CHAPTER 1

INTRODUCTION

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Learning is a process which goes on forever, throughout the life span of an individual. Learning begets a formal framework when it comes to learning through schools. The fabric of such formal education is woven with proper Instructional Strategies as the warp and weft. Apt Instructional Strategy, appropriately matching the needs and peculiarities of the learners in mind, enhances the reach of the education and ensures successful learning.

In this era of digitalization, we find the progeny more exposed and adaptive than their progenitors towards state of the art technologies and innovations introduced each day. Are the quivers and arsenals of the teaching community better equipped in such modern scenarios is a matter of concern and dispute.

Advent of novel and precise technologies and innovations in the sphere of education has made their own positive resonance in the field of Instructional Strategies also. Paramount example of such path breaking and constructive interventions is Brain Based Learning Strategy. Frontier researches in neuro and medical sciences have shed insights into the anatomical point of view of human learning leading to the evolution of a branch of science with interdisciplinary connotations. Cognitive science presents itself as an ever expanding wave front of knowledge and insights with pioneering implications in education and pedagogical sciences (Caine & Caine, 1997; Jensen, 2008). It is Hart (1983) who said that, brain is the organ of learning. Brain Based Learning Strategy helps to learn in a natural way. This is a biologically driven strategy. It also gives importance to the biological factors of a student. Brain Based Education considered how the brain learns best and encouraged educators to take this information into consideration as they planned teaching strategies with the goal of more effectively motivating of all types of learners (Kaur, 2013).
In a world of diminishing social cohesion, cooperation, cooperative mindedness between students, parents, teachers, peers and different fractions of the society is a much desirable trait and attribute. We find gloomy days ahead as once feared by Albert Einstein and this world has become an unsafe haven with loud laurels of technology completely swamping chirping sweet human interactions. Blue Whales thrive in the meantime, no surprise. The attribute of cooperation effectively imbibed in the minds of younger generation, can be a panacea for many of the modern menaces of our society. **Cooperative Learning Strategy**, if better implemented within the walls of a classroom, can be a constructive initiative in this direction.

Cooperative learning has developed in early 1970’s as an alternative to the teacher dominant classrooms. The expectation is that they will provide more individual help for students, and as a result, achievement will be improved and this strategy is also advocated for its promotion of other goals such as improved social relations between races, ethnic groups, high and low achievers, or for increased productivity in problem solving (Johnson & Johnson, 1982; Johnson, Johnson & Maruyama, 1983 and Slavin, 1980).

No time should be lost in realising the manifold benefits of Instructional Strategies like Brain Based Learning Strategy and Circles of Learning Strategy of Cooperative Learning as both of them are more engrossed in child and society centred domains (Johnson & Johnson, 1975; Sharan & Sharan, 1976; Aronson, 1978; Slavin, 1980). Usage of same method of instruction may not be effective all the time. Teachers should experiment on different Instructional Strategies to cater the learning needs of their students. It should be noted that, Instructional Strategies play a pivotal role in effective learning.

Another attribute which corroborates a learning process is individual **Learning Styles**. Learning Styles exhibit a spectrum of variations among any
class of learners. If a teacher could orchestrate his/her Instructional Strategies, keeping in mind the plethora of Learning Styles of their learners in mind, the teaching-learning process becomes an opulent success story (Gokalp, 2013). The concept Learning Style refers to how people prefer to teach (Sternberg, 1994). All individuals have a preferred Learning Style in which they acquire and process knowledge. Learning Styles also proved beneficial to learning (Morris, Bryan, & Chilcoat, 2002).

Self Efficacy is a psychological variable which influences learning and achievement (American Society of Horticultural Science, 2011). When humans have a strong sense of perceived Self Efficacy, they put forth a greater effort to accomplish a task despite the obstacles they encounter than those who have a weak sense of Self Efficacy. Self Efficacy is very crucial in a student’s success. Teachers can stimulate the level of Self Efficacy in students using different Instructional Strategies. Many of the studies shed light towards the conclusion that Instructional Strategies and Learning Styles have significant effect on the Achievement (Duman, 2006; Oludipe, 2012, and Bhatti & Bart, 2013) and Self Efficacy (Oghyanous, 2017; Guvenac 2010, & El-Hmoudovaa, 2015).

**Need and Significance of the Study**

Primeval forms of present Instructional Strategies are conspicuous from antiquity itself. Different learning theories evolved at different chronological stages in the history of Education. Through the Age, theories on learning more efficient and more successful at the implication level emerged from their earlier generation. But at the core, these novel theories remained more innovative extensions of the earlier ones.

As in any other case, Instructional Strategies, successfully implemented by a Mathematics teacher, has a significant role in the level of
Achievement of students and their overall affinity to the subject. But unlike other subjects, need of Mathematics in the future life of an individual never desists. National Curriculum Framework (NCF), 2005 states that: “At the upper primary stage, students get the first taste of the power of Mathematics through the application of powerful abstract concepts that compress previous learning and experience. This enables them to revisit and consolidate basic concepts and skills learnt at the primary stage, which is essential from the point of view of achieving universal mathematical literacy. Students are introduced to algebraic notation and its use in solving problems and in generalisation, to the systematic study of space and shapes, and for consolidating their knowledge of measurement. Data handling, representation and interpretation form a significant part of the ability of dealing with information in general, which is an essential 'life skill'. The learning at this stage also offers an opportunity to enrich students' spatial reasoning and visualisation skills”. New and abstract concepts of Mathematics are presented at the Upper primary level. If the students won’t familiarise or acquaint with the new knowledge they learn, their higher learning will get stagnant. It is at this juncture that a mathematics teacher should use the most apt strategy to convey the learning material in different ways in accordance with the content.

It’s in the hands of a primary school Mathematics teacher, to shed the formidable image of this subject in the minds of his/her pupils and get them acquainted with a magical world ahead. This being the goal set, adoption of proper Instructional Strategy becomes a point of cardinal importance. Instructional Strategies incorporating ample provisions for enhancement of cognitive and psycho motor development of children are most desirable.

Even at the beginning of the 19th century, teacher oriented Instructional Strategies were prominent and pupils were considered as mere empty vessels filled only at the mercy of their mentors. After this epoch,
paradigm shifts began to rise and now Instructional Strategies have become predominantly child centered. Brain Based Learning Strategy and Circles of Learning Strategy are two innovative strategies which were developed giving due importance to various aspects of student learning.

For the present experimental study, the investigator has chosen two independent variables (Instructional Strategies and Learning Styles) and two dependent variables (Achievement in Mathematics and Self Efficacy). Brain Based Learning Strategy, Circles of Learning strategy and the prevailing Activity Oriented Method of Teaching are the Instructional Strategies considered for the experiment. Traditional teaching may not be fully capable in rendering the desired cognitive and affective outcomes of education. So the teachers’ should be well aware and careful in selecting the appropriate Instructional Strategies while teaching.

Cutting edge developments in Science and Technology and frontier researches in modern medicine have a pioneering effect on the evolution of recent learning strategies. Of the various Child Centered Instructional Strategies, the one which stands more in proximity to modern day scientific innovations especially modern medical and neuro-science advancements is the Brain Based Learning Strategy. This strategy provides a threat free, brain-friendly environment and the meaningful presentation of content helps the learners’ brain to store, process and retrieve the information in a more comfort way. Educators working in brain friendly environments can develop an unprecedented professional competence that will enable students to reap the rewards of powerful, successful learning (Erlauer, 2003).

Many studies have showed proven benefits of Brain Based Learning Strategy (Van & Rice, 1984; Avaci & Yagbasani, 2004; Cengelci, 2005; Waters, 2005; Duman, 2006, and Inci & Erten, 2011 ) on Achievement. Hill (2013), in his study shows that this strategy is positively related to Self
Efficacy too. Studies on relationship between Brain Based Learning Strategy and its effect on Self Efficacy have found to be few in number. Some studies with negative influence of Brain Based Learning Strategy on Achievement were also found (Duman, 2010; Tilton, 2011 and Elwick, 2014).

Child Centered Instructional Strategies accentuate giving proper attention to needs and necessities of children. Conducive and cooperative learning atmosphere with stark deviation from hitherto prevailing authoritarian teacher oriented ways, were contemplated here. Among other noticeable postulations of this field a brave advancement came in the form of concept of Cooperative Learning.

“Co-operation is working together to accomplish shared goals. Within co-operative situations, individuals seek outcomes that are beneficial to themselves and beneficial to all other group members. Co-operative Learning is the instructional use of small groups so that students work together to maximize their own and each other’s learning” (Johnson, Johnson & Holubec, 2002).

More than academic accolades, this method imbibes values like compassion, sense of togetherness, positive outlook, decision making capabilities, and sense of sharing, conflict management skills, and trust building. With the decay and disappearance of joint family system in our country, it has become a concern of the society and educators, how to inculcate such values effectively on the progeny. “Let’s swim or sink together” being the key word, this strategy makes its candidates better equipped in the pursuit of life.

Studies undoubtedly prove the positive effects of Co-operative learning on achievement (Felder, 1995; Robyn & Adrian, 1996; Sasidharan, 1997, Ginsburg-Block and Funtuzzo, 1998; Sullivan & King, 1999; Hameed, 2003,
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and Thasneem, 2014). Self Efficacy, the second dependent variable selected has positive effect from Cooperative Learning (Guvenc, 2010). Some studies also showed negative effects of Cooperative Learning on Achievement (David, 1990; Abu & Flowers, 1997; Inuwa, Abdullah & Hassan, 2017).

Since Learning Style is selected as the second independent variable for the present study, investigator finds the significance with Achievement and Self Efficacy. Each individual enjoy various Learning Styles. Learning materials has to be presented in such a way that it can be blended with one’s Learning Style. Learning Styles has greater importance in a teaching-learning process. Researches on Learning Styles and achievement indicates a significant positive relationship (Abidin, Rezaee, Abdulla & Singh, 2011). Studies show that Learning Style has significant effect on Self Efficacy (Geiser, 1999; Wang, Wang, Wang & Huang, 2006, and Orhun, 2012). The investigator could also find studies which has negative effect of Learning Styles on Self Efficacy (Marszalek & Lockard, 1999; Yilmaz & Akkoyunlu, 2009; Kanadli, 2016, and Pritchard, 2014).

Recent studies which depict poor achievement in Mathematics among school children can be constructively interfered with effective corrective measures if the present educational system is reconstructed with elegant incorporation of the tenets of Brain Based Learning Strategy and Circles of Learning Strategy. From the review of related literature, the investigator could not find adequate number of studies which examined the crossover effects of Instructional Strategies (Brain Based Learning Strategy, Circles of Learning Strategy and Activity Oriented Method of Teaching) and Learning Styles on Achievement in Mathematics and Self Efficacy at Upper primary level especially in the Indian scenario. This inspired the investigator to study the effect of Instructional Strategies and Learning Styles on Achievement in Mathematics and Self Efficacy of Standard VII students.
Statement of the Problem

Statement of the problem outlines the research purpose, variables selected and the issues to be addressed. 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. Hence the study is stated as, **Effect of Brain Based Learning Strategy and Circles of Learning Strategy on Achievement in Mathematics and Self Efficacy of Standard VII Students.**

Definition of Key Terms

The key terms expressed in the statement of the problem are defined further.

**Effect**

Dictionary of Education defines 'effect' as "the treatment or the effect of an experimental factor for a given level of value of a control variable; the effect of an experimental factor under controlled conditions, that is with other factors held constant"(Good, 1973). Effect is the interaction effect attributable to the examination of variables above and beyond that which can be predicted from variables considered singly (Winer, 1977).

In the present study, Effect stands for the outcome of the treatment of independent variables on dependent variables. That is, the investigator has made an effort to find out the influence of certain Instructional Strategies (Brain Based Learning Strategy, Circles of Learning Strategy and Activity Oriented Method of Teaching Learning) on Achievement in Mathematics and Self Efficacy of Standard VII Students.
Brain Based Learning Strategy

Brain-Based Learning involves accepting the rules of how the brain processes, and then organizing instruction bearing these rules in mind to achieve meaningful learning (Caine & Caine, 1994). According to Jensen (2008), Brain-Based Learning is related to teaching strategies and principles from an understanding of how the brain functions and learning with the brain in mind. Brain based learning involves 12 major principles on which the brain works. On the basis of these principles the strategy is build on three processes like Relaxed Alertness, Active Processing of Experience and Orchestrated Immersion.

In the present study, the researcher benefited the seven staged Brain based lesson planning outlined by Jensen (2008) for framing lesson transcripts.

Circles of Learning Strategy

Circles of Learning Strategy is a Cooperative Learning method in which students work together on a given academic tasks in small groups (usually four to five members) to help themselves and their group members to learn together and achieve the goal to get rewarded in some way for performance as a group (Johnson, Johnson, & Holubec, 1994).

For the present study, researcher employed the six-staged lesson plan authored by Johnson, Johnson, & Holubec, (1994).

Achievement in Mathematics

Achievement is the accomplishment or proficiency of performance in a given skill or body of knowledge (Good, 1973).
In the present study Achievement in Mathematics is the academic achievement of an individual in Mathematics measured in terms of a Standardized Achievement Test.

**Self Efficacy**

Self Efficacy is the belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations (Bandura, 1986).

In the present study Self Efficacy refers to much more specific and situational judgment of capabilities of Standard VII students towards Mathematics Learning that is Self Efficacy in Mathematics measured using a Standardised tool.

**Standard VII Students**

Standard VII Students in the present study denote the students who are attending standard VII in any of the recognised schools of Kerala state.

**Variables of the Study**

The main intention of the study was to find 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. The Independent, Dependent and Control variables are described as follows.

**Independent Variables**

The independent variables of the present study are:

- Instructional Strategies (Brain Based Learning Strategy, Circles of Learning Strategy and Activity Oriented Method of Teaching)
- Learning Styles (Visual, Auditory and Kinesthetic Styles)
Dependent Variables

The dependent variables which were measured are:

- Achievement in Mathematics (Total and Objective wise scores) and
- Self Efficacy

Control Variables

Since the study was experimental in nature, some variables were treated as control variables. Those variables are

- Pre experimental Status in terms of Achievement in Mathematics
- Pre experimental Status in terms of Self Efficacy
- Verbal Intelligence
- Non- Verbal Intelligence
- Classroom Environment

Objectives of the Study

Objectives are considered as the statements which help or direct the investigator to analyse the variables and its influence. Three major objectives were formulated for the present study. The first objective was to find out the opinion and suggestions of Upper Primary Mathematics Teachers’ on experimenting different innovative Instructional Strategies in Upper Primary Mathematics classroom.

The second objective was to investigate and examine the effectiveness of Brain based learning Strategy and Circles of Learning Strategy over Activity Oriented Method of Teaching in terms of Achievement in Mathematics and Self Efficacy of standard VII students.
The third objective was to investigate the main and interaction effects of Instructional Strategies on Achievement in Mathematics and Self Efficacy of standard VII students.

The specific objectives formulated are as follows:

1. To identify the prevailing and innovative Instructional Strategies adopted by Teachers’ to teach Mathematics at Upper Primary School Level.
2. To find out the issues (if any) experienced by the Mathematics Teachers in implementing innovative Instructional Strategies at Upper Primary School Level and to suggest measures (if any) to overcome the constraints in implementing the innovative Instructional Strategies at Upper Primary School Level.
3. To study whether there exists any significant difference in the mean Achievement in Mathematics (Total and Objective wise scores) of the Experimental and Control groups for the Total sample, Boys and Girls.
4. To study whether there exists any significant difference in the mean Gain score of Achievement in Mathematics of the Experimental and Control groups for the Total sample, Boys and Girls.
5. To study whether there exists any significant difference in the mean Self Efficacy of the Experimental and Control groups for the Total sample, Boys and Girls.
6. To study whether there exists any significant difference in the mean Gain score of Self Efficacy of the Experimental and Control groups for the Total sample, Boys and Girls.
7. To study the effectiveness of Brain Based Learning Strategy (BBLs) over Activity Oriented Method of Teaching (AOMT), if any, in terms of Achievement in Mathematics of standard VII Students.
8. To study the effectiveness of Circles of Learning Strategy (CLS) over Activity Oriented Method of Teaching (AOMT), if any, in terms of Achievement in Mathematics of standard VII Students.

9. To study the effectiveness of Brain Based Learning Strategy (BBLS) over Circles of Learning Strategy (CLS), if any, in terms of Achievement in Mathematics of standard VII Students.

10. To study the effectiveness of Brain Based Learning Strategy (BBLS) over Activity Oriented Method of Teaching (AOMT), if any, in terms of Self- Efficacy of standard VII Students.

11. To study the effectiveness of Circles of Learning Strategy (CLS) over Activity Oriented Method of Teaching (AOMT), if any, in terms of Self- Efficacy of standard VII Students.

12. To study the effectiveness of Brain Based Learning Strategy (BBLS) over Circles of Learning Strategy (CLS), if any, in terms of Self- Efficacy of standard VII Students.

13. To study the main effects of the Instructional Strategies and Learning Styles on Achievement in Mathematics (Total and Objective wise scores) of standard VII Students for the Total sample, Boys and Girls.

14. To study the interaction effect of the Instructional Strategies and Learning Styles on Achievement in Mathematics (Total and Objective wise scores) of standard VII Students for the Total Sample, Boys and Girls.

15. To study the main effects of Instructional Strategies and Learning Styles on Self Efficacy of standard VII Students for the Total sample, Boys and Girls.

16. To study the interaction effect of Instructional Strategies and Learning Styles on Self Efficacy of standard VII Students for the Total sample, Boys and Girls.
Hypotheses of the Study

Hypotheses play a vital role in planning and executing an experimental study. A formalized hypothesis will force us to think about what results we should look for in an experiment. In the present study also, it was necessary to formulate some assumptions regarding the expected outcomes of the study.

The present study was designed to test the following hypotheses.

1. There will be no significant difference in the mean Achievement in Mathematics (Total and Objective wise scores) of the Experimental and Control groups for the Total sample, Boys and Girls.
2. There will be no significant difference in the mean Gain score of Achievement in Mathematics of the Experimental and Control groups for the Total sample, Boys and Girls.
3. There will be no significant difference in the mean Self Efficacy of the Experimental and Control groups for the Total sample, Boys and Girls.
4. There will be no significant difference in the mean Gain Score of Self-Efficacy of the Experimental and Control Groups for the Total sample, Boys and Girls.
5. Students taught through Brain Based Learning Strategy (BBLs) will not differ significantly from Students taught through Activity Oriented Method of Teaching (AOMT) in terms of Achievement in Mathematics.
6. Students taught through Circles of Learning Strategy (CLS) will not differ significantly from Students taught through Activity Oriented Method of Teaching (AOMT) in terms of Achievement in Mathematics.
7. Students taught through Brain Based Learning Strategy (BBLS) will not differ significantly from Students taught through Circles of Learning Strategy (CLS) in terms of Achievement in Mathematics.
8. Students taught through Brain Based Learning Strategy (BBLS) will not differ significantly from Students taught through Activity Oriented Method of Teaching (AOMT) in terms of Self Efficacy.

9. Students taught through Circles of Learning Strategy (CLS) will not differ significantly from Students taught through Activity Oriented Method of Teaching (AOMT) in terms of Self Efficacy.

10. Students taught through Brain Based Learning Strategy (BBLS) will not differ significantly from Students taught through Circles of Learning Strategy (CLS) in terms of Self Efficacy.

11. There will be no significant main effects of Instructional Strategies and Learning Styles on Achievement in Mathematics (Total and Objective wise scores) of standard VII Students for the Total sample, Boys and Girls.

12. There will be no significant interaction effect of Instructional Strategies and Learning Styles on Achievement in Mathematics (Total and Objective wise scores) of standard VII Students for the Total sample, Boys and Girls.

13. There will be no significant main effects of the Instructional Strategies and Learning Styles on Self -Efficacy of standard VII Students for the Total sample, Boys and Girls.

14. There will be no significant interaction effect of the Instructional Strategies and Learning Styles on Self -Efficacy of standard VII Students for the Total sample, Boys and Girls.

**Methodology in Brief**

The methodology adopted for the present study is briefed as followed. The design and sample are as follows.
Design of the Study

The present study was conducted employing the experimental design, specifically the Quasi Experimental Design. The design selected for the present study was the Non-Equivalent Groups Pretest – Posttest Control and Comparison Group Design. This design incorporates two experimental groups and one control group.

Sample Selected for the Study

Three intact class groups of 40 students each (Total 120 students) were selected as the sample for the study in Experimental Group I (BBLS), Experimental Group II (CLS) and the Control group (AOMT). Two Schools from Malappuram district of Kerala were chosen to conduct the experimental process. The three groups were selected randomly giving due representation to their previous Achievement. One division of VII Standard students of Govt. Model Higher Secondary School, Calicut University was taken as Experimental Group I (BBLS). Two divisions from Puthur Pallikkal U.P School were taken as Experimental Group II (CLS) and the Control Group respectively.

Tools, Techniques and Materials used for the Study

The investigator used the following tools to accomplish the present study. The study made use of the tools which were developed by the researcher and others which are listed below.

Semi-Structured Interview Schedule for Upper Primary Mathematics Teachers (Hameed & Asha, 2014).

The Schedule was prepared for the Upper Primary Mathematics Teachers to gather information on the prevailing and innovative Instructional Strategies they use while doing Mathematics instruction. The interview also
intended to find out the problems and constraints they face, if any, in adopting new strategies and the suggestions they wish to put forward. Expert opinion was collected on the schedule for validation.

**Lesson Transcript for Brain Based Learning Strategy (Hameed & Asha, 2014).**

Lesson Transcript for Brain Based Learning Strategy was prepared for the Experimental Group I. The investigator prepared Lesson Transcripts for Brain Based Learning Strategy following the 12 major principles (Caine & Caine, 1994) on which the brain works. On the basis of these principles the strategy was build on three processes and the elements of optimum teaching like Relaxed Alertness, Orchestrated Immersion and Active Processing of Experience.

**Lesson Transcript for Circles of Learning Strategy of Co operative learning (Hameed & Asha, 2014).**

Lesson Transcript for Circles of Learning Strategy was prepared for the Experimental Group II. Circles of Learning Strategy are derived from Cooperative learning. The investigator prepared Lesson transcripts based on six phases (Johnson, Johnson, & Holubec, 1994). They are

i. Specifying the objectives for the lesson
ii. Making pre-instructional decisions about learning groups, room arrangements, instructional materials and students, roles within the group.
iii. Explaining the task and goal structure to the students.
iv. Setting the cooperative lesson in motion.
v. Monitoring the effectiveness of the cooperative learning groups and intervening as necessary.
vi. Evaluating students' achievement and helping them discuss how well they collaborated with each other.

**Lesson Transcript for Activity Oriented Method (Hameed & Asha, 2014).**

Activity Oriented Method is the prevailing strategy practiced in the Upper Primary Schools in Kerala State. The lesson transcripts were prepared based on Activity Oriented Method which was validated by the experts in the field.

**Learning Styles Inventory (Hameed & Meharunnisa, 2014).**

Learning Styles is defined as the composite of characteristics; cognitive, affective and psychological factors that serve as relatively stable indicators of how a learner perceives, interacts with and responds to the learning environment (Kefee, 1979). Learning Styles is the general tendency to adopt a learning strategy (Entwistle, 1981).

In the present study, Learning Styles is the general tendency of preference (Visual/ Auditory/ Kinesthetic) which was measured using a standardized Learning Style Inventory. Learning Style Inventory was used to identify the individual’s preferred Learning Styles used in different situation related to learning. Three main types of Learning Styles used in this tool are Visual Style, Auditory Style and Kinesthetic Style.

**Achievement Test in Mathematics- ATM (Hameed & Asha, 2014).**

Achievement Test in Mathematics was developed and standardized by Hameed and Asha (2014). It was administered as the Pre-test and Post test before and after the treatments respectively. It was constructed based on the three topics selected for the treatment.
Scale of Self Efficacy (Hameed & Nitha, 2014).

Scale of Self Efficacy was used to measure students’ ability to solve Mathematics problems, dealing with day to day mathematics-related tasks and to meet others expectation. The major dimensions considered for the Scale on Self efficacy were Self Efficacy for Academic Achievement, Self Learning, Social Self Efficacy and Self Efficacy to meet others’ expectation.

Verbal Group Test of Intelligence - VGTI (Kumar, Hameed & Prasanna, 1997).

Verbal Intelligence, another control variable, was measured using Verbal Group Test of Intelligence, developed by Kumar, Hameed and Prasanna (1997). The test consists of five sub tests of twenty multiple choice items each (Totally 100 items) belong to five components namely Verbal Analogy, Verbal classification, Numerical Reasoning, Verbal Reasoning and comprehension.


Non Verbal Intelligence, one of the control variable, of Students of the Experimental Group I, Experimental Group II and the Control Group were measured using Standard Progressive Matrices Test, developed by Raven (1958). The test consists of five subtests of twelve items each including a diagrammatic puzzle to solve.

Classroom Environment Inventory (CEI), (Aruna, Sureshan & Unnikrishnan 1998).

The main purpose of tool was to get a fine picture of the Classroom Environment. The individual dimension used for the construction of classroom Environment Inventory were Material Environment, Cohesiveness,
Task orientation, Innovation, Teacher support, Personalization, Independence, Teacher Control, Friction and Competition.

**General Data Sheet for Assessing Socio-Economic Status (SES).**

General Data Sheet was used to obtain the Socio Economic Status of the students of two Experimental groups and the Control group. Information regarding Income, Education and Occupation of parents were included in the General Data Sheet.

**Statistical Techniques Used**

The investigator employed both the descriptive and inferential statistics to carry out the analysis. The researcher made use of the following Statistical techniques to arrive at the findings.

- Major Descriptive Statistics like Mean, Median, Mode, Standard Deviation, Skewness and Kurtosis.
- Percentage Analysis to find impressions of Upper Primary Mathematics Teachers on different Instructional Strategies.
- One Way ANOVA to compare the effect of Instructional Strategies on the Achievement in Mathematics and Self Efficacy.
- Graphical representations are also made suitably to visually compare the individual post test scores and gain scores of the three groups with respect to Achievement in Mathematics and Self Efficacy.
- Effect size was employed to find how much the effect of Instructional Strategies on Achievement and Self Efficacy is.
- Two Way Factorial ANCOVA procedure was employed to find the effectiveness of Brain Based Learning Strategy and Circles of Learning Strategy over Activity Oriented Method on Achievement in Mathematics and Self Efficacy even after controlling the covariates singly and in combination.
Two Way ANOVA was employed to find out the main and interaction effects of Instructional Strategies and Learning Styles on Achievement in Mathematics and Self Efficacy.

Scheffe’ Test of Post-hoc Comparison was used to compare the adjusted criterion means of the two experimental groups and control group. In case, detailed analysis of the data and discussion on the results are prescribed in the following chapters.

Detailed analysis of the data and discussion on the results are presented in the succeeding chapters.

Scope of the Study

Although Mathematics is an alluring subject, many of the students fear and dislike this subject due to many reasons like its abstractness, teaching methods, used poor commands over tables, poor teachers, no logical development, and long time for calculation (Kumar, 2013). Innovative and creative learning situations can eliminate this fear and can create better learning situations. Instructional Strategies like Brain Based Learning Strategy and Circles of Learning Strategy can be implemented in Mathematics education at Upper Primary School level. Researcher considers the opportunity bestowed inestimable, being able to come in close contact with path breaking innovations in the field of education, like Circles of Learning Strategy and Brain Based Learning Strategy. Even in this world of virtual class rooms and teacher nonexistent instructional scenarios, concepts like Circles of Learning and Brain Based Learning never lose their grounds.

The main aim of the present study was to find out the effectiveness of Brain Based Learning Strategy and Circles of Learning Strategy over Activity Oriented Method of Teaching in terms of Achievement in Mathematics and Self Efficacy of Standard VII Students. The study also investigated the main
and interaction effects of Instructional Strategies and Learning Styles on Achievement in Mathematics and Self Efficacy of Standard VII Students. Quasi Experimental Design, specifically the Non-Equivalent groups Pretest – Posttest, Control and Comparison Group Design, was selected for the present study. Appropriate tools, technique and Materials were used for the present Experiment Study.

Investigator feels satisfied in the result of study that it can be utilized by Mathematics Teachers in their classroom. Strategies analyzed here were Brain Based Learning Strategy, Circles of Learning Strategy and Activity Oriented Method of Teaching. From the Literature Review, many studies prove that Brain Based Learning Strategy and Circles of Learning Strategy fit well for Mathematics Instruction. It is expected that the result will shed positive thoughts on imparting instruction through these strategies.

There are numerous strategies in the present educational scenario in accordance with different learning situations. Upper primary school students are more vibrant and have eagerness to learn. Their energy can be utilized to different activities and their eagerness can be channelled to make a platform of learning, thinking, reasoning, creating, discussion and decision making. Apart from all the academic qualities, teachers can mould their students into better humans. Brain Based Learning Strategy and Circles of Learning Strategy are two different Instructional Strategies that has relevance in the present scenario and these two strategies were incorporated in the current study.

Brain learns; how it learns was an unanswered inquest posed since the beginning. Brain Based Learning Strategy is built on the notions adopted from neuroscience. Ultra-modern equipments used to trace brain images revealed the process happens in the brain while a person learns. So, the techniques to enhance learning are presented in Brain Based Learning Strategy. Brain
Based Learning Strategy is one among the new trends in Instructional Strategies since it has direct application from neuroscience. What happens in the brain while learning is the effective connection of one neuron with the other and the connections go strong. So, the connections should be made stronger while teaching. Since Mathematics is little abstract in nature, basic assumptions and concepts should be made clear to the students. What students learn in the Upper primary paves a strong foundation to build new concepts. So, Brain Based Learning Strategy can be used in Mathematics Instruction.

Circles of Learning Strategy, derived from Cooperative Learning, have proven benefits on Academic Achievement. What we lack in the present culture is sharing, and helping mentality. Cooperative Learning Strategy is the most adored Learning Strategy since it promotes sharing, discussion, cooperativeness and many more qualities. Circles of Learning Strategy is a Cooperative Learning method that paths the importance of cooperativeness which is not common among students. Psychology behind this strategy aims definitely on improving inter personal, leadership, problem solving ability, group skills and social behaviours of students.

Researcher has selected standard VII students for the Experimental Study and their Achievement in Mathematics and Self Efficacy were measured to find the effect of the two Instructional Strategies that was used for transmission of the content. Researcher expects that the study will show a path for future researchers and practice innovative teaching methods to impart education. Thus, this study can be considered as a great benefit for Upper Primary Mathematics School Teachers and Learners.

**Limitations of the Study**

The investigator has taken enough attention in selecting the variables for the present study. A detailed review of literature and the previous studies conducted on the selected variables were carried out with enough care.
Although the researcher has coordinated the whole experimental procedure such as the selection of the variables, strategies adopted, tools, techniques, and materials administered, and analysing the data with enough care, there may be some limitations percolated into its path.

Since the researcher is a student of Mathematics, the experiment was conducted only on Mathematics subject and, the medium of instruction was English. Researcher has considered only standard VII students of Kerala State.

The sample selected consisted of three intact classes which were assigned as Experimental group I, Experimental group II and Control group. But the initial differences if any in Pre-Experimental Status in terms of Achievement in Mathematics and Self Efficacy, Verbal Intelligence, Non-Verbal Intelligence, Socio Economic Status, and Classroom Environment were controlled statistically using Analysis of Covariance. So, the study could ensure a valid result. The researcher also expects that the result of the study can be generalised since all the attempts were made to eliminate the effect of extraneous variables.

Due to the time constraints, the topic selected comprised of only three units from the prescribed Mathematics text book. Since the syllabus was taken from the prescribed text book for Students studying under Kerala syllabus, the results may be applicable to Kerala State only.

Researcher has selected Achievement in Mathematics and Self Efficacy as the dependent variables for the study. Instructional Strategies and Learning Styles were selected as the independent variables. Among the cognitive and affective variables affecting learning, the selected variables were felt more pertinent to the researcher. Constraints in time, if better addressed, could have led to collection of more data from more voluminous
samples with taking into account more elaborate variables with due interpretations.

Despite the limitations, all the plausible efforts were taken by the researcher to make the present study as valid as possible. The researcher wishes that the present study will bring a positive reflection so as to experiment the Brain Based Learning Strategy and Circles of Learning Strategy in Mathematics instruction.

Organisation of the Report

The present Study is presented in five Chapters Namely Introduction, Review of Related Literature, Methodology, Analysis & Summary, Findings and Suggestions. These Chapters with its subsections are explained as follows

Chapter I  Introduction

This chapter details about the background of the study and the Need and significance of the study. It also briefs about the Statement, Definition of Key Terms, Variables Objectives and Hypotheses of the Study. This chapter also portrays the Methodology, Scope and Limitations of the study. Later part of the chapter outlines the organisation of the report.

Chapter II  Review of Related Literature

This chapter deals with the literature review and the earlier studies conducted in the area of this present research. First part details the theoretical framework of the Variables Instructional Strategies (Brain Based Learning Strategy and Circles of Learning Strategy), Learning Styles and Self Efficacy. Second part details about the Review of Related Studies on Brain Based Learning Strategy and Achievement, Studies on Brain Based Learning Strategy and Self Efficacy, Studies on Circles of Learning Strategy and Achievement, Studies on Circles of Learning Strategy and Self Efficacy,
Studies on Learning Styles and Achievement, and Studies on Learning Styles and Self Efficacy.

Chapter III Methodology

Methodology chapter details about the Variables of the study, Objectives and Hypotheses, Design of the Study, and Procedure of the study. Last section of this report deals with the Summary of the Procedure.

Chapter IV Analysis

Analysis and results of the present study is presented in this chapter. First section deals with the Percentage Analysis. Preliminary Analysis like Important Statistical Constants and Establishing the Equivalence of Groups presented in the second section. Third section deals with Major Analysis I which details the One Way Analysis, Effect Size and Two Factorial Analysis of Covariance for Achievement in Mathematics and Self Efficacy. Fourth section deals with Major Analysis II in which Two Way Analysis of Variance for Achievement in Mathematics and Self Efficacy.

Chapter V Summary, Findings and Suggestions

This chapter outlines the Study in Retrospect, Major Findings of the Study, and Tenability of Hypotheses. This chapter also describes the Educational Implications Derived and Suggestions for Further Research.