Purposive sampling was done to select sample of 94 students studying in class 11th in two schools in Thrissur District, Kerala. One school was selected as control group and other school was selected as experimental group. The control group was taught using existing method of teaching and experimental group was taught using brain based learning. The data was collected on emotional regulation questionnaire (Musthafa & Franco, 2011) and critical thinking test (Musthafa & Franco, 2011) by administering both as pre-test and post-test. The scores of pre-test and post-test were analysed using t-test and revealed that emotional regulation and critical thinking of students improved when they were taught using brain based learning.

Palavan and Basar (2014) studied the effectiveness of brain based learning on the achievement and permanence of students in social studies lesson. A half experimental design with a control group was used in the study. The study was conducted on 128 class 3rd primary school students with 67 students in experimental and 61 students in control group. Total 72 lesson plans were delivered, the experimental group was delivered lesson plans based on brain based learning approach and the control group was delivered lesson plan based on traditional teaching method. The scores of achievement test, attitude scale and critical thinking scale were analysed using
independent sample t-test. The results showed that the significant differences on achievement and retention were in favour of experimental group.

Thomas and Swamy (2014) aimed to study the impact of brain-based teaching approach on the academic achievement of the secondary school students in relation to their stress. The quasi-experimental design was used for the study with a control and an experimental group. Each group had 43 secondary school students from a private aided school in Bangalore city. The experimental group was taught using elements of brain-based learning by researcher and control group was taught by their English teacher. The data was analysed using t-test and results revealed that experimental group performed significantly better than the control group.

Valipour and Araghi (2014) studied brain-based learning strategies and its effects on student outcome in university aged Iranian EFL (English as foreign language) students. The study was experimental in nature and included sample of 20 second-year undergraduate students of Islamic Azad university of Tonekabon, Iran. The sample was divided into experimental and control group with 10 students in each group. The data collected on reading comprehension test was analysed using t-test and findings revealed significant increase in reading comprehension of experimental group in comparison to control group.

Zaydeh and Al Astal (2014) studied the effectiveness of brain-based learning with using computerized applications on the multiple intelligences of children living under stressful conditions in Gaza. The study included pre-test-post-test control group design with 48 students in control group and 45 students in experimental group. The analysis was done using t-test and findings showed that there was significant increase in multiple intelligence except for musical and interpersonal intelligence among the students of the experimental group.

Al-Khawaldeh and Qattawi (2015) studied the impact of an educational program based on brain based learning in improving the skills of creative thinking and achievement in social and national education in Jordan. The semi-experimental method of research was used in the study with 50 students of 3rd class of a public school. These were divided into 25 students in each group i.e. experimental and control group. In experimental group students got instructions based on brain based learning and the control group got instructions through regular method. The
comparison of the scores of the two groups showed significant differences on creative thinking and academic achievement of students in favour of brain based learning.

Davis (2015) conducted literature review on brain based learning activities: defeating fear and improving learning in the language classroom and he concluded that when taught through brain based learning activities it provided the students with environment in which they felt relaxed but challenged and this helped the students to learn better.

Le Roux (2015) studied a case of grade 6 decimal instruction at Sunlands primary school on application of brain based education principles with ICT as a cognitive tool. The case study included analytical review of literature, quantitative research methods, teaching methods and learner activities. The case study was taken up in duration of two school terms and 81 students from class 6th were selected for the study that were divided into experimental and control group. The two groups were taught different mathematics content; experimental group with cognitive education based teaching aids and control group with regular school’s curriculum. Same test were applied for obtaining data on pre-test and post-test and the scores were analysed indicating that though both groups had significant improvement after the intervention but in comparison to the control group, the group taught through brain based education performed significantly better to activate and enhance learner cognitive processes.

Ramakrishanan (2015) studied the effect of brain-based learning strategy on academic achievement and creativity among secondary school students. The pre-test-post-test non-equivalent group design was used in the study with 156 students studying in class 9th in four schools of Coimbatore. One government school and one government aided was selected from rural area and similarly two schools were selected from urban area. Two sections of class 9th were selected from each school and the students in these schools were divided in two groups, control and experiment, using stratified random sampling. The control and experimental group had 78 student each. Both the group were exposed to 20 hours of teaching with experimental group taught through brain based learning and control group taught using conventional method of teaching. The data was collected using achievement test and test of creativity (developed by the researcher) before and after the execution of the intervention. The data collected was analysed using t-test and analysis of covariance and revealed that the achievement and
creativity of students taught using brain based learning was statistically better than students taught using conventional method of teaching.

Sadrabad, Ghavam and Radmanesh (2015) studied the effectiveness of brain based learning on self-regulated learning among girl students of 1st grade of Yazd school. The study employed pre-test-post-test design of experimental method of research. The experiment was conducted on sample of 40 students selected randomly through multi-stage cluster sampling method from first year of high school. The experimental group had 20 students taught through brain based learning and 20 students of control group were provided no intervention. Bouffard self - regulation questionnaire by Bouffard et al. (1998) and standardized by Kadivar (2001) were used to collect data. The analysis was done by covariance analysis test and results showed that self-regulated learning is improved with the use of brain based learning.

Mahdi, Reza and Majid (2016) examined the effect of brain - based learning on the attitude and academic achievement of students in Mathematics. Semi - experimental and non-equivalent control group design was used. 52 boys studying in grade 5 were categorized into experimental and control group. Teachers and parents of the student in experimental group were given session based on brain based learning. Mathematics was taught to students in experimental group using brain based learning for a period of three months. Scores on attitude and achievement was analysed and it was found that brain based leaning helped to significantly improve the attitude and achievement in Mathematics.

Olaoluwa and Ayantoye (2016) investigated the impact of brain based instructional strategy on academic performance of deaf students in mathematics in Oyo school of handicapped, Nigeria. The quasi experimental method with pre-test post-test design was used with two intact classes having 41 students who were deaf or hard of hearing. The control group was taught using conventional instructional strategies and experimental group was taught through brain based instructional strategies. The experimental group was taught by four research assistants well versed in sign language and trained in brain based instructional strategies. Mathematics Attitude Questionnaire developed by the researcher, Cognitive Style Test by Sigel (1967) and Mathematics Anxiety Rating Scale by Beasley (2001) were used for data collection. Mean and standard deviation were used to compare the scores of the experimental and control group. The study based on the findings concluded that there was
statistically significant improvement in achievement and attitude of students when taught using brain based instructional strategies.

Salama, Qoura and El-Hadidy (2016) studied the impact of brain-compatible teaching strategies on enhancing vocabulary learning. Quasi-experimental design of experimental method of research was used with a control group and an experimental group. The sample consisted of 61 boys studying in third year of Preparatory school in Dakahlia. The experimental group had 30 students while the control group had 31 students. The intervention was executed for six weeks. The vocabulary learning test was used to collect data and it was revealed in the findings that the students of the experimental group who were taught using brain-compatible teaching strategies performed significantly better than the control group.

Shabatat and Al-Tarawneh (2016) studied the impact of a teaching-learning program based on brain-based learning on the achievement of the female students of 9th grade in chemistry. The experimental method of research was employed with purposively selected 32 female students in each control and experimental group of class 9th in a secondary school at Tafilah. The researcher developed 14 lesson plans based on brain-based learning theory and also constructed the achievement test for collecting data on achievement in chemistry. The data was analysed by using ANCOVA and results showed significant effect of teaching-learning program based brain-based learning on achievement in chemistry with high eta squared value (.80).

Tafti and Kadkhodaie (2016) investigated the effects of brain-based training on learning and retention of life skills in adolescents. The experimental research was conducted in academic year 2014-15 at the Center for Intellectual Development of Children and Adolescents in Iran and used pre-post-test control group design. Random cluster sampling was used to select subjects in experimental and control group. 10 lesson plans were executed with each group, brain based learning to experimental group and regular method for control group. Multivariate analysis of covariance was used to compare the pre-test post-test scores of experimental and control group. The results of the study showed that brain based training scores on learning and retention were higher than the control group.

Varghese and Pandya (2016) studied the effectiveness of brain based-learning of students of secondary level on their academic achievement in biology, study habits
and stress. The study was experimental in nature and used quasi experimental design. The factorial design was used and pre-test post-test design was employed for conducting the experiment. 25 lesson plan were executed in duration of 18 hours, where experimental group was taught through brain based learning and control group was taught through lecture method. The sample included 240 students from 4 English medium schools in Navi Mumbai. Tools used to collect data were the achievement test in biology constructed by the investigator, study habits inventory (Ferris, 2001) and stress scale (D’souza, 2007). The data was analysed using t-test and findings showed students taught through brain based learning achieved significantly better in biology, had improved study habit and reduced stress in comparison to the students in the control group.

Adiansha, Sumantri and Asriyadin (2017) studied the effect of brain based learning model and creative thinking on the ability of mathematics concept of elementary students. The experimental method of research was used, with a sample of 32 students of class 4th of a primary school in district Bima of Indonesia. Two-way variance of analysis was used and results showed that students taught using brain based learning model were significantly better than those taught through discussion learning model on understanding mathematics concept. Also for understanding the concept of mathematics learning significant interaction was found for brain based learning model and creative thinking ability.

Mekarina and Ningsih (2017) examined the effectiveness of brain based learning approach on motivation and students achievement in mathematics learning. This study was an action research as the students’ achievement and motivation was very low. 25 students of senior high school studying in class 11th were the subjects in the study. Data was collected by achievement test and motivation scale. The results revealed that application of brain based learning approach enhanced the achievement and motivation of the students in mathematics.

Noureen, Awan and Fatima (2017) studied the effect of brain based learning on academic achievement of VII graders in mathematics. Pre-test Post-test control group design was employed to assess the academic achievement. Students in experimental group were taught through brain based learning and students in control group were taught by conventional method. California Standardized Test for Mathematics was used to collect data on achievement in mathematics. T-test was used in analysis and
findings showed that the students taught using brain based instructions had significant improvement in their performance in comparison to control group.

Priatna (2017) investigated the application of brain based learning principles aided by GeoGebra to improve mathematical representation ability. The quasi-experimental method was employed in the study and the design used was non randomized pre-test-post-test control design. The sample comprised of 78 high school students studying in class 8th. The experimental group was taught through brain based learning principles including GeoGebra and the control group was taught through conventional method of teaching. The independent sample t-test was used and findings showed that there was significant improvement in the mathematical representation ability of the students taught through brain based learning principles the students taught through conventional method of teaching.

Salem (2017) examined the effect of brain based learning on listening skills, vocabulary retention and motivation by engaging ESP (English for Special Purposes) students. The quasi experimental method was used with one group pre-test-post-test design. The sample of the study included 36 second year students pursuing Egyptian business majors with an average age of 19.6 years. The students were administered with listening skill test (developed by researcher) vocabulary retention test (developed by researcher) and Attitude/Motivation Test Battery (Gardner, 1985) prior and after the implementation of intervention based on brain based learning. The scores obtain were analysed using paired sample t-test and results showed that there was significant increase in listening skills, vocabulary retention and motivation of students but the degree differed depending on their brain dominance.

Uzezi and Jonah (2017) studied the effectiveness of brain based learning strategy on students’ academic achievement, attitude, motivation and knowledge retention in electrochemistry. Quasi experimental research model with pre-test-post-test design was used. The study was conducted in the academic session 2015-16 in a school in Nigeria with 87 senior secondary students, with 47 students in control group and 40 in the experimental group. The experimental group was taught using brain based learning and control group was taught using lecture based teaching method. Achievement test and scale on motivation and attitude were used for data collection and scores were compared using independent t-test and analysis of covariance. The results showed that academic achievement, attitude, motivation and retention improved significantly with the use of brain based learning strategy.
Yasar (2017) studied brain based learning in science education in Turkey through descriptive content analysis and meta-analysis of dissertations. The effect size of the studies done on effect of brain based learning on science education was measured. The study included 21 dissertations that studied the effectiveness of brain based learning on achievement and attitude of students towards science education. The findings from content analysis and meta-analysis showed high effect size on achievement in science (1.382) and medium effect size for attitude (0.466) of students when taught through brain based learning.

Al-Balushi and Al-Balushi (2018) studied the effectiveness of brain-based learning for grade eight students’ direct and postponed retention in science. The quasi-experimental design was used with one control group and two experimental groups. The sample included 197 students from class VIII from six classes of two public schools in Muscat. The students were randomly assigned to two experimental and one control group, where first experimental group was taught using four brain-based learning techniques by Cardellichio and Field (1997), second experimental group was taught using Samsung® tablets and PCs and the control group was taught using conventional teaching methods. Data was collected using science achievement test, developed by researchers. The test was administered thrice as pre-test, post-test and postponed test. The scores were analysed and interpretation was done using multivariate analysis of covariance. It was found that second experimental group performed better on achievement than other two groups with no statistically significant difference between first experimental group and control group. On analysing the delayed post test scores it was found that the experimental group performed better than control group on knowledge and reasoning level. Also the first experimental group performed significantly better than second experimental group on reasoning level.

Erol and Karaduman (2018) investigated the effects of activities congruent with brain based learning model on students’ mathematical achievement. Pre-test-post-test and permanence test half–experimental design with control group was used. 91 students studying in class 4th were the participants of control and experimental group. Mathematics Achievement Test was used to collect data and t-test was used to analyse these scores which revealed a significant increase in the achievement and retention among the students in the experimental group who were taught through activities congruent with brain based learning model.
Gladys, Stella and Omobolanle (2018) investigated the effect of brain based learning model on colleges of education students’ retention and attitude in “Current Electricity” in Taraba State, Nigeria. Quasi experimental design was used with non-equivalent pre-test post-test group design. The sample was taken from two colleges of education with intact classes having 63 students of academic session 2016-17 studying physics in the Taraba State. Instructions to experimental group were based on brain based learning model and for control group conventional teaching method was used. Data was collected using current electricity achievement test and attitude scale to determine the attitude of students towards current electricity. Independent t-test was employed and findings of the study showed that there was significant improvement in scores of achievement and retention of students taught with brain based learning model and they also had significantly positive attitude towards brain based learning model rather than conventional teaching method.

Kosar and Bedir (2018) examined the effect of brain based learning environment on improving knowledge retention in English. The researcher used mixed method design with 27 learners in the age range of 18 – 21 years studying in prep-school education. The students were taught using brain based learning for four and half month for 19 hours of English lessons every week. The data was collected using proficiency exam at the beginning and end of the intervention. Retention exam was also administered after six months. The data was analysed using paired sample t-test and findings showing that proficiency in English increased on using brain based learning but there was no significant change in knowledge of students from post-test to retention.

Saleh and Subramanian (2018) examined the effects of brain based teaching method on physics achievement among ordinary school students. Quasi experimental method was used with control and experimental groups. Sample included 90 students from intact classes from two schools in Malaysia. The experimental group was taught with Brain based Teaching Method and control group was taught using conventional teaching method. Physics Achievement Test was used to collect data before and after the intervention and scores were analysed using analysis of covariance and it was found that students taught using brain based teaching method performed better than the control group.

Suarsana, Widiasih and Suparta (2018) conducted a research to study the effect of brain based learning on second grade junior students’ mathematics conceptual
understanding on polyhedron. The quasi experimental method of research was used with post-test only control group design. Sample included 99 students from junior high school using cluster random sampling technique with 51 students in control group and 48 students in experimental group. The experiment was conducted during academic session 2016-17 in month of February and March. The control group was taught using treatment of observe, ask, collect data, associate and conclude and experimental group was taught using brain based learning. The data was collected after the completion of experiment using essay test and was analysed using students t-test. The findings of the study revealed that students taught using brain based learning had significantly better mathematics conceptual understanding than the students taught using conventional teaching method.

Most of the studies in present review of literature done in the field of brain based learning revealed that instructional strategies based on brain based learning have resulted in better performance. Studies conducted by Ali, Ghazi, Shahzad and Khan (2010); Altiti (2014); Awolola (2011); Aziz-Ur-Rehman & Bokhari (2011); Bello (2007); Duman (2006); Gozuyesil and Dikici (2014); Noureen, Awan and Fatima (2017); Olaoluwa and Ayantoye (2016); Sadrabad, Ghavam and Radmanesh (2015); Saleh and Subramaniam (2018); Shabatat and Al-Tarawneh (2016); Varghese and Pandya (2016); Vyas and Vashishtha (2013); Yasar (2017) to assess effectiveness of implementation of instructional strategies based on brain based learning on achievement of various subjects including science, biology, physics, chemistry, mathematics and English and found results in the favour of brain based learning.

that brain based instructional strategies were significantly effective in improving vocabulary, reading, retention, achievement and attitude in subjects including science, mathematics, geography, understanding in science and mathematics, academic competence, creative thinking, multiple intelligence, cognitive process, mathematical representation ability, motivation, academic stress among students of various age group.

However, no significant effect of brain based instructional strategies was found on achievement, critical thinking disposition and self-efficacy (Demirhan, Onder & Besoluk, 2014), achievement (Duman, 2010; McNamee, 2011; Sumamol, 2013; Williams, 1999; Yavuz and Yagli, 2013), basic level learning achievements and basic level retention (Tufekci & Demirel, 2009), mathematical communication and mind arithmetic (Khattab, 2013) and performance in English vocabulary grammar (Agin, 2001; Getz, 2003; Pennington, 2010).

2.2 STUDIES RELATED TO BRAIN BASED LEARNING AND SELF ESTEEM

Going through related review of literature the researcher found few studies for effect of brain based learning on self esteem, therefore researcher included the review related with strategies used for implementing brain based instructional strategies. This included review of literature related with effect of meditation, yoga, physical activity, exercise, storytelling, cooperative learning, use of information and communication technology, animation, activity and project based learning on self esteem.

Dimas (1994) conducted a research to find the effects of cooperative learning on the self esteem of students learning English as non-native language. The case study of three 6th class students was done in an elementary school in duration of March to June, 1993. For case study interviews with students, cumulative records of school, attitudinal survey filled by student gauging their contribution as team member, rating their self esteem, and their enjoyment level after the activity, audio recording, field notes and video tapes were used to collect data. The analysis of the data obtained from various methods was transcribed, coded, tabulated and then meaningful pattern that emerged from the data were examined. The results showed that the cooperative learning had positively affected the self esteem of the students.

Lee, Lim and Ng (1996) studied the effects of cooperative learning structures on self esteem and classroom climate in social studies. The study was experimental in nature.
with intact classes as control group and experimental group with 38 and 36 5\textsuperscript{th} class students respectively. The control group was taught using direct instruction while the experimental group was taught by teachers trained in cooperative learning using structure of cooperative learning developed by Kagan (1992). The experiment was conducted for two school terms i.e. April-May and July-September. The data was collected using interviews, Cooper Smith Self esteem Inventory by Cooper Smith, 1981 and My Class Inventory by Fraser, 1982. The findings of the study revealed no significant difference on self esteem between experimental and control group and statistically significant difference on classroom climate favouring experimental group.

Tedesco (1999) reviewed the literature to study the effects of cooperative learning on self esteem. The literature showed that traditional method of instruction was unsuccessful in meeting the needs and interests of individual students. The review of literature also showed that students who worked together developed social skills and had an understanding of multiculturalism, human systems, and group and organizational development. The study revealed that self esteem was enhanced due to positive relations with fellows and also academic achievement was improved.

Haven (2000) in his book *Super simple storytelling: A can-do guide for every classroom, every day* has proclaimed that thousands of students across the globe have been found to have benefitted from storytelling as it helps building self esteem.

Tiggemann and Williamson (2000) examined the effect of exercise on body satisfaction and self esteem as a function of gender and age. The study was descriptive in nature for which the data was collected from 252 participants in the age range of 16 to 60 years with 70 young women, 48 young men, 73 mature women, and 61 mature men. The data was obtained on questionnaire on exercise, reason for exercise by Exercise Inventory by Silberstein et al. (1988), body satisfaction by Body Cathexis Scale by McCaulay, Mintz, and Glenn (1988) and self esteem by Self esteem Scale adapted by Bachman and O’Malley (1977) from Rosenberg’s (1965). The value of correlation showed statistically significant positive relationship between the amount of exercise on body satisfaction and self esteem but there was statistically significant negative relationship between amount of exercise on body satisfaction and self esteem among young women in age range of 16-21 years.

Tremblay, Inman and Willms (2000) studied the relationship between physical activity, self esteem, and academic achievement in 12-year-old children. The
complete population of class 6th in New Brunswick, Canada in the academic year 1996 was taken as the sample. The results of the study indicated statistically significant positive relationship between physical activity and self esteem, and negative relationship between physical activity and academic achievement.

Kearsley (2002), as quoted by Edo (2017), showed that students who learn from animation have greater self esteem and motivation. He also reported that rate of retaining information and sustaining the learning process increased.

Erlauer (2003) in his book the brain-compatible classroom using what we know about learning to improve teaching has advocated that the self esteem of students is built when strategies like multi-age group work programs within a school are applied. He also mentioned that the students are able to benefit from working in relatively small groups with students from different levels. This helps to build self esteem of children as they feel important while working in mixed groups.

Davis (2004) studied the use of theory of multiple intelligences to increase fourth-grade students’ academic achievement in science. One group pre-test-post-test design was used to conduct the study. Sample included 4th class students studying in a rural elementary school. The multiple intelligences theory and brain based learning was used to develop intervention. The data was collected using report cards, unit test scores and daily task performance reports, portfolio assessment, learning instrument to assess students’ feelings about learning in science, interview to understand students’ problems in academics, climate instrument to assess attitude about learning and the classroom climate, multiple intelligences instrument for learning in science to identify students’ preferred intelligence and also weekly journals. Paired sample t-test was used with triangulation of data and the analysis revealed that students had statistically significant results on academic achievement, behaviour and self esteem.

Ekeland, Heian, Hagen, Abbott and Nordheim (2002) did systematic review to find how exercise improves self esteem in children and young people. Sample consisted of 1821 people including children to young people in age range of 3 years to 20 years. Randomized controlled trials with exercise for more than four weeks as intervention, 23 trials with 1821 children and young people were include in the study. Out of these 23 only four had sufficient data and these were included to calculate overall effect. The analysis of the results revealed that intervention effected the self esteem with average short-term difference.
Hamilton and Wiess (2005) in the book *Children Tell Stories: Teaching and Using Storytelling in the Classroom* had written that story telling helps to build self esteem of students when they are allowed to share stories of their own lives and families.

Hannaford (2005) in her book *Smart Moves* outlines her work with special education students studying in 5th class and the effect of using Brain Gym exercises. She reported that all her students in the class showed a minimal gain of one-year in reading comprehension, two-years in overall academic growth and a minimal of a one-year gain in math test. She also reported that students’ ability to stay on-task and their self esteem improved.

Respress and Lufti (2006) conducted a study on Whole brain learning: T fine arts with students at risk. The quasi-experimental research design was used with matched control and experiment group. The sample consisted of 66 students, 33 each in control and experimental group, in age range of 11 to 14 studying in class 6th to 8th. Intervention included participation in visual arts, drama, dance, and/or music. GPA, WRAT III, Roesnberg Self-Esteem, Violence Risk Assessment and School Bonding Index were used to collect data before and after the intervention. The analysis of the results showed that there was a significant increase in academic achievement, commitment towards school, reduction in violent behaviour and improvement in self esteem of the students.

Pociask and Settles (2007) explored the use to brain based strategies in increasing student achievement. The study was conducted for seven weeks from September 2006 to January 2007 with sample of class 3rd and 4th students with learning disabilities and class 7th and 8th students who had poor test scores, poor motivation and behaviour that negatively influenced learning. Observation checklists, parent surveys, reflective journal by students and multiple intelligence surveys were used to collect the data. Data was collated and narrative analysis was used. The researchers found that the instructions with multiple intelligence helped to increase the self esteem, retention and motivation of students.

Mokhtar, Halim and Kamarulzaman (2010) conducted a study to identify the effectiveness of storytelling in enhancing communicative skills. The sample consisted of 30 students studying foundation English course in semester I of academic year 2010-11. The data was collected before and after the intervention using focus group
interview, questionnaire and audio/video recordings. The data was triangulated and analysed quantitatively and qualitatively. The results indicated that story telling improved students’ self esteem and confidence.

Wisner, Jones and Gwin (2010) reviewed the literature on school-based meditation practices for adolescents for its effect on strengthening self-regulation, emotional coping, and self esteem. The study included mindfulness meditation, the relaxation response, and transcendental meditation. The study described the benefits and challenges of meditation in schools settings. The results of the study showed that there was significant improvement in self esteem and internal locus of control in students of experimental group who had meditation sessions.

Memon, Joubish and Khurram (2011) studied the perception of students about the effects of group learning on their knowledge in academic achievements. The study was done on 150 third year students of B.A., pre and final year students of M.A. representing various teaching departments of faculty of Arts, University of Karachi in the academic year 2006. The data was collected through interview on a pre-constructed questionnaire. The data was statistically analysed using percentage and it showed that most students affirmed positive effects of group learning on self-respect and self-confidence.

Okwudishu (2011) in trainer guide to the use the manual of best practices and methods of facilitating in basic literacy programme has studied the benefits of activity-based learning. It reinforced course content, helped to develop team building skills, improved learners self esteem, promoted participatory learning, allowed creative problem solving, and promoted the concept of discovery learning.

Chavhan (2012) developed an intervention programme based on brain based learning. Mixed method design was used for the study including both qualitative and quantitative methods utilizing explanatory sequential design. Incidental sampling was used to select the sample which included 72 students studying in class 6th English medium schools of CBSE board in Navi Mumbai. The two intact sections of class 6th were randomly assigned as experimental group with 35 students and control group with 37 students. The data for qualitative analysis was collected from 13 students selected purposively. For data collection achievement test, self esteem scale, academic stress scale, attitude towards learning scale, reaction towards brain based
learning scale, evaluation rubric, interview schedule, worksheets and reflection sheets were used. The intervention i.e. teaching through brain based learning was given to experimental group for about 50 days. For analysis of data, paired t-test and two way analysis of variance was used and it was found that there was statistically significant effect of brain based learning on achievement in environment education, attitude towards learning, academic stress and self esteem.

Tedla (2012) conducted study to understand the importance, impacts and barriers of ICT on teaching and learning in East African countries. The paper was based on review of empirical researches and focused group discussion with East African Scholars on the use of Information and Computer Technology in primary and secondary schools in East African Countries. The study revealed use of ICT helps to improve confidence and self esteem.

Hoda (2013) studied the impact of physical activity on self esteem and how it may affect adolescents living under family conflict. The data for the study was taken from Icelandic Center for Social Research and Analysis from a survey done in 2007 which included 11229 high school students. Out of these 1806 students were selected randomly in the age range of 16 to 19 years. The data was analysed using analysis of variance and it was found that the self esteem of students was significantly affected by the family conflict and medium or high physical activities helped to increase the self esteem of the students.

Sethi, Nagendra and Ganpat (2013) examined the effect of Yoga in improving attention and self esteem in underprivileged girl students. The experimental study used single group pre-test and post-test design. The sample included 60 high school girl students Mysore. Rosenberg Self esteem test developed by Rosenberg (1965) and d2 test which is a cancellation test of attention and concentration was used for data collection and administered before and after 5 days of Integrated Yoga Module. Kolmogorov-Smirnov and Wilcoxon signed rank test were used for analysing the data and it was interpreted from the results that the yoga significantly improved the self esteem and attention of the students.

Sharma (2013a) studied the effect of brain based instructional strategies for improving academic achievement and self esteem. Pre-test post-test control group design of experimental method was used. A sample of 20 students each in control and
experimental group were included in the study. The experimental group was taught through brain based instructional strategies and control group was taught through tradition method of teaching. The data was collected on self-prepared achievement test and Rosenberg self esteem scale. The data was analysed using paired sample t-test and results revealed statistically significant improvement in academic achievement in science and self esteem of the students due to brain based instructional strategies.

Sharma (2013b) conducted a study on effect of brain based instructional strategies on achievement and self esteem of science student in relation to their learning style. Pre-test-post-test control group design was used to conduct the experiment. Sample included 45 students in experimental group and 45 students in control group studying in class 7th. 27 topics of class 7 science were planned according to brain based instructional strategies and were executed. Data was collected by using achievement test constructed by the researcher, Learning Style Inventory (Dangwal and Mitra, 1997) and Self esteem scale (Rosenberg, 1965). Findings from the independent t-test and analysis of variance on mean gain score of achievement test and self esteem indicated that the use of brain based instructional strategies resulted in greater academic achievement and better self esteem of the students with different learning style.

Yu and Lee (2013) studied the effects of meditation on self esteem and adaptability to school environment of South Korea. The experimental study included 50 students studying in 3rd year between March 2012 to July 2012 in an elementary school. 25 students received meditation session and served as experimental group and other 25 students served as control group and did not received any meditation session. The experimental group received meditation thirty minutes session twice per week for 15 weeks. The findings revealed enhanced self esteem and adaptability to the school environment.

Yoo and Lee (2013) studied the effects of school-based Maum meditation program on the self esteem and school adjustment in primary school students. The quasi-experimental method of research was used with a sample of 50 students, 25 in experimental group and 25 in control group studying in class 3rd in a primary school. The experimental group was subjected to Maum meditation program for a period of 15 weeks from March 2012 to July 2012. Each session of meditation lasted for 30 minutes. The data was collected by using self esteem scale modified by Jun (1999)
from children’s self esteem inventory by Coopersmith (1967) and self esteem scale by Choi and Joen (1993) and school adjustment by behaviour rating scale by Long and Henderson (1971) modified and reconstituted by Baeg (2002). Data was collected immediately after the intervention and then after gap of five weeks. The analysis was performed using paired sample t-test and analysis of covariance. The results showed improved self esteem and adjustment in post-test as well as in delayed post-test.

Canbulat and Kucukkaragoz (2014) studied the effects of the brain based learning approach on 5th grade students’ academic achievement and academic self esteem in social studies. The experimental method of research used quasi experimental method with unsynchronized pre-test-post-test control group design. The sample of the study included 117 students belonging to middle socio-economic level studying in a public school in Buca district of Izmir province, Turkey. The study included an experimental group and two control groups. The 38 students in experimental group were taught through brain based learning approach, and the two control groups had 39 and 40 students taught though lecture method. The data was collected using achievement test develop by the researcher and coppersmith self esteem scale. The analysis was done using two way analysis of variance and it was found that the experimental group had statistically significant score on achievement in social science and self esteem in comparison with both the control groups.

Hasanpour, Tabatabaei, Alaviand and Zolaktaf (2014) examined the effect of aerobics exercise on self esteem in Iranian female adolescents covered by welfare organisation. The study was randomized control trial with sample of 72 female adolescents living with no natural family in age range of 13 to 19 years. The sample was divided into experimental and control group by matched random sampling. The experimental group was given the intervention for 8 weeks. The data was collected using Coppersmith self esteem inventory before and after intervention and after one month of follow-up. Analysis of covariance, Chi-square, Mann-Whitney and independent t-tests were used for analysis and results indicated statistically significant increase in self esteem of students post intervention and also after a month of follow-up.

Liu, Wu and Ming (2015) conducted meta-analytical study to find effect of physical activity intervention in improving self esteem and self-concept in children and adolescents. Meta-analysis and meta-regression were used. The studies included for
the meta-analysis included the studies having comparison groups, participants in age range of 3 to 20 years, supervised intervention, and effect of intervention on self esteem or self-concept. Based on these 25 randomized controlled trial studies and 13 non-randomized controlled trial studies having in total 2991 cases were included. The analysis showed significant effect of randomized controlled trial on the self esteem or self-concept of the participants.

Sangya and Kiran (2015) examined the impact of meditation on the self esteem of college going students. The study was experimental in nature with 120 students studying in meditation centres and colleges in urban areas of Lucknow. These 120 students were divided into two groups 60 each, in experimental and control group. The students in experimental group were the students practicing meditation from last three months while those in the control group were not practicing meditation. Data was collected on Rosenberg self esteem scale and analysed through t-test. The results indicated no statistically significant difference on self esteem between the experimental group and control group.

Sharifi, Maddah, Moghadam, Mashhadi and Salemi (2015) studied the effect of information and communication technology on students’ test anxiety and self esteem. The experimental research utilized pre-test-post-test design with an experimental group and a control group. The sample included 44 students doing bachelors in University of Tabriz. One of the class had 23 students and the other had 21 students and were randomly divided into experimental and control groups. The experimental group was taught using information and communication technology for one semester and the data was collected using Sarason test anxiety and Coopersmith self esteem. The scores were analysed using t-test and findings indicated statistically significant decrease in test anxiety and increase in self esteem in favour of use of information and communication technology.

Muttaqin (2016) studied the cooperative learning and students’ self esteem among students studying in primary and secondary schools. The research was descriptive in nature including 30 students studying in class 6th and 7th. The researcher made use to observation in classrooms, interviews and questionnaire to enquire about students self esteem and their preference for learning through cooperative learning method. Researcher triangulated the data and inferred that the cooperative learning method has significant relationship with improving students’ self esteem.
Astawa, Artini and Nitiasih (2017) conducted a research on project-based learning activities and EFL students’ productive skills in English. The sample included 28 students studying in class 7th public junior high school in Bali-Indonesia. Mixed-method design was used. Speaking and writing tests were used to collect quantitative data and interview, observation checklist, open-ended questionnaire and field notes were used to collect the qualitative data. Paired-sample t-test was used for analysing the data and reported statistically significant improvement in reading and writing skills. The analysis of qualitative data showed to have improved students’ enthusiasm, confidence, creativity, self esteem and collaborative learning ability.

Birgisdottir (2017) examined the physical activity and self esteem among adolescents in relation to gender difference and the impact of physical activity intervention on adolescent’s self esteem. The study used randomized control trial intervention. The sample of 233 students with mean age of 16 years was randomly selected from 4 upper secondary schools. The intervention started in second week of September to second week of October. After intervention the data was collected using pedometer, questionnaire on demographic variables and self esteem and physical activity diary. The data was analysed using analysis of variance and results showed that physical activity did not have significant effect on self esteem.

Kartikasari and Widjajanti (2017) studied the effectiveness of problem-based learning approach based on multiple intelligences in terms of student’s achievement, mathematical connection ability and self esteem. This experimental research used quasi-experimental design. The sample included 30 students studying in class 10th of MIA III MAN Yogyakarta III. Learning materials based on problem-based learning approach based on multiple intelligence was implemented for chapter trigonometry and geometry. The data was collected on achievement test, connection mathematical test and self esteem questionnaire prepared by the researcher. The analysis of data revealed effectiveness of problem-based learning approach based on multiple intelligences on achievement, mathematical connection ability and self esteem.

Khalifa (2017) conducted an experiment to find effectiveness of using think- pair – share strategy on developing eleventh graders’ writing skills in Rafah governmental schools in academic year 2014-15. Quasi experimental method was used with purposive sample of 68 female students studying at a government secondary girls’ school in Rafah. Experimental and control group had 34 students in each group. The
experimental group used think-pair-share strategy for writing skills. Data was collected on achievement test prepared by the researcher. The results showed increase in writing skills. The feedback and reflection on students progress during the experiment proved that use of think-pair-share helps the students in developing positive changes towards self esteem as during the process they learnt to listen to one another and respect others' ideas.

Modaber and Far (2017) studied the effects of cooperative learning on students' self esteem in academic year 2015-16. The study used quasi experimental method of research. The sample consisted of 50 students studying in secondary schools of Sanandaj city, selected by stratified random sampling from a population of 3450 high school students. These 50 students were divided in two groups as trained and untrained in cooperative learning. The trained group was trained for cooperative learning methods for 10 weeks. After the intervention Rosenberg scale of self esteem was administered and analysis revealed that cooperative learning had statistically significant effect on self esteem of students.

Ruchim (2017) conducted a study to examine the effects of physical activity on middle school students' self esteem. Participants of the study included 25 students studying in class 6th at a middle school in a suburb of Chicago. The intact class of physical education was taken with 10 girls and 15 boys. Data were collected on pedometer for physical activity and on Harter's Global Self-Worth Scale for self esteem when the students had physical education class and other days when they had Encore class i.e. journalism, drama, art, global awareness, stem and music. The scores obtained were analysed and it was found that students were more active on day of physical education class and when students participate in physical education the global self-worth of students was found to be high but not statistically significant.

Slaviero (2017) conducted an experimental study to find the impact of guided meditation on children’s behaviour, mental health and well-being in the year 2013. The sample included 374 students studying in 5th and 6th class in a primary school in metropolitan Melbourne in age group of 10 to 12 years. For eight consecutive weeks the experimental group was subjected to 10 minutes of guided meditation and control group was told to read quietly for 10 minutes. Data was collected using self-report survey which included strengths and difficulties questionnaire by Goodman (1997) and Coopersmith self esteem inventory by Coopersmith (1981). The scores on
strengths and difficulties questionnaire and self esteem were analysed by using chi-square and t-test and the results revealed that no statistically significant effect was observed on strengths and difficulties and self esteem.

Gebauer et al. (2018) conducted a study on Mind-body practices and the self: Yoga and meditation do not quiet the ego, but instead boost self-enhancement. Within-subjects design was used with two experiments. For the first experimental group there were two groups; one group practicing yoga and other served as control. In first experimental group there were 93 yoga students who were observed for 15 weeks. In second experiment two groups were formed; one practicing meditation and other served as control. In second experimental group there were 162 students practicing meditation who were observed for 4 weeks. Data was collected for self-centrality by using self-central scale by Brown (2012) and self-enhancement. Self-enhancement included better-than-average (self-enhancement measure by Alicke & Govorun, 2005), self esteem (self esteem scale by Robins, Hendin, & Trzesniewski, 2001) and communal narcissism (communal narcissism inventory by Gebauer, Sedikides, Verplanken, & Maio, 2012). The data on these were collected and assessed revealing that self-enhancement was higher in the yoga and meditation conditions, indicating high self esteem of those who practice yoga and meditation.

U.S. Department of Education (n.d.) in the research project on technology and education reforms has mentioned Effects of Technology on Classrooms and Students. The report mentioned that technology helps to increase the motivation and self esteem of students. 5th class students in this report have said that students want to master technology as they felt that learning to use it enhanced their self esteem and made them excited about coming to school. Teachers emphasized that after mastering a technology based task students felt more competent and the value laid on the use of technology gave a sense of self-worth, thus improving the self esteem of students.

Sly (n.d.) in teaching strategies has mentioned about benefits of using project based learning as identified by the elementary teachers like better attitudes toward learning, better work habits, improved problem-solving capabilities, and more self esteem.

In the present section of review of literature it was found that brain based instructional strategies significantly affect self esteem (Canbulat & Kucukkaragoz, 2014; Chavhan, 2012; Davis, 2004; Erlauer, 2003; Pociask & Settles, 2007; Respress & Lufti, 2006;

Certain studies on effect of meditation and yoga (Rathore and Kiran, 2015) and exercise and physical activity (Birgisdottir, 2017; Ruchim, 2017; Slaviero, 2017) on self esteem did not reveal any statistically significant improvement.

2.3 STUDIES RELATED TO CLASSROOM ENVIRONMENT AND ACHIEVEMENT

Bennett (2001) studied the relationship between classroom climate and student achievement. The sample included total 262 students studying maths in class 6th in schools in Texas. The data was collected using My Class Inventory and Stanford Achievement Total Math scores. Pearson product-moment correlation was used for the analysis and results revealed that there was little correlation and classroom climate explained only 10.5% of the variance in mathematics achievement.

Utne (2001) conducted research to study the relationship between students socioeconomic status, perception of school environment, academic achievement and school attendance. The study was quantitative in nature including a sample of 108 students studying in 14 schools in 5th class. The data was collected from 108 students. My school inventory by Fraser, Anderson and Walberg (1982), Stanford achievement test (9th edition), and daily attendance record for the year 1999-2000 was taken for
data collection. The analysis was done by calculating correlation coefficient and it was found that students’ perception of classroom environment showed statistically significant relationship with their academic achievement.

Lizzio, Wilson and Simons (2002) studied university students’ perceptions of the learning environment and academic outcomes: implications for theory and practice. Survey method was used with a sample of 2130 students from 14 faculties of the university. The tools used for data collection were tertiary entrance scores from office records for prior academic ability by students’, course experience questionnaire (Ramsden, 1991) for teaching environment, approaches to learning constructed by investigators based on scale developed by Entwistle et al. (1979), students’ grade point average for academic achievement, for course satisfaction only one statement and generic skills scale of the course experience questionnaire for generic skills were used. Multiple regression analyses and path analysis were used for analysing the data. The results indicated that favourable perceptions of teaching environment influence students towards deep approaches, perceptions to outcomes, perceptions to approaches to outcomes, and also academic achievement and qualitative learning outcomes.

Wilson, Abbott, Joireman and Stroh (2002) examined the relations among school environment variables and student achievement through structural equation modelling approach to effective schools research. Data in this study were collected from two sources at school level: achievement scores from the Washington State Office of the Superintendent of Public Instruction in Washington and Teacher Perspectives Questionnaire from the Washington State District Grant Project (Fouts & Associates, 2001). The Washington Assessment of Student Learning was used to collect data on reading, mathematics, and writing for achievement. Teacher perspectives questionnaire was filled by 4,307 teachers on seven attributes of high achievement in schools identified by the Bill & Melinda Gates Foundation (Fouts & Associates, 2001). The study included data from teachers of 4th class. The structure equation modelling analysis revealed school-level attributes have an effect on constructivist teaching and student achievement also ‘environment’ and ‘partnership’ were found to account for significant variance in teaching and achievement of students.
Madrazo and Motz (2005) in the paper *Brain research: Implications to diverse learners* talked about the significant role of classroom setting and emotions of students in their ability to learn. Authors mentioned that connecting the indoor activities with outdoors for movement helps to revive the oxygen uptake; classrooms with rich colours, textures, hands-on activities and activities of students that indicate responsibility for knowledge helps to motivate and improve the performance of the students.

Dwivedi (2005) conducted research to study the influence of school environment and approval motive on academic achievement of students. The sample included 400 students studying in class 10th were randomly selected from sixteen schools located in Gorakhpur and Varanasi in Uttar Pradesh. The data was collected using school environment scale developed by the researcher; approval motive scale (Tripathi and Tripathi) group test of mental ability by Jalota and socio-economic status scale by Kulshreshtha. The analysis was done by using F-ratios and it was found that better classroom environment, high approval seekers and students of urban school had better academic achievement.

Vazalwar and Yadav (2005) traced the relationship of reading comprehension in english with respect to anxiety, socio-economic status and school environment. The sample comprised of randomly selected 547 boys and 413 girls studying in higher secondary schools of Bilaspur and Janjigir-Champain Chhattisgarh. The data was collected using Sinha’s comprehensive anxiety test (Sinha and Sinha) Socio economic status scale (Shah), School environment inventory (Mishra) and Silent reading comprehension test (Patel). Analysis was done using partial correlation and multiple correlation and results revealed significant joint effect of school environment, anxiety and socio-economic status on reading comprehension in English.

Sunitha (2005) conducted study on academic learning environment of students from aided and unaided coeducational high schools. The study was conducted in the year 2004-05, four aided and four unaided high schools of Dharwad, Karnataka. The sample included randomly selected 240 students studying in class 8th, 9th and 10th. The data was collected on academic learning environment scale comprising of school learning environment schedule and home learning environment schedule developed by the investigator and academic achievement of students taken as the scores of
previous and current years marks. The results revealed no significant association between academic achievement and the school and home learning environment.

Davis (2007) conducted study on effects of motivation, preferred learning styles, and perceptions of classroom climate on achievement in 9th and 10th grade math students. The data was collected from 103 students studying in 9th and 10th class on motivation, classroom climate, and learning styles preferences. The data was collected twice, i.e. at the beginning of the academic year and at the midpoint of the academic year. Results indicated students in classrooms with low classroom involvement and high task orientation had better achievement in comparison to those with high classroom involvement and low task orientation.

Sunitha and Khadi (2007) conducted a study on academic learning environment of students from English and Kannada medium high schools. The sample included 240 students from 8 coeducational high schools in Dharwad, Karnataka. Data was collected on academic learning environment scale developed by the investigator, academic achievement scores from previous and current year marks and Socio-economic status schedule (a combination of items developed by Aaron et al., 1969; Venkataramaiah, 1983 and Hauser, 1994). The findings showed that students in English medium schools had better school environment and home environment also had significantly better academic achievement than students in Kannada medium schools.

Adesoji and Olatunnosun (2008) studied student, teacher and school environment factors as determinants of achievement in senior secondary school chemistry in Oyo state, Nigeria. An ex-post facto research method was used for the study. 621 students and 27 teachers from 10 secondary schools were the sample of the study. The tools used for collecting data were chemistry achievement test, teachers’ attitude towards chemistry scale, teachers’ attitude towards chemistry teaching scale and laboratory adequacy inventory. The findings of the study established that school environment and teacher-related factors had positive effect on achievement of students in chemistry.

Ekpo, Akpan, Essien and Imo-Obot (2009) studied the classroom climate and students’ academic achievement in social studies in Cross River, Nigeria. Ex post facto design was used for the study. Using stratified random sampling 24 schools
were selected from the three Educational Zones in Cross River State. The sample included 1,200 students from Junior Secondary School (year three). The data was collected and was analysed by using Pearson product moment correlation and multiple regression. The findings of the study revealed that academic achievement in social studies is effected by unfavourable classroom environment including physical layout of the classroom, effectiveness of teachers and their teaching behaviour.

Saini (2010) studied academic achievement of scheduled caste secondary school students in relation to study habits, home environment and school environment. Descriptive survey method of research was used. A sample of 600 students studying in class 10\textsuperscript{th} were selected randomly from 30 schools from Rohtak, Jhajjar and Jind districts of Haryana. The data was collected using study habit inventory, home environment inventory, school environment inventory and academic achievement scores were taken from class 10\textsuperscript{th}board examination result. Pearson coefficient of correlation and t-test were used for analysis. The results revealed no relationship between study habit and academic achievement, negative relationship between home environment and academic achievement and no relationship between school environment and academic achievement.

Adeyemo (2012) did research to study the relationship among school environment, student approaches to learning and their academic achievement in senior secondary school Physics. Descriptive survey research method was used for the study. The sample included 100 randomly selected students from five secondary schools. Out of these 20 physics students were selected. The data was collected and the analysis was done using percentage and Chi-square methods. The findings showed that physical environment, and the school social environment had significant influence on the students’ academic achievement in senior secondary physics. Significant relationship existed between school social environment and students’ attitude to learning of physics and showed significant relationship with academic achievement.

Lawrence and Vimala (2012) studied school environment and academic achievement of standard IX students. Using stratified random sampling 400 students were selected as sample studying in class 9\textsuperscript{th} in high and higher secondary schools in Tirunelveli. The school environment scale was developed by the researcher and scores for academic achievement were taken from quarterly marks of the students. The data was analysed using Pearson's product moment coefficient of correlation and t-test and
results revealed that there was no significant relationship between academic achievement and school environment.

Mehdipour and Balaramulu (2013) conducted research to study the influence of teacher’s behaviour on the academic achievement. The sample included 18 faculty members and 900 students from five universities in Hyderabad. The data included views of faculty and students about teachers’ behaviour in relation with students’ academic achievement. The data was analysed using chi-square and Pearson’s product moment coefficient of correlation. The findings of the study revealed that there is a statistically significant correlation between the behaviour of teachers and students’ academic achievement.

Swamy (2013) studied classroom environment, scientific creativity, self-concept as predictors of achievement in science of 7th class SC\ST and non SC\ST students. The sample was selected using stratified proportionate random sampling technique. The data was collected using achievement in science scale (Narayanaswamy & Ramesha, 2008), classroom environment Narayanaswamy and Ramesha (2008), scientific creativity (Sharma and Shukla) and self – concept inventory (Ahluwalia). The results of study showed that classroom environment, scientific creativity and self-concept were significantly related with achievement of the students.

Tope (2013) studied the influence of school environment on academic performance of secondary school students in selected Lagos state secondary schools. Descriptive research design was used in the study. To collect data the questionnaire was constructed and analysis was done by using simple percentage. The results showed that poor school facilities, large class size, inappropriate school location, and poor school plant planning negatively affected students’ academic performance.

Applying Brain based Learning in the Classroom (2014) advocated that learning is enhanced in classrooms when colours, music, movement and novelty of tasks are utilized. Non- threatening feedback from teachers, working in collaboration and building relationship with classmates make students feel secure and they try new skills without fear of failing and ridicule.

Gietz and McIntosh (2014) conducted a study to find the relations between student perceptions of their school environment and academic achievement. The study included students from 969 elementary schools and 73 middle schools in Canada. The
data was collected from the students who took part in a province wide achievement test and student satisfaction survey. Analysis was done using hierarchical multiple regression to find amount of variance in student achievement as explained by students’ perceptions of the school environment when school-level poverty and accounting for nesting by district were controlled. The findings revealed perceptions of school environment were significantly related with academic success.

Mucherah and Ambrose-Stahl (2014) explored the relationship between classroom climate, reading motivation and achievement. The sample included 107 students (49 girls and 55 boys) studying in class 7th in a public school. Motivation for reading questionnaire (Wigfield& Guthrie, 1995), Classroom climate questionnaire (Trickett & Moos, 1995) and Pennsylvania system of school assessment for scores on academic achievement were used to collect data. The findings revealed the relationship between classroom climate and reading achievement was mediated by reading motivation of students.

Suleman and Hussain (2014) conducted research study to find the effects of classroom physical environment on the academic achievement scores of secondary school students in Kohat Division, Pakistan. The study used pre-test post-test control group design of experimental method of research. The sample included randomly selected 40 students studying in class 9th in a government high school. The data was collected and significance of the difference between the mean scores was analysed by using t-test. It was found that experimental group with favourable classroom environment had significant positive effect on the academic achievement of students.

Mary and Jebaseelan (2014) studied the relationship of student learning behaviour and academic achievement. Descriptive research design was used including 90 students of class 9th from lower secondary schools in Tiruchirapalli. Data was collected by administering Student Learning Behaviour Scale (Saxena, 2002) and total scores in examination were taken as the academic achievement. The scores were analysed using t-test and coefficient of correlation and it was found that students’ learning behaviour and academic achievement were significantly related with each other.

Rahmi and Diem (2014) studied junior high school students’ perception of classroom environment and their english achievement. The sample included 378 students studying in class 8th from 55 state junior high school in Palembang. The data was
collected on achievement in English and What is Happening in this Class (Fraser, Fisher, and McRobbie, 1996). The data analysis was done using Pearson Product Moment Correlation and results revealed significant positive correlation between academic achievement and classroom environment.

Kekare (2015) studied the classroom physical environment and academic achievement of students. Pre-test post-test equivalent group design of experimental method of research was used. The sample comprised of 80 students studying in class 11th in different colleges of Aurangabad through random sampling method. The experimental group was provided with the physical facilities including spacious classrooms with benches, whiteboard, drinking water, projector, ventilation, lighting etc. The control group had small classrooms with blackboard and benches only. The data was collected from selected sample and was analysed using t-test. The findings revealed that the experimental group with physical facilities performed better on achievement test in comparison with control group, thus, establishing relationship between good classroom physical environment with better academic performance.

Miah (2015) studied the influence of school environment in relation to the academic achievement of secondary school students of Malda district. The sample consisted of 400 students of class 9th studying in English and Bengali Medium School. The data was collected using School Environment Scale developed by the researcher and academic achievement was taken as scores in quarterly examination. The data was analysed using t-test and person product moment coefficient of correlation. The finding showed no statistically significant relationship between school environment and academic achievement.

Sivakumar and Malliga (2015) conducted research to study school environment in relation to academic achievement of higher secondary school students. Survey method of research was used in the study including 300 students studying in class 11th from six schools in Tiruppur District. Questionnaire was developed by the researcher to collect data and analysis through percentage and t-test showed no statistically significant relationship between the scores of classroom environment and academic achievement.

Bellamy (2016) studied classroom environment and did content analysis to examine characteristics of classroom environments that affect students’ academic achievement.
The study was qualitative in nature. The sample was taken from 10 classes from elementary schools in Kingsport City. The data was collected through observation by researcher. The coding was done and categories were formed. It was found that positive discipline, organized classrooms, accountable talks, collaborative groups, and positive students teacher interaction formed positive classroom environment which effect the achievement of the students.

Koroye (2016) studied the influence of school physical environment on secondary school students’ academic performance in Bayelsa state. Ex-post facto research design was used. The sample included 1620 students studying in junior secondary school (year three) from Public Secondary School of Bayelsa selected through multistage random sampling. Physical school environment questionnaire and score of students’ performance in English, Mathematics, Social Studies, Basic Science and Agricultural Science were used for data collection. T-test was used for analysing the data and it was revealed from the findings that there was no significant effect of aesthetic beauty of the school, infrastructural facilities, equipment and instructional materials and location of school on the academic achievement of the students.

Anbalagan (2017) studied the impact of school environment on academic achievement of secondary school students in Madurai district. The sample included 1600 students studying in higher secondary. The researcher conclude from the analysis and interpretation of results that classroom environment had significant positive relationship with academic performance of the students.

Iweka (2017) did a correlational study on learning environment as correlate of students’ academic achievement in junior secondary school integrated science. The study was conducted in Ogba-Egbema-Ndoni in Nigeria. The sample of 2000 students studying in junior secondary school were selected by simple random sampling technique. The marks of students in term end examination were taken as scores on achievement in integrated Science. Pearson’s product moment coefficient of correlation and t-test were applied. The results revealed statistically significant positive relationship between learning environment and academic achievement of students in integrated science.

Javed and Asghar (2017) researched the association of classroom environment with academic achievement of secondary school girls in Pakistan. Descriptive survey
method was used to collect the data. The sample included 190 female teachers and 215 female students from 19 federal Government Girls Secondary Schools in Rawalpindi. Classroom environment scale was developed by the researcher to collect the data and academic achievement of the students were taken from the annual result gazette for the year 2014. The statistical analysis was done using chi-square and Mann-Whitney U test. The results revealed significant positive association between classroom environment and academic achievement of the girl students.

Kausar, Kiyani and Suleman (2017) studied the effect of classroom environment on the academic achievement of secondary school students in the subject of Pakistan studies at secondary level in Rawalpindi district, Pakistan. The experimental study utilized pre-test and post-test design. The sample included 10th class students and were divide into control group and experimental group. The data for achievement was collected using achievement test developed by the researchers and independent sample t-test was used for analysing the data. The results showed that a well-managed and vibrant classroom environment has a statistically significant positive effect on the academic achievement of students in comparison to the students in control group.

Kumara, Devi and Mayuri (2017) conducted a comparative study of residential school children and rural government school children for school factors and academic achievement. The sample included 120 teachers from private residential schools and 30 teachers from rural government schools. The questionnaire for data collection was developed by the investigators. Z-test, coefficient of correlation and multiple linear regression were used for analysing the data. The results revealed no significant relationship between school factors and academic achievement for rural government schools but in private residential schools these were found to be statistically significantly correlated.

Kumari and Rajani (2017) reviewed academic achievement and its influencing factors. The researchers concluded in their works that in the school environment the teacher characteristics, their qualification, organized school processes, positive psycho-social environment were positively related with the academic achievement.

Mahmood and Gondal (2017) conducted cross comparison of Urdu and english medium classes in Punjab province to find the effect of school environment on students’ achievement. The sample included 36 head teachers and 72 science teachers.
Rating scale for teachers and checklist for head teachers were used to collect data. On analysing the data from scores obtained the findings showed statistically significant positive effect of school environment on academic achievement and in English medium schools the effect of classroom environment on academic achievement was significantly better than the schools in Urdu medium.

Maxwell, Reynolds, Lee, Subasic and Bromhead (2017) did multilevel modelling with student and teacher data to find the impact of school climate and school identification on academic achievement. The study utilized multilevel model. The data was collected from longitudinal project of Australian National University and the Australian Capital Territory Education and Training Directorate. The sample of the study included 2,257 from class 7th and 9th students studying in 17 public schools and 760 staff members from the same schools. School climate and school identification measurement scales (Lee et al., 2017), academic achievement in numeracy, reading and writing ability were measured on NAPLAN test, school climate, school identification measurement scale and index of community socio-educational advantage were used for data collection. The analysis was done using multilevel structural equation modelling analysis and results showed perception about school climate significantly affected the academic achievement and it was mediated by psychological identification of students with the school.

Umar (2017) did case study of secondary school students in Gezira state of Sudan to find the effect of classroom environment on achievement in English as a foreign language during the first academic session 2016. The study was experimental in nature. The experimental group consisted of 122 students in three well renovated classrooms and the control group consisted of 135 students with non-renovated classrooms. The two groups were compared on the scores of English final examination and on analysis the findings revealed that the students in experimental group with renovated classrooms had better academic achievement than the students in the control group.

Varshney (2017) in the article This is why school infrastructure is important for a child’s growth stated that infrastructure plays an important role in creating a favourable environment for development of children. Learning ability of students gets affected due to poor infrastructure whereas properly planned school infrastructure proves beneficial for effective teaching and learning.
Ezike (2018) studied the classroom environment and academic interest as correlates of achievement in senior secondary school in chemistry in Ibadan south west local government area, Oyo state, Nigeria. The study used descriptive survey method with correlational design of research. The sample of 208 senior secondary year two students were selected randomly from ten Public Secondary Schools. Classroom environment students’ questionnaire (Kelly, 2010), students’ academic interest scale (Addison, Althoff & Pezold, 2009) and chemistry achievement test developed by the researcher were used to collect the data from the selected sample. Pearson product moment correlation coefficient and multiple regression analysis were used for analysing the data and it was found that interest and classroom environment were related positively with the academic achievement of students. Also the classroom environment predicted academic achievement better than the interest of students.

Tabibian (2018) in an article on Brain based learning: What is it and how to apply it talked about creating positive emotional environment in the classroom. He mentioned a positive environment in the classroom should be promoted where teachers are close and empathetic with students, excessive stress in the classroom should be avoided but a small level of stress is necessary to keep students motivated and active, thus improving their performance. Marinating an optimal physical classroom environment like visual capacity, new stimulation, a dynamic change to the classroom structure, calm music and natural light help students to concentrate, relax and feel comfortable, thus helping students for achievement.

infrastructure, teacher effectiveness and teaching behaviour, positive teacher-student interaction, use of colours, music, etc. showed correlation between classroom environment and achievement. Koroye (2016), Lawrence & Vimala (2012), Miah (2015), Saini (2010), Sivakumar & Malliga (2015), Sunitha (2005) did not found association between the classroom environment and academic achievement.

### 2.4 STUDIES RELATED TO CLASSROOM ENVIRONMENT AND SELF-ESTEEM

Burnett and Howard (2002) conducted a study on discrimination between primary school students with high and low self-esteem. The study was descriptive in nature. It included sample of 747 students studying in class 3 to 6 from six rural elementary schools in New South Wales. Of these, 116 students i.e. top 16% with high self-esteem and 111 students i.e. 15% with low self-esteem were taken for the study. Using Burnett self-scale (1994, 1996b) the items were prepared on self-esteem, my classroom scale, self-talk inventory, academic related self-concept, school self-concept and preference for teacher praise. Data was analysed using multivariate analysis of variance and discriminant function. It was found that the students with high self-esteem had positive self-talk, self-concept and also perceived classroom variables positively i.e. teacher feedback, praise, teacher-student relationship and classroom environment. Learner self-concept, positive and negative self-talk, classroom environment, and effort feedback were found to be the best discriminators of students’ self-esteem.

Trautwein, Ludtke, Koller and Baumert (2006) studied how the learning environment moderates the dynamics of self-concept in terms of self-esteem, academic self-concept, and achievement. The empirical basis for this investigation was provided by the longitudinal study Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood (BIJU) conducted at the Max Planck Institute for Human Development, Berlin. A sample included 5,648 students studying in class 7th from three federal states in Germany from 309 classes. The test were administered thrice; at the beginning, in the middle, and at the end of academic session 1991–1992. The data was collected for domain-specific self-concept, self esteem, achievement tests, individual achievement scores, school grades and learning environment. Multiple-group mean and covariance structures analyses and central analyses were used for analysing the data. The results were found to have the effect of
learning environments on self esteem and academic self-concept. In conformance with the meritocracy principle, support for bottom-up effects was stronger in the meritocratic learning environment.

Roskam and Nils (2007) researched to predict intra-individual academic achievement trajectories of adolescents nested in class environment as an influence of motivation, implicit theory of intelligence, self esteem and parenting. It was longitudinal study conducted on 1130 adolescents in age range of 11-20 years studying in classes 1st to 6th from eight schools in Belgium. Data was collected from November 2004 till June 2005. Academic achievement was collected for the exam sessions of June 2004, December 2004 and June 2005. The influence of individual factors including motivational constructs, implicit theory of intelligence and self esteem and environmental determinants including parenting and class environment of academic achievement were tested. Using hierarchical linear models, a decrease of grade over the course of the study, reciprocal relations between motivational constructs, self esteem and academic achievement were observed. There was also found to be a strong positive impact of supportive parenting on motivational constructs, self esteem and academic achievement and moderate influence of class environment.

Bucholz and Sheffler (2009) published a paper on creating a warm and inclusive classroom environment: planning for all children to feel welcome. They mention that the type of classroom environment created and encouraged by the teacher affected the ability of students to learn. The classroom environment fostered cooperation and acceptance among students, as the teaching methods. Teachers need to plan and create classroom that welcomes and supports all children. They make mention of procedure to change classroom environment like classroom meetings which not only decrease the disciplinary issues but also increase the self esteem of the students.

Chionh and Fraser (2009) studied the classroom environment, achievement, attitudes and self esteem in geography and mathematics in Singapore. The sample included 2310 students studying in class 10th aged 15 years from 75 randomly selected intact class 10th. The data was obtained on WIHIC questionnaire measuring student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation and equity. Simple and multiple correlation were used for analysis. Student cohesiveness dimension of classroom environment showed significant relationship with achievement and the classroom environment dimensions; teacher
support, task orientation and equity were found to be linked with more positive attitudes and self esteem of the students.

Strauss (2011) reported in the article on \textit{how much does stress affect learning} that the classroom environment affects children’s chances of showing learning problems like difficulties with attentiveness, task persistence, and flexibility, externalizing problems like increased frequency with which the child argues, picking up fights, disturbing ongoing activities, and acting impulsively and problems while interacting with peers like difficulties in forming friendships, dealing with other children, expressing feelings, and showing sensitivity. The classroom also affects internalizing problems like presence of anxiety, loneliness and causing low self esteem and sadness among children.

Gunnell (2012) in the article creating an effective classroom environment: factors which affect learning mentioned that in classrooms the teachers with classroom set-up, materials, and visual aids also need to be a positive role model to promote self esteem of students.

Tran (2012) conducted a study to predict the attitudes and self esteem of the grade 9\textsuperscript{th} lower secondary school students towards mathematics from their perceptions of the classroom learning environment. Survey research design was used for the study. The sample included 487 students from 14 mathematics classes studying in 9\textsuperscript{th} class in lower secondary schools in Vietnam. The data was collected by using My Class Inventory by Anderson, Walberg & Fraser (1982), Aiken Attitude Scale by Aiken’s (1974) and self esteem scale developed by the researcher. The scores obtained were analysed by using Pearson product-moment correlation coefficient and multiple regression. The results revealed that the positive classroom environment develop positive attitudes and positive self esteem in students.

Kilbride (2014) published paper on recognising self esteem in our pupils: how do we define and manage it? She wrote the classroom environment that allows students to judge their own abilities in relation to their fellow students help to develop competence and worthiness and enhance self esteem of students.

Demirdag (2015) published a research paper on Classroom management and students’ self esteem: Creating positive classroom. The study was quantitative in nature employing random sampling to collect data from 8 teachers of classes 6\textsuperscript{th} and 7\textsuperscript{th} and
30 students from class 6th and 30 students from class 7th. The data was collected using classroom management self-assessment by Sugai (2008), Coopersmith self esteem inventory by Coopersmith (1967). The mean difference of the obtained scores were analysed using independent sample t-test. The finding showed that the teachers who had better classroom management skills had students with better self esteem.

Lawer, Isaac, Seth and Nashiru (2016) conducted study on effective classroom management, self esteem and academic achievement. The study employed cross-sectional survey design. Multistage sampling techniques was used to collect the data from sample of 110 second year Arts students studying in first and second year of Senior High School in Brong Ahafo region. The data was collected on Rosenberg Self Esteem Scale by Rosenberg (1965), Behavioural and Instructional Management Scale by Martin and Sass (2009) and scores on end of term examination. The data was analysed using independent sample test and coefficient of correlation. The results showed that effective classroom management skills lead to high self esteem and high academic achievement in students. Also no effect of self esteem was found on academic achievement and no differences were found on self esteem in relation to gender.

Meskauskiene (2017) wrote in paper the impact of teaching environment on adolescent self esteem formation that the humanistic environment, which includes democratic work methods, participation and integration of students in decision making, respect, fairness, self-discipline, communication and flexibility, enables students to have confidence in their own abilities and enhance the self-esteem of students. On analysing the data given by class 7th to 9th students it was found that high academic achievements, trust, teacher’s support, encouragement, praise and respect of the pupil’s opinion positively affected the formation of self esteem of students.

Watson (2017) mentioned in the article improving self esteem that self esteem in students is important in and out of the classroom. Teacher when avoids criticism, assigns tasks to students that matches their strengths and abilities and use differentiated instruction it helps to develop self esteem.

Brooks (2018) wrote an article on how can teachers foster self esteem in children? In his book he wrote that classroom environment where the fear of failure is
acknowledged, students have respect and understanding for fellow peer, there students feel respected and it helps to develop self esteem, motivation, hope, and resilience among the students.

Shore (2018) wrote on the student with low self esteem. He mentioned that praising the student, expressing confidence and trust in a student's ability, engaging students in classroom activities of their interest and organizing group activity helps to make positive changes in classroom environment and develop self esteem of the students.

Barter-Colcord (n.d.) mentioned in 'The educator’s role in the fragile spectrum of student self esteem' mentioned teachers play an important role in creating positive classroom environment by setting realistic expectations for students, personalizing the curriculum by keeping students’ interest in focus, maintaining respect for students, thereby increasing motivation and engagement of students which promotes increased self esteem in students.

Akin and Radford (2018) explored the development of student self esteem and resilience in urban schools. The qualitative methodology and phenomenological research design was used including interview and survey questions with 14 graduates of high schools in the states of Illinois, and Indiana. Data was analysed using coding and sorting. He reported that teachers’ actions in form of encouragement, verbal praise, positive language, and efforts to develop rapport and relationship with students helped to develop the self esteem of the students.


2.5 STUDIES RELATED TO BRAIN BASED LEARNING AND CLASSROOM ENVIRONMENT

Green(1999) in the paper on Brain and learning research: Implications for meeting the needs of diverse learners advocated for classrooms to be closely related with real-world environments. He focused that school environment if stressful inhibits learning
and if positive it encourages students to learn. The integration of emotional expression in classroom environment improves memory and stimulates the brain to learn.

Ruston and Larkin (2001) in \textit{Shaping the learning environment: Connecting developmentally appropriate practices to brain research} mentioned recent researched focused on environment that are designed to gain the learner's attention, foster meaningful connections with prior understanding, and maximize both short and long-term memory through patterns and active problem solving. Each learner needs to be felt challenged, but not fearful in the classroom, so that it stimulates experiences that can result in an exchange of ideas and promote deeper understanding.

Prince (2005) in \textit{Using the principles of brain based learning in the classroom how to help a child learn} has mentioned the performance of the students improve as brain performs better in a positive emotional state when students perceive the classroom environment physically and emotionally safe and their efforts are encouraged and praised.

Barbara, Lauren, Patty and David, 2008 (2008) mentioned in paper \textit{Coming to our senses: incorporating brain research findings into classroom instruction} that negative influences like undue stress in the learning environment must be eliminated as it hampers the success of brain based practices. Classroom environment applying brain based learning should include enhanced visual environment by use of colour and lighting in instructional settings, music in classrooms and sense of smell, etc. to produce more effective learning.

Bringing Brain based Learning Theories into the Classroom (2013) has mention that the classroom space must be so designed that it arouses all senses. A classroom should not promote stress in students but should keep students relaxed in order to improve alertness and thus improve learning.

Arzy-Mitchell (2013) did review of literature on Brain based Learning for Adolescent Science Students and mentioned in the paper that when brain friendly and student centred classroom are designed it helps in forming a deeper understanding and increased retention of information by creating safe, stress-free classrooms and designing lessons that involve active learning and project-based learning. Deep learning is created by building positive classroom environment by constructing positive emotions and creating connections to deeper learning.
White (2014) wrote an article on *How can brain based learning change the classroom?* He mentioned that when positive, safe and nurturing environment is provided to students, they feel positive about their learning environment and hormone called endorphins are released in the brain producing a feeling of euphoria and thus stimulating frontal lobes of brain. This stimulation of frontal lobes makes learning experience more pleasurable and successful.

The studies and articles by Arzy-Mitchell (2013), Green (1999), Prince (2005), Ruston and Larkin (2001), Barbara, et al. (2008), White (2014) revealed that in classrooms based on brain based learning positive environment is promoted by ensuring physically and emotionally safe and secure environment, providing emotional support, promoting threat free but challenging environment, encouraging students, involving all sense of learners, integrating music and colours, etc. This helps to improve academic performance of the students.

From the review of related literature done for the present study it can be concluded that the brain based learning is not the much researched field in India. Researcher could only find studies by Binulal and Aravind (2013), Chavhan (2012), Grover (2015), Francis (2014), Panse (2012) Ramakrishnan (2015), Sharma (2013), Sumamol (2013), Thomas & Swamy (2014), Vyas and Vashishtha (2013) conducted in brain based learning in India. But the most studies revealed that instructional strategies based on brain based learning improved the achievement and self esteem of the students. There are certain contradicting results also for effect of brain based learning on achievement and self esteem. The classroom environment which forms an integral part of brain based learning is also not much researched in relation with brain based leaning. Researches show contradictions but most of the researches have proved to significantly affect the achievement, motivation, self-confidence and self esteem of the students.