CHAPTER 2

REVIEW OF RELATED LITERATURE

➢ Theoretical Framework of the Variables
  ▪ Instructional Strategies (Brain Based Learning Strategy and Circles of Learning Strategy)
  ▪ Learning Styles
  ▪ Self Efficacy

➢ Review of Related Studies
  ▪ Studies related with Brain Based Learning Strategy on Achievement and Self Efficacy
  ▪ Studies related with Circles of Learning Strategy on Achievement and Self Efficacy
  ▪ Studies related with Learning Styles on Achievement and Self Efficacy
Review of related literature is important in conducting a study. It gives an overall idea about the theory, related studies, research patterns adopted and the importance of the variables selected for the study. Review also helps a researcher to get in depth knowledge and aspects related to the selected variables; it also helps in avoiding duplication.

The present study aimed to find out the effectiveness of Brain Based Learning Strategy and Circles of Learning Strategy over Activity Oriented method of Teaching and to study the effect of three Instructional Strategies and Learning Styles in case of Achievement in Mathematics and Self Efficacy of Standard VII students of Kerala State. Researcher has made an earnest effort to conduct the review on the available sources regarding the selected variables up to the year 2017. The Theoretical aspects and the related studies are arranged under the following headings.

Theoretical Framework of the Variables
Review of Related Studies

Theoretical Framework of the Variables

This section details mainly about the major theoretical aspects of the independent variables and dependent variables of the present Study. Independent variables of the study are Instructional Strategies (Brain Based Learning Strategy, Circles of Learning Strategy and Activity Oriented Method of Teaching) and Learning Styles. The dependent variables are the Achievement in Mathematics and Self Efficacy.

Theoretical overview of the independent variables for the present study ie. Instructional Strategies (Brain Based Learning Strategy and Circles of Learning Strategy) and Learning Styles are detailed as follows.
Instructional Strategies

Instructional Strategies may be described as the process of sequencing and organizing content, specifying learning activities, and deciding how to deliver the content and activities.

Teaching is not a singular way anymore. Various aspects meet together for a harmony in teaching and learning. Authoritative teaching may not change a child’s behaviour or learning process. To impart learning, better experiences, communication with peers and teacher, efficient problem solving and many more factors should be provided to the learner.

Teacher plays a vital role in communicating the learning material (Knowledge) to the learner. The result expected after teaching the content is the behavioural change of the learner. So it is in the hands of a teacher that which method is to be adopted to get the best output (behavioural change) in students. The teacher, whether in the formal or informal set up, has the unlimited freedom to change his/her tactics to make the behaviour of the target group to change (Kumar & Bindhu, 2002).

Each teaching strategy is developed on a strong theoretical footing and it is on the basis of this theoretical background developed out of endless experiments, the teachers' activities in the classroom are designed. A teacher can make use of one or more than one strategy at a time to produce desired, pre determined outcomes. In meaning as well as in practice, Instructional Strategies hold an additional dimension rather than Strategy of Teaching. It includes Instructional Strategies followed by the teacher as well as learning strategies adopted by the students (Hameed, 2003).

Instructional Strategies can be Authoritative, Democratic, Facilitator, Delegator or Blended according to Gill (2013).
“Authority strategy is teacher-centered and frequently entails lengthy lecture sessions or one-way presentations. Students are expected to take notes or absorb information. This style is acceptable for certain higher-education disciplines and auditorium settings with large groups of students. The main drawback of this strategy can be said as, it is a questionable model for teaching children because there is little or no interaction with the teacher.

Demonstrative strategy retains the formal authority role while allowing teachers to demonstrate their expertise by showing students what they need to know. This style gives teachers opportunities to incorporate a variety of formats including lectures, multimedia presentations and demonstrations.

Facilitator style strategy promotes self-learning and helps student to develop critical thinking skills and retain knowledge that leads to self-actualization. This style trains students to ask questions and helps develop skills to find answers and solutions through exploration; it is ideal for teaching science and similar subjects. This strategy challenges teacher to interact with students and prompt them toward discovery rather than lecturing facts and testing knowledge through memorization.

The Delegator, or group style is best-suited for curriculum that requires lab activities, such as chemistry and biology, or subjects that warrant peer feedback, like debate and creative writing. Guided discovery and inquiry-based learning places the teacher in an observer role that inspires students by working in tandem toward common goals. It is considered as a modern style of teaching, it is sometimes criticized as newfangled and geared toward teacher as consultant rather than the traditional authority figure.

Hybrid, or blended style, follows an integrated approach to teaching that blends the teachers’ personality and interests with students’ needs and curriculum-appropriate methods. Achieves the inclusive approach of
combining teaching style clusters and enables teachers to tailor their styles to student needs and appropriate subject matter”.

Planning of instructional strategy is so crucial in the overall instructional design process. Main elements of instructional strategy are content sequencing, learning components, planning of design and selecting of media and delivery systems.

**Brain Based Learning Strategy.**

Various Instructional Strategies were developed and constructed based on the different theories adopted from learning Theories from psychology. Earlier theories were conceptualised and practised on assumptions and later on using experiments. These theories have influenced the education as well. Instructional Strategies were structured and developed based on these learning theories. But the Brain Based Learning Strategy has its root from Neuroscience. The development in Science and Technology had influenced the education field also. The Magnetic resonance imaging (MRI), Functional MRI (fMRI) Positron Emission Topography (PET), Computed Tomography (CT), Electroencephalography (EEG), Magneto Encephalography (MEG) and Near Infrared Spectroscopy (NIRS) are the techniques used for brain imaging. These techniques help the scientist to unveil the secrets behind learning and these images showed what was happening in the brain.

**History of Brain Based Learning Strategy.**

Until 19th century there has been a primitive model of how the brain works. It was in 1970’s that the concept of ‘brain’ gets highlighted. Many books giving importance to concept of brain were published (Buzan, 1974; Edwards, 1979). Leslie Hart (1983) argued through his book Human Brain and Human Learning that cognitive processes were significantly impaired by classroom threat and he said brain as the organ of learning. It was in the same
year Howard Gardner (1983) talked of multiple intelligences. These developments in this area gave a new insight among educationalist.

**Brain Anatomy.**

It is important for a teacher get knowledge about the basics of brain its anatomy and functions. Brain is mostly of water content (78%), fat and protein. Brain contains neurons and glial cells. Brain weight and size may vary according to the individuals and the average weight may be 1300 to 1400 grams. Neurons have a body named axon and its hairy projections named dendrites. It is through these neurons they communicate with the nearby neurons creating a network of impulses passed along the axon. Glial cells actually support the neural system by carrying nutrients, speed repair, provide myelin for axons, support the blood-brain barrier and may form their own communication network. Every second a neuron can register and transmit between 250 and 2500 impulses. The brain comprises of four regions namely Brainstem, Cerebellum, Diencephalon and Cerebrum. These four parts work together as the central command center for the body to move, think, and react (Jensen, 2008).

Brain structure can be seen as two hemispheres right and left. It is in 1960’s that the Nobel Prize neuroscientist Roger W. Sperry through his experiment on epilepsy patients found out that the two sides of the brain performed different task. Thus the idea and concept of the Left Right brain hemispheres evolved. Although it was a path breaking phenomenon, new researches (Jensen, 2008) says that no person can be judged as a right brained or left brained. Each area of the brain sense what is needed and interacts with other areas in split of second.

**Properties of Brain.**

Brain possesses properties of inter connections, changes and plasticity.


**Inter connections.**

Every system is dependent on some other system for a better functioning and organization.” The brain also has an infinite number of possible interconnections. It is because this parallel and interrelated processing of the brain, it is described as interconnected. Brain involves a busy functioning and because every element influences every other element, an understanding of this complexity is paramount for education”.

**The Changing Brain and Brain Plasticity.**

Even a new born baby’s brain have a definite organization. They are alert and active even at the time of birth. That is why they cry, breathe, sleep and maintain their body temperature. These basic, natural ways of responding to the external world begin to expand as the brain continues its development. Vast numbers of nerve cell connections are made in the developmental years also.

Brain plasticity means that the physical structure of the brain changes as the result of experience. Scientists learnt that brain maintains its plasticity for life (Bennett, Diamond, Krech, and Rosenzweig, 1967). They also found a remarkable fact from the research that brain is possible to selectively modify one or another region of the cortex, depending on the particular program of enrichment used. This helps us to understand why neither inherited characteristics nor the environment can ever be the sole determinant of development and behaviour. Children are not blank slates. They change, both psychologically and physiologically, as they absorb life. We could as easily say that our experiences shape our brains, and then our brains shape our experiences (Caine & Caine, 1991).

**Components of Brain Based Learning Strategy.**

The brain processes information all the time. It is always responding to
the complex global context in which it is immersed. Brain-based education, therefore, involves: 1. Designing and orchestrating lifelike, enriching, and appropriate experiences for learners. 2. Ensuring that students process experience in such a way as to increase the extraction of meaning. Among the features of brain-based learning are active uncertainty or the tolerance for ambiguity; problem solving; questioning; and patterning by drawing relationships through the use of metaphor, similes, and demonstrations. Students are given many choices for activities and projects.

Teaching methods are complex, lifelike, and integrated, using music and natural environments. Brain-based learning is usually experienced as joyful, although the content is rigorous and intellectually challenging; and students experience a high degree of self-motivation. It acknowledges and encourages the brain's ability to integrate vast amounts of information. It involves the entire learner in a challenging learning process that simultaneously engages the intellect, creativity, emotions, and physiology. It allows for the unique abilities and contributions from the learner in the teaching-learning situation. It acknowledges that learning takes place within a multiplicity of contexts classroom, school, community, country, and planet. It appreciates the interpenetration of parts and wholes by connecting what is learned to the greater picture and allowing learners to investigate the parts within the whole.

Brain-based learning is meaningful to the learner. What is learned makes sense. It is not necessarily brain based if parameters are strictly defined, the learning process is constricted and controlled, and students engage in specified activities for the purpose of identifying predetermined outcomes (Caine & Caine, 1991). The brain continues to build its learning capacity as long as it continues to be used. When people stop using their brain the capacity for learning is diminished. (D'Arcangelo, 1998).
Principles of Brain Based Learning Strategy and its Classroom Implications.

These principles provide us with a framework for learning and teaching that moves us irrevocably away from the older methods dominated education for more than a century. Caine and Caine, (1991) developed twelve brain principles which were derived from various disciplines and it acts as a framework for teaching methods. They are,

“The brain is a parallel processor.

Human brain has the ability to do many things at a time. Many emotions and thoughts operate simultaneously and interact with other modes of information processing and with the expansion of general social arid cultural knowledge.

Implications.

Good teaching must orchestrate the learner's experience that all these aspects of brain operation are addressed. Teaching must, therefore, be based on theories and methodologies that guide the teacher to make orchestration possible. No one method or technique can adequately encompass the variations of the human brain. However, teachers need a frame of reference that enables them to select from the vast repertoire of methods and approaches that are available.

Learning engages the entire physiology.

Interaction of the different parts of the brain attests to the importance of a person's entire physiology. The brain is a physiological organ functioning according to physiological rules. Learning is as natural as breathing, but it can be either inhibited or facilitated. Neuron growth, nourishment, and interactions are integrally related to the perception and interpretation of
experiences. Stress and threat affect the brain differently from peace, challenge, boredom, happiness, and contentment. In fact, some aspects of the actual wiring of the brain are affected by school and life experiences.

**Implications.**

Everything that affects the physiological functioning affects our capacity to learn. Stress management, nutrition, exercise, and relaxation, as well as other facets of health management, must be fully incorporated into the learning process. Usage of drugs and unhealthy habits should be curtailed. The timing of learning is influenced by the natural development of both body and brain, as well as by individual and natural rhythms and cycles. There can be a five-year difference in maturation between any two children of the same age. Expecting equal achievement on the basis of chronological age is therefore in appropriate.

**The search for meaning is innate.**

The search for meaning (making sense of our experiences) and the consequential need to act on our environment are automatic. The search for meaning is survival oriented and basic to the human brain. The brain needs and automatically registers the familiar while simultaneously searching for and responding to novel. This dual process is taking place every waking moment and even while sleeping. The search for meaning cannot be stopped, only channelled and focused.

**Implications.**

The learning environment needs to provide stability and familiarity; this is part of the function of routine classroom behaviors and procedures. At the same time, provision must be made to satisfy our curiosity and hunger for novelty, discovery, and challenge. Lessons need to be generally exciting and
meaningful and offer students an abundance of choices. The more positively life like such learning, the better. Many programs for gifted children take these implications for granted by combining a rich environment with complex and meaningful challenges. Brain Based Learning advice that, most of the creative methods used for gifted students should be applied to all students.

**The search for the meaning occurs through patterning.**

Patterning refers to the meaningful organization and categorization of information. In a way, the brain is both artist and scientist, attempting to discern and understand pattern they occur and giving expression to unique and creative patterns of its own. The brain is designed to perceive and generate patterns, and it resists having meaningless patterns imposed on it. Meaningless patterns are isolated pieces of information unrelated to what makes sense to a student. When the brain's natural capacity to integrate information is acknowledged and invoked in teaching, then vast amounts of initially unrelated or seemingly random information and activities can be presented and assimilated.

**Implications.**

Learners are patterning, or perceiving and creating meanings, all the time in one way or another. It cannot be stopped, but can influence the direction. Daydreaming is a way of patterning, as are problem solving and critical thinking. Although we choose much of what students are to learn, the ideal process is to present the information in a way that allows brains to extract patterns, rather than attempt to impose them. ‘Time on task’ does not ensure appropriate patterning because the student may actually be engaged in ‘busy work’ while the mind is somewhere else. For teaching to be really effective, a learner must be able to create meaningful and personally relevant patterns.
Emotions are critical to patterning.

Humans do not simply learn things. What we learn is influenced and organized by emotions and mind sets based on expectancy, personal biases and prejudices, degree of self-esteem, and the need for social interaction. Emotions are also crucial to memory because they facilitate the storage and recall of information. Moreover, many emotions cannot be simply switched on and off. They operate on many levels, somewhat like the weather. They are ongoing, and the emotional impact of any lesson or life experience may continue to reverberate long after the specific event.

Implications.

Teachers need to understand that students’ feelings and attitudes will be involved and will determine future learning. Because it is impossible to isolate the cognitive from the affective domain, the emotional climate in the school and classroom must be monitored on a consistent basis, using effective communication strategies and allowing for student and teacher reflection and metacognitive processes. In general, the entire environment needs to be supportive and marked by mutual respect and acceptance both within and beyond the classroom.

The Brain processes parts and wholes.

There is evidence of brain laterality, meaning that there are significant differences between left and right hemispheres of the brain. In a healthy person, however, the two hemispheres are inextricably interactive, whether a person is dealing with words; mathematics, music, or art. The "two brain" doctrine is most valuable as a metaphor that helps educators acknowledge two separate but simultaneous tendencies in the brain for organizing information. One is to reduce information into parts; the other is to perceive and work with it as a whole or series of wholes.
Implications.

People have enormous difficulty in learning when either parts or wholes are overlooked. Good teaching necessarily builds understanding and skills over time because learning is cumulative and developmental. However, parts and wholes are conceptually interactive. They derive meaning from and give it to each other. Equations and scientific principles should be dealt with in the context of living science.

Learning involves both focused attention and peripheral perception.

The brain absorbs information of which it is directly aware and to which it is paying attention. It also directly absorbs information and signals that lie beyond the field of attention. These may be stimuli that one perceives subtle signals that are within the field of attention but are still not consciously noticed (such as a hint of a smile or slight changes in body posture).

Implications.

The teacher should organize materials that will be outside the focus of the learner's attention. In addition to traditional concerns with noise, temperature, and so on, peripherals include visuals such as charts, illustrations, set designs, and art, including great works of art. The use of music has also become important as a way to enhance and influence more natural acquisition of information. And the subtle signals that emanate from a teacher have a significant impact. Our inner state shows in skin color, muscular tension and posture, rate of breathing, and eye movements. Teachers need to engage the interests and enthusiasm of students through their own enthusiasm, coaching, and modelling, so that the unconscious signals appropriately relate to the importance and value of what is being learned. In effect, every aspect of a student's life, including community, family, and technology, affects student learning.
Learning always involves conscious and unconscious processes.

We learn much more than we ever consciously understand. Most signals that are peripherally perceived enter the brain without the learner’s awareness and interact at unconscious levels. Teaching, therefore need to be designed in such a way as to help students benefit maximally from unconscious processing. In part, it is done through instruction.

Implications.

Much of the efforts in teaching and studying is wasted because students do not adequately process. What we call ‘active processing’ allows students to review how and what they learned so that they begin to take charge of learning and the development of personal meanings. In part, active processing refers to reflection and metacognitive activities.

We have at least two different types of memory: A Spatial Memory system and a set of systems for Rote Learning.

We have a natural, spatial memory system that does not need rehearsal and allows for ‘instant’ memory of experiences. The system is always engaged and is inexhaustible. It is possessed by people of both gender and all nationalities and ethnic backgrounds. It is enriched over time as we increase the items, categories and procedures that we take for granted. Facts and skills that are dealt with in isolation are organized differently by the brain and need much more practice and rehearsal. The counterpart of the spatial memory system is a set of systems specifically designed for storing relatively unrelated information. The more separated information and skills are from prior knowledge and actual experience, the more dependence there needs to be on rote memory and repetition. Emphasizing the storage and recall of unconnected facts is an inefficient use of the brain.
Implications.

Educators are adept at the type of teaching that focuses on memorization. Common examples include multiplication tables, spelling words, and unfamiliar vocabulary at the lower levels, and abstract concepts and sets of principles in different subjects for older students and adults. Sometimes memorization is important and useful. In general, however, teaching devoted to memorization does not facilitate the transfer of learning and probably interferes with the subsequent development of understanding. By ignoring the personal world of the learner, educators actually inhibit the effective functioning of the brain.

We understand and remember best when facts and skills are embedded in natural, spatial memory.

Our native language is learned through multiple interactive experiences involving vocabulary and grammar. It is shaped both by internal processes and by social interaction. That is an example of how specific ‘items’ are given meaning when embedded in ordinary experiences. All education can be enhanced when this type of embedding is adopted. That is the single most important element that the new brain-based theories of learning have in common.

Implications.

The embedding process is complex because it depends on all the other principles discussed here. Spatial memory is generally best invoked through experiential learning, an approach that is valued more highly in some cultures than in others. Teachers need to use a great deal of real-life activity, including classroom demonstrations, projects, field trips, visual imagery of certain experiences and best performances, stories, metaphor, drama, and interaction of different subjects. Vocabulary can be experienced through skits. Grammar
can be learned in process, through stories or writing. Mathematics, science, and history can be integrated so that much more information is understood and absorbed than is currently the norm. Success depends on using all of the senses and immersing the learner in a multitude of complex and interactive experiences. Lectures and analysis are not excluded, but they should be part of a larger experience.

**Learning is enhanced by challenge and inhibited by threat.**

The brain deprives under threat and learns optimally when appropriate challenge is given. The learner becomes less flexible and reverts to automatic and often more primitive routine behaviors. Under perceived threat, portions of our brain function sub optimally.

**Implications.**

Teachers and administrators need to create a state of relaxed alertness in students. This combines general relaxation with an atmosphere that is low in threat and high in challenge. This state must continuously pervade the lesson, and must be present in the teacher. All the methodologies that are used to orchestrate the learning context influence the state of relaxed alertness.

**Each brain is unique.**

Although we all have the same set of systems, including our senses and basic emotions, they are integrated differently in every brain. In addition, because learning actually changes the structure of the brain, the more we learn, the more unique we become.

**Implications.**

Teaching should be multifaceted to allow all students’ to express visual, tactile, emotional, and auditory preferences. There are other individual
differences that also need to be considered. Providing choices that are variable enough to attract individual interests may require the reshaping of schools so that they exhibit the complexity found in life. In sum, education needs to facilitate optimal brain functioning”.

**Curriculum Planning.**

As changes take place all around the globe, these should be integrated to the curriculum also. According to Jensen (2008), curriculum must be planned to make a great deal of senses and embody the brain principles. Curriculum must give importance to social fluency, Personal Development, Scientific Enquiry, Information literacy and Artistic expression.

**Social Fluency.**

No human can live alone. We rely on one another and depend on our relationships. Every learner should develop the ability to interact productively. The aspect of the curriculum ought to include Emotional Intelligence, Appreciating Diversity, Language skills, Work place literacy, Religious/ Spiritual identities, appropriate family behaviours, and Conflict Resolution.

**Personal Development.**

Curriculum must give importance to personal development in accordance to age appropriate manner. This area should address the aspects like Stress management, Physical Fitness, Metacognition and reflection, Nutrition and health, Goal setting and Achievement, Learning Skills and Personal responsibility.
Artistic Expression.

Normal schools do not cater the needs of artistic expression unlike Vocational training Schools. Since each human being has a need to express their feelings and thoughts so as their talents. Schools should open up such ventures like Music, Writing, Dance, Sculpture, Theater, Sports, Hobbies, Crafts and Design.

Scientific Inquiry.

The ability to rationalize and think makes humans unique. Asking questions, analyzing situations, conducting experiments, strategizing solutions, formulating plans of action, and interpreting results are basic steps in the scientific process. Environmental Studies, Global studies, Sciences, mathematics.

Information Literacy.

Today we are living a world which is flooded with knowledge. Children will be in a dilemma on how to access, process and manage these information. The aspects to be included in curriculum regarding this are Reading and writing skills, Hunting and gathering skills, Cognitive manipulation, Speaking and presentation skills, and technological skills.

Conditions for Brain Based Learning.

Brain Based Learning Strategy does not follow a fixed template. Since every brain is unique, a fixed structure would not fix every learner. Caine and caine (2000), identified three main conditions for learning to occur. They are Relaxed alertness, Orchestrated immersion and Active processing.
Orchestrated immersion.

Orchestrated immersion involves immersing the student in learning through the environment. (Funderstanding, 2007). A student's interaction in their environment increases their sense of ownership of their classroom, and learning. (Lackney, 2007). Teachers should be able to immerse students in the learning environment so as to get a better learning and learning outcome. Relaxed alertness is at its most powerful, when introducing highly sophisticated information. The point is always to challenge and stretch the learner so naturally and innocently, that process of mapping appears to be automatic, (Caine & Caine, 1991).

Relaxed alertness.

Relaxed alertness is the process of achieving safety in the classroom. Teachers strive to create a demanding curriculum encouraging students to stretch their learning potential. For students to be fully relaxed and alert they can not be afraid of the educational material (Funderstanding, 2007). For students to excel the fear of failure needs to be eradicated from the educational environment. Students need to be able to take academic chances without the fear of repercussions. (Lackney, 2007). Students should have a threat free, failure free atmosphere while learning. Orchestrated immersion provides learners with rich, complex experiences that include options and a sense of wholeness. It presents what is to be learned in ways that allow for the perception of new patterns and relationships and make what is being learned intrinsically more meaningful (Caine & Caine, 1991). The classroom should be recreated as the best place to teach students how to explore, and learn new topics.

Active processing.

Active processing is the consolidation and internalization of
information, by the learner, in a way that is both personally meaning-fill and conceptually coherent. Active processing is extremely important in education. To some extent, it is often the only way for students to make sense of experience. Active processing also gives students opportunities to take charge of the direction and nature of the way they change (Caine & Caine, 1991). A constructive way to help students process their learning is through journaling. Journaling provides the student time to reflect on the material just presented, process their level of understanding, and develop questions for areas needing clarification. (Funderstanding, 2007).

There has also many critics to this Brain based Learning. Their main query is that which learning is not brain based? This area is yet to be mainstreamed and the following years will surely serve the answers to these queries. Knowing the brain and planning the activities that brain likes- this is the main aim of Brain Based Education. Its only two decades that the neuroscience has started its studies more on brain developments and reveal the mystery of the brain. So this area is much to be explored. Craig (2003) says, “It does not prescribe how to run your classroom or offer specific techniques to use. Rather, it provides empirical data about how the brain learns and suggests guidelines to be considered while preparing lessons for your students. These guidelines may be incorporated into every educational setting, with every type of curriculum and every age group”. Brain-based learning is neither a panacea nor a magic bullet that will solve education's problems. It is not yet a program, a model, or a package for schools to follow (Jensen, 2000).

Circles of Learning Strategy.

The investigator has given a brief theoretical overview of Circles of Learning Strategy, the second strategy under Instructional Strategies in the following sections.
A teacher can structure the classroom in three different ways. That is competitive, individualistic and cooperation. Circles of learning strategy come under the cooperative structuring classroom. Johnson, Johnson, and Holubec (1994) define cooperative learning as “the instructional use of small groups that allows students to work together to maximise their own and each other’s learning”. The whole class is divided into small groups of five or six and they work together following the instructions to achieve their tasks. Such a classroom situation moulds a child to interact with others and achieves problem solving capacity as an individual and helps to acquire group skills.

**Historical Background.**

Cooperation setting evolved in ambiguity. It is innate that human being lived together and join hands together for a better living. Education also has no exception. It is in late 1700’s That Cooperative learning got structured in England and later on to the other parts of America.

Johnson and Johnson (1938) developed different Cooperative Learning strategies and also started training teachers in such strategies. They also started a center for cooperative learning so as to synthesise existing knowledge concerning cooperative, competitive and individualistic efforts, to formulate theoretical models concerning the nature of cooperation and its essential component, to conduct systematic program of research to test theories and to build and maintain a network of schools and colleges implementing cooperative strategies around the world (Johnson, Johnson, and Holubec, 1994).

**Components of Co operative Classroom.**

Group activities are practiced in the school classroom now a day. But most of these classes don’t get enough satisfactory outcomes. It is more than sitting in groups and work. A classroom becomes a ‘cooperative classroom’
only if satisfies certain essential conditions to work with. The essential components that make cooperative efforts more productive (Johnson, Johnson, and Holubec, 1994) are,

**Positive Interdependence.**

Two responsibilities of students in a cooperative classroom is to learn the assigned material and to ensure that all members of their group learn it. They should perceive that they are linked with group mates and each group member’s efforts are required and indispensable for group mates to complete the task.

**Face to Face Interaction.**

It refers to students facilitating each other, success. It fosters among individuals most powerfully influences efforts to achieve, caring and committed relationships, psychological adjustment and social competence. This enables students to encourage and facilitate each other’s efforts to achieve, complete tasks, and work toward achievement of common goals.

**Individual Accountability.**

It exists when the performance of each individual student is assessed and the results are given back to the individual and the group who holds each person responsible for contributing a fair share to the group's success.

**Interpersonal and Small Group Skills.**

Cooperative learning groups require students to learn academic subject matter and the interpersonal and small group skills necessary to function as part of a team. The greater the members’ team work skills, the higher the quality and quality of one’s own learning.
Instructional Strategies on Achievement in Mathematics

Group Processing.

Main purpose of this component is to clarify and improve member’s effectiveness in contributing the collaborative efforts to achieve the group goals. This helps the group members to make decisions about their tasks and get a room for improvement.

The three main types of Cooperative learning are Formal cooperative learning, Informal cooperative learning and Cooperative base groups. It helps to improve academic achievement, behaviour, attendance, self confidence, motivation, critical thinking, team work and positive relations. Learning Together, Group Investigation, Student Team Learning, Jigsaw I, Jigsaw II, Student Teams - Achievement Divisions, Teams Games Tournaments, Team-Assisted Individualisation, Cooperative Integrated Reading and Composition, Numbered Heads Together, Think Pair Share, Complex Instruction, Turn to Your Neighbour, Pairs of pairs, Inside - Outside Circle, Reciprocal Teaching, Circles of Learning are some of the Cooperative Learning Strategies used for instruction.

Thus the Cooperative Learning Strategies share a common idea of students work as teams in five or six to achieve a common goal with well specified group tasks. Circles of Learning Strategy gives a proper structuring of the tasks accomplished, Group works and student’s involvement, assessment and teacher facilitator.

Circles of Learning.

It is a Co-operative Learning model in which the whole class are divided into small groups comprising 5-6 methods. It was earlier developed by Johnson, Johnson, Holubec and Ray (1984) and it had eighteen steps in which this strategies were worked on; They were
1. Specifying Instructional Objectives
2. Deciding on the Size of the Group
3. Assigning Students to Groups
4. Arranging the Room
5. Planning the Instructional Materials to Promote Interdependence
6. Assigning Roles to Ensure Interdependence
7. Explaining the Academic Task
8. Structuring Positive Goal Interdependence
9. Structuring Individual Accountability
10. Structuring Intergroup Cooperation
11. Explaining Criteria for Success
12. Specifying Desired Behaviors
13. Monitoring Students' Behavior
14. Providing Task Assistance
15. Intervening to Teach Collaborative Skills
16. Providing Closure to the Lesson
17. Evaluating the Quality and Quantity of Students' Learning and

It is later modified by Johnson, Johnson and Holubec (1994) and it utilizes a cooperative goal structure that requires mutual acceptance of the common goal by the group members and that minimizes individualistic striving. It follows the six steps like which are describe in Chapter III.

a) **Specifying the instructional objectives.**
b) **Making pre-instructional decisions.**
c) **Explaining the task and goal structure.**
d) **Setting the cooperative lesson in motion.**
e) **Monitoring the effectiveness of cooperative learning groups and intervening as necessary.**
f) **Evaluating learning and processing interaction.**
Circles of Learning Strategy can be used in school classes to get higher achievement, skill in human interaction and social interdependence.

**Advantages of Cooperative Learning.**

Cooperative Learning helps children to work cooperatively and enables them to learn from one another. It removes the stigma of failure from the students and enables children to work at their own pace and respect others' strength and weaknesses. It encourages joint decision making and affords the children, the opportunity to exercise leadership and stimulates the development of autonomy, resourcefulness and self esteem. It also improves discussions and classroom talk. vii) Promotes higher order thinking and promotes mental integration of children from all ethnic backgrounds (Morrison and Ridely, 1988).

Cooperative Learning Strategy also enhances student learning achievement and ensuring that the students construct their own knowledge. It Motivate students to learn the materials and it provides formative feedback. It also helps in developing group and social skills necessary for success outside the classroom and promoting positive interaction between members of different cultural and socioeconomic groups( Millis, 1996).

Cooperative Learning was considered as a great paradigm shift and it practised by many educators all over the world. It is clearly based on a variety of theories, extensively validated by research and operationalised into clear procedures educators can use (Johnson, Johnson, & Stanne, 2000).

**Learning Styles.**

Learning Styles is the second independent variable selected for the present study. The investigator has given a brief theoretical overview of Learning Styles.
Concept of Learning Styles.

Each individual has their own preferred Learning Styles. It is actually the way an individual learn and process things. “It is apparent to many of those who have considered learning, even if only in passing, that we learn in different ways from one another and we often choose to use what has become known as preferred learning styles” (Pritchard, 2014).

Definitions of Learning Styles by Entwistle and Eysenck are, “Learning Styles is the general tendency to adopt a particular learning strategy” (Entwistle, 1981) and “Learning Styles is a general tendency to adopt similar set of strategies consistently across different tasks and settings” (Eysenck, 1994).

Models of Learning Styles.

It is in 1970’s the research on Learning Styles got ignited and ‘learning preferences’ were the word used to refer ‘Learning Styles’. The studies on Learning Styles also had impulses in the fields like Education, Psychology and Learning. The early work related to Learning Styles was from the classical work of Guilford (1967) and its intensive exploration contributed by Kolb and Fry (1974) who developed Experiential Learning in 1974 and extensive work by Pask (1976). There were various theories attempted by many theorists. Some of the cardinal theories which paved the ground for the Learning Styles concept are discussed as follows.

Learning Style Model by Kolb.

David Kolb found a description in another model named Learning Style Model in 1984. It was developed mainly on major dimensions,

- The concrete experience mode or the abstract conceptualization mode (the dimension concerning how the learner takes in information)
The active experimentation mode or the reflective observation mode (the dimension concerning how the learner internalises information).

Kolb defines four general learning types based on the two dimensions. They are

- Type I – Diverger (concrete, reflective)
- Type II – Assimilator (abstract, reflective)
- Type II – Converger (abstract, active) and
- Type IV – Accommodator (concrete, active).

In this model, the dimensions interact to form the four learning types. Kolb was in the view that almost every individual makes use of all learning modes to some extent, each person acquires a preferred learning style.

Honey Mumford Model.

Learning Styles are not fixed traits that an individual will always display. It may or may not change vary to the environment or other depending factors. Honey and Mumford (1986) suggest that we need to be able to adopt one of the four different styles (Activist, Reflector, Theorist and Pragmatist) in order to complete any given learning task satisfactorily. An inability or reluctance to adopt any particular style has the potential to hamper our ability to learn effectively. These four dimensions can be used as a way of classifying learners. The classifiers Activist, Reflector, Theorist and Pragmatist are really different from one another, but it can be said that most of the learners are not extreme examples of just one preferences. An individual may have characters of all the classifiers. They also developed a Learning Style Inventory to help individuals to find out which predominant type of learner he/she might be.
**The Myers-Briggs Model.**

This system is used in portraying individual different styles. This model (Briggs and Briggs, 1975; Briggs and Myers, 1980) classifies individuals according to their preferences on scales derived from the theories of psychological typed developed by Carl Jung. According to this the learners may be Extroverts, Introverts, Sensors, Intuitors, Thinkers, Feelers, Judgers, and Perceivers.

**The Felder-Silverman model.**

Another model that describes about Learning Styles is Felder-Silverman learning style model (1988). It has indistinguishable features with other models of Learning Styles. The classification of Learning Styles in the model are sensing learners, visual learners, inductive learners, active learners, and sequential learners.

**Learning Styles and multiple Intelligences.**

Gardner and Hatch (1990) is in a view that it will be helpful for the teachers to “detect the distinctive human strengths and use them as a basis for engagement and learning”. In this model they consider various learning activity preferences for the different intelligences like Linguistic/Verbal Learner, Logical/Mathematical Learner, Spatial/Visual Learner, Kinaesthetic Learner, Musical Learner, Interpersonal Learner, Intrapersonal Learner and Naturalistic learner.

More research were carried out in the later part of 20th century (Dunn, Cavanaugh, Eberle and Zenhaursern, 1982; Della, Dunn, Dunn, Geisert, Sinatra and Zenhaursern, 1986, and Lemmon, 1985) in which they produced a similar and consistent ideas. Pritchard (2014) says the results were consistent like
• Pupils do learn in different ways to one another
• Pupil performance in different subject areas is related to how individuals learn and
• When pupils are taught with approaches and resources that complement their particular learning styles, their achievement is significantly increased.

It is very important that the teachers should be aware of the learning style of their students. So that it can be incorporated to their teaching strategies. There are many inventories to measure Learning Style. Some major Inventories related to Learning Styles are developed by Kolb and Fry (1974), Pask (1976), Revised the LSI Kolb (1983), and Torrance’s Inventory (Torrance & Rockenstein, 1988).

If a teacher adopts a strategy with a specific approach of learning style, it may be difficult for all the students to follow. So the teacher must be capable of imparting education through all sensory preferences. First of all teachers should be well aware of the different Learning Styles and should include it in teaching through their different strategies. Learners who are actively engaged in learning process may achieve more success(Hartman, 1995 and Dewar & Wihittington, 1996).

**Self- Efficacy**

The investigator has given a brief theoretical overview of the dependent variable, Self Efficacy in the following sections.

**Concept of Self- Efficacy.**

Self- Efficacy is considered as the major concept in Social Cognitive Theory. “Perceived self-efficacy is defined as people’s beliefs about their capabilities to produce designated levels of performance that exercise
influence over events that affect their lives. Self-Efficacy believes determine how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes. They include cognitive, motivational, affective, and selection processes” (Bandura, 1994). Self-efficacy is not merely a belief in one’s own ability to accomplish a task but, a wide spectrum in assessing one’s capability in motivation, resources and action.

It cannot be considered as a generalized trait. “It is a persons’ belief in his/ her ability to perform a specific task” (Bandura, 1986). It can be considered as a predictor of a person’s behaviour and performance. It motives a person in achieving something. At a given point of time, it determines the initial decision to perform a task, the amount of effort to be expended, and the level of persistence (Rothmann and Cooper, 2015).

**Self-Efficacy Process.**

The four major psychological process through Self-Efficacy works are cognitive, motivational, affective, and selection processes.

**Cognitive Processes.**

According to Bandura, Cognitive processes is regulated by the perceived goals. If a person has stronger Self Efficacy the goal set will be stronger. Also self-efficacy shapes their goal setting. Those who have high efficacy results in positive thoughts and success; and those who doubt in efficacy ends in failure.

**Motivational Processes.**

Self-efficacy plays a prominent role in the motivation. A person motivate himself by cognitive actions and guide their actions anticipatorily. Each
individual set goals for himself/herself and consider an action plan to achieve the set goals.

**Affective processes.**

As an individual set his goal, he works to achieve for that. They experience stress when difficult situation arises. Those who cop up with the threats and overcome it, they ends up in success. If a person who cannot control or overcome the threats end up in stress.

**Selection Processes.**

Environment influences a person in a large perspective. Person who avoids the threats and overcome the difficult situations, they cultivate certain competencies by coping up with such situations.

**Components of Self Efficacy.**

The main components of Self Efficacy are considered as performance outcomes, vicarious experiences, verbal persuasion, and physiological feedback (Bandura 1977). These components help individuals determine if they believe they have the capability to accomplish certain tasks (Redmond, 2010).

**Personal outcomes.**

Personal outcomes are the beliefs that an individual’s accomplishments are greeted. Positive and negative experiences can influence the ability of an individual to perform a given task. If one has performed well at a task previously, they are more likely to feel competent and perform well at a related task (Redmond, 2010).

**Vicarious experiences.**

Vicarious experiences are dealt with a model observation, that is both
positive and negative experiences can influence the ability of an individual to perform a given task. If one has performed well at a task previously, they are more likely to feel competent and perform well at a related task (Redmond, 2010).

**Physiological feedback.**

Physiological feedback refers to the physiological response to one’s own emotional arousals.

Bandura (1986) says that these factors and its relationship is an integral part of one’s efficacy. It can be said that the relationship between the components reciprocate and reinforce one another. Students in a classroom also have the variations of the perceived self-efficacy. It motivates the learner to accomplish a task, activities, environment, home works and peer adjustment.

**Review of Related Studies**

Theoretical overview of the independent and dependent variables were discussed so far. This section deals with the related studies regarding the variables. Studies are arranged in such a way related with:

- **Studies Related with Brain Based Learning Strategy on Achievement and Self Efficacy.**
- **Studies Related with Circles of Learning Strategy on Achievement and Self Efficacy.**
- **Studies Related with Learning Styles on Achievement and Self Efficacy.**

**Studies Related with Brain Based Learning Strategy on Achievement in Mathematics and Self Efficacy**

This section deals with the studies related to Brain Based Learning
Strategy. Since this study has two dependent variables (Achievement and Self Efficacy). Studies are presented in relation to both these variables.

**Studies related with Brain Based Learning Strategy on Achievement.**

Studies related with Brain Based Learning Strategy and Achievement are presented. Studies are presented in the chronological order.

**Studies showing Positive Results.**

Van and Rice (1984) studied the effect of three types of Brain-Based Instruction on the Mathematics Achievement and Attitudes of Grade two Students explored the effects of a left-hemispheric, right-hemispheric, or integrated teaching approach on students' achievement and attitudes. 118 – grade two pupils were randomly assigned to four groups to receive two weeks of instruction on geometry and measurement. The achievement and attitudes was significant with the manipulative approach (right hemispheric), while the textbook approach (left hemispheric) resulted in the low gains.

Della (1986) explains in his article the merits of "brain-compatible" learning. Study describes about a pilot program conducted at New Jersey elementary school that transformed conventional, graded classrooms into ‘multi-teacher interactive learning units’ that promote thinking in terms of programs and patterns. Results showed pedagogical changes and improved test results of students.

Robinson, (1988) studied the difference between rote and locale learning, and their effects on neurons, and their impact on short and long term memory. The study also explored the effects of stress and boredom on learning.
Caine and Caine (1990) in an article Understanding a Brain-Based Approach to Learning and Teaching explains about twelve brain principles that pave the foundation of Brain Based Learning Strategy.

Caine and Caine (1991) in their book Making Connections: Teaching and the Human Brain describes about the need of this theory. They also challenge for a change from behaviourist method that was predominant at that period. They explain the brain principles, the techniques and classroom implications of Brain Based Learning.

Diaz (1992) in his study he termed brain based instruction as neurobiological instruction. Study explains the use of the neuropsychological knowledge in imparting this strategy in learning disabilities to stimulate those parts of the brain that moderate behaviour/learning.

Pinkerton (1994) a physical science teacher examined how brain-based learning environments could enhance better learning conditions for students. He used thematic teaching, enriched language, naturally complex, long-term design and construction projects, and multifaceted assessment tools. The study also examined how Brain Based Learning.

Sylwester, (1997) conveyed through his study that emotions plays important part in learning and schools need to give importance on meta cognitive activities that allow students to identify and deal with their own emotions and those of others. Emotionally stressful environments can inhibit learning.

Caine and Caine, (1997) in his study explains how the human brain work. They also explains about the are three Instructional Strategies compatible with brain based teaching that is relaxed alertness, orchestrated immersion and active processing.
Becktold (2001) Brain used learning strategies that may be inappropriate in corrections for security reasons. Problems encountered in correctional education complicate the used of these strategies. Incorporating brain-used instruction in these settings requires creativity and time.

McGeehan and Jane (2001) in their paper gives a brief report of the latest key brain research findings and invites educators to incorporate the biology of learning into teaching practices. Curriculum should be environmental friendly based on concepts that help students understand and predict what is going on and around them at school and in their communities.

Winters (2001) examines brain based teaching and its relevance as a teaching methods and knowledge base. It gives positive attributes of Brain-Based Education include, student engagement and active involvement in their own learning and

Lackney (2002) reported about 12 design principles based on Brain-based learning research which are placed in rich stimulating environments, for linking indoor, and outdoor plates, safe places, variety of places, changing displays, have all resources available use places for increasing motivation flexibility, active places, personalized space and the community.

Johnson (2003) in her thesis ‘Teaching Mathematics with the brain in mind: Learning pure Mathematics with meaning and understanding’ applies data and information discovered in a content analysis of research documents to create a brain-based pure math teacher resource that will help teachers to teach the pure mathematics 20 program with meaning and understanding. The resource includes a rationale, as well as explanations for the brain-based mathematics lesson framework. Current research on the science of learning has brought to light some very interesting ideas of how a student's brain works and the applications of this work to classroom practice which can
translate this information into classroom practice in order to help our students learn pure mathematics with meaning and understanding.

Konecki and Schiller (2003) studied the brain based learning in Elementary Science. It focused on the possible relationships between and implications of research on Brain Based Learning to the teaching of science education. The implication of the study on three implication from current brain research that is Stress limits children's ability to learn, Doing activities have immediate connection to the real world increased learning and to maintain dendrite and learning, it is important to use them.

Davis (2004) in his paper discussed the current fashion for brain based learning, in which value-laden claims about learning are grounded in neuropsychology. It argues that brain science cannot have the authority about learning that some seek to give it. The heart of the paper tries to show how the contribution of brain science to our grasp of the nature of learning is limited in principle.

Wolfe and Brandt (2006) in this article discusses the potentially important implications of neuroscience or main research, the newest breakthrough in education, for educators and the importance of sorting out claims on brain based programs. It is obvious that brain research is not the elusive silver that will answer all education problems.

Duman (2006) compared social studies instruction based on the brain-based instruction (BBI) and traditional teacher-centered method. The study concluded by saying that, there exists a significant difference between experimental group and control group in terms of academic achievement.

A study by Parker, Director, and Sedona (2007) reports in their paper that the system of Brain Education for Enhanced Learning (BE) is a powerful, innovative approach to education for grades pre-K to 12. Research reports that
Brain Education has impact on student performance and behaviour tend to support these benefits.

Wilmes, Lauren, and Patty (2008) through their paper addressed the need of brain based teaching strategies and making the educators aware about best quality learning environments for enhancing instruction. He also suggests that sensory and brain based teaching strategies can no longer be left behind and incorporating brain research findings into classroom instruction is the need of the hour.

Tufekci and Demirel (2009) studied the effect of learning organized instruction which designed according to the brain based learning on achievement, retention, attitude and the learning process. The study points out that brain based learning environment has a positive effect on the higher level learning, retention of the learning and the attitude toward course of the university students.

Morris (2010) examined and studied instructional methodologies of urban school teachers to determine the implementation of brain based Instructional Strategies among 40 teachers serving at elementary, middle and high school within the Memphis city school district. The study revealed that the elementary teachers applied more of the surveyed brain-based practices than middle or high school teachers. The mean scores suggested that National Board Certified teachers used each of the surveyed brain-based practices more often than other teachers.

Awolola (2011) studied the effect of brain-based learning strategy on the achievement regarding the learning of Mathematics of 522 Senior Secondary School Students in Oyo State, Nigeria. The result revealed significant main effect of treatment, cognitive style and significant interaction effect of treatment and cognitive style on achievement in mathematics. The
result showed that brain-based instructional strategy enhanced students’ achievement in mathematics more than the conventional method.

Samur and Duman (2011) conducted a study to examine if there is a significant relationship between brain-based e-learning and grammar translation method in middle school students’ academic achievements and attitudes towards an English course taught in Turkey. The findings of the study revealed that the academic achievement of the experimental group showed higher than the control group taught through grammar translation method.

Panse (2012) conducted a study in Pune for deprived students on the development of brain based program for enrichment of oral communication of first standard. The program was implemented for 116 hours on 82 girl students through direct interactions between researcher and students. The study revealed positive effect on Brain Based program for enrichment of oral communication for 1st standard deprived students.

Seyihoglu and Kaptan (2012) determined the effect of brain-based learning approach on attitudes and achievements of teacher candidates in geography courses. The study was conducted with the participation of 131 freshmen studying at the Department of Primary School Teaching of Education Faculty at Rize University. The result was found significant and also it was found that using brain based learning approach in geography teaching had a positive effect on the students’ attitudes toward the course.

Siercks (2012) in her thesis “Understanding and achieving Brain based instruction in the elementary classroom: A qualitative study of strategies used by teachers” takes a closer look at the perspective of teachers when it comes to what brain-based instruction strategies are. Teachers were given a survey to opinion about brain-based instruction and how they incorporate it into their
classrooms. This study gathered information about how teachers perceive and understand brain-based instruction. The use of brain-based instruction is quickly becoming vital to the education field.

Akyurek and Afacan (2013) examined the effect of brain-based learning approach on attitudes and motivation levels in 8th grade students’ science classes. The main reason for examining attitudes and motivation levels, the effect of the short-term motivation, attitude shows the long-term effect. Results show that, using brain-based learning approach the experimental group's success was found to be significant differences in favour of the Experimental Group.

Binulal and Aravind (2013) suggested that Brain based learning can be considered as one of the methods to create such meaningful learning experience in the classroom. They also recommends to make the classroom learner centered, teachers must develop students’ understanding of course content by enriching the classroom environment to include physical, emotional and social aspects.

Francis and Musthafa (2013) studied the effectiveness of Brain-based Learning strategy on achievement in economics of higher secondary school students. Quasi experimental design was employed on the sample. The findings showed that brain-based learning strategy is more effective than the existing method and also there existed significant difference between gain scores of achievement of experimental and control group for the total sample.

Haghighi (2013) in his study “The Effect of Brain- Based Learning on Iranian EFL Learners’ Achievement and Retention” investigated the effects of brain-based learning in students majoring in Aircraft Repair & Maintenance on academic achievement and retention. This experimental study, which was designed as pre- and post-test control group model, was conducted at Civil
Aviation Technology College in Tehran, Iran. The study lasted 16 weeks for a total of 63 class hours. Analysis of post-test achievement and retention tests revealed a significant difference between the groups favoring brain-based learning.

Hodges (2013) developed Quantum Learning, a professional staff development program that teaches strategies to stimulate the brain and increase learning, was implemented in the subject school district. When implemented in the classroom, the brain-based strategies of Quantum Learning should increase student achievement through better listening skills and reduced off-task behaviors.

Varghese (2013) in his experimental study on ‘Brain-based learning- A compatible equation for stress management of students’ revealed significant difference in the post-test scores on academic stress, Examination stress, social stress of experimental and control groups and also the effect size stood high for the significance. The study was conducted among 240 students.

Gozuyesil and Dikici (2014) in their study aimed is to measure the effect sizes of the quantitative studies that examined the effectiveness of brain-based learning on students’ academic achievement. They examined literature research, 31 studies (42 effects) which investigated the effectiveness of brain-based learning on students’ academic achievement between the years 1999-2011. The findings indicate that 35 out of 42 comparisons had positive effect sizes. It revealed that brain-based learning has a positive but medium effect (d=.640) on students’ academic achievement.

Ozturk (2014) in his paper demands the need of brain-based learning to be utilized in classrooms. He also displeases the criticism, voiced in the literature, against the understanding of brain-based learning in order to evaluate it more objectively and to presents implications for future research.
Valipour and Araghi (2014) studied the effectiveness of brain based learning strategies for University level students that administer reading comprehension test. Participants were 20 students in Islamic Azad University, Tonekabon, Iran. The results revealed that the experimental group had higher scores than the control group for the given test.

D’Amato and Yuan (2015) advocates for a more contemporary ecological neuropsychology approach, where brain-learner-environmental interactions are the focus of study, assessment, and evidence-based intervention.

Edelenbosch, Kupper, Krabbendam, and Broerse (2015) studied on the gap between neuroscience and educational practice. They interviewed, neuroscientists and education professionals about their perceptions in regard to the gap between science and practice and the role they play in creating, managing, and disrupting this boundary. Neuroscientists and education professionals often hold conflicting views and expectations of both brain-based learning and of each other. The study reveals that there are increased prospects for a neuro scientifically informed learning practice if science and practice work together as equal stakeholders in developing and implementing neuroscience research.

Sharma (2015) conducted a research with the brain-based Instructional Strategies on VII class science students who were taught. The findings revealed that the students taught with the brain-based Instructional Strategies improved their achievement in science as well as self esteem.

Meltzoff and Kuhl (2016) in their article presents the state-of-the-art findings about brain functioning during the first 3 years of life that underscore how important social interactions are to early learning. In this study they explore learning opportunities that occur during everyday interchanges.
between adults and infants and how these influence the brain. This study also examined longitudinal data to understand how children’s earliest social interactions set the stage for school readiness and lifelong learning.

Shabatatand (2016) aimed at recognizing the impact of teaching-learning program based on a brain-based learning on the achievement of female students of 9th grade in chemistry. The study was conducted on a sample of 64 female students in the 9th grade at a secondary school in Tafilah. The results indicated statistically significant differences at the level (α≤0.05) in contemporary and instructional achievement on the experimental group and the researchers recommended applying the approaches of instructional methods which are based on brain-based learning in chemistry and science.

Finn et al., (2017) studied whether family income is associated with variation in the functional brain organization on working memory (WM). WM capacity reflects executive functions associated with performance on a wide range of cognitive tasks and education outcomes, including mathematics achievement, and is associated with dorsolateral prefrontal and parietal cortices. Behaviourally, the higher-income group had greater WM capacity and higher mathematics achievement scores. Findings indicate that the functional neural architecture of WM varies with family income and is associated with education measures of mathematics achievement.

Yasar (2017) aimed at performing content analysis and meta-analysis on dissertations related to brain-based learning in science education to find out the general trend and tendency of brain-based learning in science education and find out the effect of such studies on achievement and attitude of learners with the ultimate aim of raising awareness about increasing brain-based learning in science education in Turkey. Document analysis on 21 dissertations was carried out by the author. It was found out that brain-based
learning is mostly applied in science and technology education (66.67%) at secondary level-I; some studies, though few, are conducted in biology (23.81%) and physics (4.76%) education however, no study is available in the field of chemistry education at secondary level-II and primary education. These results indicate a positive and significant effect of brain-based learning approach on achievement and attitude of learners. Based on the study results, it is suggested that brain-based learning should be more widespread in the fields of chemistry, physics and biology and primary education and that qualitative and mixed research as well as quantitative research methodology should be done for obtaining reliable, valid and in-depth results in the future.

A study by Uzezi and Jonah (2017) conducted a study to examine the effect of Brain-Based Learning strategy on students’ academic achievement, attitude, motivation and knowledge retention in Electrochemistry. Both the experimental group (40) and control group (47) was of Senior Secondary Classes. The findings of the study revealed that the Brain-Based Learning approach used in the experimental group was more effective in increasing student achievement, attitude and motivation of students towards chemistry than the Lecture-Based approach used in the control group. It was identified that the difference between retention test scores were also statistically significant in favour of experimental group.

**Studies showing Negative or No results.**

During the literature review, the researcher could find some studies which has negative influence of Brain Based Learning Strategy. The studies are,

Duman (2010) examined the effects of brain-based learning on the academic achievement of students with different learning styles. 68 students from the department of Social Sciences teacher education in the faculty of Education at Mugla University were the sample selected. The findings of the
study revealed that no significant difference was observed among the achievement levels of the experimental group students with different learning styles.

Tilton (2011) experimented on 62 adult professionals using a quasi-mixed-method to assess the effectiveness of Brain-Based Teaching Strategies on learning. The findings noted that the additional brain-based teaching interventions had no significant effect on participant outcomes.

Elwick (2014), Study examined the impact of teaching pupils about the brain on academic performance and assessed whether teaching pupils about their brain had an effect on actual academic performance. Results revealed that there was no impact on academic performance on Mathematics.

**Studies related with Brain Based Learning Strategy on Self Efficacy.**

Studies related with Brain Based Learning Strategy and Self Efficacy is presented. From the literature search it was noted that there are few studies related to Brain Based Learning Strategy and Self Efficacy.

Hill (2013) investigated the moderating influences of counseling students in Brain Based Learning on the relationships between mastery experiences and academic self-efficacy and academic performance; and the influence of academic self-efficacy on the relationship between counseling students in BBL and academic performance. Sample consisted of students of ages 14 to 17, 42 consenting female students. 24 high achievers and 18 low achievers, ages 14 to 17 from two high schools in East Trinidad. The participants were randomly assigned to either a treatment (counseling in BBL) or a control group (no counseling in BBL) in each school. Results of the paired-sample t tests implied that there was a significant difference in academic self efficacy scores compared to the control group.
Hakim, Chaya, Nurlaelah and Lestari (2015) in their study placed Emotional Quotient (EQ) and Spiritual Quotient (SQ) in addition to Intelligence Quotient (IQ) as learning objectives. Study is based on current situation, that previously IQ is considered as the intelligence that strongly support students’ success in learning study aims to identify the improvement of students’ mathematical connection skills and self-efficacy that experience Brain-Based Learning approach that apply EQ and SQ compare to students who experience conventional learning, both in terms of overall students as well as Mathematics initial ability. The sample for the study was 68 students of the 11th grade at senior high school, which consists of 34 students as the experimental class and 34 as control class. Results showed that that the increase of students’ mathematical connection skills and self-efficacy who experience Brain-Based Learning approach that apply EQ and SQ are better than students who received conventional learning, both in terms of overall students as well as the Mathematics Initial ability.

Keshavarzi, Sani, and Shami (2016), conducted with the aim of the effects of teaching method of writing with brain-based learning on educational self-efficacy and written ability of female students in fifth grade of primary school. The sample of this study included 30 people of Esfarayen elementary school fifth grade female students in the academic year of 94-95. The results of the study revealed that there is statistically significant difference between written language of the control group and the experimental group as well as between academic self-efficacy of experimental and control group.

Oghyanous (2017), investigated the effect of brain-based teaching on the self-efficacy of young EFL learners. The initial participants of the study were 90 learners within the age range of 13-16 who were selected based on convenience sampling. Experimental study resulted in indicating that brain-based teaching approach had a significant effect on students’ self-efficacy.
Studies related with Circles of Learning Strategy on Achievement and Self Efficacy.

This section deals with the studies related to Cooperative Learning Strategy. Since this study has two dependent variables (Achievement and Self Efficacy), studies are presented in relation to both these variables.

Studies related with Circles of Learning Strategy on Achievement.

Studies related with Circles of Learning Strategy of Cooperative Learning and Achievement are presented. Studies are presented in the chronological order. Numerous studies can be spotted regarding Cooperative learning since the later half of twentieth century. So the researcher has focused on the latest studies.

Studies Showing Positive Results.

Christison (1990) studied the effects of class learning on academic achievement and self-esteem and found that class learning has a significant and positive effect on pupil’s academic achievement and self esteem.

A study conducted by Watson (1991) studied the effects of cooperative learning on cognitive achievement of high school biology students. The results showed that there is significant difference in achievement in favour of students using Group Educational Module materials and students in cooperate learning situation.

Olsen & Kagan (1992) in their study investigated the effect created by the class learning on second language and proposed social advantages for class learning increased student talk, more released atmosphere, greater motivation and increased amount of comprehensible learning output.

Berg (1993) conducted a study on 11th graders to find the effectiveness of instruction that used a structured class learning technique. The study shows
that verbal interaction influenced learning and appeared to be a mediator of the effects of student characteristics on achievement. Results of the study also proved that students' responded positively to the experience and to work cooperatively and productively together.

Sachar and Sharan (1994) studied the effects of cooperative learning and whole class instruction on eighth grade students. Results implied that cooperative classrooms were found effective for achievement than the other instruction.

Mulryan (1994) studied some factors associated with differential involvement and participation of student's in cooperate small group, observed 5th and 6th grade students responses in Maths. The result proves that students generally spent more time on task, in groups than the whole class setting. Students in cooperative setting showed more active participation in groups.

Townsend and Hicks (1995) studied the relationship between Form Two students' (n=162) academic task values in two school subjects, mathematics and language, and their perceptions of social satisfaction in classrooms using a cooperative goal structure or in regular. Results showed that Task values for engagement in mathematics and language activities were higher, and perceived costs lower, in classrooms using a cooperative goal structure.

Verduin (1996) conducted a study to find the effect of students achievement in and the study resulted that there is a significant influence of cooperate learning for the enhancement of students academic achievement and also students can accomplish and pursue meaningful students initiated and student existed topics.

Vojnovich (1997) in his study described cooperative learning programme in a study to increase student motivation and learning
achievement. The study was conducted on High School Students in Chicago City. Result of the study implied that a higher level of critical thinking and increased learning achievement for the sample. Cooperative activities also resulted in a comfortable peer environment also.

Bindu (1999) conducted a study so as to find out the interaction effect of cooperative learning, peer teaching and cognitive entry behaviours of Standard VI pupil on achievement in Malayalam language skills. Results showed a positive relationship was found between cooperative learning strategy and achievement in Malayalam language skill.

Crawford, Krajacik & Mark (1999) in the study “Elements of a community of learners in a middle school science classroom” examines the influence of peer interaction with in collaborative work in socially and academically integrated classes. The researchers found the dynamic of student interaction in the specific lessons analyzed did not give all students the same opportunity for learning. Their conclusion found a very clear "unofficial" classroom was regard much controlled by the student and it seemed to result in a student controlled.

A study by Onwuegbuzie (2001) investigated the capability of the relationship between peer orientation and achievement to remain in research methodology courses when cooperative learning techniques are introduced. Findings of the study revealed a small but statistically significant relationship between peer orientation and achievement; students who were more oriented toward cooperative learning attained lower levels of achievement than did those who did not have an orientation toward cooperative learning. Further research is warranted.

Kumar and Bindu (2002) conducted an experiment with a sample of 100 standard VI pupils which utilized to study the relative effectiveness of
cooperative learning strategy and conventional method of teaching on achievement in Malayalam language skills cooperative learning strategy. The results found that experimental group was found more effective than the control treatment.

Hossain, and Tarmizi (2003) studied the effects of cooperative learning on students’ mathematics achievement and attitudes towards mathematics in selected secondary schools in Bangladesh. Sample consisted of 80 students (40 from Boys’ school and the other 40 from Girls’ school) of grade nine participated in this study where quasi-experimental design was administered. The results proved that cooperative learning had significant effects on mathematics achievement and attitudes towards mathematics. It was also found that students’ performance in mathematics and attitudes towards mathematics were affected by exposure to the cooperative learning.

Hameed (2003) has found positive result towards cooperate learning strategies on Achievement and Retention and established that there is a significant different with cooperate learning strategy on individual learning style in Social Studies of standard VII Students different school education achievement.

Ozsoy and Yildiz (2004) in their study determined the effect of learning together technique of cooperative learning method on student’ mathematics achievement. Results proved that there was a significant difference between the results of experiment and control groups. Learning together technique of cooperative learning method was found more effective than traditional teaching methods.

Hijzen, Boekaerts, & Vedder (2006). This study examined relationships between the quality of cooperative learning (CL) and students’ goal preferences and perceptions of contextual factors in the classroom among
1,920 students in secondary vocational schools. They found that the quality of CL was best predicted by a combination of social support goals, evaluations of the extent that students were taught cooperation skills, perception of teacher monitoring behavior, and the availability of academic and emotional peer support.

Nkebem and Okon (2006) found when Cooperative, competitive and individual goals were exposed to Self Instruction Method, it showed a significant effect on academic performance and attitude towards library skills. The cooperative mode of applying SIM should be adopted in library skills teaching. Researchers

Fong and Kwen (2007) in their study reports the results of an action research to examine the effectiveness of cooperative learning strategy on pupils’ academic achievement and their motivation to learn in the physics classroom. Findings of this study shows that it has the potential to contribute towards building the corpus of local knowledge on the effectiveness of cooperative learning as a teaching and learning strategy in the physics classroom.

Slavin and Lake (2008) studied the effectiveness of cooperative learning programs in elementary mathematics. The results showed that there was significant effect for the cooperative learning techniques in teaching mathematics at elementary level.

Chianson, Kurumeh, and Obida, (2010) in their study investigated the effect of cooperative learning method compared with the conventional learning method in order to find out the retention level of students’ in circle geometry. The study was experimented on senior secondary II students in the three education zones (Zone A, Zone B and Zone C) in Benue State, Nigeria. The ability of students to grasp and memorize a mathematical concept or topic
that was taught adopting the cooperative learning strategy to teach 358 senior secondary two (SSII) students circle geometry, and see how well the learning method may effectively improve on students’ ability to retain concepts in mathematics in comparison to the conventional learning method of teaching. The findings of the study revealed that students who were subjected to the cooperative learning strategy were able to retain the concepts of circle geometry more than those students who were taught using the conventional learning approach.

Reza, Tahmasbi, Heydari, and Ghasemi (2011) in their study examined the impact of cooperative learning on the topic of Algebra in math course between student third grades of secondary in Marv-Dasht city. The results revealed a significant effect of cooperative learning method on student’s academic achievement in algebra concept in the experimental groups than controls in total sample, boys and girls. This result proves the success of cooperative learning versus conventional teaching methods.

Shoja, Zainalipour, Hasan, Saadi, Javdan, and Sezide (2012) investigated the effects of cooperative learning on self-efficacy and academic achievement in English lesson of high school students. Sample consisted of 60 middle school students selected and were divided into two control and experimental groups. Results of study indicate in both variables (self-efficacy and academic achievement in English lesson), differences were in favor of experimental group.

Torchia (2012) studied the relationship between the use of cooperative learning strategies and student achievement, and student perceptions of self-efficacy and motivation in mathematics. Study also explored teacher perceptions of the impact that cooperative learning strategies have on student achievement, intrinsic motivation, and self-efficacy were. The findings
revealed that cooperative learning does influence student achievement positively.

Tran (2013) in his study investigated the effect of cooperative learning on the academic achievement in mathematics and attitudes of seventy four 9th-grade mathematics students toward mathematics in a high school in Vietnam. The study revealed that cooperative learning was effective in improving the academic achievement level of participating students, and in promoting the positive attitudes of students toward mathematics in the level of Vietnamese high schools.

Zakaria, Daud, and Abidin (2013) in their study examined the effects of cooperative learning on students’ mathematics achievement in secondary school students in Pekanbaru, Indonesia. The results of the study showed that there was a significant difference of mean in students’ mathematics achievement between the cooperative group and the traditional group. Also, the Content analysis of the data revealed that students in the cooperative group were able to increase their understanding and to develop their self-confidence.

A study conducted by Orprayoon (2014) reported on the results of a quasi-experimental research to explore the effectiveness of using a cooperative learning method on students’ academic achievement, their group working behavior and their perception and opinions towards cooperative learning in a Modern French Literature course. The results showed that the use of Learning Together technique raised significantly the students’ learning achievement at 0.01 statistical level. The results also indicated that, according to the teacher’s assessment, the students gained group working skills at a high level while they self-evaluated their group working skills from a high to the highest level. Regarding their perception of cooperative learning, the overall
satisfaction with Learning Together technique was positive, ranking from a high level to the highest level.

Pons, Prieto, Lomeli, Bermejo and Bulut (2014) in their study aimed to find the effect of three cooperative learning techniques on in three mathematics classrooms at a secondary school and the sample was composed of 72 third year students. These results of the experiment proved the existence of different levels of academic performance between the three treatment groups. Post-hoc comparisons between the three groups and found that the relationship of peer-tutoring is considerably superior to the relationships of cooperation and collaboration), and the difference between the two latter groups insignificant.

Thasneem (2014) studied the effect of Circles of Learning Strategy on Achievement and retention in Physics on eight standard students of Kerala. Results showed that there exists a significant difference in the mean achievement scores favouring the experimental group.

Gambrari, Yusuf, and Thomas (2015) studied the effectiveness of computer-assisted instruction on Student Team Achievement Division (STAD) and Learning Together Model (LTM) cooperative learning strategies on Nigerian secondary students' achievement and motivation in physics. They developed computer assisted instructional package (CAI) for teaching physics concepts in cooperative settings was determined using Pretest-Posttest Experimental group design. Sample consisted of 90 (45 male and 45 female) students from three secondary schools in Minna, Nigeria. Results proved that the students taught with STAD and LTM performed significantly better than their counterparts taught using individualized computer instruction (ICI).

Gul, and Shehzad (2015) Following conducted an experiment to determine the effect of cooperative learning method on students' achievement
in subject of Education. Study was experimented on a Sample consisted of 63 female students enrolled in grade 12 of a public college. Cooperative Learning Methods were multiple cooperative learning activities including STAD, TGT and Jigsaw II were performed for 8 weeks with experimental group. The results revealed that there was a significant difference in scores of control and experimental group in post-test. Results concluded from results that cooperative learning activities had a positive effect on academic achievement of students enrolled in the subject of Education.

A study conducted by Khanthaphum, Tesaputa, and Visoot (2016) aimed to examine the results of implementation of the co-operative network model in the primary school at Thai. They studied the results of the implementation of the co-operative network model in developing the learners' quality. The results revealed that as per the use of the model, the students under study had increased learning achievement and had the desirable characteristics as stated in the core course of the basic education.

Pesen and Bakir (2016) studied the effect of cooperative learning approach on 6th grade students’ success in the field of mathematics was examined in the research. The experiment was carried out with a total of 56 students at a secondary school of Ministry of National Education in the city center of Siirt. And the results revealed that there was a significant difference in favor of cooperative learning method.

Investigators Chinna and Reddy (2017) made an attempt to study the effect of Jigsaw Cooperative learning technique in enhancing the Scholastic achievement in Mathematics of Junior Intermediate students (+1 students). The study was intended to find the effectiveness of Jigsaw cooperative learning strategy in enhancing scholastic achievement in mathematics of junior intermediate students. And to find out the significant difference if any in the scholastic achievement in mathematics of junior intermediate students.
due to different teaching methods. Findings of the research revealed that the group of students assigned for Jigsaw Cooperative learning technique is achieved significantly higher mean score in scholastic achievement test than that of the Conventional method of teaching in terms of Total Sample and subsamples based on gender than that to Conventional method of teaching.

Eshetu, Gebeyehu, and Alemu (2017) in their research paper aimed at investigating the effect of cooperative learning method on students’ physics achievement. The design was quasi-experimental pre-test post-test non equivalent control groups. Student Teams Achievement Division (STAD) method of cooperative learning was provided to treatment groups while the traditional method was used in the comparison groups. The findings revealed that the treatment group students out performed significantly than the comparison group on post test in each of the two grade levels. The result also reported that the effectiveness of the method for teaching physics to the low achievers as compared to high achievers.

Lin, Chen, Chang, and Chang (2017) conducted a study to explore knowledge distribution in social learning and its effects on learning achievement, and they developed a social learning platform and explored students’ behaviors of peer interactions by the proposed algorithms based on social network analysis. Result of the experiment results show that the students who tended to actively contribute knowledge to peers on the social learning platform had better learning achievements than the students who were used to the passive reception of knowledge.

**Studies Showing Negative or No Results.**

The researcher during her literature review found some studies which shows negative effect of Cooperative learning on achievement.
David (1990) in two of his studies in which, 36 junior high school students and intermediate level students with mild disabilities worked together to complete Computerised Instructional activities on capitalisation and punctuation. The intervention of the strategy resulted in significant increase in behaviour that were positively related with learning but did not produce significant increase in learning.

Pisani (1984) conducted a study to find the effects of Cooperative Learning environment on Academic Achievement and persistence and examining the precursory measure of student Achievement. Sample consisted of 68 freshman from 1992 entering class at the University of Illinois were used. The results implied that the positive influence of Cooperative Learning environment is carried into student involvement and not into other areas.

A study conducted by Peterson (1991) examined the achievement difference between sixth grade boys and girls in individualistic and Cooperative Learning situations. The result of the study showed no difference in Achievement between individualistic and Cooperative Learning situations.

A study conducted by Laney (1996) compared four instruction conditions with 121 first and second graders. The four conditions were Cooperative Learning, mastery learning, Cooperative-mastery learning and a control treatment. The results of the experiment showed the effectiveness of cooperative mastery method in promoting student learning than the Cooperative Learning alone and other methods.

Abu and Flowers (1997) conducted a study to find the effect of Cooperative Learning methods on Achievement, Retention and Attitude of high school students. A nutrition unit was taught to a sample of 91 high school Home Economics students (Experimental group) using Cooperative Learning and 106 controls. No significant difference in achievement was
found in Achievement test immediately after instruction and a retention test 3 weeks.

A study Krank and Moon conducted a study (2001) in which, 104 undergraduate social science students enrolled in three learning conditions such as mastery learning condition, Cooperative Learning condition and combined mastery/Cooperative Learning condition. The results showed that combined mastery/cooperative Learning condition was found more effective than mastery learning alone or Cooperative Learning alone.

Hanze and Berger (2007) studied on 137 students in 12th grade physics classes participated in a quasi-experimental study comparing the jigsaw classroom method of cooperative instruction with traditional direct instruction. The results showed that no positive effects of the cooperative learning on academic achievement.

Inuwa, Abdullah and Hassan (2017) in their study examined the effect of cooperative learning approach on financial accounting achievement among secondary school students in Gombe state, Nigeria. A pre-test-post-test-control group design was adopted. 120 students participated in the study were selected randomly from six schools. The study found that at the pre-test stage, there was no statistically significant difference between the achievement of cooperative learning students and conventional approach students, the results suggested that the students were initially equal in terms of their achievements.

**Studies related with Circles of Learning Strategies on Self Efficacy**

Studies related with Cooperative Learning Strategy and Self Efficacy is presented. From the literature search it was noted that there are few studies related to Brain Based Learning Strategy and Self Efficacy.

Guvenac (2010) investigated the effects of cooperative learning and learning journals on teacher candidate students’ self-regulated learning.
Sample of the study consisted of 84 university students (52 girls and 32 boys). The research showed that there is a difference between experimental and control groups and experimental groups’ students have been effected more positively on self-efficacy for learning and performance, elaboration, organization, critical thinking and metacognitive control strategy dimensions of self-regulated learning.

Shoja, Zainalipour, Hasan, Saadi, Javdan, and Sezide (2012) investigated the effects of cooperative learning on self-efficacy and academic achievement in English lesson of high school students. Sample consisted of 60 middle school students selected and were divided into two control and experimental groups. Results of study indicate in both variables (self-efficacy and academic achievement in English lesson), differences were in favor of experimental group.

Torchia (2012) studied the relationship between the use of cooperative learning strategies and student achievement, and student perceptions of self-efficacy and motivation in mathematics. Study also explored teacher perceptions of the impact that cooperative learning strategies have on student achievement, intrinsic motivation, and self-efficacy were. The findings showed that students' self-efficacy and intrinsic motivation are influenced positively.

A study conducted by Bada and Okan (2000) found that for students to achieve effective learning, teachers must consider effectively to the skills and assumptions of learners and to their individual learning preferences.

Ross, Drysdale and Schulz (2001) conducted a study and found that Learning Styles influence the types of learning experiences that students find effective, comfortable and growth promoting. The study also implies that the effect of learning style on academic performance was significant in student
performance with sequential learners performing significantly better than did random learners in two computer science courses.

**Studies related with Learning Styles on Achievement**

Studies related to Learning Styles and Achievement is presented in this section.

Studies are presented in the chronological order. Numerous study can be spotted regarding Learning styles since half of twentieth century. So the researcher has focused on the latest studies.

**Studies Showing Positive Results.**

A study conducted by Smith and Holliday (1986) studied the relationship of Learning Style and Academic Achievement on fourth, fifth and sixth grade students. The results of the study showed that the high achievers display a significant preference for a particular Learning Style.

An study was conducted by Atchinson (1988) to study the relationship of sixth made students, revealed that there exist statistically significant relationship between style and total Reading Achievement.

Moskwa and Claire (1992) conducted a study to investigate the correlation between student's Learning Style and their Academic Achievement. The sample of the study consisted of fifth grade students. Results of the study show that overall, there was a negligible relationship between Learning Style and academic achievement, but the relationship between certain Learning Style and academic performance was significant.

A study conducted by Carthey (1993) tried to find the relationship between Learning Styles and Academic Achievement and brain hemisphere dominance and academic performance. Findings of the study suggested that post-secondary business and accounting instructors should consider testing
their students to determine student's Learning Style and brain hemisphere dominance so that the instructors may suggest study approaches and methods that may increase Academic Achievement.

A study by Nunn (1995) finds the effect of learning style and strategies intervention upon at risk middle school student's Achievement. Result of the study shows a significant relation exists between Learning Style and Achievement.

A study conducted by Kumar (1997) investigated the effect of Learning Style on Achievement in secondary school Biology on 650 students. Result of the study indicated that Learning Style has significant main effect on Achievement in Biology.

Roark (1998) in his study attempted to show that students that are classified as visual learner will score higher on standard tests than those students that are classified as non-visual learners. Vocational Learning Styles Inventory, Piney Mountain Press, Inc., was used to measure the Learning Style. Result of the study shows that visual learners group had higher mean scores than non-visual learners group in all area assessed.

A study conducted by Geiser (1999) examined the effect of traditional versus Learning Style responsive study strategies on eighth grader's Mathematics Achievement, frequency of studying and attitudes. Results showed that students applying Learning Style - responsive study strategies had significantly higher Mathematics Achievement and attitude scores than students using traditional strategies.

A study by Rourke and Lysynchuck (2000) investigated the influence of Learning Styles on achievement in hypertext. Sample consisted of twenty one female and twenty male students enrolled in a psychology class was assessed using the learning style inventory. The learning style inventory
categorises respondents into one of four Learning Styles based on their abilities in the four stages of the experiential learning cycle. Study revealed a significant difference was found between divergers who scored highest and accommodators who scored lowest. The results of the research implied that benefits of hypertext are differentially distributed across learning styles.

Abidin, Rezaee, Abdullah, and Singh (2011) asserts that Learning Styles make an important component in the learning environment. Learning Styles Survey was employed in this study, appears to be a viable tool to determine students’ learning style. The present study tried to investigate of the relationship between Learning Styles and overall academic achievement. The analyses of the data revealed a significant relationship between overall academic achievement and learning styles.

Jilardi, Damavandi, Mahyuddin, Elias, Daud, and Shabani (2011) in their study investigated the impact of Learning Styles on academic achievement of secondary schools in Iran. 285 10th grade students were considered as the sample. The results of the study revealed that there is a significant difference in the academic achievement that corresponds to four learning styles.

Orhun (2012) conducted a study to raise the success level of the engineering students in calculus course which is an essential course in engineering education. It also analyzed whether the success depends on the way of learning style or not. Results of the study showed a significant difference among students’ Learning Styles and their performance on the calculus course.

A study was conducted by Bhatti and Bart (2013) to explore the influence of Learning Styles on scholastic achievement levels. The sample selected for the study were undergraduate students studying social sciences at
a Division 1 research university. The frequencies of the participants in the four learning style categories are the following: Convergent (n = 28), Divergent (n = 49), Assimilator (n = 76), and Accommodator (n = 40). The study implied that the dominant learning style was Assimilator and that learning style and gender influenced academic achievement.

Gokalp (2013) conducted a study to evaluate the Learning Styles of education faculty students and to determine the effect of their success and relationship between their Learning Styles and academic success. Sample includes 140: 68 art, 72 pre-school teacher department students. The study was found statistically significant between the results of the first and final applications of the subtests on Learning Styles and academic success; those subtests covered the items as learning, planned study, effective reading, listening, writing, note taking, using the library, getting pre- pared for and taking exams, class participation and motivation.

Mutua (2015) conducted a research to determine the relationship between learning style and academic achievement among secondary school students in Kenya’. Visual Auditory Kinesthetic model was used for the data collection. The findings of the study indicate that majority of the students are trimodal learners, followed by bimodal (VA) learners and thirdly by unimodal (V) learners. There is strong positive and statistically significant relationship between Learning Styles and academic achievement for the trimodal learners, and among male and female students.

Wickramasinghe and Hettiarchchi (2017) conducted a study to identify Learning Styles of students and observe the relationship among students’ learning styles, assessment methods and students' performances. Students at faculty of Information Technology in Horizon Campus were the sample selected for the study. The study was examined in such a way that depending on the students’ marks obtained in pre-assessments; it is aimed to
Instructional Strategies on Achievement in Mathematics

improve students' knowledge and skills in studying. Survey outcome revealed that there is a significant difference between marks of pre and post assessments and further it is fact that the students are performed better in preferred assessment methods/assessment methods based on their learning styles. So from survey outcomes it is evident that there is a relationship among students' learning styles, assessment methods and students performances of the selected group of students.

Studies Showing Negative or No Results.

The researcher could also find some studies which has negative effects of Learning Styles on Achievement. The studies are briefed as follows.

Garton, Spain, Lamberson, & Spiers (1999) in their study examined the relationship between Learning Style and achievement among 187 animal science students. Result showed that achievement was not significantly correlated with Learning Style.

A study conducted by Marszalek and Lockard (1999) investigated and compared the level of initial and long-term retention of frog internal anatomy using an interactive CD tutorial, a desk top micro world and conventional frog dissection. Additional data on student's preferred Learning Style were used to explore possible interaction effect with their respective instructional activity. No significant difference in Achievement by Learning Style was observed.

Stahl (2002) considers learning style approach to teaching as an utter failure and says that to find that assessing children’s Learning Styles and matching to instructional methods has no effect on their learning.

Massa and Mayer (2006) in their study claim that the usefulness of paying great attention to Learning Styles and matching them with teaching approaches is not proven.
Pashler, McDaniel, Rohrer, and Bjork (2009) in their report says that, they doubt on the usefulness to teachers, and others, on considering different Learning Styles in their practice.

Yilmaz and Akkoyunlu (2009) conducted this study to investigate the effect of Learning Styles on students’ achievement in different learning environments which were designed according to principles of Generative Theory of Multimedia Learning. The study used students’ achievement score and Kolb’s Learning Style Inventory to measure students’ learning style. Result of the study shows that the type of the learning style was not significantly effective on students’ achievement in different learning environments.

Pritchard (2014) says that individual learners have preferred ways of working, thinking and learning. If an individual’s preferred approach to learning tasks is ignored in the ways that a teacher expects them to work, there is distant possibility that their learning will not progress as efficiently and effectively as it might.

Wilkinson, Boohan, and Stevenson (2014) conducted a study to check whether Learning Styles have a direct effect on student performance in examinations, specifically in different forms of assessment. First year medical and dental students at Queen's University Belfast were considered as the sample. The study revealed that although the Learning Styles of students vary, they have little effect on academic performance, including in specific forms of assessment.

Kanadli (2016) conducted as study to calculate the effect size, by running a meta-analysis, of the experimental studies carried out in Turkey between 2004 and 2014 that investigate the effect of Learning Styles on academic achievement, attitude, retention, and to define whether the academic
achievement shows a significant difference in terms of Learning Styles model, experimental design and course type. A Meta analytical review method was conducted to combine the outcome of the independent experimental studies. The result of meta-analysis implied that the instructional designs based on the Learning Styles model had a large effect on the academic achievement ($d = 1.029$), attitude ($d = 1.113$) and retention ($d = 1.290$). Moreover, the academic achievement did not show any significant difference according to learning style model, course type and experimental design.

Xiaojie & Xianmin (2016) examined the interaction effects of Learning Styles and interest on the learning concentration and academic achievement of students who were asked to learn conceptual knowledge via their mobile phones in a classroom setting. 92 Chinese college students majoring in education were the sample of the study. The result of the study revealed that: Interest is significantly correlated with concentration, Learning Styles have no significant effect both on concentration and achievement; and learning styles, interest, and concentration do not yield interaction effects on the academic achievement of students.

Studies related with Learning Styles on Self Efficacy

Studies related with Learning Styles and Self Efficacy is presented. Studies are presented in the chronological order. Studies related to this section are almost few in numbers.

A study was conducted by El-Hmoudovaa (2015) to investigate the relationship between learning style preferences and self-efficacy for learning in a group of bachelor students of Tourism Management at the University of Hradec Kralove. This study aimed to check if the specific learning style preferences of the university students, who took part in the research within
lessons of professional English language, were associated with their self-efficacy for learning. The results of the study showed that there was a significant positive relationship between all of the learning style preferences with academic English lesson self-efficacy of students, but they also provided a good foundation for English language teachers from the Department of Applied Linguistics to design a teaching approach that would address the learning needs of all students.

Wongtienlai, Yaemsuda, Kampak and Mornthawee (2015) conducted a study aiming at studying the Learning Styles and self-efficacy of 177 nursing students studying in the first year to the fourth year in the academic year 2012 at the Royal Thai Navy College of Nursing, Naval Medical Department. The findings revealed that: Most of the nursing students were sensing learners in perception dimension (89.8 percent) while the rest of them were intuitive learners (10.2 per cent), and their self-efficacy was quite high ($X = 3.49$, $S.D. = .38$), and there was no significant association in Learning Styles and self-efficacy among students with different background, consisting of hometown, willingness to enroll and learning achievement.

**Conclusion**

A thorough survey of literature revealed a number of studies on Instructional Strategies (Brain Based Learning Strategy and Circles of Learning Strategy), and Learning Styles on Achievement and Self Efficacy.

Investigator reviewed many of studies related to the variables of the study from 1980 onwards. However, studies which have more pertinent relationship with independent and dependent variables after 1990s are only presented in the review of related studies. Investigator has presented 127 studies all together which were conducted both in India and other parts of the world.
In the literature review, investigator has mentioned 47 studies which is related to the effect of Brain Based Learning Strategy on Academic Achievement, in which 44 studies found a positive influence and 3 studies showed negative influence.

In the literature review, investigator could find only four studies which is related to effect of Brain Based Learning Strategy on Self Efficacy. It points to possibility of conducting deeper studies in this area.

In the literature review, investigator has mentioned 43 studies which is related to the effect of Circles of Learning Strategy on Academic Achievement, in which 35 studies found a positive influence and 8 studies showed negative influence.

Investigator could find only 5 studies which is related to effect of Circles of Learning Strategy on Self Efficacy. This area also needs further studies.

In the literature review, investigator has mentioned 26 studies which is related to the effect of Learning Styles on Academic Achievement, in which 16 studies found a positive influence and 10 studies showed negative influence.

Investigator could find only 2 studies which is related to effect of Learning Styles on Self Efficacy.

Studies reveal that Instructional Strategies (Brain Based Learning Strategy and Circles of learning Strategy) influences academic achievement. Most of the studies seeking the effect of Learning Styles reveal less influence on achievement. It is also noted from the review that very limited studies were found on Self Efficacy as a dependent variable. Thus, the investigator got an in depth knowledge of the variables and also the investigator was exposed to
the varied dimensions of the variables. Review of related studies made the investigator to feel a need to investigate into the effect of Instructional Strategies and Learning Styles on Achievement and Self Efficacy.