**EFFECT OF INSTRUCTIONAL LEARNING STRATEGIES ON ACHIEVEMENT IN MATHEMATICS OF
STANDARD VIII STUDENTS**

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**the University of Calicut in partial fulfillment of the
requirements for the award of the degree of**

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**2010**

**DECLARATION**

 I, **DILSHATH. K**., do hereby declare that this dissertation entitled **“EFFECT OF INSTRUCTIONAL LEARNING STRATEGIES ON ACHIEVEMENT IN MATHEMATICS OF STANDARD VIII STUDENTS”** has not been submitted by me for the award of any Degree, Diploma, Title or Recognition before.

Farook Training College **DILSHATH. K.**

18.11.2010

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 Farook Training College

18.11.2010 **DILSHATH. K.**

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**One**

**INTRODUCTION**

* Need and Significance
* Statement of the Problem
* Definition of Key Terms
* Variables Selected for the Study
* Objectives
* Hypotheses
* Procedure
* Scope and Limitations of the Study
* Organization of the Report

 Research studies are always a search to find out something new. In the field of education, research should help teachers, academicians and policy makers to develop, implement and analyse new modalities in curriculum construction and transaction. Today’s world needs teachers who can do more than executing traditional way of thinking and teaching. It is equally important that teachers should participate in the process of curriculum development and implementation. This is possible only if teachers have a research aptitude and experience. Experimental studies in the field of education is a way to suggest new instructional strategies and techniques in classroom atmosphere.

 Indian educational system has been constantly subjected to reforms. Reforms in the educational policies, administration, curriculum, text books and also in pedagogic techniques make our educational scene more complex than ever before. The pivotal aspect in all educational reforms was the raw material of the pedagogic process-the child. Educational researchers, policy makers, administrators and all well wishers of our educational system aim at the fuller development of the child. All reforms are made with this end in view. Instructional strategies have been developed and practiced one by one to boost-up student achievement in different academic subjects especially in Mathematics. Previously, efforts have been mainly vested in the areas of curriculum, school policies and textbooks. But more recently, attempts are being concentrated to make classroom practices more flexible and attractive to pupils. At the same time, a growing interest has also been sensing to make the students to feel the process of learning as a meaningful and happy affair. In connection with these efforts some reflections of success have been reported from some kind of innovative practices in the classrooms; but these attempts are very rare.

 The notion that the teacher is the supreme authority in the classroom has gone behind the curtain. Because, it is accepted that students are able to construct knowledge by themselves. Teacher is only a helper who makes the avenues for learning. The concept of the psychological process of student learning is also changed drastically. Present day teachers should be able to realize the fact that all classical theories of learning explain the process of learning from the point of view of an observer. All classical learning theories do not consider the learner’s views about their own learning. Each and every student has his own perspectives about the what and how of his learning, because student learning in the classroom is a personal mental event; an event through which the learner constructs his own knowledge from the psychosocial and pedagogical environment of the classroom. So the brightness of the picture and the role of the teacher is minimized. That is why new generation teachers strongly believe that no teacher can teach any student; but the student can learn. What the teacher does is to show them how the materials to be taught are associated, derived or explained. What the students learn is what they themselves do. Thus learning becomes a live, interactive process.

 When we think in these lines, it is very appropriate to look at the pedagogic practices adopted in most of our classrooms. Teacher still holds the supreme position. Instead of constructing knowledge by the students themselves, the teacher acts as the knowledge giver and students as the knowledge recipients. What pathetic the situation is! No act of knowledge construction goes on. Students are competing each other to get high position in the grading system. They become more and more selfish in academic matters. In all walks of life, competition and selfishness is prevailing. Our classrooms are not an exception. In the very early childhood years, parents train them to be competitive and selfish for individual gains. Consequently, what happens is the inevitable human quality for a community life is alienated from them. Individual interest predominates and a we feeling or togetherness is away from our students.

 Cooperative Learning exists when students work together to achieve joint learning goals. Any assignment in any curriculum for any age students can be done cooperatively. It promotes student’s psychological health and social competencies. Psychological health is the ability to develop, maintain and modify inter dependent relationships with others to succeed in achieving goals. Here comes the relevance of innovative instructional strategies developed by several researchers (Johnson & Johnson,1975; Sharan & Sharan,1976; Aronson,1978; Slavin,1980), Cooperative Learning is one of the important strategy among them.

**1.1. NEED AND SIGNIFICANCE**

 Mathematics is a systematized, organized and exact branch of science. It is the numerical and calculation part of man’s life and knowledge. It helps man to give exact interpretations to his various ideas and calculations. It is a science of logical reasoning and numerical problems. It deals with qualitative facts and relationships as well as with problem’s involving space and form. The scope of Mathematics is very wide, as it covers all the activities of human beings. Therefore the systematic and organised study is an essential for Mathematics learning.

 Using the existing methods, children are not getting successful results in Mathematics. But using Cooperative Learning (Jigsaw-II) every child will be having better understanding and maximum output( Artzt, *et al*., 1997) Cooperative Learning is a social process and that Cooperative Learning activities are essential if students are want to be able to construct their own knowledge. Jigsaw method is intended to maximize the learning of children in Mathematics. It helps in reducing the stress on child while solving the problem and this method will help children to learn things directly connected with life. John Dewey, in his book “Democracy and Education”, was one of the first to argue that the classroom should mirror the larger society and be a laboratory for real life learning. Better result of group working is utilized in this method, because group is not a occasional one but a permanent system. Though we have applied so many new methods of instruction, achievement in Mathematics is still reducing and in such a situation Jigsaw Method will be of sure help in academic achievement in Mathematics.

 Normally the context of learning in our classrooms are characterized by tension, fear and anxiety from the part of the students. Teachers are making the classroom environment in such a way to create tension, fear and anxiety among students.

 Over seriousness attached by teachers in the instructional process is the curse of the existing teaching learning process. Students have to lose the smoothness and flexibility of their learning. The ultimate result is that students may develop an aversion towards the classroom process. Consequently, classroom learning becomes a boring, fearful and tensed event, and an event in which the teacher dominates and tries to get the things done for him/her; not for students.

 Academic achievement is one of the prime concerns of learning, whether it is individual learning, whole class learning or Cooperative Learning like Jigsaw. Plenty of studies revealed that there is a positive relationship between Jigsaw learning (or such collaborative learning strategies) and academic achievement. Fraser and Walberg (1984) give evidence from studies that Cooperative Learning was more successful than other competitive or individualistic learning. In the study of Sharan (1980), it has been consistently demonstrated that student’s cooperation facilitates academic achievement. Several other studies proved the positive relationship between Cooperative Learning and Academic Achievement. Intensive studies conducted by Slavin (1980), Glass *et al.* (1982), Olsen and Kagan (1992) reported that there is a positive relationship between Cooperative Learning Strategy and pupil’s Academic Achievement. Review of related literature revealed that Cooperative Learning also promotes self esteem, inter-ethnic relations, collaborative work, intergroup relations etc. Three major volumes of Cooperative Learning research (Johnson and Johnson, 1975; Sharan, 1990; Slavin, 1990) have been published and that extended the findings of earlier researches to include further evidence that cooperation promotes self-esteem increased efforts to achieve and enhanced psychological health.

 One of the important aims of education is to prepare the individual for the future social life. But instructional strategies based on competition would not help him/her to be a social being. Without cooperation, human being cannot proceed in life. Competitiveness produces stress and strain in the life of the individual. Perhaps it may lead him to a state of helplessness and disgust. He/she may be isolated from the society. Hence competitiveness practiced during the school life would negatively affect the future social life of the individual. In such a situation, we can see the relevance of Cooperative Learning methods such as Jigsaw learning.

 The current education system rewards students achievement by separating students of differing abilities rather than encouraging them to utilize their abilities to help each other. Jigsaw builds more positive heterogeneous relationships, i.e., students of higher ability work with students of lower ability and both benefit. Both observe each other’s approaches to problem solving and begin to appreciate their difference.

 Jigsaw provides different roles for the group members, such as reader, group leader, reporter etc. These roles are rotated among the group members when they practice all the roles. It would help to create quality and confidence among the students. In an existing group work, more probably the leadership goes to a male student. Jigsaw reduces gender bias and racial conflict (Aronson & Patnoe, 1997) as the roles such as leadership are rotated, not considering the gender difference. Female students get equal chances with male students in all of the activities conducted in the classroom. Thus a sense of gender equality is created.

 Traditional educational system puts the importance on academic development. When social experiences in the school are avoided, student’s attitudes about the school is not favourable. Hence most of them avoid the participation in the extracurricular activities. Jigsaw brings the students together to develop support mechanisms similar to self help groups in their local communities. Thus a community environment is created within the school and a favourable attitude towards the school is developed. Hence they are actively involved in the extracurricular activities and campus life experiences.

 Research works have been conducted to find out the defects of the input and to maximize the output of the educational system. Former researches on learning were primarily concerned with characteristics of the pupils, teachers and contextual factors in which learning take place. Little attention was paid to what actually happened in the classrooms or how much pupils learned. These deficiencies were filled by some researchers who concentrated on the classroom and learning process (Watson & Johnson, 1972; Slavin, 1983 and Olsen & Kagan, 1992). Some of them found that Instructional Learning Strategies could influence the outcome of education tremendously. As a result of these findings, the argument for changing the conventional whole class instruction was strengthened. In whole class instruction, individual attention in the class room is not possible. Bennett and Dunne (1992) considered whole class instruction as unacceptable because it is undifferentiated. Thus individualized instruction and competitive learning were experimented in the educational field. But such procedure had defeats and difficulties.

 Individulized instructions such as programmed learning, contracting, mastery programmes etc. would require a heavy workload for the teacher (Varaprasad, 1997). Bennet and Dunne (1992) consider individualized instruction as unworkable because it requires a huge amount of material, time and teaching staff. More over there is no provision for interaction.

 In competitive learning, a negative interdependence among students will be promoted. Slavin (1990) has noted that competition tends to discourage students from helping each other. This situation is quite opposite to the theories of socialization.

 There is wide spread dissatisfaction with the use of competition in our class rooms, because there is a number of undesirable outcomes of competition. Johnson and Johnson (1975) compared the different goal structures and listed a number of disadvantages for competition.

1. The purpose of evaluation is to rank students from ‘best’ to ‘worst’.
2. Individual will try to obstruct each other’s goal accomplishments, and they will dislike behaviours that facilitate another person’s goal accomplishment.
3. Individuals dislike each other and make a hostile relationship with others.
4. Competition has been found to increase anxiety in students performing a skill.

 In order to avoid the inherent problems of competition in the existing classroom, some new learning strategies have been developed and tried out in the western countries. Cooperative Learning is one among them. The concept of Cooperative Learning Strategy is revolutionary because it respects the existing ways of thinking about education. Principles of teaching are not conceived as static tenets but as dynamically interactive with social and cognitive purpose with the learning theory underline procedures, with available support technology, and with the personal and intellectual characteristics of learning groups (Joyce and Weil, 1985).

 The ultimate aim of education is not mere learning. Nunan (1989) is of the view that pupils need to learn how to learn. Students need to develop skill and attitudes towards learning that form the basis of future academic growth (Franklin, 1990). For these needs, Cooperative or Collaborative Learning would be a solution strategy because it has been found that Cooperative Learning contribute not only to academic achievement but also helps to develop social skills and democratic values that are beneficial to society as well as to each individual (Angry, 1990; Jackson, 1990; Felder, 1995 and Xing, 1996).

 The investigator could not find adequate number of studies which examined the effect of the Jigzaw II method of Cooperative Learning Strategies on pupil’s Academic Achievement in Mathematics. Lack of such studies in India are evident from the survey of related literature. In the case of Kerala no such study had been yet conducted in Mathematics using Jigsaw method. This inspired the investigator to study the effect of Instructional Learning strategies on Achievement in Mathematics.

* 1. **. STATEMENT OF THE PROBLEM**

The present study is entitled as EFFECT OF INSTRUCTIONAL LEARNING STRATEGIES ON ACHIEVEMENT IN MATHEMATICS OF STANDARD VIII STUDENTS.

**1.3. DEFINITION OF KEY TERMS**

The definition of the key terms used in the statement of the problem are given in the following.

* + 1. EFFECT

Effect is the interaction effect attributable to the examination of variables above and beyond that which can be predicted from the variables considered singly (Winer, 1977).

1.3.2. INSTRUCTIONAL LEARNING STRATEGIES

Instructional Learning Strategy refers to a generalized plan for a lesson which includes structure, desired learning behaviour in terms of goals of instructions and on outline of planned tactics necessary to implement the strategy (Stones and Morris, 1977). For the present study, the particular Cooperative Learning method selected in the Jigzaw II Model (Slavin, 1980). Existing Method of Teaching refer to the method adopted by most of the teachers in the Secondary Schools of Kerala at present.

1.3.3. ACHIEVEMENT IN MATHEMATICS

Achievement in Mathematics is the level of performance of an individual in Mathematics as measured in terms of a standardized Achievement test.

* + 1. STANDARD VIII STUDENTS

The term Standard VIII students is used to denote pupils attending standard VIII in any of the recognized schools of Kerala State.

* 1. **VARIABLES OF THE STUDY**

The Independent, Dependent and Control Variables selected for the present study are the following.

1.4.1. INDEPENDENT VARIABLE

The independent variable selected for the study was Instructional Learning Strategies [Cooperative Learning Strategy – Jigsaw II and Existing Method of Teaching].

1.4.2. DEPENDENT VARIABLE

 The Dependent Variable selected for the study is the Achievement in Mathematics of Standard VIII students.

* + 1. CONTROL VARIABLES

The following are the control variables selected for the study.

**1.4.3.1. Pre Experimental Status in the Subject Matter Measured by a
 Pretest** and

* + - 1. **Verbal Intelligence**

**1.5. OBJECTIVES**

The following are the objectives of the present study.

* + 1. To study whether there exists any significant difference in the Mean Pretest scores of Experimental and Control Groups for the Total Sample, Boys and Girls.
		2. To study whether there exists any significant difference in the Mean Achievement scores of Experimental and Control Groups for the Total Sample, Boys and Girls.
		3. To study whether there exists any difference in the Mean Gain Scores of Experimental and Control Groups for the Total Sample, Boys and Girls.
		4. To study the effectiveness of Jigsaw II method of Cooperative Learning Strategy over Existing Method of Teaching in terms of Achievement in Mathematics of Standard VIII Students.

**1.6. HYPOTHESES**

The present study was designed to test the following hypotheses.

* + 1. Thereis no significant difference in the Mean Pretest scores of the Experimental and Control groups for the Total Sample, Boys and Girls.
		2. There is no significant difference in the Mean Achievement Scores of the Experimental and Control groups for the Total Sample, Boys and Girls.
		3. There is no significant difference in the Mean Gain Scores of the Experimental and Control Groups for the Total Sample, Boys and Girls.
		4. Students taught through Jigsaw II Method of Cooperative Learning Strategy do not differ significantly in terms of Achievement in Mathematics than students taught through Existing Method of Teaching.

**1.7. PROCEDURE**

The procedure of the present study is outlined as the following.

* + 1. DESIGN OF THE STUDY

The present study has been conducted by employing the True Experimental Design. The Design used in the present study was the Pre-test Post test Equivalent Group Design. The Experimental Group was taught through the Cooperative Learning Strategy (Jigsaw II) and the Control Group was taught through the Existing Method of Teaching.

* + 1. SAMPLE FOR THE STUDY

The sample of the study consisted of two intact class groups of 35 students each in the Experimental and 35 Control groups (Total 70 students). The Experimental and Control groups were selected at random by giving equal representation to efficiency level and Socio Economic status of students.

* + 1. TOOLS USED FOR THE STUDY

The investigator used the following tools for the study.

* + - 1. **.Lesson Transcript for Cooperative Learning Strategy – Jigsaw II Model (Hameed & Dilshath, 2010)**

The investigator prepared Lesson Transcript for Cooperative Learning Strategy following the steps proposed by Slavin (1980), for his ‘Jigsaw II’ model and used for treatment in the Experimental group. On the basis of the Cooperative goal structure proposed by Slavin, the investigator prepared the Lesson Transcript for Cooperative Learning Strategy in four different phases.

Phase I - Formation of Base Groups

Phase II - Formation of Expert Groups

Phase III - Peer-tutoring

Phase IV - Reconvene the class, exchange of ideas and rewarding the best group.

* + - 1. **Lesson Plan for Existing Method of Teaching (Hameed & Dilshath, 2010)**

The Lesson Transcript for teaching through the Existing Method for the Control Group were prepared by the investigator in Malayalam, on the basis of the newly introduced activity curriculum of Kerala state. The teaching method used in the Control group was Existing Method of Teaching Mathematics in the academic year (2010-2011).

**1.7.3.3. Verbal Group Test of Intelligence - VGTI (Kumar, *et al*., 1997)**

For the present study, the confounding variable, Verbal intelligence was measured using Verbal Group Test of Intelligence (VGTI) developed by Kumar, *et al*. (1997). The test consists of five subtests namely.

Test I Verbal Analogy

Test II Verbal Classification

Test III Numerical Reasoning

Test IV Verbal Reasoning

Test V Comprehension

**1.7.3.4. Achievement Test in Mathematics -ATM(Hameed & Dilshath, 2010)**

This test of Achievement in Mathematics was developed and standardized by Hameed and Dilshath (2010) to be used as Pretest and Post test on the topic selected for treatment.

1.7.4. STATISTICAL TECHNIQUES USED FOR ANALYSIS

In the present study, the collected data were analysed using the following statistical techniques.

* + - 1. **Mean Difference Analysis**

Mean Difference analysis was mainly employed to study whether the experimental and control group differ in pre test, post test and gain scores without controlling the effects of the covariates. Mean difference analysis was also employed to equate the Experimental and Control groups with regard to pre-experimental status (Pretest Score and Verbal Intelligence).

**1.7.4.2. Analysis of Covariance (ANCOVA)**

 To control the effect of covariates i.e., Pre Experimental Status in the Subject Matter Measured by a Pretest and Verbal Intelligence singly and in combination and thereby to confirm the effectiveness of Cooperative Learning Strategy (Jigsaw II) over the Existing Method of Teaching, Analysis of Covariance (ANCOVA) was utilized.

* 1. **SCOPE AND LIMITATIONS OF THE STUDY**

The present study is aimed to test the effectiveness of Cooperative Learning Strategy (Jigsaw II) over Existing Method of Teaching Mathematics of Standard VIII students. Appropriate standardized tools were used for data collection from a selected sample of standard VIII students. The investigator hopes that the results obtained from the present study may help the educationists to reform the existing classroom situations.

Even though precautions were taken to make the study objective, certain limitations had crept in to the study. The important limitations of the study are the following:

* + 1. The study was confined to only two divisions of standard VIII students. Limitation of time and economy were the main obstacles in selecting the sample.
		2. The present study was conducted in Malayalam medium class only.
		3. There were no facilities in classroom for the quick rearrangement of groups.
		4. The investigator selected only one chapter for teaching mathematics, due to time constraints.
		5. Only Jigsaw II Method of Cooperative Learning Strategy is used.
		6. The study was limited to Mathematics only.
		7. The confounding variables like learning readiness, classroom condition, interest, aptitude, fatigue etc. could not be controlled.
	1. **ORGANISATION OF THE REPORT**

 The organization of the present research report is as follows. Each chapter is explained in the relevant sub units.

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|  | Need and Significance  |
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**Two**

**REVIEW OF RELATED LITERATURE**

* Theoretical Framework of the Variable
* Review of Related Literature

**REVIEW OF RELATED LITERATURE**

The present study is an investigation of the effect of Instructional Learning Strategies on Achievement in Mathematics of Standard VII students. For this purpose, the investigator tried to review almost all the available studies in this area up to year 2009. The reviewed literature are classified and presented under the following headings.

**2.1. THEORETICAL FRAMEWORK OF THE VARIABLE**

2.1.1. COOPERATIVE LEARNING STRATEGY (JIGSAW II)

**2.2. REVIEW OF RELATED LITERATURE**

2.2.1. STUDIES ON COOPERATIVE LEARNING STRATEGY
 AND ACHIEVEMENT

**2.1. THEORETICAL FRAMEWORK OF THE VARIABLES**

 In this section, the most important theoretical view points regarding Cooperative Learning Strategy has been brought out by the investigator.

2.1.1. COOPERATIVE LEARNING STRATEGY (JIGSAW II)

 The investigator has presented a detailed theoretical outline of the Cooperative Learning strategy in this part.

**2.1.1.1. What is Cooperative Learning ?**

 Cooperative Learning is an instructional strategy where small teams of students, usually two to six members, work together to maximize their individual and collective learning. After team members are organized in to these small groups and receive instruction from their teacher, students within the team cooperate with one another and work through the assignment until each team member successfully understands and completes it. Ultimately the shared goals are accomplished individually by each team member, and collectively by the group as a whole.

Cooper (1989) defined Cooperative Learning as “an instructional task design that engages students actively in achieving a lesson objectively through their own efforts and the efforts of their small team.”

Cooperative Learning is an instructional learning strategy which increase the academic achievement of an individual (Slavin, 1983; Johnson and Johnson, 1975). It can be characterised as a strategy for the class room, widely used to increase academic achievement, to help students develop collective image of self and others, provide vehicle for critical thinking and problem solving and to encourage collaborative social skills, (Calderon, 1987).

The Johnsons say that effective implementation of Cooperative Learning involves specifying instructional objectives; placing students in appropriate learning groups, explaining to students the academic tasks and cooperative methods to be used in achieving these tasks: monitoring the progress of the groups to provide assistance; and evaluating students achievements with student input.

Slavin (1989) cautions that, in recent years, Cooperative Learning has been proposed as a solution to many problems in education. Slavin thinks that under certain circumstances, the use of Cooperative Learning can help educators achieve many of their goals. He points out, however, that all forms of Cooperative Learning are not equally effective for all goals. Because achievement is a frequently desired goal, Slavin stresses that two conditions must be present if achievement effects are to be produced.

**i. Cognitive Development Effect**

 Collaboration promotes cognitive growth because students model for each other in more advanced ways of thinking than any would demonstrate individually.

**ii. Cognitive Elaboration Effect**

 New information that is elaborated (restructured and related to existing knowledge) is more easily retrieved from memory.

* + - 1. **What Does a Cooperative Model Look Like?**
1. Students work cooperatively compared with traditional models where individuals are only looking out for themselves.
2. Team members are responsible for their own individual learning as well as for their teammates learning.
3. Teams are made up of high, medium and low academic achieving students.
4. Teams are heterogeneous in gender, race, culture and socioeconomic status.
5. Team members contribute their knowledge, experience, skills and resources to the group.
6. Team members cooperate and collaborate.
7. Team members benefit from the contributions of the individual team members. Team members acquire new skills and knowledge.
8. Rewards are oriented towards individual and group.

**2.1.1.3. Five Elements of Cooperative Learning**

 Five elements of cooperative Learning are as follows.

**1. Positive inter dependence**

* Tasks and goals are clearly defined.
* Efforts of each team member benefits the individual as well as the group.
* Commitment is made to both personal as well as group success.

**2. Individual and Group Accountability**

* Each team member must contribute to the group as a whole.
* Each team member is accountable for helping the group reach its goals.
1. **Interpersonal and Small Group Skills**

 Each team member must

* be motivated
* provide effective leadership
* be able to make decisions
* be able to build trust
* be able to communicate
* be able to manage conflict
1. **Face to Face Promotive Interaction**

Students

* promote one another’s success by sharing resources
* encourage, help and applaud each other’s efforts.
* support one another academically and personally.
* explain how to solve problems
* teach each other
* check for one another’s understanding
* discuss concepts being learned
* connect present with past learning
* foster the groups mutual goal
1. **Group Processing**

Students

* communicate openly, freely, respectfully discussing their concerns.
* maintain effective working relationships.
* describe what member actions are helpful/unhelpful.
* make decisions about behaviours to continue/change/discontinue.
* Process status of goal achievement and accomplishments.
	+ - 1. **Essentials of Effective Cooperative Learning Groups**

The important essentials of Cooperative Learning are as follows:-

* Participation
* Each team member should contribute their time and energy.
* Each team member should participate in the decision making process.
* Trust.
* Each team member should trust that other team members will be contributing to the group.
* Communication.
* Each team member should listen respectfully and attentively to other team members.
* Each team member should contribute ideas.
* Each team member should ask questions when clarification is needed.
* Each team member should give constructive feed back.
* What children can do together today, they can do alone tomorrow (Vygotsky, 1962).

**2.1.1.5. Planning for Cooperative Learning in the Class Room**

There are six key steps involved in planning for Cooperative Learning.

1. Choose an approach
2. Choose appropriate content
3. Form student teams
4. Develop materials
5. Plan for orienting students to tasks and roles
6. Plan for the use of time and space

**I. Choose an Approach**

 There are different types of cooperative learning techniques: Learning Together (LT), Group investigation (GI), Numbered Heads Together (NHT), Think Pair Share (TPS) etc., we choose an appropriate technique from above.

**II. Choose Appropriate Content**

Teachers must be sure to choose content that will spark and keep the interest of the students.

 If the students do not find the content interesting and appropriately challenging, they will quickly lose interest and the Cooperative Learning approach will fail. Research shows that the more conceptual knowledge is emphasized, the more successful Cooperative Learning will be.

**III. Form Student Teams:**

The information of student teams will vary according to the goals and objectives of the lesson as well as the diversity among racial, ethnical, gender and ability groups.

 Teacher selected groups have been proven again and again to be the best method of forming teams because it ensures a good mix and will minimise the chance of friends working together, which neglects to achieve the goal of improvement of social interactions among students who do not know each other as well.

**IV. Develop Materials**

 Teachers usually provide verbal information along with worksheets, outlines and study guides during a Cooperative Learning lesson.

 Good materials take time to develop and must be both interesting and at an appropriate reading level for the students or they will no be able to understand the lesson and will quickly become uninterested and give up.

 Teacher can reach out to librarians and media specialists for assistance in choosing exciting and appropriate materials to implement it to the Cooperative Learning lesson.

**V. Plan for Orienting Students to Tasks and Roles**

 Students who are unfamiliar with the Cooperative Learning Model will need to be taught about the model and be clear on their roles as well as the teacher’s expectations during this type of lesson. Students also need to be made aware that the reward structure will be cooperatively based, not competitively based like most other class work.

 Cooperative Learning helps students to develop social skills naturally or by specific teaching of the required skills in areas. Leadership, Decision making, Trust-building, Communication, Conflict-management skills, provide opportunities for students to “naturally” use social skills in fun or high interest topics.

**VI. Plan for the use of Time and Space**

 Most teachers under estimate the amount of time it takes to conduct a successful Cooperative Learning Lesson. Research shows the minimum time for a Cooperative Learning Lesson to produce real cognitive change to be atleast 4 weeks. It is crucial to carefully plan for the additional time that it will take students to interact with one another during Cooperative Learning Lessons.

**2.1.1.6. Assessing and Evaluating Cooperative Lessons**

 Cooperative Learning is a strategy where students can work on linguistic skills and academic skills of the same time. In this strategy the students work together is small groups. The groups should be mixed culturally and by achievement level.

 There are two levels of assessment and evaluation; individual and group. Individual assessment is more frequent than group assessment.

**Seven Principles of Assessment and Reporting**

* Make an assessment and reporting plan.
* Use Cooperative Learning groups and understand their benefit in assessment, evaluation and reporting.
* Avoid groups or traditional learning groups in your assessment plan.
* Ensure that learning groups are truly cooperative.
* Make assessment practices an integrated whole by implementing procedures before, during and after instruction.
* Involves students, classmates and parents in reporting assessment results.
* Use Cooperative Learning groups to help individualize the educational goals, learning processes, assessment .
* Procedures and reporting procedures for gifted and disabled students.

**2.1.1.7. Different Cooperative Learning Methods**

 There are different types of Cooperative Learning techniques. Some of them are briefly described below.

**I. Learning Together (LT)**

This is one of the famous models of cooperative/collaborative learning and instruction. The classroom is to be rearranged in the form of small groups of the students comprising 6-9 members. All psychological aspects are proceeding through the following steps.

* the teacher presents the objectives of the lessons as a group/common goal.
* teacher facilitates and encourages the sharing of the ideas and learning materials.
* teacher facilitates and encourages a division of labour.
* Teacher rewards the group for the successful completion to the learning task.

Togetherness in the classroom is stressed by not giving importance to individual learning. Instead, students learn together. Swim or Sink together is the principle. Learning Together (LT), developed by Johnson and Johnson (1975) utilizes a cooperative goal structure that requires mutual acceptance of the common goal by the group members and that minimizes individualistic striving. The two distinctive features of this methods are:

1. students are sensitized towards and receive training in human relation skills necessary for group functioning and
2. only one completed product or outcome is submitted from each working group and the participation of each group member in that product is expected.

**II. Group Investigation (GI)**

Training in doing investigation is the major feature. But this investigation is on group activities. This Cooperative Learning strategy was developed by Sharan and Sharan (1976). Two additional features that give the GI approach distinctiveness among general Cooperative Learning strategies are:

1. Each student group is expected to present a report, demonstration or display to the rest of the class and
2. In addition to the teacher’s evaluation of group’s work, students themselves are involved in assessment procedure either by direct comment on their peers by contributing questions to a common test or by self evaluation of their own.

**III. Numbered Heads Together (NHT)**

Numbered Heads Together is a recently developed Cooperative Learning Strategy. It was developed by Olsen and Kagan (1992). There are four steps in this strategy:

1. Each student in a group of four gets a number 1, 2, 3, or 4.
2. The teacher or a student asks a question based on the text, the class is reading.
3. All members in the group put their heads together to come up with an answer or answers, and
4. The teacher calls a number from one to four. The person with that number answers for the group.

**IV. Think Pair Share (TPS)**

Think Pair Share (TPS) is a recent mode of Cooperative Learning developed by Andrini (1994). In this model, students pair with a partner to share their responses to a question. Students are then invited to share their responses with the whole class. There are a variety of ways to share including stand up and share. Everyone stand up and as each student responds he or she sits down. Any one with a similar response also sits down. It will continue until everyone is seated or do a quick whip through the class in which students respond quickly one right after another.

**V. Complex Instruction (CI)**

This Cooperative Learning Strategy was developed by Cohen (1998). The programme is a set of Cooperative Learning approaches focused on Spanish bilingual students. It provides students with a series of activity cards on English and Spanish, which direct them to do experiments, take measurements, solve problems and so on. Student work in small heterogeneous groups to do experiments and answer the questions intended to evoke high level thinking and build language fluency in first Spanish then English. Complex Instruction adds to a group structure, in which students take on specified roles and learn group process skills. It emphasises positive expectations for all students.

**VI. Turn to Your Neighbour (TYN)**

 In this Cooperative Learning Method, turn to your neighbour, a student pairs up with another student to discuss an idea, to write or to draw as instructed by the teacher. They may be asked to share their work with the class.

**VII. Pairs of Pairs (PP)**

 In Pairs of Pairs, students write out a list of responses to a statement such as all the states and their capitals they know. They first work in pairs and make one list. Two pairs get together and make a single combined list. All the members of the groups are responsible to know what is in the list.

**VIII. Student Team Learning (STL)**

 Learning in teams is more fascinating than individual learning. This is because learning process in the teams is carried out in the form of a game. Games are more interesting to students than anything else. If such a game is played with a team of peers, classroom learning is no longer a boring event, but an attractive, motivated and enthusiastic game. This idea is exploited in the classroom transactions in the name of Student Team Learning Procedures.

 Instead of focusing individual learning, learning in students’ teams is on the emphasis. Among different Cooperative Learning techniques, student team learning methods are the most extensively researched and widely used. Three of the student team learning methods are now in widespread use. There are Team Games – Tournaments (TGT), Student Teams Achievement Divisions (STAD); Jigsaw I and Jigsaw II. A fourth technique, Team Assisted Individualisation (TAI) has been developed recently. These methods are described in the following part.

**a) Student Teams Achievement Division (STAD)**

 In STAD, developed by Slavin (1983) classroom teams of four or five students study together, frequently quiz and tutor each other with specifically assigned material for the current topic. At designated times, the students take Individual Tests, and each student on the basis of improvement from the previous test, contribute points to the study team total. Team totals are then tabulated and compared competitively with each other.

**b) Teams – Games – Tournaments (TGT)**

 This strategy was developed by Devries, *et al*. (1980). The procedure is identical to STAD in all respects except one. The testing is carried out in a game composed of three students, each drawn from a different original study team. The students ask questions to one another in turn. Points are awarded for correct answers. The earned points for each students are contributed to the total for the study team, and the team totals are compared competitively.

**c) Team Assisted Individualisation (TAI)**

 Team Assisted Individualisation (TAI) is the most recent development of Student Team Learning Methods (Slavin *et al*., 1984). It is a combination of team learning and individualised instruction applied to the teaching of Mathematics. Students follow a regular sequence of activities, involving reading an instruction sheet. Team-mates work in pairs, exchanging answer sheets and checking each other’s skill sheets and checkouts. Student’s test scores and the numbers of tests they can complete in a week go in to team score and team members receive certificates for exceeding pre-test team standard. TAI is unique among all Cooperative Learning methods in its use of individualised instead of class-paced instruction (Slavin, 1985).

**d) Jigsaw I**

 In Jigsaw Learning developed by Aronson *et al*. (1978), a learning task is Jigsawed or cut in to pieces that when fitted together recreate the total picture. Each group of five or six students get a complete set of task sections and each student in the group takes the responsibility for one of these sections. After learning the sections of material, discussions take place in expert groups for strengthening learning. After discussion the members are returned to their base groups and tutor other members of the group and are tutored in turn by them. Tests are taken individually over the whole of the material. Individual grades are given to students after taking individual quizzes.

**e) Jigsaw II**

 Slavin (1980) found the individual incentives in Jigsaw-1 as a demerit, so that it would promote competition rather than cooperation. So he made a modification in Jigsaw-1 and then incorporated it in the Student Team Learning Programme. In this method called Jigsaw II, instead of each student having a unique section, all students read a common narrative, such as a book chapter or a short story. However, each student is given a topic on which to become an expert. The students who have the same topic meet in expert groups and return to their teams. Then students take individual quizzes, which are formed in to team scores and the highest scoring team and individuals are recognized in a class newsletter. Jigsaw method of learning transfers the classroom as a game board, learning as a game, an intellectual game in which all members of the team have something to be done, and something to be contributed. This individual’s inevitable contribution through the group or team processing ultimately leads to the expertise gained by each member regarding the learning materials. This expertise as a personal asset, they share with other members in the team. Jigsaw, if practiced once, it will be demanded more by students. This is the indication of how students accept the Jigsaw model.

* 1. **REVIEW OF RELATED STUDIES**

In this section, relevant studies related to Cooperative Learning Strategies and Achievement is presented in Detail.

2.2.1. STUDIES ON COOPERATIVE LEARNING STRATEGY AND ACHIEVEMENT

Review of related literature revealed a number of studies which shows positive as well as negative effects on achievement. Hence, the reviewed studies are mainly categorized and presented in the following order.

**2.2.1.1.Studies Showing Positive Results**

**2.2.1. 2.Studies Showing Negative / No Achievement Results**

Here it is attempted to review and present the research findings and summarise literature related to Cooperative Learning and Achievement.

* + - 1. **Studies Showing Positive Results**

Improved achievement was expected by the use of Cooperative Learning Strategy, because in a cooperative group, students are likely to encourage and help one another to learn. A wide series of outcomes on achievement have been studied in the course of the Cooperative Learning field research. They are presented below.

Laughlin, *et al*. (1969) studied the individual versus triadic performance on a unidimensional complementary task and found the superiority of triadic or group performance on individual performance.

Johnson and Johnson (1974) investigated, whether cooperative tasks and reward structured affect learning outcomes positively. The study obtained positive relationship between Cooperative Learning and the achievement of children. Similar results were reported by Johnson and Johnson (1981) and Slavin (1990).

Johnson and Johnson (1975) conducted rigorous studies on
Cooperative Learning and compared the effects of cooperative, competitive and individualistic goal structures on pupil’s Academic Achievement, attitude and ethnic relations. The result of the study showed that there was increased achievement and positive altitude towards others in Cooperative Learning methods than those worked competitively or individually.

Lucker, *et al*. (1976) contrasted learning by the Jigsaw method with learning by the wholeclass method with respect to elementary academic achievement. The participants in this study were 242 white, 25 Mexican American and 26 black children. Findings reveals a significant gain for minority students but no significant gain or losses for white students.

Aronson, *et al*. (1977) conducted an experimental study using a cooperative form of small grouping with regular classroom instruction. Results indicated that students who received small group instruction gain in self esteem while a decrease in self esteem occurred in the control group.

Sharan (1980) reviewed twenty seven major researches on Cooperative Learning programmes on student achievement and found that there were no significant differences in seven of these studies and one study favoured the control group.

Sharan and Hertz-Lazarowitz (1980) studied the effect of Group Investigation (GI) on Academic Achievement and social relation on a sample of elementary school children. The investigators reported that, the more pervasive the cooperative climate, the more positive the students toward both the learning tasks and toward each other.

Johnson and Johnson (1981) examined the effects of Cooperative and Individualistic Learning experiences on inter ethnic relations and found that higher performance on individual problem solving in cooperative than individualistic situation.

Glass, *et al*. (1982) investigated the effect of class size on student learning and found that class size has a significant effect on student learning not only in skill based subjects like language learning but also in other subjects. Similar results were found out by Noli (1980).

Studies by Fennema and Paterson (1987) states that although female students learn best cooperatively and males learn more easily through competition, it is not worthy for teachers to give all students opportunities to participate in both learning modes.

Newmann and Thompson (1987) investigated the effects of Cooperative Learning on Achievement in secondary schools has established that the Cooperative Learning Method can be very effective in increasing student achievement in many subjects and many levels, when student groups are rewarded. Studies by Slavin (1990) also obtained the same result.

Slavin’s (1987) research on Cooperative Learning has revealed that the individual can grow cognitively through cooperative efforts. Multi age students spend a great deal of time working in cooperative groups and have considerable opportunity to learn from each other.

Stevens, *et al.* (1987) conducted three experimental studies comparing Cooperative Learning with the traditional methods and found out positive effects on scores from standardized tests of reading comprehension, reading vocabulary, language expression, mechanic and spelling.

Kutnick (1988) examined the effect of Cooperative Learning on student’s academic performance, self esteem, racial school friendship and found that there was corresponding increase in student’s academic performance, self esteem and inter-racial friendship.

Angry (1990) conducted a study through Cooperative Learning, in which the samples were provided with 12 weeks of lessons, activities and projects that were designed to increase their knowledge and increase and build positive communication skills, thereby enhancing ethnic relations among them. The outcome of the study were very positive.

Brickle (1990) used a variety of learning performance such as Cooperative Learning, Socratic Questioning and Computer-Assisted Instruction so as to improve interest and success in Mathematics. The result showed that students performance was improved and the class attendance was increased.

Christison (1990) studied the effects of Cooperative Learning on Academic Achievement and self esteem and found that Cooperative Learning have a significant and positive effect on pupils Academic Achievement and Self-esteem.

Dunne and Bennett (1990) conducted study and found that students of all abilities improved the skills of discussion, suggesting, concluding, testing, inferring and reflecting when working in mixed-ability groups and that they improved in terms of both cooperation and independence.

The study conducted by Hassard (1990) on ‘Science experience: Cooperative Learning and the Teaching of Science’ The results indicates that students who work cooperatively absorb more and higher level subject area knowledge more effectively than students who work individually and also proved that working cooperatively develops students – higher level thinking skills, such as meta cognition, as students compare their own knowledge and strategies with that of others.

Lowman (1990) divided his students in to two groups, asking one group to prepare and teach a body of material to the class, and the other to master the information for test performance alone. When tested, the former group demonstrated much greater mastery of the material than did the students who had learned the material by more traditional techniques.

A study by Seaman (1990) investigated the effect of the study skill strategies of concept mapping and Cooperative Learning on student’s academic achievement. 45th grade students were placed in three groups. *ie.,* Cooperative concept mapping group, a standard concept mapping group and a control group. The students studied a science text and were later tested on their learning. Students in both concept mapping groups received higher scores on weekly vocabulary tests and the final unit test than did students in the control group.

 The result of the study of Wills (1990) revealed that the target group in which cooperation in learning was experimented evidenced significantly higher level of achievement than the control group on vocabulary skills.

 Stevens, *et al.* (1991) conducted three experimental studies comparing Cooperative Learning with the traditional methods and found out positive effects on scores from standardised test of reading comprehension, reading vocabulary, language expression, mechanic and spelling.

 In the study conducted by Fiedler, *et al*. (1992) it was found that providing heterogeneously grouped Cooperative Learning experience is most effective for serving all students, including the gifted.

 Olsen and Kagan (1992) investigated the effect created by the Cooperative Learning Strategy on second/foreign language and proposed several advantages for Cooperative Learning like increased student talk, more released atmosphere, greater motivation and increased amount of comprehensible out put.

 Cooperative Learning Techniques used by Keeler (1994) proved that they were effective in improving student performance in a freshman level statistics course. There is a positive relationship between Cooperative Learning and Academic Achievement.

 In the light of a project conducted among 24 grade 11 basic U.S. history students in a growing, middle class, sub urban community in Northern Illinois, Ellett (1994) recommends Cooperation in Learning as a solution strategy to improve Academic Achievement.

 In the light of the study, Kumar and Rai (1994), suggests Cooperative Learning as a better strategy for achieving more as Shacker and Sharan (1994) found in their study that Cooperative Learning was more effective than wholeclass instruction.

 Kumar and Rai (1994) studied different Cooperative Learning methods and the problems of its dissemination among teachers. They reported that Cooperative Learning is a method which improves learning and social relations among classmates.

 Cooper and James (1995) suggests in their studies about Cooperative Learning and critical thinking that teaching in colleges has remained largely unchanged since the days of the midlevel university. They made research up on minority group, non traditional students, and found out that the role of Cooperative Learning in higher education enhance critical thinking skills.

 Cooperative homework, Cooperative quizzes, electronic-mail communication and open office hours were used by Dougherty (1995) with a view to improve student performance, retension and attitudes in general chemistry. As a result, student achievement was improved.

 As a part of an ongoing longitudinal study, Felder (1995) taught five chemical engineering course in consecutive semesters to a cohort of students, using Cooperative Learning and other instructional methods to. The results suggest that active and Cooperative Learning methods facilitate both learning and a variety of interpersonal and thinking skills.

 A Cooperative Learning strategy was experimented by Keeler and Anson (1995) in a college computer skills lab course. The results indicated that this Cooperative Learning Strategy improved students academic achievement when compared to traditional individual learning.

 Lurie and Ovrebo (1995) describe the content and instructional techniques used in a college course on programme evaluation. They discuss the use of Cooperative Learning Methods and field work as instructional strategies and maintain that students evaluations indicate the course achieved its objectives.

 Randon (1995) studied the effect of autonomous learning and Cooperative Learning on Learner’s performance and revealed that the idea of group interaction establishes a valuable frame work in which individual’s learning process can develop.

 Stevens and Slavin (1995) made a study in order to find out the effectiveness of a Cooperative Learning approach on academically handicapped and non-handicapped students. The reading and writing skills of the students (of both category) were found to increase.

 A New Zealand study by Townsend and Hicks (1995) examined the relationship between form two student’s (n=162) academic task values in two school subjects, mathematics and language, and their perceptions of social satisfaction in classroom using a Cooperative goal structure. It was found that task values for engagement in mathematics and language activities were higher and perceived costs lower, in classroom using a Cooperative goal structure.

 Brush (1996) conducted a study on integrated learning system and found Cooperative Learning as a better strategy for effective learning. A sample consisting of 192 sixth graders participated in a study conducted by Gillies and Ashman (1996) that compared the effects on behaviour and achievement of Cooperative Learning with group members trained to facilitate each other’s learning and Cooperative Learning in which members did not receive such training. Training resulted in positive effects on achievement and behaviour.

 The Study conducted by Cohen (1996) investigated about interaction among students as a source of learning and found out that elements of collaborative situations such as the importance of assigned task, fostering interaction in small groups and maintaining inequalities within groups.

 A three year project conducted by Hill (1996) proved that students taught through Cooperative Learning demonstrated significant gains in achievement and critical thinking skills, team work skills and sense of communication.

 The study conducted by Hirsch, *et al*. (1996) titled “61 Cooperative Learning activities in ESL” designed to help students to develop English language skills through conversation based on Cooperative Learning principles, and found out that rich content choices and collaborative design of each activity encourage student interaction.

 Xin (1996) conducted a research project to find out the effects of Computer Assisted Cooperative Learning in Mathematics instruction within integrated classroom for 118 third graders (25 with learning disabilities) and 92 fourth – graders (16 with learning disabilities). Result showed that the Cooperative groups scores on Maths achievement were statistically higher than those of the wholeclass learning group.

 Artzt, *et al.* (1997) conducted a study on focussed use of Cooperative Learning in the Mathematic class. The study suggests that Cooperative Learning is a social process and that Cooperative Learning activities are essential if students want to be able to construct their own knowledge.

 In an action research project, conducted by Brauer, *et al.* (1997), Cooperative learning strategies were used to enhance student engagement active listening, turn-taking, appropriate behaviour and voice volume, and use of ‘happy’ talk. Findings indicated an increase in student critical thinking skills, improvement in interpersonal skills and an increase in the use of conflict resolution skills.

 Hameed (1997) conducted an experimental study on a sample of 80 students of standard VII from two upper primary schools in Kerala State. The investigator found that Cooperative Learning was a better strategy than conventional method of teaching for social science.

 Hodges and Wolf (1997) conducted an action research project for increasing student self-esteem through a caring and positive classroom environment incorporating Cooperative Learning and the use of praise and rewards. Post intervention data indicated an increase in positive self-esteem, greater student engagement and increased achievement levels.

 Johnson and Johnson (1997) observed that the members of Cooperative Learning group feel personally responsible for learning and persist in working towards goal achievement.

 Leung and Chung (1997) investigated the effect of Cooperative Learning on students achievement in an educational technology course in an initial teacher training programme. The Cooperative Learning Strategy was compared with the traditional whole class direct instruction approach. Results indicated that the Cooperative Learning Strategy had a positive effect.

 In an experimental study, done with a sample of 110 students from two upper primary schools in Palakkad District, Sasidharan (1997) found that pupils taught through Jigsaw Learning acquired higher achievement in Malayalam language than pupils taught through conventional method of teaching.

 Geiss and Mayer (1998) report a research programme that was intended for improving listening skills, lack of which interferes with second language acquisition. The target population was first and second year Spanish students in one middle school and one high school. Cooperative group discussions, as a teacher strategy were implemented. The results indicated improved student listening skills and understanding of content.

 A programme, reported by Klein, *et al*. (1998) was implemented to increase class achievement by raising the motivational level of adolescents. The target population consisted of high school mathematics students from a metropolitan area located in central Illinois. The post intervention data indicated that Cooperative Learning and multiple intelligence activities enhanced student’s motivation for learning mathematics and thereby achievement.

 The study ‘Impact of Self Evaluation Tracking on Mathematics Achievement in a Cooperative Learning Environment’ conducted by Ross,
*et al*. (1998) examined the effects of self-evaluation on student performance up on 300 students. Treatment students became more accurate in their self appraisals. The findings also weaken the argument for consequential validity of an authentic assessment achievement, at least with respect to student achievement.

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

 A study named “Effectiveness of Cooperative Learning Strategy were over Traditional Method of Teaching English in Eighth Standard Pupils” conducted by Golda (1999) and concluded that there was a positive result while teaching through Cooperative Learning Strategies.

 A year-long school based study, conducted by Lee, *et al*. (1999) in Singapore investigated the effects of the use of Cooperation in elementary social studies classrooms on social studies achievement. Results indicated that lower ability pupils benefited the most from the use of Cooperative Learning on social studies lessons. These students had better social studies test scores than the control class and did just as well as the high ability pupils on the recall items of the test.

 An action research project conducted by Dekeyrel, *et al*. (2000) sought to improve student motivation in order to increase academic performance among eighth graders in an urban community. A variety of Cooperative Learning and social skills activities were incorporated in the intervention. The post intervention data indicated an overall improvement in many areas including academic achievement.

 A research work by Holliday (2000) aimed at contributing to the literature on Cooperative Learning, especially Jigsaw-II at the secondary level. The research also represents a continuation of research conducted on Jigsaw II and III, subsequently leading to the development of Jigsaw-IV as a Cooperative Learning Strategy. The findings suggested that Jigsaw-IV answered the concerns of students and teachers using Jigsaw-II and had a positive impact on student’s academic achievement.

 An action research project conducted by Janes, *et al*. (2000) examined the impact of a multifacted intervention on student motivation and achievement. The sample was second and third graders from three schools. The 12 week intervention was comprised of three elements including Cooperative Learning. The participating teachers concluded that Cooperative Learning and engaged learning were used together to successfully increase student motivation and achievement.

 Johnson, *et al*. (2000) studied about the effectiveness of Collaborative Learning strategies via internet found out that the internet based Collaborative Learning courses at statistically significant level. The collaborations learning model produces superior academic outcomes in terms of the student comprehensions and mastery of the course material, critical reasoning skill communicative competence and knowledge application to problem solving skill and overall satisfaction.

 Kumar and Hameed (2000) report a study in which 40 standard VII pupils were taught through Learning Together model of Cooperative Strategy. The post-test scores were compared with that of another 40 pupils who were taught through conventional method of teaching. Higher achievement was observed with pupils taught through Cooperative Learning Strategy.

 Mahenthiran and Rouse (2000) studied whether the performance and attitudes of students could be improved by giving them some control over the group selection process in Cooperative Learning. The results with 110 college students showed that student’s attitudes towards the Cooperative Learning experience were better and their grades were higher.

 Bartscher, *et al*. (2001) conducted a study which describes a programme for students in the target, fourth, seventh and eighth grades who exhibit low achievement in writing. The solution strategy involved co-operation, journalizing and creative writing. The results showed improvement in writing.

 Inorder to increase motivation in fifth-grade social studies students, Carroll and Leander (2001) conducted an action research project. Two categories of intervention including Cooperative Learning were implemented. The post-intervention data indicated an improvement in student motivation, attitudes and academic performance.

 A project was created by Copeland, *et al*. (2001) for seventh and eighth grade students to improve their academic success. Interventions consisted of Cooperative group activities and the results suggested that classroom strategies and combined efforts of teacher helped to improve both students motivation and academic achievement.

 Fuller (2001) examined the effectiveness of the Partners Advancing the Learning of Maths and Science (PALMS) educational model for teachers. The PALMS model was based on Cooperative Learning and used student research, primary resources, critical thinking, ongoing assessment, student presentations and comprehensive, standards-based state testing. The data from this study indicated that active training events significantly influenced the willingness of teachers to use PALMS, and students enjoyed substantial educational benefits of the model.

 Ghaith (2001) investigated the perceptions of the Cooperative experience of a group of Lebanese middle school learners who studied the rules and mechanics of English as a foreign language, according to the dynamic of the student Teams – Achievement Divisions (STAD) Cooperative Strategy. The results indicated that learners were generally positive about their experience.

 Golberg, *et al*. (2001) used Cooperative Learning strategies to increase high school and middle school student’s motivation for doing well in school. The targeted population consisted of middle school students in physical education and science classes, and high school students in science, technology and special education classes. The results indicated that Cooperative Learning improved students motivation and academic achievement.

 Krank and Moon (2001) applied instructional strategies derived from the concept of mastery learning and cooperative group activity to 104 undergraduate social science students enrolled in three sections of a required course and found significant effects for the combined mastery Cooperative Learning condition when compared to mastery learning alone.

 Holliday (2002) conducted a study on middle school students, the subjects were seven graders in two. The two classes consisted of 20 at risk students and one control group of 24 high achievers. Results indicated that Jigsaw worked well and improved the achievement of the risk students.

 Kumar and Bindhu (2002) report an experiment in which a sample of 100 standard VI pupils were utilised to study the relative effectiveness learning strategy and conventional method of teaching on achievement in Malayalam language skills. Cooperative Learning Strategy was found more effective than the control treatment.

 Box and Little (2003) conducted a study, which was done on 125 third graders, showed that the use of Jigsaw approach combined with advanced organizers positively affect both the academic achievement and the self concept of elementary students.

 Gaith and Malak (2004) conducted a study on university bound student and lasted for 10 sessions. They reported that no significant differences between the control group and the experimental on the development variables of overall reading comprehension and literal comprehension although the result showed significant difference on the variable of higher order comprehension.

 Studies which investigated the effects of self and Cooperative Instructional Strategies on senior secondary school student’s cognitive achievement in mathematics were summarised by Adesoji and Adebola (2007) and concluded that Cooperative Learning packages in the classroom since the strategies were found to be more effective in enhancing student’s achievement in Mathematics than the conventional teaching method.

 Thangarajathi (2007) conducted a study on “Cooperative Learning Approach in Learning Mathematics.” This study conduct that the Cooperative Learning method (Jigsaw method of cooperative learning) was found to more effective than the conventional method.

 Kaul (2008) conducted a study on “The Effect of Learning Together Techniques of Cooperative Learning Method on Students Achievement in Mathematics in 7th class in N.S. Public School, Uttar Pradesh”. The conclusions showed that there is a significant difference between the results of experimental and control groups. Learning Together Technique of Cooperative Learning method is more effective than traditional teaching method.

 Pallavi (2008) conducted a study “The effect of Learning Together Techniques of Cooperative Learning Method on Students Achievement in Mathematics.” This study concluded that the learning together technique of Cooperative Learning method is more effective than traditional teaching methods.

 Shihab (2009) conducted an experimental study on sample of 50 teacher trainees from University Teacher Education Centre Malappuram and from MCT Training College Malappuram. The results indicates that Cooperative Learning Strategies are more effective than traditional methods in the teaching pedagogy of social studies.

 Pandya (2009) conducted a study “A study of the effect of Cooperative Learning model on the academic achievement in Mathematics among students with different learning styles,” concluded that there is a significant effect of the Cooperative Learning Model on Academic Achievement of students. The magnitude of the effect of the treatment on a academic achievement is maximum.

 The studies mentioned earlier suggest a positive relationship between Cooperative Learning and Academic Achievement. But survey of related literature exposed a few studies showing a no relationship or negative relationship between Cooperative Learning and Academic Achievement. Some such studies are reviewed and presented.

* + - 1. **Studies Showing Negative/No Achievement Results**

 There are a number of studies showing a favourable influence of Cooperative Learning on Academic Achievement. Where as only very few of them are there with negative results.

 Miller and Hamblin (1963) conducted experimental studies on learning strategies and found no achievement benefits for Cooperation when compared with individualistic and competitive learning strategies.

 A series of studies conducted by Haines and McKeachie (1967) have found that while daily performance is superior under a cooperative goal structure there are no significant differences on examination performance among individuals who studies in a competitive or cooperative group.

 Several lengthier studies of ‘pure’ Cooperation that lasted for two to ten weeks, conducted by Wheeler and Ryan (1973) on elementary school students, found no achievement benefits for cooperation compared with individualistic or traditionally taught control classes.

 A study by Hythecker, *et al*. (1984) indicated that students who were taught a learning strategy (net working) by interacting with both a microcomputer and a cooperating partner performed significantly worse than students who received the same training individually.

 Despite most of other research work indicating the superiority of Cooperative Learning over competitive methods, Okebukola (1984) found in a Nigerian study that students did equally as well under cooperative and competitive conditions so long as students were placed in a learning setting which matched their preferences.

 Slavin (1985) summarised some studies and found Learning Together Model (one among Cooperative Learning Strategies) as equal to the control group in achievement effects and lower than the control group in another.

 In two studies of Malouf (1990), 36 Junior high students and 66 inter mediate level students with mild disabilities worked together to complete computerised instructional activities on capitalization and punctuation. The intervention produced significant increase in behaviour that was positively related to learning but did not produce significant increase in learning.

 Achievement difference between sixth grade boys and girls in Individualistic and Cooperative situations was studied by Petersen (1991). and found no difference in achievement between Individualistic and Cooperative Learning situations.

 The effectiveness of small-group Cooperative Learning and a more teacher-centered instructional style on student performance in Mathematics was studied by Urion and Davidson (1992). The sample was junior high school and college students. No significant difference in performance was found between the small group class and the teacher-centered class.

 A study conducted by Pisani (1994) examined the effects of
Cooperative Learning environment on academic achievement and persistence by examining the precursory measure of student involvement. A sample of 68 fresh men from the 1992 entering class at the University of Illinois were used. The findings suggest that the positive influence of Cooperative Learning environment is carried in to student involvement and not in to other areas.

 Fourts (1995) reports a study, which was conducted in to two schools, one focusing on the area of Health Science Studies (HSS) the second focussing on the International Business and Global Studies (IBGS). Both schools feature an integrated curriculum, Cooperative Learning, the direct application of learning to life situations, flexible scheduling, cohort learning and alternative assessment strategies. The result indicated the First Year Participation in both schools did not translate conditions were compared.

 In a study reported by Abu and Flowers (1977) high school home economic students were taught by a nutrition unit (91 using Cooperative Learning and 106 controls). The results showed no difference in achievement or attitudes.

**Studies and Results in a Nut Shell Positive Results**

| **Year** | **Author** | **Result** |
| --- | --- | --- |
| 1969 | Laughlin, *et al.* | Superiority of group performance on individual performance |
| 1974 | Johnson and Johnson | Cooperative tasks positively effect learning outcomes |
| 1975 | Johnson and Johnson | Increased achievement in Cooperative Learning Methods |
| 1976 | Lucker, *et al.* | Jigsaw learning positively effect on minority students. |
| 1977 | Aronson, *et al.* | Increase self esteem theory Cooperative Learning |
| 1980 | Sharon | Positively related to achievement |
| 1981 | Johnson and Johnson | Higher performance on individual problem solving in Cooperative Learning  |
| 1982 | Glass. *et al.* | Class size has a significant effect on student learning in all subjects. |
| 1983 | Slavin | Effect of Cooperative Learning on students achievement appear in different levels of schools, localities and subjects. |
| 1987 | Fennema and Paterson | Females learn more easily through Cooperative Learning |
| 1987 | Newmann and Thompson | Effective in increasing student achievement when groups are rewarded. |
| 1987 | Slavin | Individuals can grow cognitively through Cooperative efforts. |
| 1987 | Stevens, *et al.* | Cooperative Learning Strategy had a positive effects in reading comprehension, reading vocabulary, language expression, mechanic and spelling. |
| 1988 | Kutnick | Corresponding increase in student’s academic performance |
| 1990 | Angry | The outcomes of the study were very positive |
| 1990 | Brickle | Student’s performance was improved. |
| 1990 | Christison | Significant and positive effect on Academic Achievement |
| 1990 | Dunne and Bennett | Positive relationship between the variables |
| 1990 | Hassard | Cooperative Learning and the teaching of Science is more effective |
| 1990 | Lawman | Much greater mastery of the material than the traditional techniques |
| 1990 | Seaman | The variables were positively correlated |
| 1990 | Wills | Significantly higher level of achievement than the control group. |
| 1991 | Steven, *et al.* | Cooperative Learning is more effective in reading comprehension, reading vocabulary, language expression, mechanic and spelling. |
| 1992 | Fiedler Brand, *et al.* | Heterogeneously grouped Cooperative Learning experience was most effective. |
| 1992 | Olsen and Kagan | Several advantages for Cooperative Learning and increased amount of out put. |
| 1994 | Keeler | Effective in improving students performance |
| 1994 | Kumar and Rai | Cooperative Learning is better strategy for achieving more. |
| 1994 | Kumar and Rai | Different Cooperative Learning methods improves learning and social relations. |
| 1994 | Shacker and Sharan | Cooperative Learning was more effective than the whole class instruction |
| 1995 | Cooper  | Cooperative Learning improve Critical thinking |
| 1995 | Dougherty | Students achievement was improved |
| 1995 | Felder | Cooperative Learning Methods facilitates both learning and impersonal skills |
| 1995 | Keeler and Anson | Cooperative Learning Strategy improved student’s academic achievement |
| 1995 | Lurie and Ovrebo | Significant positive effect |
| 1995 | Randon | Cooperative Learning was more effective. |
| 1995 | Steven and Slavin | Reading and Writing skills of the students were found to increase |
| 1995 | Townsend and Hicks | Achievement benefits for Cooperation |
| 1996 | Brush | Cooperative Learning is a better strategy for effective learning |
| 1996 | Cohen | Cooperative situations fostering interaction |
| 1996 | Hill | Gains in achievement |
| 1996 | Hirsch, *et al.* | Develop English language skills |
| 1996 | Xin | Achievement was statistically higher |
| 1997 | Brauer, *et al.* | The variables were positively correlated |
| 1997 | Hameed | Cooperative Learning was a better strategy than conventional method of teaching |
| 1997 | Hodges and Wolf | Greater student engagement and increased achievement |
| 1997 | Johnson and Johnson | Members show responsibility in goal achievement |
| 1997 | Leung and Chung | Cooperative Learning had a positive effect |
| 1997 | Sasidharan | Pupils taught through Jigsaw Learning Strategy acquired higher achievement than the control group |
| 1998 | Geiss and Mayer | Improved students listening skills and understanding of content |
| 1998 | Klein, *et al.* | Enhanced student’s motivation and thereby achievement |
| 1998 | Ross, *et al.* | Improve mathematics achievement through Cooperative Environment |
| 1999 | Crawford | Increasing students interaction in any work |
| 1999 | Golda | Cooperative Learning Strategy was more effective than the traditional method |
| 1999 | Lee, *et al.* | Lower ability pupils benefited the most from the use of Cooperative Learning |
| 2000 | Dekeyrel, *et al.* | An overall improvement in many areas including achievement.  |
| 2000 | Janes, *et al.* | Successfully increased student achievement |
| 2000 | Johnson, *et al.* | Superior academic outcome |
| 2000 | Mahenthiran and Rouse | Student’s grades were higher |
| 2001 | Bartscher, *et al.* | The sample showed an improvement in writing |
| 2001 | Carroll and Leander | An improvement in student motivation, attitudes and academic performance |
| 2001 | Copeland, *et al.* | Improved both students motivation and academic achievement |
| 2001 | Fuller | The variables were positively correlated |
| 2001 | Gaith | Learner, were generally positive about their achievement |
| 2001 | Golberg, *et al.* | Cooperative Learning improved student achievement |
| 2001 | Krank and Moon | Significant positive effect on achievement |
| 2002 | Holliday | Jigsaw worked well and improved the achievement of the risk students. |
| 2002 | Kumar and Bindhu | Cooperative Learning Strategy was found more effective than the control treatment |
| 2003 | Box and Little’s | Positively effect both the academic achievement and the self concept.  |
| 2004 | Gaith and Malak | Significant difference on the variable of higher order comprehension |
| 2007 | Adesoji and Adebola | Cooperative Learning Strategies were more effective in enhancing student’s achievement than conventional teaching method. |
| 2007 | Thangarajathi | Cooperative Learning Strategy was more effective than the conventional method. |
| 2008 | Kaul | Cooperative Learning Method is more effective than traditional teaching methods. |
| 2008 | Pallavi | Cooperative Learning method is more effective than traditional teaching methods. |
| 2009 | Shihab | Cooperative Learning Strategies are more effective than traditional methods. |
| 2009 | Pandya | 1. Significant effect of the Cooperative Learning Model on academic achievement.
2. Cooperative Learning Model was more effective than independent, avoidant and competitive learning styles.
 |

**Negative Results**

| **Year** | **Author** | **Result** |
| --- | --- | --- |
| 1963 | Miller and Hamblin | No achievement benefits for cooperation. |
| 1973 | Wheeler and Ryan | No achievement benefits for Cooperation when compared to the control treatment. |
| 1984 | Hythecker, *et al.* | Performance was significantly worse.  |
| 1984 | Okebukola | No achievement benefits. |
| 1985 | Slavin | Student performance was equal to that of the control group. |
| 1990 | Malouf | Did not produce significant increase in learning. |
| 1991 | Peterson | No difference in achievement between the individualistic and Cooperative Learning situations. |
| 1992 | Urion and Davidson | No significant difference in performance when compared to the control treatment. |
| 1994 | Pisani | Cooperative Learning environment was carried in to student involvement and not in to other areas. |
| 1995 | Fourts | Did not translate in to higher grades |
| 1997 | Abu and Flowers | No difference in achievement.  |

**CONCLUSION**

 Many studies on Cooperative Learning showed its greater impact and importance in the educational field. The Cooperative Learning methods bring more outcome than traditional methods do. Moreover, the studies conducted in this area are the best example to show how this Method brings forth co-operation among students.

 The investigation could not locate studies showing the effectiveness of the Jigsaw II Method of Cooperative Learning Strategy over Traditional Method of teaching Mathematics in Kerala situation.

**Three**

**METHODOLOGY**

* Variables of the Study
* Objectives
* Hypotheses
* Design of the Study
* Procedure

**METHODOLOGY**

The main purpose of the present study was to investigate the effects of Instructional Learning Strategies [Cooperative Learning Strategy and Existing Method of Teaching] on Achievement in Mathematics of Standard VIII Students.

 The methodology of the present study is present under the following headings.

* 1. VARIABLES OF THE STUDY
	2. OBJECTIVES
	3. HYPOTHESES
	4. DESIGN OF T HE STUDY
	5. PROCEDURE
	6. **VARIABLES OF THE STUDY**

The Independent, Dependent and Control variables selected for the present study are the following.

3.1.1. INDEPENDENT VARIABLE

The independent variable selected for the study was Instructional Learning Strategies [Cooperative Learning Strategy – Jigsaw II and Existing Method of Teaching].

3.1.2. DEPENDENT VARIABLE

 The Dependent Variable selected for the study WAS the Achievement in Mathematics of Standard VIII students.

* + 1. CONTROL VARIABLES

The following are the control variables selected for the study.

* + - 1. **Pre Experimental Status in the Subject Matter Measured by a Pretest** and
			2. **Verbal Intelligence**

**3.2 OBJECTIVES**

The objectives formulated for the present study are presented below to get an idea regarding the nature and scope of the experiment. They are as follows:

* + 1. To study whether there exists any significant difference in the Mean Pretest scores of Experimental and Control Groups for the Total Sample, Boys and Girls.
		2. To study whether there exists any significant difference in the Mean Achievement scores of Experimental and Control Groups for the Total Sample, Boys and Girls.
		3. To study whether there exists any significant difference in the Mean Gain Scores of Experimental and Control Groups for the Total sample, Boys and Girls.
		4. To study the effectiveness of Jigsaw II method of Cooperative Learning Strategy over Existing Method of Teaching in terms of Achievement in Mathematics of Standard VIII Students.

**3.3. HYPOTHESES**

The present study was designed to test the following hypotheses.

* + 1. Thereis no significant difference in the Mean Pretest scores of the Experimental and Control groups for the Total Sample, Boys and Girls
		2. There is no significant difference in the Mean Achievement scores of the Experimental and Control groups for the Total Sample, Boys and Girls.
		3. There is no significant difference in the Mean Gain Scores of the Experimental and Control Groups for the Total Sample, Boys and Girls.
		4. Students taught through Jigsaw II Model of Cooperative Learning Strategy do not differ significantly in terms of Achievement in Mathematics than students taught through Existing Method of Teaching.

**3.4. DESIGN OF THE STUDY**

The present study has been conducted by employing the True Experimental Design. Experimental Design is the blue print of the procedures that enables the researcher to test hypotheses by reaching valid conclusions about relationship between independent and dependent variables (Best and Kahn, 1996).

3.4.1 RESEARCH DESIGN SELECTED

The research design selected for the present experimental study was the Pre test - Post test Equivalent Groups Design. The design of the study is illustrated as follows:

G1 O1 x O2­

G2 O3 C O4

O1 O3 Pre test

O2 O4 Post test

O2 - O1

Gain Score

O4 - O3

G1 - Experimental Group

G2 - Control Group

X – Application of the Experimental Treatment

C – Application of the Control Treatment

 One class division from one school was treated as the Experimental group and one class division from another school was treated as the Control group. The experimental group was taught through the Cooperative Learning Strategy (CLS) for fifteen class periods and each period was of a duration of 90 minutes. The control group was taught through the Existing Method of Teaching (EMT) for thirty class period and each periods was of a duration of 45 minutes.

 Since, the design adopted for the present study was Pretest-Post test Equivalent Group Design, it is appropriate to apply Analysis of Covariance (ANCOVA) to control statistically any difference in the initial status of the groups, because, Analysis of Covariance is a method of analysis that enables the researcher to ensure statistical control of the confounding variables, such as the pre-experimental status and Verbal Intelligence of the subjects.

**3.5. PROCEDURE**

The procedure followed for the conduct the present study is as detailedbelow.

3.5.1. SAMPLE FOR THE STUDY

 As it was an experimental study, the investigator felt that it would be difficult to conduct the experiment if the sample is too large. Therefore two intact class divisions of standard VIII from two schools were selected as samples, one for the experimental and the other for the control group where the two different teaching methods were employed. The schools selected were G. M. H. S. S. University Campus, Malappuram District and G.V.H.S.S Chelari, Malappuram District.

 The Experimental Group consisted of 35 subjects (26 boys and 9 girls) and the Control group consisted of 35 subjects (18 boys and 17 girls). Details of initial sample selected for the study is presented in Table 3.1

TABLE 3.1

**Details of Initial Sample Selected for the Study**

|  |  |
| --- | --- |
| **Experimental Group** | **Control Group** |
| **Boys** | **Girls** | **Total** | **Boys** | **Girls** | **Total** |
| 26 | 14 | 40 | 20 | 20 | 40 |

3.5.2. TOPIC SELECTED FOR TREATMENT

The topic for the treatment in the present study was selected from the syllabus prescribed for standard VIII students of Kerala State for the academic year 2010-2011. The topic selected was “Algebra”. The sub topics were:-

1. Product of sums
2. Product of two sums
3. Product of two differences
4. Square of a sum
5. Difference square and
6. Product of a sum and difference

3.5.3. TOOLS USED FOR MEASUREMENT

The tools used for the present study are given below.

* + - 1. **Lesson Transcript for Cooperative Learning Strategy**

Cooperative Learning Strategy enables most of the students to achieve the same level of achievement as the above average students achieve (Sharan, 1980; Slavin 1980; 1983; Peterson, *et al*., 1980; Johnson and Johnson, 1975).

The investigator prepared Lesson Transcripts for Cooperative Learning Strategy, following the steps proposed by Slavin (1980) for their ‘Jigsaw II’ Model of Cooperative Learning. The topic selected for treatment i.e., ‘Algebra’ was divided in to six subunits. The topic selected and the specific objectives were same for the Experimental group and Control group.

The investigator reviewed different Cooperative Learning Procedures like Learning Together (Johnson and Johnson, 1975); Group Investigation (Sharan and Sharan, 1976); Numbered Heads Together (Olsen and Kagan, 1992); Think Pair Share (Andrini, 1994); Complex Instruction (Cohen, 1998); Student Team Learning (Slavin, 1980); Student Teams Achievement Divisions-STAD (Slavin, 1983a); Teams Games Tournaments (TGT) (Devries, *et al*., 1980); Team Assisted Individualisation (Slavin *et al*., 1984); Jigsaw Learning-1 (Aronson, *et al*. 1978); Jigsaw-II (Slavin, 1980). Among these methods, the investigator selected the ‘Jigsaw-II Model’ of Cooperative Learning Strategy for treatment.

Slavin (1980) found that individual incentives in Jigsaw I is a demerit, so that it would promote competition rather than cooperation. So he made a modification in Jigsaw-I and then incorporated it in the student Team Learning Programme. This method is called Jigsaw-II.

In Jigsaw II, instead of each student having a unique section, all students read a common narrative, such as a book, chapter or a short story. However, each student is given a topic on which to become an expert. The students who have the same topic meet in expert groups and return to their teams. Then students take individual quizzes, and their scores are formed in to team scores and the highest scoring team and individuals are recognized in a class newsletter. Jigsaw method of learning transfers the class room as a game board, learning as a game, an intellectual game in which all members of the team have something to be do, and something to contribute. The individual’s inevitable contribution through the group or team processing ultimately leads to the expertise gained by each member regarding the learning materials. This expertise as a personal asset, they share with other members in the team. Jig saw, if practised once, it will be demanded more by students. This is the indication of how students accept the Jigsaw model.

 Jigsaw learning is a learner – based strategy in which the students learn the content or language skills by mutual interaction within the group and between the groups. Jigsaw is more different and advanced than conventional group activities. Generally Jigsaw is proceeding through four different phases. They are:

Phase I - Formation of Base Groups

Phase II - Formation of Expert Groups

Phase III - Peer tutoring

Phase IV - Reconvene the class, exchange of ideas and rewarding
 the best group.

 The investigator followed these four phases, in the preparation of the draft Lesson Transcript in Malayalam for Co-operative Learning Strategy. The model lessons described by Slavin (1980) for the Jigsaw-II model were studied thoroughly by the investigator.

 The draft Lesson Transcript was executed by the investigator on 35 students of Standard VIII. Before the beginning of the try out, through a Jigsaw puzzle game, the investigator created a good rapport with the students. The investigator also explained the main objectives and features of Jigsaw-II model and how instruction is designed in tune with Cooperative Learning Strategy.

**Grouping Techniques**

 Jigsaw Learning is a widely practiced technique that is similar to group to group exchange with one important difference. Every single student teaches something to the others and the base group formation and expert group formation are the important aspects of Jigsaw. Hence the teacher should be aware of the grouping techniques. Grouping for Jigsaw should not be mechanical and conventional. It should provide a joyful mood to the students. A number of conventional techniques should not be against the idea of cooperation. Some of the relating new techniques are described here.

**a) The teacher distributes paper strips to all the students.**

 In the strips, there are names of flowers, fruits, birds etc. After distributing strips the teacher asks the students to form groups based on the strips [e.g.: students who got the names of flowers form a group). While making strips the teacher should consider the number of groups and number of members in each group.

1. **The teacher distributes comic strips or picture strips to the students.**

The students are asked to walk around the room to find the rest of their strips which creates a team. The investigator tried out the above techniques and formed seven groups consisting of five members each. The diagrammatic representation of classroom seating arrangement for the Jigsaw method is as follows.

Teachers concerned in the school was invited to attend the tryout session and their opinion about implementation was sought. On the basis of suggestion given by the teachers and the feed back from the students, to whom the try out was done, the draft Lesson Transcript was modified and reedited and used for treatment in the Experimental Group. A copy of the Lesson Transcript for Cooperative Learning Strategy and its English version are presented as Appendix I and I A respectively.

**3.5.3.2. Lesson Plan for Existing Method of Teaching**

Lesson Transcript for Existing Method of teaching for the Control group were prepared in Malayalam, on the basis of newly introduced Activity Based Curriculum of Kerala. Each lesson was prepared by the following format.

1. Identification of Curriculum Statements
2. Formation of Curriculum Competencies.
3. Presentation of Suitable Activities
4. Recording the Response of the Student
5. Recapitulation and Assignments

 While the method of teaching in Experimental group varied from unit to unit, depending upon the nature of the subject, the teaching method followed in the Control group was the Existing one. No separate teaching aids were made for the control group, but available teaching aids in the school were used. Model Lesson Plan in Malayalam\ and its English version are presented as Appendix II and IIA respectively.

* + - 1. **Verbal Group Test of Intelligence (VGTI)**

In the present study, the control variable, Verbal Intelligence was measured using the Verbal Group Test of Intelligence developed and standardized by Kumar, *et al*. (1997). The test battery consists of five sub-tests and each subtest consists of twenty items. The duration of the test is one hour. The details of the subtests are given in the following sub sections.

**Test 1 – Verbal Analogy**

 This test involves the ability to find out the relationship between two things or ideas and to apply the same to other situations. To each item three words are given with the fourth one missing. The subject has to find out the missing word for the four alternatives.

*Examples*:

1. Ship: Captain : Aeroplane :\_\_\_

 A. Sea B. Airport C. Driver D. Pilot

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | D🗸 |

**Test II - Verbal Classification**

 In this subtest, each item is a set of four words, of which three can be grouped together according to some principle or law. The subject has to choose that word which stands out of this group.

***Example***

1. A. Bus B. Aeroplane C. Cycle D. Lorry

|  |  |  |  |
| --- | --- | --- | --- |
| A | B🗸 | C | D |

**Test III – Numerical Reasoning**

 The items under this test includes **series type, odd man out** and **analogy type**. Certain numbers are given under each item. Some sort of relationship exists between these numbers. The subjects should perceive the relationship between the given numbers to choose the correct answer from the four alternatives given.

***Examples for series type***

1. 0, 2, 4, 6, \_\_\_, 10

 A. 7 B. 5 C.8 D. 9

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C🗸 | D |

***Example for odd man out type***

1. A.3 B. 4 C.7 D.9

|  |  |  |  |
| --- | --- | --- | --- |
| A | B🗸 | C | D |

***Examples for analogy type***

1. 10: 20: 18: -----

 A. 26 B. 36 C. 46 D. 32

|  |  |  |  |
| --- | --- | --- | --- |
| A | B🗸 | C | D |

**Test IV – Verbal Reasoning**

 Each item in this test is a problem, representing some sort of relationship. The subject should identify the correct answer from the four alternatives given.

***Example***

1. Ajay works more than Vijay. Asok and Ajith has the same capacity to work. Vijay works better than Asok. Who is the hard worker?

 A. Asok B. Ajith C. Vijay D. Ajay

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C🗸 | D |

**Test V Comprehension**

 In this test four types of items are included. Each item is in the form of a puzzle involving several relationships. The subject has to understand and analyse the relationship given in each problem and then choose the correct answer for the five questions from the given four alternatives.

***Example***

1. W, X, Y and Z are the members of a home. Among them W, X and Y are educated and W, Y and Z are honest. Y and Z are employed and W, X and Z have humility

i) Who have education and honesty, but is not employed?

 A. W B. X C. R D. Z

|  |  |  |  |
| --- | --- | --- | --- |
| A🗸 | B | C | D |

***Validity of the VGTI***

Validity of the Verbal Group Test of Intelligence was established using criterion related techniques. The validity coefficients obtained (sub-test-wise and total test) are given in Table. 3.2.

TABLE 3.2

**Validity Coefficients Obtained for
Verbal Group Test of Intelligence (Sub test Wise and Total test)**

|  |  |  |
| --- | --- | --- |
| **Sl.No.** | **Components of VGTI** | **Obtained ‘r’** |
| 1. | Verbal Analogy | 0.5498 |
| 2. | Verbal classification | 0.5436 |
| 3. | Numerical reasoning | 0.5249 |
| 4. | Verbal Reasoning | 0.4041 |
| 5. | Comprehension | 0.4606 |
| 6. | Total Test | 0.6557 |

p < 0.01

Since the content was adopted from reputed tests of verbal Intelligence, the VGTI possesses high level of content validity as reported by the test constructors.

***Reliability of the VGTI***

Reliability of the VGTI has been established using the Split Half Method and the reliability has been corrected using Spearman Brown Prophecy Formula. The reliability coefficients of the five sub tests and the Total test are given in Table 3.3.

TABLE 3.3
**Reliability Coefficient Obtained for
Verbal Group Test of Intelligence (Subtest-Wise and Total Test)**

|  |  |  |
| --- | --- | --- |
| **Sl.No.** | **Tests** | **Obtained ‘r’** |
| 1. | Verbal Analogy | 0.6636 |
| 2. | Verbal classification | 0.5649 |
| 3. | Numerical reasoning | 0.7214 |
| 4. | Verbal Reasoning | 0.6328 |
| 5. | Comprehension | 0.4700 |
| 6. | Total Test | 0.8283 |

p < 0.01

 The validity and reliability coefficients indicated that the test is a valid as well as reliable measure of verbal Intelligence. The internal structure of the VGTI has been examined by the test constructors correlating the component wise score with total score on the VGTI. The inter correlation matrix is presented in Table 3.4.

TABLE 3.4
**Inter Correlation of the Components
of Verbal Group Test of Intelligence with Total Score**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.No.** | **Components** | **Verbal Analogy** | **Verbal Classification** | **Numerical Reasoning** | **Verbal Reasoning** | **Comprehension** | **Intelligence** |
| 1 | Verbal Analogy | (.) | 0.6209 | 0.4177 | 0.433 | 0.3457 | 0.7623 |
| 2 | Verbal classification |  | (..) | 0.4203 | 0.4123 | 0.3954 | 0.7692 |
| 3 | Numerical Reasoning |  |  | (..) | 0.4653 | 0.4652 | 0.7673 |
| 4 | Verbal Reasoning |  |  |  | (..) | 0.4079 | 0.7171 |
| 5 | Comprehension |  |  |  |  | (..) | 0.6896 |

p <0.01

 One copy each of the Verbal Group Test of Intelligence in Malayalam and in English, its Response Sheet and the scoring key are presented in Appendices III, IIIA, IIIB and IIIC respectively.

**3.5.3.4 Achievement Test in Mathematics (ATM)**

This test of Achievement in Mathematics was constructed and standardised by Hameed and Dilshath (2010) to use as pretest and posttest, on the topic selected for treatment as explained earlier. The procedure adopted for the construction and standardisation of Achievement Test in Mathematics is described in this section.

***Planning of the Test***

The investigator studied thoroughly the curriculum, syllabus and text book of Mathematics for the standard VIII students, for the academic year 2010-2011. For guidance, the investigator consulted with subject experts and experienced teachers in Mathematics. The investigator also referred available source book and Text books for framing the items for the test. The books referred for the purpose are:

1. Taxonomy of Educational Objectives Book 1 (Bloom, 1979).
2. Essentials of Educational Measurement (Ebel and Frisbie, 1991).
3. Educational Measurement and Evaluation (Nunnally, 1972).

For the Achievement Test in Mathematics, the investigator planned to prepare a test consisting of 30 items for a time duration of 45 minutes.

***Preparation of the Test***

 Items for the Achievement Test in Mathematics were prepared on the basis of the major objectives of the revised Taxonomy of Cognitive Domain. When the test was prepared, due weightage was given to objectives, content and difficulty level of items.

***a. Weightage to Objectives***

Objectives are broad goals and are stated in terms of desired changes in student behaviour. Items were prepared on the basis of Blooms revised taxonomy of educational objectives. The weightage given to the categories of objectives under cognitive domains are

* Remembering
* Understanding
* Applying
* Analyzing
* Creating
* Evaluating

 The weightage given to different objectives for the Achievement Test are given below in Table 3.5.

TABLE 3.5
**Weightage to Objectives**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No.** | **Objectives** | **Marks** | **Percentage** |
| 1. | Remembering | 8 | 26.67 |
| 2 | Understanding | 14 | 46.66 |
| 3 | Applying | 4 | 13.33 |
| 4 | Analysing | 2 | 6.7 |
| 5 | Creating | 1 | 3.3 |
| 6 | Evaluating | 1 | 3.3 |
|  | Total | 30 | 100 |

**b. *Weightage to Content***

 The investigator analysed and divided the entire content in to six sub units and tried to give adequate weightage to each subunit. The weightage given to each subunit is given in Table 3.6.

TABLE 3.6
**Weightage to Content**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No.** | **Content** | **Marks** | **Percentage** |
| 1 | Product of sums | 5 | 16.66 |
| 2 | Product of two sums | 8 | 26.66 |
| 3 | Product of two differences | 4 | 13.33 |
| 4 | Square of a sum | 5 | 16.66 |
| 5 | Difference square | 5 | 16.66 |
| 6 | Product of a sum and difference | 3 | 10.00 |
|  | Total | 30 | 100 |

***c. Weightage to Difficulty Level***

 Weightage given to the difficulty level is presented in Table 3.7.

TABLE 3.7
**Weightage to Difficulty Level**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No.** | **Difficulty level** | **Marks** | **Percentage** |
| 1 | Easy | 8 | 26.66 |
| 2 | Average | 15 | 50.00 |
| 3 | Difficult | 7 | 23.33 |
|  | Total | 30 | 100 |

**Blue Print**

 On the basis of the weightages given for the instructional objectives, content etc, the investigator prepared a blue print. The blue print for the Achievement Test in Mathematics incorporating weightage given to instructional objectives, content area and difficulty level are presented in
Table 3.8.

TABLE 3.8
**Blue print for the Achievement Test in Mathematics**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Objectives** | **Remembering**  | **Understanding**  | **Applying** | **Analysing** | **Creating**  | **Evaluating** | **Total** |
| **Form of Qns.****Sub units** | O | S | E | O | S | E | O | S | E | O | S | E | O | S | E | O | S | E |  |
| 1 |  |  |  | 3(3) |  |  | 1(1) |  |  | 1(1) |  |  |  |  |  |  |  |  | 5 |
| 2 | 1(1) |  |  | 4(4) |  |  | 2(2) |  |  |  |  |  |  |  |  |  |  |  | 7 |
| 3 | 2(2) |  |  | 3(3) |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 5 |
| 4 | 1(1) |  |  | 2(2) |  |  | 1(1) |  |  |  |  |  | 1(1) |  |  |  |  |  | 5 |
| 5 | 2(2) |  |  | 1(1) |  |  |  |  |  | 1(1) |  |  |  |  |  | 1(1) |  |  | 5 |
| 6 | 2(2) |  |  | 1(1) |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Sub Total | 8(8) |  |  | 14(14) |  |  | 4(4) |  |  | 2(2) |  |  | 1(1) |  |  | 1(1) |  |  |  |
| Total | 8(8) | 14(14) | 4(4) | 2(2) | 1(1) | 1(1) | 30 |

Note: The number outside the brackets indicates marks and those inside, number of questions.

 Based on the blue print, the investigator prepared 60 multiple choice items in Malayalam representing each objective and subjected to expert’s scrutiny and criticism. Thus 60 items were selected for the draft test. A draft copy of the Achievement Test in Mathematics (Draft) together with its English Version, Response sheet and Scoring Key are presented in Appendix No IV, IVA, IVB and IVC respectively.

***Try out***

 The draft test with 60 multiple choice items was tried out by the investigator on a representative sample 87 students in two class divisions of standard VIII, in an school other than the Experimental and Control subjects were selected. Before the administration of the test, its purpose was made clear to the subjects. The draft test and response sheets in sufficient members were provided to the students. The test included all the necessary guidelines about the test and additional information were given by the investigator.

 A window screen was prepared as per the scoring key and all the 87 response sheets were scored and consolidated for items analysis.

***Item Analysis***

 For item analysis, the procedure suggested by Ebel and Frisbie (1991) was used. The selected response sheets were arranged in the descending order of the magnitude of scores. The scores obtained by upper 24 subjects (27 percentage) and lower 24 subjects (27 percentage) were taken as the upper group and lower group respectively. For the selection of the items in the final test, the difficulty index and discriminating power of each item were found out.

***a). Difficulty Index***

 The following formula suggested by Ebel (1991) was used to calculate the difficulty index of each item.

 Difficulty index = 

Where,

U = The number of correct responses in the upper group.

L = The number of correct responses in the lower group

N = The number of subjects in each group

***b). Discriminating Power***

 The higher the average discrimination index for items in a test, the more variable the scores are likely to be and more reliable the scores are expected to be (Ebel, 1991)

Formula used for calculating the discriminating power is the following

 Discriminating power = 

Where,

 U = The number of correct responses in the upper group

 L = The number of correct responses in the lower group

 N = The number of subjects in each group

The difficulty index and discriminating power of each item are given in
Table 3.9.

TABLE 3.9

**Difficulty Index and Discriminating
Power for 60 items of Achievement test in Mathematics**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Item No.** | **U** | **L** | **DI** | **DP** | **Selected items** | **Item No** | **U** | **L** | **D1** | **DP** | **Selected Item** |
| 1. | 23 | 14 | 0.77 | 0.37 |  | 31 | 18 | 5 | 0.47 | 0.54 | \* |
| 2. | 21 | 6 | 0.56 | 0.62 | \* | 32 | 14 | 3 | 0.35 | 0.45 |  |
| 3. | 23 | 6 | 0.60 | 0.70 | \* | 33 | 4 | 7 | 0.22 | 0.12 |  |
| 4. | 23 | 6 | 0.60 | 0.70 | \* | 34 | 9 | 5 | 0.29 | 0.16 |  |
| 5. | 21 | 10 | 0.64 | 0.45 |  | 35 | 7 | 3 | 0.20 | 0.16 |  |
| 6. | 9 | 10 | 0.39 | 0.04 |  | 36 | 19 | 4 | 0.47 | 0.62 | \* |
| 7. | 24 | 10 | 0.70 | 0.58 |  | 37 | 13 | 6 | 0.40 | 0.30 |  |
| 8. | 17 | 8 | 0.52 | 0.37 |  | 38 | 19 | 4 | 0.47 | 0.62 | \* |
| 9. | 17 | 8 | 0.52 | 0.37 |  | 39 | 17 | 7 | 0.50 | 0.41 | \* |
| 10. | 23 | 12 | 0.72 | 0.45 |  | 40 | 21 | 8 | 0.60 | 0.54 | \* |
| 11. | 16 | 7 | 0.47 | 0.37 |  | 41 | 8 | 7 | 0.31 | 0.04 |  |
| 12. | 21 | 7 | 0.58 | 0.58 | \* | 42 | 23 | 4 | 0.56 | 0.79 | \* |
| 13. | 23 | 4 | 0.56 | 0.79 | \* | 43 | 9 | 5 | 0.29 | 0.16 |  |
| 14. | 18 | 7 | 0.52 | 0.45 | \* | 44 | 22 | 2 | 0.50 | 0.88 | \* |
| 15. | 17 | 7 | 0.50 | 0.41 | \* | 45 | 10 | 6 | 0.33 | 0.16 |  |
| 16. | 14 | 4 | 0.37 | 0.41 |  | 46 | 6 | 8 | 0.29 | 0.83 | \* |
| 17. | 23 | 6 | 0.60 | 0.70 |  | 47 | 15 | 4 | 0.40 | 0.45 | \* |
| 18. | 23 | 5 | 0.58 | 0.75 | \* | 48 | 21 | 10 | 0.64 | 0.45 |  |
| 19. | 1 | 1 | 0.04 | 0.00 |  | 49 | 23 | 2 | 0.51 | 0.87 | \* |
| 20. | 19 | 6 | 0.52 | 0.54 | \* | 50 | 14 | 3 | 0.35 | 0.45 |  |
| 21. | 18 | 6 | 0.50 | 0.50 | \* | 51 | 23 | 6 | 0.64 | 0.70 |  |
| 22. | 7 | 8 | 0.31 | 0.41 |  | 52 | 10 | 6 | 0.33 | 0.16 |  |
| 23. | 16 | 3 | 0.40 | 0.54 | \* | 53 | 22 | 7 | 0.60 | 0.62 |  |
| 24. | 24 | 6 | 0.62 | 0.75 | \* | 54 | 20 | 3 | 0.47 | 0.70 | \* |
| 25. | 19 | 4 | 0.47 | 0.62 | \* | 55 | 21 | 5 | 0.54 | 0.66 | \* |
| 26. | 5 | 8 | 0.27 | 0.12 |  | 56 | 20 | 6 | 0.54 | 0.58 | \* |
| 27. | 17 | 4 | 0.43 | 0.54 | \* | 57 | 20 | 9 | 0.60 | 0.45 | \* |
| 28. | 16 | 8 | 0.50 | 0.33 |  | 58 | 17 | 6 | 0.47 | 0.45 | \* |
| 29. | 11 | 8 | 0.39 | 0.12 |  | 59 | 18 | 1 | 0.39 | 0.70 |  |
| 30. | 19 | 7 | 0.54 | 0.50 | \* | 60 | 19 | 7 | 0.54 | 0.50 | \* |

\*Items selected for the final test

 From the total items of draft test, 30 items were selected for the final test having the discriminating power more than 0.4 and difficulty index between 0.4 & 0.6 initially. Some items having the difficulty index more than 0.6 were also selected. Thus the investigator prepared the final test with 30 multiple choice items selected from the draft test. The time duration fixed for the test was 45 minutes. The maximum scores of the test was 30 and minimum zero.

***Validity of the Test***

 Validity of a test implies the truthfullness of the test. In the present study, for estimating the validity of the Achievement Test in Mathematics Criterion related technique is used. For this purpose, the final test was administered on the students of two class divisions of standard VIII in a school, other than the two schools from which Experimental and Control groups were taken, the marks obtained by the same sample is the half yearly examination was also taken.

 The validity of the test was estimated by correlating the scores of the Achievement Test with the marks obtained is the half yearly examination, using Karl Pearson’s Product Moment Correlation Coefficient.

 The validity obtained was 0.86. It suggests that the test is highly valid.

*a). Content validity*

 For establishing the content validity, the investigator subjected the test item for expert’s evaluation. As per the evaluation of the experts, the test content covers the significant concepts and is comprehensive enough in terms of the instructional objectives.

***Reliability of the test***

 Reliability of the Achievement test in Mathematics was established using the split half, odd and even number method. To establish reliability, the scores obtained by the same sample upon which the validity established was used. For this purpose, the 30 items in this test were divided in to two equal halves. The first set of scores represents their performance is the odd numbered items 1, 3, 5, 7 etc and the second set of scores, performances on even numbered items 2, 4, 6, 8 etc. Scores obtained by each subject in each half were counted and correlated using Karl Person’s Product Moment Method.



X = Total score for first half items

Y = Total score for second half items

N = Number of students.

 The reliability co-efficient for the half test obtained was 0.80. From the correlation of half test, reliability of the whole test was estimated using Spearman Brown Prophecy formula (Garret, 1981)

 The reliability of the whole test obtained was 0.85. It suggests that the test was a reliable one. A Final copy of the Achievement Test in Mathematics together with its English version, Response Sheet and Scoring Key are presented in Appendix No V, VA, VB and VC respectively.

3.5.4. EXECUTION OF THE EXPERIMENT

After obtaining the permission from the Head of the respective schools, arrangement were made to collect the data from both schools and schedule was prepared accordingly. Before starting the experiment both Experimental and Control Groups were given the same Pre test to measure the initial status of the subjects. After that the Experimental group was taught through Jigsaw lessons for 15 periods (of a duration of 90 minutes) and the Control Group was taught the Existing Method of Teaching for the same topics for 30 periods (of a duration of 45 minutes). The topic selected was Algebra.

 During the Experiment, the investigator administered Verbal Group Test of Intelligence and response sheets were collected.

 The same Achievement Test in Mathematics was given to both the Control Group and the Experimental Group, after the completion of the treatments as post Test. The scores on these tests were used for determining the effectiveness of Jigsaw II Method over Existing Method of Teaching.

 While administering the standard tests, instructions given in the respective tests were strictly followed and explained to the pupils before taking the test. All tests were administered by the investigator personally.

3.5.5. SCORING AND CONSOLIDATION OF DATA

 The investigator scored all the response sheets according to the scoring key provided with the respective tests.

 Scores on Achievement Test in Mathematics were tabulated separately for each group. The investigator then consolidated the scores obtained for the selected variables for final analysis. All variables were coded to facilitate computer analysis. The break up showing the actual data obtained for analysis is presented in Table 3.10.

TABLE 3.10

**Break-up showing the Actual Data Obtained for Analysis**

|  |  |
| --- | --- |
| **Experimental Group** | **Control Group** |
| Boys | Girls | Total | Boys | Girls | Total |
| 9 | 26 | 35 | 18 | 17 | 35 |

* + 1. STATISTICAL TECHNIQUES USED FOR ANALYSIS

The present study demands the use of following statistical techniques.

**3.5. 6.1. Mean Difference Analysis**

Test of significance of Difference between Means was used to compare the relevant variables between Experimental and Control Groups (Garret, 1981) .

The statistical technique was mainly used to test whether the Experimental and Control Groups differ a Pretest, Achievement and Gain scores without controlling the effects of the covariates. For the large sample, the following formula suggested by Garret (1981) was used.



 [Here M1, M2 are the means; σ1, σ2  are the standard deviations and N1, N2 are the sample size of the groups.] The difference between means is said to be significant, depending upon whether the t-value exceeds the Table value set for 0.01 and 0.05 level of significance

For small sample, the following formula suggests by Garret (1981) was used.



In the above formula, denoted the means, σ1, σ2 are the Standard deviations and N1­, N2 are the sample size of the groups.

The difference between the means is said to be significant depending upon whether t- values exceeds the table value of ‘t’ for N1+N2-2 degrees of freedom at 0.05 level and 0.01 level of significance.

**3.5.6.2 Analysis of Covariance (ANCOVA)**

In the present study, One way ANCOVA employing two covariates singly and in combination were used to confirm the effectiveness of Jigsaw II method of Cooperative Learning Strategy over the Existing Method of Teaching. Through Analysis of covariance, the investigator can control or adjust the effect of one or more uncontrolled variables and there by permits a valued evaluation of the outcome of experiment. It is applied when there are one or more correlated variables existed with the Dependent variable. It is able to control the effects of any of the covariates on the Dependent Variables using ANCOVA.

 An application of a simple Analysis of covariance requires paired observation on K groups of the experimental subjects. The number of pairs of observation in the K groups is denoted by N1, N2 ................. Nk. The paired observations are assumed to be paired samples drawn from k populations.

**Four**

**ANALYSIS**

* Preliminary Analysis
* Major Analysis

**ANALYSIS**

The main purpose of the present study was to investigate the effect of Cooperative Learning Strategy over Existing Method of Teaching Mathematics of Standard VIII students. The collected and tabulated data were analysed using the statistical techniques like Mean Difference Analysis and ANCOVA.

 Analysis of the data has been done, classified and presented in the following order.

* 1. PRELIMINARY ANALYSIS
	2. MAJOR ANALYSIS
	3. **PRELIMINARY ANALYSIS**

The statistical properties of the variables in the study and the comparison of the mean scores of relevant variables for the Experimental and Control Groups (Total Sample, Boys and Girls) were done and presented in this section.

4.1.1. IMPORTANT STATISTICAL PROPERTIES

As a part of the preliminary analysis, the important statistical constants like Mean, Median, Mode, Standard Deviation, Skewness and Kurtosis for the Pretest, Post test and Gain Scores were examined separately for Experimental and Control Groups (Total Sample, Boys and Girls) and presented in Table 4.1 and 4.2 respectively.

TABLE 4.1
**Statistical Constants for Experimental Group (Total Sample, Boys and Girls)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No.** | **Variables** | **Total Sample (N=35)** | **Boys (N=26)** | **Girls (N=9)** |
| **Mean** | **Median** | **Mode** | **S.D** | **Skewness**  | **Kurtosis** | **Mean** | **Median** | **Mode** | **S.D** | **Skewness**  | **Kurtosis** | **Mean** | **Median** | **Mode** | **S.D** | **Skewness**  | **Kurtosis** |
| 1. | **Pre test** | 1.486 | 1 | 2.457 | 1.039 | 0.373 | -0.372 | 1.385 | 1 | 2.154 | 1.10 | 0.515 | -0.233 | 1.778 | 2 | 1.333 | 0.833 | 0.501 | -1.275 |
| 2. | **Post test**  | 33.514 | 37 | 26.543 | 10.648 | 0.054 | -0.739 | 30.885 | 27.5 | 37.654 | 11.01 | 0.623 | -0.226 | 41.1 | 39 | 45.333 | 3.983 | 1.131 | 0.339 |
| 3. | **Gain score** | 32.029 | 34 | 28.086 | 10.291 | 0.168 | -0.564 | 29.5 | 26 | 36.5 | 10.66 | 0.758 | 0.105 | 39.333 | 38 | 42 | 3.808 | 1.731 | 2.969 |

TABLE 4.2
**Statistical Constants for Control Group (Total sample, Boys and Girls)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No.** | **Variables** | **Total Sample (N=35)** | **Boys (N=18)** | **Girls (N=17)** |
| **Mean** | **Median** | **Mode** | **S.D** | **Skewness**  | **Kurtosis** | **Mean** | **Median** | **Mode** | **S.D** | **Skewness**  | **Kurtosis** | **Mean** | **Median** | **Mode** | **S.D** | **Skewness**  | **Kurtosis** |
| 1. | Pre test | 2 | 2 | 2 | 1.188 | 0.558 | -0.115 | 2.167 | 2 | 2.5 | 1.04 | 0.330 | -1.056 | 1.824 | 2 | 1.471 | 1.334 | 0.900 | 0.742 |
| 2. | Post test  | 23.514 | 21 | 28.543 | 8.455 | 1.192 | 0.808 | 19.944 | 18 | 23.883 | 5.49 | 1.821 | 3.384 | 27.294 | 24 | 33.882 | 9.505 | 0.623 | -0.293 |
| 3. | Gain score | 21.514 | 20 | 24.543 | 8.122 | 0.979 | 0.280 | 17.778 | 17 | 19.333 | 5.42 | 1.382 | 2.641 | 25.471 | 22 | 32.41 | 8.754 | 0.466 | -0.668 |

4.1.2. MEAN DIFFERENCE ANALYSIS

In this part of the preliminary analysis, comparison of the mean scores of Experimental and Control Groups for the Total Sample, Boys and Girls on the Pretest, Achievement and Gain Scores were attempted using Mean Difference Analysis and presented.

**4.1.2.1. Comparison of the Mean Pretest Scores of Experimental and Control Groups for the Total Sample, Boys and Girls**

 The mean performance of Experimental and Control groups on the Pre-test scores was studied and compared using the Mean Difference Analysis. The comparison was done for the Total Sample, Boys and Girls in each of the Experimental and Control Groups.

 The means and standard deviations of the pre-test of both of the groups were found out and subjected to Mean Difference Analysis. The data and results of the t-test are presented in Table 4.3.

TABLE 4.3
**Data and Results of the t-test for the
Mean Scores of Pretest Between Experimental
and Control Groups (Total Sample, Boys and Girls)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sample** | **Experimental Group** | **Control Group** | **t-value** | **Level of Significance** |
| **M1** | **σ1** | **N1** | **M2** | **σ2** | **N2** |
| Total Sample | 1.486 | 1.039 | 35 | 2 | 1.188 | 35 | 1.927 | N.S |
| Boys | 1.385 | 1.098 | 26 | 2.167 | 1.043 | 18 | 1.938 | N.S |
| Girls | 1.778 | 0.833 | 9 | 1.824 | 1.333 | 17 | 0.93 | N.S |

N.S. – Not Significant

 As per the Table 4.3, the obtained t-value for the Pretest for the Total sample is 1.927 which is not fount statistically significant. This shows that there is no significant difference in the mean Pretest scores between Experimental and Control groups for the Total sample. The obtained result indicates that the performance of Experimental and Control groups (Total Sample) on the Pre-test do not differ significantly.

The performance of the Experimental and Control Groups (Total Sample) on the Pretest were examined graphically and the pattern of their performance were studied. The graphical representation is presented in the Figure 4.1.

****

Scale

X axis = ½ cm = 1 No. of Student

Y axis = 1½cm = 1 Score

**Figure 4.1 Comparison of Pretest Scores of Experimental and Control Groups for Total Sample**

As per Figure 4.1, it can be noted that somewhat similar performance of the Experimental and Control Groups (Total Sample) can be noted in case of their pre-experimental status of achievement as measured in terms of the pre test. Statistically significant difference is not observed through the Mean Difference Analysis on the Pretest. Hence Graphical representation for comparison of Pretest Scores confirmed the result of the Mean Difference Analysis.

 From the Table 4.3 it is also evident that the t-value obtained for the pretest for Boys was 1.938, which was not found statistically significant. It can be considered from the result that the Boys in the Experimental group and Control group do not differ significantly in case of their performance in the Pretest.

For Girls, the t-value obtained in Table 4.7 for pretest was 0.93 which was not found significant. It can be inferred from the result that, the performance of girls in the Experimental and Control Groups do not differ significantly.

**4.1.2.2. Comparison of the Mean Achievement Scores of Experimental
 and Control Groups for the Total Sample, Boys and Girls**

 To study whether the Experimental and Control groups differ in Achievement scores or not Mean Difference Analysis was used. The comparison was done for the Total Sample, Boys and Girls in each of the Experimental and Control Groups.

 The mean and standard deviation of the Post test of both of the groups were found out and subjected to the Mean Difference Analysis. The data and results of the t-test are presented in Table 4.4.

TABLE 4.4
**Data and Results of the t-test for the
Mean Achievement Scores Between the
Experimental and Control Groups (Total Sample, Boys and Girls)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sample** | **Experimental Group** | **Control Group** | **t-value** | **Level of Significance** |
| **M1** | **σ1** | **N1** | **M2** | **σ2** | **N2** |
| Total Sample | 33.514 | 1.04 | 35 | 23.51 | 1.188 | 35 | 4.351\*\* | 0.01 |
| Boys | 30.885 | 11.007 | 26 | 19.944 | 5.493 | 18 | 3.885\*\* | 0.01 |
| Girls | 41.111 | 3.983 | 9 | 27.294 | 9.505 | 17 | 4.14\*\* | 0.01 |

\*\* Significant at 0.01 level.

 As per the Table 4.4, the obtained t-values for Achievement for the Total sample is 4.35, which is found significant at 0.01 level and this shows that there is significant difference in Mean Achievement scores between Experimental and Control Groups for the Total sample. The obtained result indicated that the performance of Experimental and Control Groups (Total Sample) on the Achievement was dissimilar. Since the higher mean was associated with the Experimental group, they were found advantageous over the control group in case of the Achievement in Mathematics.

The performance of the Experimental and Control groups on Achievement Test (Total), were examined graphically and the pattern of their performance were studied. The graphical representation is presented in Figure 4.2.



Scale

X axis = ½ cm = 1 No. of Student

Y axis = 1½cm = 10 Score

**Figure 4.2 Comparison of Achievement Scores of Experimental and Control Groups for Total Sample**

 A visual examination of the Figure 4.2. indicates that the performance of Experimental and Control Groups (Total Sample) are dissimilar. Variation in their performance is clear in the case of the Post test (Total). Hence, the results of the t-test ascertained the features in the Graphical representation of the comparison of Post test Scores (Total).

 From the table 4.4, it is also clear that the t-values obtained for Post test for Boys was 3.88, which is significant at 0.01 level. It can be considered from the result of the t-test that the Boys in the Experimental and Control Groups differ significantly in the case of their Achievement. High mean scores for Boys in the Experimental group over the Boys in the Control group were noticed. This revealed the superiority of Boys in the Experimental group over the Boys in the Control group.

 For Girls the t-value obtained in Table 4.4 for Achievement was 4.14, which is found significant at 0.01 level. From the result, it is clear that the Mean of Achievement Scores of Experimental and Control groups for girls differ significantly. High mean scores for Girls in the Experimental group over the Girls in the Control group were noticed in case of Achievement, which revealed the superiority of the Experimental group over the Control group.

**4.1.2.3. Comparison of Mean Gain Scores of Experimental and Control
 Groups for the Total Sample, Boys and Girls**

 The Mean Gain scores of the Experimental and Control Groups were studied and Compared using the Test of Significance of difference between means of large and small independent samples. The comparison was done for the Total sample, Boys and Girls.

 The mean and standard deviations for the Gain Scores of both of the groups were found out and subjected to the Mean Difference Analysis. The data and result of the t-test are presented in the Table 4.5.

TABLE 4.5

**Data and Results of the t-test for the
Mean Gain Scores Between Experimental
and Control Groups (Total Sample, Boys and Girls)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sample** | **Experimental Group** | **Control Group** | **t-value** | **Level of Significance** |
| **M1** | **σ1** | **N1** | **M2** | **σ2** | **N2** |
| Total | 32.029 | 10.291 | 35 | 21.514 | 8.122 | 35 | 4.745\*\* | 0.01 |
| Boys | 29.500 | 10.656 | 26 | 17.778 | 5.418 | 18 | 4.289\*\* | 0.01 |
| Girls | 39.333 | 3.808 | 9 | 25.470 | 8.754 | 17 | 4.497\*\* | 0.01 |

\*\* Significant at 0.01 level.

 As per the Table 4.5 the obtained t-value for Mean Gain scores for the Total sample is 4.14 which is found significant at 0.01 level. This shows that there is significant difference in the mean Gain Scores between Experimental and Control groups for the Total sample. Since the higher means were associated with the Experimental group, they were found advantageous over the control group in case of their Gain Scores.

The Gain in performance of the Experimental and Control Groups were examined graphically, and the graphical representation is presented in the Figure 4.3.



Scale

X axis = ½ cm = 1 No. of Student

Y axis = 1½cm = 10 Score

**Figure 4.3 Comparison of Gain Scores of Experimental and Control Groups for Total Sample**

 Figure 4.3 suggests the dissimilar performance between the Experimental and Control Groups (Total Sample) in Gain scores. The result of the t-test is confirmed by the features in the graphical representation

 From the table, it is also evident that t-value obtained for the Mean Gain Scores for Boys is 4.28 which is found significant at 0.01 level. From the result it can be considered that Boys in the Experimental Group and Control Group differ significantly. High Mean Gain Scores of Boys in the Experimental group revealed their superiority over the Control Group.

 The t-value obtained for Girls for the Gain Score is 4.49 which is found significant at 0.01 level. This suggests that the Gain Score of the Experimental and Control groups differ significantly. High Mean Gain Score of Girls in the Experimental group indicated that they are superior to Girls in Control Group, in their performance.

**4.1.2.4. Summary and Discussion of Mean Difference Analysis**

 The result of the Mean Difference Analysis conducted for the comparison of Mean Pre test, Post test and Gain scores between Experimental and Control groups, (Total sample, Boys and Girls) are summarised and presented in Table 4.6.

TABLE 4.6
**Summary of the t-values for Pretest
Achievement and Gain Scores for Experimental
and Control Groups (Total Sample, Boys and Girls)**

|  |  |
| --- | --- |
| **Variables** | **t - value** |
| **Total Sample** | **Boys** | **Girls** |
| Pre-test | 1.927 | 1.938 | 0.093 |
| Achievement | 4.351\*\* | 3.885\*\* | 4.141\*\* |
| Gain score | 4.745\*\* | 4.289\* | 4.497\*\* |

\*\*Significance at 0.01 level

 From Table 4.6, the t-value obtained for Pretest for Total sample, Boys and Girls were not significant. The t-value obtained for Achievement for Total sample, Boys and Girls are significant at 0.01 level of significance. From the summarised result, it can be said that Achievement in Mathematics differentiate the Experimental and Control Groups for the Total Sample, Boys and Girls. Also the t-values obtained for Gain Score for Total Sample, Boys and Girls are significant at 0.01 level of significance. From the result, it can be said that Mean Gain Scores differentiate the Experimental and Control Groups for the Total Sample, Boys and Girls. In all these comparisons the superiority of the Experimental Group over the Control Group is evident.

 The graphical representation of Gain Scores and Achievement Scores of the subjects in the Experimental and Control Group (Total Sample, Boys and Girls) revealed differences. In all graphs, it is evident that the Experimental Group has higher Achievement and Gain Scores compared with that of the Control Group.

**4.2. MAJOR ANALYSIS**

The consolidated and tabulated data has been analysed using the statistical technique One way ANCOVA. By employing this technique, the Effectiveness of Instructional Learning Strategies on Achievement in Mathematics has been studied. The results of the covariance Analysis is presented in this section of analysis.

4.2.1. ANALYSIS OF COVARIANCE FOR ACHIEVEMENT

 Effectiveness of Instructional Learning Strategies particularly Cooperative Learning Strategy over the Existing Method of Teaching Mathematics for standard VIII students is studied employing the One-way ANCOVA with two Covariates singly and in combination. The Covariates controlled are Pre Experimental Status in the Subject matter measured by a Pretest and Verbal Intelligence. In the ANCOVA procedure, two levels of Instructional Learning Strategies (Cooperative Learning Strategy and Existing Method of Teaching) was incorporated as the Independent VariableandAchievement in Mathematics was treated as the Dependent Variable.

**4.2.1.1. Classificatory Technique**

 For facilitating the One -way ANCOVA procedure, the Independent Variable, Instructional Learning Strategies was classified into two levels as Cooperative Learning Strategy and Existing Method of Teaching. The Experimental group was taught through the Cooperative Learning Strategy (Jigsaw II) and the Control group was taught through the Existing Method of Teaching.

 Total number of subjects consisted in each of the two Instructional Learning Strategies (Cooperative Learning Strategy and Existing Method of Teaching) is presented in Table 4.7.

TABLE 4.7

**Details of Actual Data Obtained for ANCOVA**

|  |  |  |  |
| --- | --- | --- | --- |
| **Instructional Learning Strategies** | **Boys** | **Girls** | **Total** |
| Cooperative Learning Strategy | 26 | 9 | 35 |
| Existing Method of Teaching | 18 | 17 | 35 |
| Total | 44 | 26 | 70 |

 Prior to ANCOVA, the data used for Analysis is subjected to a thorough examination with a view to know whether the data is sufficient to satisfy the major assumptions suggested by Winer (1977), Ferguson (1971) and Wildt and Ahtola (1978) to carry over the ANCOVA procedure. It is seen that the data is satisfied with the following assumptions (Wildt & Ahtola, 1978).

1. The scores on the Dependent Variable are a linear combination of four independent components, an overall mean, a treatment effect, a linear covariate effect and an error term.

2. The error is normally and independently distributed with mean zero and variance σ2E.

3. The (weighted) sum of all groups of the treatment/group effect is zero.

4. The coefficient of the covariate (slope of the regression line) is the same for each treatment group.

5. The covariate is a fixed mathematical variable measured without error, not a stochastic variable.

 Entire computations were done using the software, Statistical Package for Social Sciences – SPSS (Einspruch, 1998).

**4.2.1.2. Tests for Basic Assumptions**

 To satisfy the basic assumptions of ANCOVA procedure, the collected date were statistically analysed and examined. The results of this analysis is presented in this section of the report.

**a. Linear Relationship Between the Dependent Variable and the Covariates**

 To satisfy initially the assumption of the existence of linear relationship between the Dependent Variables (Achievement in Mathematics) and the Covariates (Pre Experimental Status of the subject matter measured by a Pretest and Verbal Intelligence), the nature of relationship is studied using the scatter plotsof Dependent Variables by Covariates.

 The visual examination of the scatter plots revealed that the relationship between the Dependent Variables (Achievement in Mathematics) and the Covariates (separately and in combination) was in a linear way. The scores of the Dependent Variable and the respective Covariates did not departgreatly from the line of good fit. Hence, the assumption of linear relationship between the Variate and the Covariate was successfully satisfied.

**b. Test of Homogeneity of Variance**

 To satisfy the assumption of homogeneity of variance, separate Analysis of Variance was used, to test whether the slopes of the regression lines are the same (Homogeneity of within-class regression) for the two levels of the Independent Variable (Instructional Learning Strategies).

 Separate Tests of Homogeneity of Variance were employed for each ANCOVA for Achievement with two Covariates (Pre Experimental Status of the subject matter measured by a Pretest and Verbal Intelligence) separately and in combination. From all the tests of homogeneity, it was inferred that the within-class regression coefficients were homogeneous or the same for two levels of Instructional Learning Strategies. (Tables not attached). The outcome of this test, in part does not rule against pooling the within class regression (Winer, 1977). Thus the data were found appropriate to suit the ANCOVA model.

**c. Analysis of Variance for Achievement**

 Separate Analysis of Variance for each ANCOVA, disregarding the Covariates, was used to study whether the treatments given in the Experimental and Control groups create any significant difference in the Criterion Variable (Achievement – Total score). For the purpose, the sum of squares, mean square variance along with the corresponding degrees of freedom and the F-ratios were calculated (Tables not attached). The entire analysis employed, all ANOVA yielded significant F-values for Instructional Learning Strategies on Achievement. This is due to the fact that the treatment means appears to have different Covariate means. If difference between the criterion means remain after a statistical adjustment has been made, the ANCOVA attempts to approximate the difference in which each of the treatment means is equated on the covariate (Winer, 1977). A detailed description of the procedures employed in the ANCOVA is dealt in this section of the report.

**4.2.1.3. Analysis of Covariance for Achievement Pre Experimental Status as Covariate**

 One -way ANCOVA with Pre Experimental Status as Covariate was employed to study the effectiveness of Instructional Strategies, over Existing Method of Teaching Mathematics of standard VIII students.

 Summary of One -way ANCOVA is presented in Table 4.8.

TABLE 4.8

**Summary of One-way ANCOVA for Achievement
in Mathematics for Total Sample – Pre Experimental Status as Covariate**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample** | **Number of Students** | **Dependent Variable** | **Source of Variation** | **Sum of Squares** | **Mean Square Variance** | **df** | **F-value** |
| Total Sample | 70 | Achievement in Mathematics  | Instructional Learning Strategies | 2231.93 | 2231.93 | 1 | 27.34\*\* |

\*\*Significant at 0.01 level.

 From the Table, the F-value obtained for Instructional Learning Strategies on Achievement in Mathematics is found beyond the tabled value (6.96) and significant at 0.01 level of significance (1,67 df). The results indicates statistically significant difference between the criterion means in case of Achievement in Mathematics, even after the adjustment is made for the linear effect of the Covariate ie. Pre Experimental Status. From the Covariance Analysis, it can be inferred that, when a linear adjustment is made for the effect of variation due to difference in Pre Experimental Status, there is statistically significant differencestill existing between the two types of Instructional Learning Strategies.

 The result of ANCOVA showed that standard VIII Students taught through Cooperative Learning Strategy significantly differ in Achievement in Mathematics than the pupils taught through the Existing Method of Teaching. As higher mean Achievement Scores were associated with the Experimental Group to which Cooperative Learning Strategy was implemented, Cooperative Learning Strategy is found advantageous over Existing Method of Teaching in case of Achievement in Mathematics.

**4.2.1.4. Analysis of Covariance for Achievement – Verbal Intelligence as Covariate**

 One-way ANCOVA with Verbal intelligence as covariate was employed to study the Effectiveness of Instructional Strategies, over Existing Method of Teaching Mathematics of standard VIII Students.

 Summary of One -way ANCOVA is presented in Table 4.9.

TABLE 4.9

**Summary of One-way ANCOVA for Achievement
in Mathematics for Total Sample – Verbal Intelligence as Covariate**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample** | **Number of Students** | **Dependent Variable** | **Source of Variation** | **Sum of Squares** | **Mean Square Variance** | **df** | **F-value** |
| Total Sample | 70 | Achievement in Mathematics  | Instructional Learning Strategies | 150.55 | 150.55 | 1 | 7.45\*\* |

\*\*Significant at 0.01 level.

 From the Table, the F-value obtained for Instructional Learning Strategies on Achievement in Mathematics is found beyond the tabled value (6.96) and significant at 0.01 level of significance (1,67 df). The results indicates statistically significant difference between the criterion means in case of Achievement in Mathematics even after the adjustment is made for the linear effect of the Covariate ie. Verbal Intelligence. From the Covariance Analysis it can be inferred that, when a linear adjustment is made for the effect of variation due to difference in Verbal Intelligence there is statistically significant differencestill existing between the two types of Instructional Learning Strategies.

The result of ANCOVA showed that standard VIII students taught through Cooperative Learning Strategy is significantly differ in Achievement in Mathematics than the pupils taught through the Existing Method of Teaching. As higher mean Achievement Scores were associated with the Experimental Group to which Cooperative Learning Strategy was implemented, Cooperative Learning Strategy is found advantageous over Existing Method of Teaching in case of Achievement in Mathematics.

**4.2.1.5. Effectiveness of Cooperative Learning Strategy over Existing Method of Teaching Pre Experimental Status and Verbal Intelligence as Covariate in Combination**

 One way ANCOVA with Pre Experimental Status and Verbal Intelligence as Covariates in combination were employed to study the effectiveness of Instructional Learning Strategies over Existing Method of Teaching Mathematics of Standard VIII Students.

 Summary of the One-way ANCOVA is presented in Table 4.10.

TABLE 4.10

**Summary of One-way ANCOVA
for Achievement in Mathematics for Total Sample – Pre
Experimental Status and Verbal Intelligence as Covariates in Combination**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample** | **Number of Students** | **Dependent Variable** | **Source of Variation** | **Sum of Squares** | **Mean Square Variance** | **df** | **F-value** |
| Total Sample | 70 | Achievement in Mathematics  | Instructional Learning Strategies | 144.93 | 144.93 | 1 | 4.19\* |

\* Significant at 0.05 level.

 As per table 4.10, The F-value obtained for Instructional Learning Strategies on Achievement in Mathematics is 4.19, which is found significant at 0.05 level (1, 67 df). In case of Achievement in Mathematics, even after the adjustment is made for the effect of variation due to the combined effect of Pre-Experimental Status and Verbal Intelligence, there is statistically significant difference still existing between the two types of Instructional Learning Strategies.

The result of ANCOVA showed that standard VIII students taught through Cooperative Learning Strategy significantly differ in Achievement in Mathematics than the pupils taught through the Existing Method of Teaching. As higher mean Achievement Scores were associated with the Experimental Group to which Cooperative Learning Strategy was implemented, Cooperative Learning Strategy is found advantageous over Existing Method of Teaching in case of Achievement in Mathematics.

**4.2.1.6. Summary and Discussion of ANCOVA for Achievement**

 The results of three ANCOVA undertaken to study the effectiveness of Instructional Learning Strategies, particularly Cooperative Learning Strategy over Existing Method of Teaching on Achievement in Mathematics of Standard VIII Students are summarised and discussed in this section.

 The F-values obtained for three ANCOVA are consolidated and presented in Table 4.11.

TABLE 4.11
**Summary of F-values of ANCOVA for Achievement**

|  |  |  |
| --- | --- | --- |
| **Source of Variation** | **Dependent Variable** | **F-value - Covariates** |
| **Pre-Experimental Status**  | **Verbal Intelligence** | **Pre Experimental Status and Verbal Intelligence**  |
| Instructional Learning Strategies | Achievement in Mathematics | 27.34\*\* | 7.45\*\* | 4.19\* |

\* Significant at 0.05 level

\*\* Significant at 0.01 level

 All the three ANCOVA conducted to study the effectiveness of Cooperative Learning Strategy over Existing Method of Teaching a topic in Mathematics of Standard VIII Students yielded significant F-values, using Pre-Experimental Status and Verbal Intelligence as covariates separately and as covariate in combination. Effectiveness of the Cooperative Learning Strategy is very clear when the effect of Pre Experimental Status and Verbal Intelligence singly and in combination were successively removed.

The result of ANCOVA showed that standard VIII students taught through Cooperative Learning Strategy significantly differ in Achievement in Mathematics than the pupils taught through the Existing Method of Teaching. As higher mean Achievement Scores were associated with the Experimental Group to which Cooperative Learning Strategy was implemented, Cooperative Learning Strategy is found advantageous over Existing Method of Teaching in case of Achievement in Mathematics.

**CONCLUSIONS AND INTERPRETATIONS**

The main objective of the present study was to find out the Effectiveness of Cooperative Learning Strategy over Existing Method of Teaching Mathematics to Standard VIII students. The entire statistical analysis was performed through employing the statistical techniques like the Mean Difference Analysis and One way Factorial ANCOVA keeping the objectives in mind. From the results of the analysis, the investigator arrived at the following conclusions.

1. The t-value obtained for the comparison of Pre-test for Total Sample, Boys and Girls are found not significant. The result suggests that the Achievement in Mathematics does not differentiates the Experimental and Control Groups (Total Sample, Boys and Girls).
2. The t-values obtained for the comparison of Post test for Total sample, Boy and Girls are found significant. The result suggests that the Achievement in Mathematics differentiates the Experimental and Control groups (Total sample, Boys and Girls). High mean achievement scores associated with the Experimental group suggests that they are advantageous over the control group.
3. Significant difference in the Mean Gain Scores between the Experimental and Control groups (Total sample, Boys and Girls) are found. It suggests the Experimental and Control groups (Total sample, Boys and Girls) are dissimilar in the case of their Gain score. Superiority of the Experimental group over the Control group is noted as revealed from their high Mean gain scores.
4. One way Factorial Analysis of Covariance is employed to study the effectiveness of Cooperative Learning Strategy over Existing Method of Teaching Mathematics of Standard VIII students using Pretest and Verbal intelligence are covariate separately and in combination. All three ANCOVA shows that the two teaching methods differ significantly, ie. Cooperative Learning Strategy is found advantageous over the Existing Method of Teaching.

**FIVE**

**SUMMARY FINDINGS AND SUGGESTIONS**

* Study in Retrospect
* Major Findings of the Study
* Tenability of Hypotheses
* Educational Implications Derived
* Suggestions for Further Research

**SUMMARY FINDINGS AND SUGGESTIONS**

This chapter gives an overview of the procedure adopted for the study, conclusions based on findings, educational implications and suggestions for further research in this area.

* 1. **STUDY IN RETROSPECT**

Significant aspects related to the different phases of the present Experimental study like the Statement of the Problem, Variable, Objectives, Hypotheses, procedure etc are given in retrospect.

5.1.1. RESTATEMENT OF THE PROBLEM

 The present study was titled “EFFECT OF INSTRUCTIONAL LEARNING STRATEGIES ON ACHIEVEMENT IN MATHEMATICS OF STANDARD VIII STUDENTS.”

5.1.2. VARIABLES OF THE STUDY

 The Independent, Dependent and Control Variable selected for the present study were the following.

**5.1.2.1. Independent Variable**

 The independent variable selected for the study was Instructional Learning Strategies (Cooperative Learning Strategy – Jigsaw II and existing Method of Teaching).

**5.1.2.2. Dependent Variable**

 The Dependent Variable incorporated for the study was the Achievement in Mathematics of Standard VIII students.

* + - 1. **Control Variable**

The following are the control variables selected for the study.

1. Pre Experimental Status in the Subject matter Measured by a Pretest and
2. Verbal Intelligence.
	* 1. OBJECTIVES

The following were the objectives of the present study.

5.1.3.1. To study whether there exists any significant difference in the Mean Pretest Scores of the Experimental and Control Groups for the Total Sample, Boys and Girls.

* + - 1. To study whether there exists any significant difference in the Mean Achievement Scores of Experimental and Control Groups for the Total Sample, Boys and Girls.
			2. To study whether there exists any difference in the Mean Gain Scores of the Experimental and Control Groups for the Total Sample, Boys and Girls.
			3. To study the effectiveness of Jigsaw II Method of Co-operative Learning Strategy over Existing Method of Teaching Mathematics in terms of Achievement in Mathematics of Standard VIII Students.
		1. HYPOTHESES

The present study was designed to test the following hypotheses.

* + - 1. There is no significant difference in the Mean Pretest Scores of
			the Experimental and Control groups for the Total sample Boys and Girls.

5.1.4.2. There is no significant difference in the Mean Achievement Score of the Experimental and Control groups for the Total Sample, Boys and Girls.

5.1.4.3. There is no significant difference in the Mean Gain Scores of the
 Experimental and Control groups for the Total Sample, Boys and
 Girls.

5.1.4.4. Students taught through Jigsaw II Method of Cooperative Learning Strategy do not differ significantly in terms of Achievement in Mathematics than students taught through the Existing Method of Teaching.

5.1.5. PROCEDURE

 The procedure of the present study is outlined as the following.

**5.1.5.1. Design of the Study**

 The present study has been conducted by employing the True Experimental Design. The design used in the present study was the Pretest -Post test Equivalent Groups Design. The Experimental Group was taught through the Cooperative Learning Strategy (Jigsaw II) and the Control Group was taught through the Existing Method of Teaching.

**5.1.5.2. Sample of the Study**

 The sample of the study consisted of two intact class groups of 35 students each in the Experimental and Control groups (Total 70 students). These two groups were equated with regard to some select variables.

**5.1.5.3. Selection of Topics for Treatment**

The topic for the treatment in the present study was selected from the syllabus prescribed for standard VIII pupils of Kerala state for the academic year 2010-2011. The topic selected was “Algebra”.

**5.1.5.4. Tools used for the Study**

 The investigator used the following tools for the study.

***a) Lesson Transcript for Cooperative Learning Strategy – Jigsaw II model (Hameed & Dilshath, 2010)***

The investigator prepared Lesson Transcript for Cooperative Learning Strategy following the steps proposed by Slavin (1980), for his ‘Jigsaw II’ model and used for treatment in the Experimental group.

***b) Lesson Plan for Existing Method of Teaching (Hameed & Dilshath, 2010)***

The Lesson Transcript for teaching through the Existing Method for the Control Group were prepared by the investigator in Malayalam, on the basis of the newly introduced Activity Based Curriculum of Kerala.

***c) Verbal Group Test of Intelligence - VGTI (Kumar, et al*., 1997)**

For the present study, the confounding variable Verbal Intelligence was measured using Verbal Group Test of Intelligence (VGTI) developed by Kumar, *et al*., (1997).

***d) Achievement Test in Mathematics (ATM)***

This test of Achievement in Mathematics (ATM) was developed and standardized by Hameed and Dilshath (2010) and was used as Pretest and Post test on the topic selected for treatment.

**5.1.5.5. Statistical Technique Used for the Study**

 In the present study, the collected data were analysed using the following statistical technique.

***a) Mean Difference Analysis***

Mean Difference Analysis was mainly employed to study whether the Experimental and Control groups differ in Pre test, Post test and Gain Scores without controlling the effects of the covariates.

***b) Analysis of Covariance (ANCOVA)***

 To control the effect of Covariates i.e., Pre Experimental Status in the Subject Matter and Verbal Intelligence singly and in combination and there by to confirm the effectiveness of Cooperative Learning Strategy (Jigsaw II) over the Existing Method of Teaching, One way Analysis of Covariance (ANCOVA) was utilized.

**5.2. MAJOR FINDINGS OF THE STUDY**

 The major findings of the study are given briefly in this section of the report. For analysis nine Mean Difference Analysis and three ANCOVA were done to compare the relevant and to find out the effectiveness of Cooperative Learning Strategy over Existing Method of Teaching in Mathematics respectively for Total sample, Boys and Girls.

5.2.1. RESULTS OF MEAN DIFFERENCE ANALYSIS

Mean Difference Analysis was employed in the study to investigate the difference between the Experimental and Control groups (Total Sample, Boys and Girls) with respect to Pretest, Achievement and Gain Scores in Mathematics, without controlling the select Covariates. Results of Mean Difference Analysis are briefly presented in the following section.

**5.2.1.1.** **Comparison of the Mean Pretest Scores of Experimental and Control Groups (Total Sample, Boys and Girls).**

 No significant difference in the mean Pre test Scores for Total Sample, Boys and Girls were obtained. The obtained t-values are presented below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No.** | **Variable** | **Sample** | **t-value** | **Level of Significance** |
| 1 | Pre test | Total | 1.927 | NS |
| 2 | ” | Boys | 1.938 | NS |
| 3 | ” | Girls | 0.93 | NS |

**5.2.1.2.** **Comparison of the Mean Achievement Scores of Experimental and Control Groups (Total Sample, Boys and Girls)**

 Significant difference in the Mean Post test scores for the Total Sample, Boys and Girls were obtained. The significant t-values are presented in the decreasing order of magnitude.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No.** | **Variable** | **Sample** | **t-value** | **Level of Significance** |
| 1 | Achievement in Mathematics  | Total | 4.351 | 0.01 |
| 2 | ” | Girls | 4.14 | 0.01 |
| 3 | ” | Boys | 3.88 | 0.01 |

**5.2.1.3.** **Comparison of the Mean Gain Scores of the Experimental and Control Groups (Total Sample, Boys and Girls)**

 Significant Difference in the Mean Gain scores between the Experimental and Control groups (Total sample, Boys and Girls) were obtained. Significant t-values are presented in the decreasing order of magnitude.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No.** | **Variable** | **Sample** | **t-value** | **Level of Significance** |
| 1 | Gain Score | Total | 4.745 | 0.01 |
| 2 | ” | Girls  | 4.49 | 0.01 |
| 3 | ” | Boys | 4.29 | 0.01 |

5.2.2.RESULTS OF THE COVARIANCE ANALYSIS

 Results of the one-way Analysis of Covariance employed to investigate the effectiveness of Cooperative Learning Strategy over Existing Method of Teaching by controlling the select Covariates are presented in the section.

**5.2.2.1.Effectiveness of Instructional Learning Strategies on Achievement – Pre Experimental Status as Covariate**

Results of the ANCOVA using Pre Experimental Status as Covariate revealed that the F-Value obtained for the Effectiveness of Instructional Learning Strategies on Achievement is statistically significant.

|  |  |  |
| --- | --- | --- |
| **Dependent Variable**  | **F-Value** | **Level of Significance** |
| Achievement in Mathematics  | 27.34 | 0.01 |

The result of ANCOVA showed that standard VIII students taught through Cooperative Learning Strategy significantly differ in Achievement in Mathematics than the pupils taught through the Existing Method of Teaching. Even after the removal of the effect of Pre-Experimental status as covariate singly. Higher mean Achievement Scores associated with the Experimental Group to which Cooperative Learning Strategy was implemented revealed the effectiveness of Cooperative Learning Strategy over the Existing Method of Teaching.

**5.2.2.2. Effectiveness of Instructional Learning Strategies on
 Achievement-Verbal Intelligence as Covariate**

Results of the ANCOVA using Verbal Intelligence as Covariate revealed that the F-Value obtained for the effectiveness of Instructional Learning Strategies on Achievement is statistically significant.

|  |  |  |
| --- | --- | --- |
| **Dependent Variable**  | **F-Value** | **Level of Significance** |
| Achievement in Mathematics  | 7.45 | 0.01 |

The result of ANCOVA showed that standard VIII students taught through Cooperative Learning Strategy significantly differ in Achievement in Mathematics than the pupils taught through the Existing Method of Teaching. Even after the removal of verbal intelligence as covariate singly. Higher mean Achievement Scores associated with the Experimental Group to which Cooperative Learning Strategy was implemented revealed the effectiveness of Cooperative Learning over the Existing Method of Teaching.

**5.2.2.3. Effectiveness of Instructional Learning Strategies on Achievement – Pre Experimental Status and Verbal Intelligence as Covariates in Combination**

Results of the ANCOVA using Pre Experimental Status and Verbal Intelligence as Covariates in combination revealed that the F-Value obtained for the Effectiveness of Instructional Learning Strategies on Achievement is statistically significant.

|  |  |  |
| --- | --- | --- |
| **Dependent Variable**  | **F-Value** | **Level of Significance** |
| Achievement in Mathematics  | 4.19 | 0.05 |

The result of ANCOVA showed that standard VIII Students taught through Cooperative Learning Strategy significantly differ in Achievement in Mathematics than the pupils taught through the Existing Method of Teaching even after the statistical removal of the covariates in combination . As higher mean Achievement Scores were associated with the Experimental Group to which Cooperative Learning Strategy was implemented, Cooperative Learning Strategy is found effective over the Existing Method of Teaching.

**5.3. TENABILITY OF HYPOTHESES**

 In this section, tenability of the Hypotheses set for the present experimental study was examined in the light of the major findings of the study.

5.3.1. The first hypotheses states that, ***There is no Significant Difference in the Mean Pretest Scores of the Experimental and Control Groups for the Total Sample, Boys and Girls***

It was found that the difference in the Mean Pre-test scores of Experimental and Control groups for Total sample, Boys and Girls are not found statistically significant. Thus the first hypothesis is not rejected.

5.3.2. The second hypothesis states that, ***There is no Significant Difference in the Mean Achievement Scores of the Experimental and Control Groups for the Total Sample, Boys and Girls.***

Significant difference between the Experimental and Control groups in the Mean Achievement Scores is obtained for the Total Sample, Boys and Girls. Hence the second hypothesis is rejected.

5.3.3. The third hypothesis states that, ***There is no Significant Difference in the Mean Gain Scores of the Experimental and Control Groups for the Total Sample, Boys And Girls***

 The difference in Mean Gain Scores of Experimental and Control groups was found to be significant in Total Sample, Boys and Girls. Thus the third hypothesis is rejected.

5.3.4. The fourth hypothesis states that, ***Pupils Taught Through Jigsaw ii Method of Cooperative Learning Strategy do not Differ Significantly in Terms of Achievement in Mathematics than Pupils Taught Through Existing Method of Teaching***

 The result of ANCOVA showed that standard VIII students taught through Cooperative Learning Strategy is significantly differ in Achievement in Mathematics than the pupils taught through the Existing Method of Teaching. Thus the fourth hypothesis is rejected.

* 1. **EDUCATIONAL IMPLICATION DERIVED**

The main objective of the present study was to find out the Effectiveness of Cooperative Learning Strategy over the Existing Method of Teaching Mathematics in Standard VIII students. The entire statistical analysis was performed through employing the statistical techniques like the Mean Difference Analysis and one way ANCOVA, keeping the objectives in mind. Based on the findings of the study, some practical measures are suggested which may be helpful to improve the existing system of Education in the Secondary Schools.

 The present study has helped to find out the Effectiveness of Cooperative Learning Strategy over Existing Method of Teaching Mathematics. One of the important findings of the study is that the Cooperative Learning Strategy is more advantageous over the Existing Method of Teaching in enhancing student’s Academic Achievement. The implication of the findings is that the Cooperative Learning Strategy may be implemented as a teaching method throughout Kerala atleast on an experimental basis. The result also shows that, irrespective of Sex, Cooperative Learning Strategy has significant advantage over the Existing Method of Teaching Mathematics of Standard VIII students. On the basis of finding it can be said that Cooperative Learning Strategy may equally be applicable in mixed sex schools and single sex schools. It is also implied that students of different ability levels can be brought to optimum level, if Cooperative Learning Strategy is utilised in an effective way.

 Today’s classrooms are mainly based on unhealthy competition which adversely effects the social relationship of students. From the findings of the present study, Cooperative Learning Strategies may be suggested as a strategy to curb this unhealthy competitive mentality and to inculcate cooperation among students.

 Application of Cooperative Learning Strategies in the educational field is comparatively easy since it is time saving and practicable in the ordinary classrooms. No additional requirements other than usual classroom requirements are necessary. The teacher in the Cooperative Learning Strategy is a friend to the students, rather than an autocrat. The relationships between the teachers and the students, and also among students become more flexible. So it is implied that Cooperative Learning Methods are preferable to promote social values.

 Education is an ongoing process which commences with birth and lasts till death. Hence, in order to maintain interest in studies, the education is to have to implement innovative techniques in the field of Education. The usual, existing methods may cause drudgery or boredom on the part of the learners. Since Cooperative Learning allows a lot of participation of the students in the teaching-learning process, it may be a great help to maintain interest.

 The main purpose of education is high academic performance. Many advanced countries have adopted Cooperative Learning as a technique to improve achievement, at an early stage itself. The educational field in India also, should try new techniques to observe the main purpose of education. So, the implementation of Cooperative Learning may be considered at all levels of education to facilitate achievement, good social relationship and also nourish many other qualities like mature personality and leadership.

**5.5. SUGGESTION FOR FURTHER RESEARCH**

 The findings of the present study made the investigator to suggest the following areas for further research.

1. The present study was limited to the students of class VIII of two Government Schools only. This study may be extended to in aided and unaided secondary schools also comprising the entire topics.

2. Comparative Study of the Effectiveness of Cooperative Learning Strategy over the Existing Method of Teaching for Primary and Secondary (IX and X) school children can be considered.

3. Further studies can be conducted by taking combinations of learner variable like, self-concept, self-esteem, personality, creative ability, cognitive development, motivation etc.

4. Conduct of the study using more classes in different schools and with different experimental designs may be attempted.

5. The study can be extended to other disciplines like science and languages.

6. A study can be conducted to find out the attitude of teachers towards Cooperative Learning strategies.

7. The study can be extended to study the effect of Cooperative Learning Strategy with other student specific variables like study Habits, Learning style, Study Approaches and student Achievement.

8. Cooperative Learning Methods other than Jigsaw can be applied while conducting research on Cooperative Learning Strategies.

9. An objective-wise study of the effectiveness of Cooperative Learning Strategy on Achievement in a specific subject with the help of he statistical technique ANCOVA can be taken up.

**BIBLIOGRAPHY**

**BIBLIOGRAPHY**

Abu, R.B. & Flowers, J. (1997). The Effect of Cooperative Learning Methods on Achievement, Retention and Attitudes of Home Economic Students in North Carolina, *Journal of Vocational and Technical Education*, 13, 16-22.

Adesoji, F.A. & Adebola, I.S. (2007). Effect of self and Cooperative Instructional Strategies on Senior Secondary School Student’s cognitive achievement in Mathematics *European Journal of Scientific Research*, 18, 402-416.

 Alice, F, Newman, P & Claire, M. (1997). *How to use Cooperative Learning is the Mathematics class second edition National Council of teachers of Mathematics. Guide to Classroom teacher*. U.S. Virginia.

Andrini, E. (1994). Models that Promote Cooperative Learning. *Classroom Compass*, 1, 7-12.

Angry, R. (1990). *Enhancing Ethnic Relations Through Teaching* *Multicultural Education in the secondary schools*, Florida, (ERIC Document Reproduction Services, No.ED 329459).

Aronson, E., Blaney, N.T., Rosenfield, D., Sikes, J & Stephan, C. (1997). Interdependence in the classroom: A field study. *Journal of Educational Psychology*, 69(2), 121-128

Aronson, E, Blancy, N, Stemphan, C, Sike, J. & Snapp, M. (1978). *The Jigsaw class room*. California: Sage Baverly Hills.

Aronson, E, Blaney, N, Stemphan, C., Sike, J. & Snapp, M. (1978). *The Jigsaw Classroom,* California: Sage Baverly Hills.

Aronson, E. & Patnoe, S. (1997). *The Jigsaw classroom: Building Cooperative in the classroom (2nd Ed.)*. New York: Addison Wesley Longman.

Artzt, A.F., Newman, C.M. (1997). How to use Cooperative Learning in the Mathematics class second edition National council of teachers of Mathematics. *Guide to Classroom teacher*. U.S:, Verginia.

Bartscher, M.A., Lawler, K.E., Ramirez, A.J. & Schinault, K.S. (2001). *Improving Student’s Writing Ability Through Journal and Creative Writing Exercises*, Illinois, (ERIC Document Reproduction Service, No. ED455525).

Bennett, N & Dunne, E. (1992). *Managing Classroom Groups*, Hemel Hempstead: Simon & Schuster.

Best, J.W & Kahn. J.V. (1996). *Research in Education, (7th ed.)*, New Delhi: Prentice Hall of India Private Limited.

Bloom, B.S (1979). *Taxonomy of educational objectives. Hand Book* *No.1. Cognitive domain*. London, Long man Group Limited.

Box, J.A. & Little, B.C. (2003). Cooperative small group instruction combined with advance organizers and their relationship to self-concept and social studies achievement of elementary school students. *Journal of Instructional Psychology*, 30(4), 285-288.

Brauer, C., Grady, F., Mathews, K. & Wilhite, S. (1997). *The Effect of Problem-Solving an Academic Achievement in Elementary Education*, Illinois (ERIC Document Reproduction Service, No.ED321167).

Brickle, W. (1990). *Improving the Problem Solving Skills of At-risk High School Mathematics Students Through Cooperative Work Groups and Computer Assisted Instruction*, Georgia, (ERIC Document Reproduction Services, No. ED 332874).

Bronfenbrenner, U. (1989). Ecological systems Theory, In R. Vasta (Ed.) *Annals of Child Development*, Greenwich, CT: JAI Press, 187-249.

Brush (1996, April). *Using an Integrated Learning System,* Paper presented at the national convention of the Association for Educational Communication and Technology, Alabama.

Carroll, L. & Leander, S. (2001). Improving student motivation through the use of active learning strategies, Illinois (ERIC Document Reproduction Service, No. ED455961).

Christison, M.A. (1990). Cooperative Learning in the EFL Classroom. *English Teaching Forum*, 28, 6-9.

Clifford, M.M. (1971). *Motivational Effects of Competition and Goal-setting in Reward and Non-Reward Conditions*. Journal of Experimental Education, 39, 65-76.

Cohen, E.G. (1996). *A sociologist works at talking and working together in the Mathematics classroom.* Paper presented at the Annual Meeting of the American educational research Association, (77th, New York).

Cohen, E. (1998). Complex Instruction. *New Horizons for Learning,* Seattle, WA: USA.

Cooper, J. (1989). *Classroom teaching skills*. Vanderbilt:

Cooper and James, L. (1995). Cooperative Learning and Critical thinking. Abstract. *Psychological Abstract*, 82, 41981.

Copeland, T., Davis, K., Foley, B., Morley, B. & Nyman, K. (2001). *Improving Middle School Student’s Academic Success through Motivational Strategies*, Illinois, (ERIC Document Reproduction Service, No. ED455463).

Crawford, B.A., Kralei, K.J.S. & Mark, R.W. (1999). Elements of a community of learners in a middle school science classroom. *Science Education*, 8396), 701-703.

Culderon, M. (1987). Cooperative Learning Personal Communication and handout material from the August 1987 inservice presentation. Y selta Independent School District, EI Paso, Texas.

Dekeyrel, A., Dernovish, J., Epperly, A. & Mckay, V. (2000). *Using Motivational Strategies to Improve Academic Achievement of Middle School Students.*  Illinois, (ERIC Document Reproduction Service, No. ED443550).

Devries, D.L., Slavin, R.E., Fennessey, G.M., Edward, K.J & Lombardo, M.M. (1980). *Teams Games Tournaments: The Team Learning approach*, Englewood Cliffs, N.J. Educational Technology Publications.

Devries, D.L., Slavin, R.E. Fennessey, G.M., Edward, K.J. & Lombardo, M.M. (1980). *Teams Games – Tournaments: The Team Learning Approach*. Englewood (ciffs, NJ: Educational Technology, Publications.

Dougherty, R.C. (1995). Cooperative Learning and Enhanced Communication: Effects on Students Performance, Retention and Attitudes in General Chemistry. *Journal of Chemical Education*, 72, 793-97.

Dunne, E. & Bennett,N. (1990). *Talking and Learning in Groups,* Basingstoke:MacMillan.

Ebel, L & Frisbie, A. (1941). *Essentials of Educational Measurement*, U.S.A: Prentice –Hall Inc.

Einspruch (1998). *An introductory guide to SPSS for Windows*, California: Sage Publication.

Ellet, D.R. (1994). *Improving Academic Achievement of Eleventh Grade Basic U.S. History Students Through the use of Cooperative Learning*, Illinois, (ERIC Document Reproduction Service, No.ED 384538).

Felder, R.M. (1995). A Longitudinal study of Engineering students Performance and Retention. IV Instructional Methods and Students Responses to Them. *Journal of Engineering Education*, 84, 361-367.

Feldusen, J.F., Dai, D.Y & Clinkenbeard, P.R. (2000). *Dimensions of Competitive and Cooperative Learning Among Gifted Learners*, Journal for the Education of the Gifted, 23, 328-42.

Fennema, E. & Peterson, P. (1987). Effective teaching for girls and boys: The same or different. In D.C. Berliner and B.V. Rosenshine (Eds) *Talks to teachers* (pp.11-125) New York: Random House.

Ferguson, G.A. (1971). *Statistical Analysis in Psychology and Education*
(3rd Ed.). Tokyo: Mac Graw Hill.

Fiedler-Brand, E., Lange, R.E. & Winebrenner, S. (1992). *Tracking, Ability Grouping and the Gifted,* Pennsylvania, (ERIC Document Reproduction Service, No. ED 427466).

Fourts, J.T. (1995). *Schools within a School: Evaluation Results of Year Two of a Restructing Effort*, Washington, (ERIC Document Reproduction Service, No. ED 385003).

Fraklin, M. (1990). *Add-ventures for Girls: Building Maths confidence, Elementary Teacher’s Guide*, Nevada, (ERIC Document Reproduction Service, Bo. ED 323096).

Fuller, J.L. (2001). *Effective Strategies for Creating change with the Educational System: A Three-cycle Action Research Study*, Massachusetts, (ERIC Document Reproduction Service, No. ED 453597).

Gaith, G. (2001). Learner’s Perceptions of their STAD Cooperative Experience, *System*, 29, 289-301.

Gaith, G.M. & Malak, M.S. (2004). Effect of Jigsaw 11 on literal and higher order EFL reading comprehension. *Educational Research Evaluation*, 10(2), 105-115.

Garrett, H.E. (1981). *Statistics in Psychology and Education*. Bombay: Vakils Fetter and Simons Ltd.

Geiss, P.A. & Mayer, R. (1998). *Improving listening skills*. Illinois (ERIC Document Reproduction Service, No. ED 426613).

Glass, G.V., Cohen, L.S., Smith, M.L. & Filby, N.W. (1982). *School class size: Research and Policy*. Baverly Hills Cali: Sage Publishers.

Golberg, K., Foster, K., Maki, B., Emde, J. & O’Keilly, M. (2001). *Improving Student Motivation Through Cooperative Learning and other Strategies*, Illinois, (ERIC Document Reproduction Service, No. ED390781).

Golda, C. (1999). *Effectiveness of Cooperative Learning Strategy over Traditional Method of Teaching English Language in standard VIII pupils*. Unpublished master dissertation, University of Calicut, Calicut.

Haines, D.B. & McKeachie, W.J. (1967). *Cooperative Versus Competitive Discussion Methods in Teaching Introductory Psychology*, Journal of Educational Psychology, 58, 386-90.

Hameed, A. (1997*). Effectiveness of Cooperative Learning Strategy and Achievement Motivation on Achievement in Social Science of Standard VII pupils*, Unpublished Master’s dissertation University of Calicut, Calicut.

Hameed, A. & Dilshath, K. (2010). *Achievement Test in Mathematics*. Calicut: Farook Training College, University of Calicut.

Hameed, A. & Dilshath, K. (2010). *Lesson transcript for Cooperative Learning Strategy*, Calicut : Farook Training College, University of Calicut.

Hameed, A. & Dilshath, K. (2010). Achievement Test in Mathematics. Calicut: Farook Training College, University of Calicut.

Hameed, A. & Dilshath, K. (2010). *Lesson Plan for to Existing Method of Teaching.* Farook Training College, University of Calicut.

Hasard, J. (1990). *Science experiences: Cooperative Learning and the teaching of science*. Melno Park, CA: Addison-Wesley.

Hill, S.S. (1996). *Cooperative Learning: A Catalyst for change in the college classroom. Final Report*, Florida, (ERIC Document Reproduction Service, No. ED 413946).

Hirsch, C. & Supple, D. (1996). *61 Co-operative Learning Activities in ESL-J*. Weston walch, Publisher, 321 Valley St., Portland, ME 04 104-0658.

Hodges, L. & Wolt, C.J. (1997). *Promoting self-esteem in a caring Positive Classroom*, Illinois, (ERIC Document Reproduction Service, No. ED 411070).

Holliday, D.C. (2000). *The Development of Jigsaw-IV in a Secondary Social Studies Classroom*. Indiana, (ERIC Document Reproduction Service, No. ED 447045).

Holliday, D.C. (2001, April), *Using Cooperative Learning in a Middle School Computer Lab*, Paper presented at the annual meeting of the American Educational Research Association, Seatlle, WA.

Holliday, D.C. (2002). *Using cooperative to improve the academic achievement of inner city middle school students.* (ERIC Document Reproduction Service, No. ED464136).

Hythecker, V.I., Danserean, D.F., Rockin, T.R., O’Donnell, A.M., Lambiotte, J.G., Larson, C.O. & Young, M.D. (1984). *Networking: Development and Evaluation of a CACL Module*, Unpublished Manuscript, Johns Hopkins University.

Jackson, S.A. (1990). *Accelerating Academic Achievement for Black Students: Transforming the Teaching Learning Environment and Behaviours to Accommodate the Preferred Learning style of African American Children*, Paper presented at the conference of the National Alliance of Black School Educators, Dalls, TX.

Janes, L.M., Koutsopanagoes, C.L., Mason, D.S. & Villaranda, I. (2000). *Improving Student Motivation through the use of Engaged Learning, Cooperative Learning and Multiple Intelligence*, Illinois, (ERIC Document Reproduction Service, No. ED 443559).

Johnson, D.W. & Johnson, R.T. (1974). Instructional goal structure: Cooperative, Competitive or individualistic. *Review of Educational Research*, 44, 213-240.

Johnson, D.W. & Johnson, R.T. (1975). *Learning together and alone.* Englewood Cliffs. N.J. Prentice Hall, Inc.

Johnson, D.W. & Johnson, R.T. (1998). *Cooperation in the classroom (7th ed.).* Cornelia Drive, Edina: Interaction Book Company.

Johnson, D.W., & Johnson, R.T. (1981). Effects of Cooperative and Individualistic learning experiences on inter-ethnic interaction. *Journal of Educational Psychology*, 68, 446-452.

Johnson, D.W., Jonhson, R.T. & Slanne, M.B. (2000). *Cooperative Learning Method; A meta Analysis*. Minnepolicy S.E. University of Minnesota.

Kalaiyarasan, G. & Krishnaraj, R. (2002). Effectiveness of Co-operative Learning Aproaches in Learning Science at Secondary Level. *Journal of Educational Research & Extension,* Vol.39 (3), 5-13.

Kaul, P. (2008). The Effect of Learning Together Techniques of Cooperative Learning method on students Achievement in Mathematics *Edutracks*, Vol.7, No.12, 28-32.

Keeler, C.M. & Anson, R. (1995). An Assessment of Cooperative Learning used for Basic Computer Skills Instruction in college classroom. *Journal of Educational Computing Research*, 12, 379-93.

Keeler, C.M. (1994). Cooperative Learning in Statistics, *Teaching Statistics*, 16, 81-84.

Klein, D., Pfledereo, B. & Truckenmiller, M.A. (1998). Increasing Student Motivation Through Cooperative Learning, Writing in Mathematics and Multiple Intelligence, Illinois, (ERIC Document Reproduction Service, No.ED436351).

Krank, H.M. & Moon, C.E. (2001). Can combined Mastery/Cooperative Learning Environment Positively Impact Undergraduate Academic and Affective Outcomes? *Journal of College Reading and Learning,* 31, 195-208.

Kumar, S. & Rai, K. (1994). Cooperative Learning and Teachers: The problem of determination*. The Progress of Education*, 49, 6-9.

Kumar, S.P.K, Hameed, A & Prasanna, A (1997). *Verbal Group Test of Intelligence.* Calicut: Department of Education, University of Calicut.

Kumar, S.P.K. & Hameed, A. (2000). “Effectiveness of Instructional Learning Strategies on Achievement in Social Science,” *Calicut University Research Journal*, 1, 136-143.

Kumar, S.P.K. & Bindhu, C.M. (2002). *Instructional Learning Strategies and Cognitive Entry Behaviour: An Experimental Analysis*, New Delhi: Kanishka Publishers & Distributors.

Kutnick, P.J. (1988). *Relationships in the primary classroom.* London: Paul Chapman Publishing, Ltd.

Laughlin, P., Branch, L. & Johnson, H. (1969). Individual versus tiadic performance on a unidimensional complementary task as a function of initial ability level. *Journal of Personality and Social Psychology*, 12, 144-150.

Lee, C.K.E., Maureon, N. & Phany, R. (1999). *A school based Study of Cooperative Learning and its Effects on Social Studies Achievement.* *Attitudes towards the subject and Classroom Climate in four social studies Classroom*, Singapore, (ERIC Document Reproduction Service, No.ED 327096).

Leung, C.D. & Chung, C. (1997). Student Achievement in an Educational Technology course as enhanced by Cooperative Learning. *Journal of Science Education and Technology*, 6, 337-43.

Lowman, J. (1990). Promoting Motivation and Learning, *Journal of College Teaching*, 38, 136-39.

Lucker, G., Rosenfield, D., Sikes, J. Aronson, E. (1976). Performance in the interdependence classroom: A field study. *American Educational Research Journal*, 13, 115-123.

Lurie, E.E. & Ovrebo, B. (1995). Using a Cooperative Classroom Climate and Experimental Learning in Teaching Evaluation Research, *Journal of Teaching Sociology*, 23, 252-58.

Mahenthiran, S. & Rouse, P.J. (2000). The Impact of Group selection on Students Performance and Satisfaction, *International Journal of Educational Management*, 14, 225-64.

Malouf, D.B. (1990). *Computer-Assisted Instruction with Small Groups of Mildly Handicapped Students*, Journal of Special Education, 24,
51-68.

Miller, R.H & Hamblin, R.L. (1963). *Independence, Differential Rewarding and Productivity*, American Sociology Review, 28, 768-778.

Newmann, F.M. & Thompson, S.J. (1987). Effect of Cooperative Learning on Achievement in Secondary Schools. A summary of research. Madison, Wisc: University of Wisconsin, National Center on effective Secondary Schools.

Nunan, D. (1989). *Designing Tasks for the communicative Classroom*, Cambridge: Cambridge University Press.

Nunnally, J.C. (1972). *Educational Measurement and Evaluation*. New York: Mc Graw Hill Book Company.

Okebukola, P.A. (1984). *On Eco-Culture and Cooperative Learning in Science Classes*, Unpublished Paper, University of Ihadan, Nigeria.

Olsen, R.W.B & Kagan, S. (1992). *About Cooperative Learning, In C. Kessler (Ed.), Cooperative Language Learning: A Teacher’s Resource Book*”, Englewood Cliffs, NJ: Prentice- Hall.

Pandya, S.R. (2009). A study of the effect of Cooperative Learning model on the academic achievement in Mathematics among students with different learning styles. *Journal of Educational Research & Extension*, Vol.47(1), 79-96.

Peterson, P.L, Janicki, T & Swing, S. (1980). *Individual Characteristics and children’s learning in large-group and small-group approaches: study II*. Wisconsin Research and Development center for individualized schooling Report No. 561.

Peterson, R.P. (1991). *Effects of Cooperative Learning on Perceived Status of Male and Female Pupils*, Journal of Social Psychology, 31, 717-35.

Piaget, J. (1973). *The Psychology of Intelligence*, Totowa, NJ: Little field & Adans.

Pisani. (1994). *Involvement through Cooperative Learning: An Attempt to Increase Persistence in the Biological Sciences*, Paper presented at the annual meeting of the Association for the study of Higher Education, Tucson, A.Z.

Randon, M.J. (1995). Learner autonomy and Cooperative Learning. *English Teaching Forum*, 33, 41-43.

Ross, J.A., Rotheiser, M.C. & Hou Boumgray, A. (1998). *Impact of Self Evaluation training or Mathematic Achievement in a Cooperative Learning Environment*, Department of Education, Toronto.

Rost, M. (1991). Listening is Action, London: Prentice Hall.

Sangeetha (2005). Role of multimedia and Cooperative Learning in enhancing the writing competence of students. *Edutracks*, Vol.4, No.7, 25-27.

Sasidharan, P. (1997). *Influence of Instructional Learning Strategies and Classroom Environment on Achievement in Malayalam Language of Standard VII pupils*, Unpublished Master’s dissertation, University of Calicut, Calicut.

Scheffe, H. (1959). *The Analysis of Variance*, New York: John Wiley & Sons. Inc

Seaman, T. (1990). *On the High Road to Achievement: Cooperative Concept Mapping*, Virginia, (ERIC Document Reproduction Service, No.ED 335140).

Shacher, H. & Sharan, S. (1994). *Talking, Relating and Achieving: Effects of Cooperative Learning and whole Class Instruction*, Journal of Cognition and Instruction, 12, 313-354.

Sharan, S. & Sharan, Y. (1976). *Small Group Teaching*. Englewood Cliffs, NJ: Educational Technology Publications.

Sharan, S. & Hertz-Lazorowitz, R. (1980). Academic Achievement of elementary school children in small group versus whole – class instruction. *Journal of Experimental Education*, 48, 120-129.

Sharan, S. (1980). Cooperative Learning in small groups: Recent methods and effects and achievement, attitude, ethnic relations. *Review of Educational Research*, 50, 241-171.

Sharan, S. (1980). Learning in teams: A critical review of recent methods and effects on achievement, attitudes and race ethnic relations. *Review of Educational Research*, 50, 241-73.

Sharan, S. & Shacker, H. (1988). *Language and learning in the Cooperative Classroom*. New York: Springer-Verlay.

Sharan, S. (1990). *Cooperative Learning: Theory and research*. New York: Praeger.

Shihab, M.K.M. (2009). Cooperative Learning in Teaching Pedagogy of Social Studies. An Experimental Study, *Journal of Studies in Teacher Education*, Vol.2, Issue 1, 62-66.

Slavin, R..E. (1980). Cooperative Learning. *Review of Educational Research*, 50, 315-42.

Slavin, R. E. (1980). *Using student Team Learning*, Baltimore : Maryland, John Hopkins University, Centre for social organisation of school.

Slavin, R. E. (1983). *Cooperative Learning*. New York: Longman.

Slavin, R. E. (1985). Small-group instruction. In T. Husen & Postelthwaite, T.N. (Ed.). *The International Encyclopedia of Education*. Vol. 8 Oxford: Pergamon Press.

Slavin, R.E (1989). Research on Co operative learning: Consensus and controversy. *Educational Leadership*, 47 (4), 52-54.

Slavin (1990). *Cooperative Learning: Theory, Research and Practice*. Englewood Cliffs, N.J: Prentice Hall.

Slavin, R.E, Leavey, M & Madden, N.A. (1984). Combining Cooperative learning and individualised instruction on main streamed students. *Exceptional Children*, 50: 434-43.

Slavin, R.E, Leavey, M & Madden, N.A. (1984). Combining Cooperative Learning and Individualised Instruction on Main streamed students. *Exceptional Children*, 50, 434-43.

Slavin, R.E. (1987). Ability Grouping and Student Achievement in Elementary Schools: a Best-Evidence Synthesis. *Review of Educational Research*, 60, 293-336.

Slavin. R.E. (1983). When Does Cooperative Learning Increase Student Achievement, *Psychological Bulletin*, 94, 429-445.

Stevens, R. J., Madden, N.A, Slavin, R. E & Farnish, A. M. (1987) cooperative integrated reading and composition. *Reading Research Quarterly*, 22, 431-453.

Stevens, R. J, Slavin, R.E. & Farnish, A.M. (1991). The effect of Cooperative learning and direct instruction in reading comprehension strategies. On main idea identification. *Journal of Educational Psychology*, 83 (1), 8-16.

Stevens, R.J. & Slavin, R.E. (1995). Effect of a Cooperative Learning approach in Reading and writing on Academically Handicapped and Non Handicapped Students. *Abstract: Psychological Abstract*, 82, 350 47.

Stones, E. & Morris, S. (1977). *Teaching Practice; Problems and Prospective*. London: Co, Ltd.

Sudheesh, S.P.K. & Sasidharan, P (2004). *Jigsaw Process in Education*. Delhi Kanishka Publishers.

Tauroza, S. (1997). *Listening Comprehension: How to Teach It Rather Than Test It*, Cario: American University is Cairo Press.

Thangarajathi, S. (2007). Cooperative learning approaches in Learning Mathematics. *Journal of Educational Research & Extension* Vol. 44 (1). 37-47.

Townsend, M.A. R & Hicks, L (1995, April). *Classroom Goal Structures, Social Satisfaction an the perceived values of Academic Tasks*, Paper presented at the annual meeting and exhibit of the American Educational Research Association, San Francisco, CA.

Urion, D.K. & Davidson, N.A. (1992). *Student Achievement in Small-Group Instruction Versus Teacher- Centered Instruction in Mathematics*, Primus, 2, 257-64.

Varaprasad, C. (1997). Some Classroom Strategies, Developing Critical Literary Awareness. *Journal for the Teachers of English Outside the United States*, 35, 25-27.

Watson, G & Johnson, D.W. (1972). *Social Psychology: Issues and Insights”, (2nd ed.)*. Philadelphia: JB. Lippincott Co.

Wheeler, R & Ryan, F.L. (1973). Effect of Cooperative and Competitive Classroom Environments on the Attitude and Achievement of Elementary school students Engaged in Social Studies Inquiry Activities, *Journal of Educational Psychology*. 65, 402-407.

Wildt, A.R. & Ahtola, D.T. (1978). *Quantitative application in the social science series*, Vol.12, Analysis of Covariance, Newbury Park: California, Sage Publishers.

Wills, L. (1990). *A Program to Develop Vocabulary Success Through Multimedia Techniques,* Florida, (ERIC Document Reproduction Service, No. ED 323-532).

Winer, B.J. (1962). *Statistical Principles in Experimental Design* (2nd Ed.) Tokyo, McGraw Hill, Kogakushu Ltd.

Winer, B.J. (1977). *Statistical principle in experimental design* (2nd Ed.) Tokyo: McGraw Hill, Kogakush Ltd.

Xin, F. (1996). *The Effects of Computer Assisted Co operative Learning in Mathematics in Integrated Classroom for Students with and without Disabilities,* New Jersy, (ERIC Document Reproduction Service. No. ED 412-696).

**APPENDIX IV A**

**FAROOK TRAINING COLLEGE, CALICUT**

**ACHIEVEMENT TEST IN MATHEMATICS**

**DRAFT FORM**

**Dr. A. HAMEED DILSHATH. K.**

**Instructions:**

* This is a test on mathematics. Nothing should be written on the question paper. Seperate response sheet is given to mark the answers.
* Each question is given with four options, of which only one is correct. Put a tick mark (🗸) against the right choice from A, B, C and D.
* If you happen to mark a wrong answer, to change the answer, draw a rectangle ⬜ and put a tick mark against the right choice.
* Be careful to answer every question. For rough work, use the additional sheet given.
* Example: Length of a rectangle is ‘x’ and breadth is ‘y’. Then the area = ......

a) xy b) x + y

c) x2 d) x2 + y2

Proper way of marking answer

A🗸 B C D

1. (x+y) z = xz + ..........

 a) xz b) yz c) xy d) yx

2. (x+y)2 = x2 + ....... + y2

 a) xy b) xy2 c) x2y d) 2xy

3. (x+y) (x-y) = x2- ..............

 a) y2 b) xy c) x2 d) 2xy

4. (x-y) (u-v) = xu - ....... – yu + yv

 a) ux b) xy c) yv d) xv

5. If length = x + y and breadth = u+v then area of the rectangle = ....

 a) xy b) (x+y) (u+v) c) uv d) xu + yu

6. Find the odd one

 a) x2 – y2 b) (x+y( (x-y) c) (x+y)z d) x2 + 2xy – y2 – 2xy

7. (x+y) (u+v) = ...... + xv + yu + yv

 a) xu b) xy c) uy d) vy

8. (-4c-2b)-3c = 12c2 + ..........

 a) 8cb b) 12 bc c) 6 bc d) 2 bc

9. abc [a-b-c) = a2bc – ab2c - .........

 a) abc b) a2b2c2 c) abc2 d) ab2c

10. (y-q) (d+c) = yd + ....... – qd-qc

 a) yq b) dc c) yc d) yd

11. If (2p2 + 3q) and (2r + c2) are multiplied, which of the following is not a term of the answer?

 a) 2p2 b) 4p2r c) 2p2c2 d) 6qr

12. There are ‘c’ men and ‘d’ women working in a company. If ‘a’ is the daily wage, what will be the total amount to be paid?

 a) a(c+d) b) c(a+d) c) d(c+a) d) (c+d)

13. It (p-q) and (r-s) are multiplied, which of the following is not a term of the answer?

 a) pr b) -ps c) pq d) –qr

14. (20+1)2 = 400 + ...... + 1

 a) 200 b) 30 c) 40 d) 440

15. A rectangular shaped playground has 150 m length and 100 m breadth. It has 5 m wide foot path surrounding it. What would be the area of the footpath?

 a) 2600 m2 b) 2500 m2 c) 2300 m2 d) 2000 m2

16. If (3a-5b) and (2a-5c) are multiplied, which of the following is not a term of the answer?

 a) 6a2 b) -15ac c) -10ab d) 10 ac

17. (100-2)2 = ................-400 + 4

 a) 100 b) 10000 c) 1000 d) 10

18. (x+......) z = xz + yz

 a) x b) z c) y d) w

19. If (x+1/x) = 2 then (x2 + 1/x2) = .............

 a) 4 b) 2x c) x2 d) 2

20. If (7-q) (4-q) are multiplied, which of the following is not a term of the answer?

 a) 28 b) 11 c) -7q d) -4q

21. What should be added to square of x to gets square of x+1?

 a) x+1 b) 2x + 1 c) 2 d) x-1

22. What is the difference between the square of the sum and the square of the difference between x, y?

 a) 2xy b) 4xy c) 2x2 d) 2y2

23. Which of the following is not a term in the square of x + 2 ?

 a) x b) x2 c) 4 d) 4x

24. (x-y)2 = x2 – 2xy + ................

 a) x2 b) x2y2 c) y2 d) xy

25. If the length of a rectangle is x+y and breadth is z then which one is not equal to surface area?

 a) (x+y)z b) xz+yz c) (y+x)z d) x+y2z

26. Which one is not a term in the square of (5-z)?

 a) 25 b) -10z c) 5z d) z2

27. If length = x+y and breadth = x-y what will be the area of a rectangle?

 a) x2 + y2 b) x2 + 2xy + y2 c) x2 – y2 d) (x-y)2

28. Which one is not a term in the square of (3-5b)?

 a) 9 b) 6 c) -30b d) 25b2

29. If the diagonal of the rectangle is 5 cm long and length is 4 cm, what will be the breadth?

 a) 3 cm b) 2 cm c) 6 cm d) 1 cm

30. Which one is not a term in the square of (x-y)?

 a) x2 b) y2 c) -2xy d) xy

31. How may terms will be there if (a-b)2 is expanded?

 a) 2 b) 1 c) 3 d) 4

32. What should be added to a2 + ab + b2 to get (a+b)2?

 a) a2 b) ab c) b2 d) 2ab

33. Which one is not a term in the square of a (m+1/2)

 a) m2 b) 1/m2 c) ¼ d) m

34. What is the area of a rectangle?

 y

 x 2

 a) (2+y)x b) 2x + 2y c) (x+y)2 d) (x+2) y

35. Which of the following is not a term in the square of (2p+3q)?

 a) 2p2 b) 4p2 c) 9q2 d) 12 pq

36. The length of a rectangular courtyard is x unit and breadth is y then area is xy. Consider another yard of the same shape of which the length is 2 unit less than the first one and breadth is one unit greater than the first, what will be its area?

 a) (x-2) (y+1) b) (x+2) (y-1) c) (x+2) (y+1) d) (x-2) (y-1)

37. If (2x + 5y), (2x-5y) are multiplied, which of the following is not a term of the answer?

 a) 4x2 b) 4x c) -25y2 d) 22x2

38. If 5, (7c+8) are multiplied, which of the following is not a term of the answer?

 a) 40 b) 35c c) 15 d) 5 x 8

39.

a+b

a-b

In the figure the greater square has one side, (a+b) and the small one has side (a-b). What will be the area of a shaded portion?

 a) (a+b)2 b) (a-b)2 c) (a+b)2 – (a-b)2 d) (a+b)2 + (a-b)2

40. If 2 and (2p-4q+5) are multiplied, which of the following is not a term of the answer?

 a) 20 b) -8q c) 10 d) 4 p

41. (xy-z) (x+yz) = ..........+ xy2 z – zx-yz2

 a) xyz b) xy2 c) x2y d) 2xy

42. If (c+d) and (e+f) are multiplied, which of the following is not a term of the answer?

 a) cd b) ce c) de d) df

43. (m-8)2 = m2-16m + ..........

 a) 64 b) 8m c) 49 d) 8m2

44. If (2x + 5y) and (3x + 4z) are multiplied, which of the following is not a term of the answer?

 a) 6x2 b) 15xy c) 8xz d) 10yz

45. (3a-bc)2 = ........ -6abc + b2c2

 a) 3abc b) 3a2 c) 9a2 d) 9a

46. Which of the following is not a term in the square of (2x + 3y)?

 a) 4x2 b) 6xy c) 12 xy d) 9y2

47. (a+11) (a-11) = a2 - .............

 a) 11 b) 121 c) 11a d) 2a

48. If (y-g) and (w-m) are multiplied, which of the following is not a term of the answer?

 a) gm b) yg c) -ym d) yw

49. (6x+y) (2x+3y) = ............... + 20xy + 3y2

 a) 12x2 b) 6xy c) 5xy d) x2

50. Which of the following is not a term in the square of (2a-b)

 a) 4a2 b) a2 c) -4ab d) b2

51. 98 x 57 = (100-2) (60 - ......)

 a) 2 b) 4 c) 5 d) 3

52. Which of the following is not a term in the square of (5-7b)?

 a) 25b2 b) 49b2 c) 25b d) -70b

53. (10.2)2 = (10 + ....)2

a) 2 b) 0.2 c) 10 d) 0.3

54. If (2m+3) and (4n+5) are multiplied, which of the following is not a term of the answer?

 a) 8 mn b) 10m c) 12 n d) 6

55. (p+q) (......) = p (r+s) + q (r+s)

 a) r+s b) p + r c) p + s d) q + s

56. (X - ......) (x-12) = x2 – 24x + 144

 a) 11 b) 10 c) 9 d) 12

57. ......... is used to generalise the principle found through Arithmetic

 a) Geometry b) Algebra c) Compound interest d) Proportion

58. (5m + 6n) (5m – 6n) = 25 m2 - ................

 a) 30n2 b) n c) 6n2 d) 36n2

59. (7p-2q) (5p-3q) = 35 p2 – 21pq + ........

 a) 14 pq b) 15 pq c) 5 pq d) 6q2

60. If (4x + 12y) and (4x – 12y) are multiplied, which of the following is not a term of the answer?

 a) 16x2 b) 16 xy c) -144y2 b) 42x2

**APPENDIX III B**

**UNIVERSITY OF CALICUT**

**DEPARTMENT OF EDUCATION**

**VERBAL GROUP TEST OF INTELLIGENCE**

**SCORING KEY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test I** | **Test II** | **Test III** | **Test IV** | **Test V** |
| **Sl.No.** | **Answers** | **Sl.No.** | **Answers** | **Sl.No.** | **Answers** | **Sl.No.** | **Answers** | **Sl.No.** | **Answers** |
| 1 | D | 1 | C | 1 | C | 1 | B | 1 | A |
| 2 | B | 2 | B | 2 | A | 2 | A | 2 | C |
| 3 | B | 3 | B | 3 | D | 3 | D | 3 | D |
| 4 | D | 4 | A | 4 | A | 4 | B | 4 | B |
| 5 | A | 5 | C | 5 | C | 5 | D | 5 | D |
| 6 | B | 6 | C | 6 | C | 6 | C | 6 | C |
| 7 | C | 7 | B | 7 | A | 7 | C | 7 | A |
| 8 | D | 8 | A | 8 | B | 8 | B | 8 | D |
| 9 | C | 9 | B | 9 | C | 9 | A | 9 | A |
| 10 | A | 10 | A | 10 | A | 10 | B | 10 | B |
| 11 | B | 11 | C | 11 | B | 11 | D | 11 | B |
| 12 | D | 12 | D | 12 | D | 12 | B | 12 | A |
| 13 | D | 13 | B | 13 | A | 13 | A | 13 | B |
| 14 | C | 14 | B | 14 | B | 14 | B | 14 | A |
| 15 | A | 15 | D | 15 | D | 15 | B | 15 | D |
| 16 | C | 16 | D | 16 | B | 16 | A | 16 | D |
| 17 | B | 17 | A | 17 | C | 17 | C | 17 | C |
| 18 | A | 18 | D | 18 | A | 18 | A | 18 | A |
| 19 | D | 19 | A | 19 | C | 19 | D | 19 | D |
| 20 | A | 20 | C | 20 | D | 20 | B | 20 | C |

**APPENDIX IVB**

**FAROOK TRAINING COLLEGE, CALICUT**

**ACHIEVEMENT TEST IN MATHEMATICS**

**RESPONSE SHEET**

**(DRAFT FORM)**

Name………………………………..Class………………No....……………… School………………………………Division……… Boy/Girl ………...…….

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.No.** | **A** | **B** | **C** | **D** |  | **Sl.No.** | **A** | **B** | **C** | **D** |  | **Sl.No.** | **A** | **B** | **C** | **D** |
| 1 |  |  |  |  | 21 |  |  |  |  | 41 |  |  |  |  |
| 2 |  |  |  |  | 22 |  |  |  |  | 42 |  |  |  |  |
| 3 |  |  |  |  | 23 |  |  |  |  | 43 |  |  |  |  |
| 4 |  |  |  |  | 24 |  |  |  |  | 44 |  |  |  |  |
| 5 |  |  |  |  | 25 |  |  |  |  | 45 |  |  |  |  |
| 6 |  |  |  |  | 26 |  |  |  |  | 46 |  |  |  |  |
| 7 |  |  |  |  | 27 |  |  |  |  | 47 |  |  |  |  |
| 8 |  |  |  |  | 28 |  |  |  |  | 48 |  |  |  |  |
| 9 |  |  |  |  | 29 |  |  |  |  | 49 |  |  |  |  |
| 10 |  |  |  |  | 30 |  |  |  |  | 50 |  |  |  |  |
| 11 |  |  |  |  | 31 |  |  |  |  | 51 |  |  |  |  |
| 12 |  |  |  |  | 32 |  |  |  |  | 52 |  |  |  |  |
| 13 |  |  |  |  | 33 |  |  |  |  | 53 |  |  |  |  |
| 14 |  |  |  |  | 34 |  |  |  |  | 54 |  |  |  |  |
| 15 |  |  |  |  | 35 |  |  |  |  | 55 |  |  |  |  |
| 16 |  |  |  |  | 36 |  |  |  |  | 56 |  |  |  |  |
| 17 |  |  |  |  | 37 |  |  |  |  | 57 |  |  |  |  |
| 18 |  |  |  |  | 38 |  |  |  |  | 58 |  |  |  |  |
| 19 |  |  |  |  | 39 |  |  |  |  | 59 |  |  |  |  |
| 20 |  |  |  |  | 40 |  |  |  |  | 60 |  |  |  |  |

**APPENDIX IVF**

**FAROOK TRAINING COLLEGE, CALICUT**

**ACHIEVEMENT TEST IN MATHEMATICS**

**RESPONSE SHEET**

**(FINAL FORM)**

Name………………………………..Class………………No....……………… School………………………………Division……… Boy/Girl ………...…….

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.No.** | **A** | **B** | **C** | **D** |  | **Sl.No.** | **A** | **B** | **C** | **D** |
| 1 |  |  |  |  | 16 |  |  |  |  |
| 2 |  |  |  |  | 17 |  |  |  |  |
| 3 |  |  |  |  | 18 |  |  |  |  |
| 4 |  |  |  |  | 19 |  |  |  |  |
| 5 |  |  |  |  | 20 |  |  |  |  |
| 6 |  |  |  |  | 21 |  |  |  |  |
| 7 |  |  |  |  | 22 |  |  |  |  |
| 8 |  |  |  |  | 23 |  |  |  |  |
| 9 |  |  |  |  | 24 |  |  |  |  |
| 10 |  |  |  |  | 25 |  |  |  |  |
| 11 |  |  |  |  | 26 |  |  |  |  |
| 12 |  |  |  |  | 27 |  |  |  |  |
| 13 |  |  |  |  |  | 28 |  |  |  |  |
| 14 |  |  |  |  |  | 29 |  |  |  |  |
| 15 |  |  |  |  |  | 30 |  |  |  |  |

**APPENDIX III**

**APPENDIX IIIA**

**APPENDIX IV**

**FAROOK TRAINING COLLEGE, CALICUT**

**ACHIEVEMENT TEST IN MATHEMATICS (FOR STANDARD VIII PUPILS )**

**DRAFT FORM**

**Dr. A. HAMEED DILSHATH. K.**

**Instructions:**

**\nÀt±-i-§Ä :**

 CsXmcp KWnX ]co-£-bmWv. tNmZy-¡-S-em-knÂ H¶pw Fgp-X-cp-Xv. D¯-c-§Ä AS-bmfs¸-Sp-¯p-¶-Xn\v {]tXyIw joäv X¶n-cn-¡p-¶p.

 FÃm tNmZy-§Ä¡pw A,B,C,D F¶n-§s\ \mev D¯-c-§Ä hoXw sImSp-¯n-cn-¡p-¶p. Ah-bnÂ H¶p-am-{X-amWv icn. D¯-c-¡-S-em-knÂ Hmtcm tNmZy \¼-dn\p t\scbpw A,B,C,D F¶n-§s\ tcJ-s¸-Sp-¯n-bn-cn-¡p-¶p. icn-bp-¯cw I­p-]n-Sn-¨-tijw D¯-c-¡-S-em-knÂ icn-bp-¯-cs¯ kqNn-¸n-¡p¶ A£-c-¯nÂ ‘’AS-bmfw tcJ-s¸-Sp-¯p-I.

 \n§Ä BZyw AS-bm-f-s¸-Sp-¯nb NnÓw sXämb Øm\-¯m-sW-¦nÂ, Øm\w amäp-¶-Xn\v AXn\p Npäpw Hcp ka-N-Xpcw () hc-bv¡p-Ibpw icn-bmb Øm\¯v ‘’NnÓw tcJ-s¸-Sp-¯p-Ibpw sN¿p-I.

 FÃm tNmZy-§Ä¡pw D¯cw tcJ-s¸-Sp-¯m³ {i²n¡p-I. Bh-iy-amb IW¡p Iq«-ep-IÄ sN¿m³ {]tXyIw joäv D]-tbm-Kn-¡p-I.

 amXrI : \ofw x Dw hoXn y Dw Bb NXp-c-¯nsâ ]c-¸-fhv = --------

 A) xy B ) x + y C) x2 D) x2 + y2

 D¯cw AS-bm-f-s¸-Sp-¯p¶ coXn

 A  B C D

1. (x + y) z = xz + ..............

 A) xz B) yz C) xy D)yx

2. (x+y)2 = x2 + ....... + y2

 A) xy B) xy2 C) x2y D)2xy

3. (x + y) (x-y) = x2 - ................

 A) y2 B) xy C) x2 D) 2xy

4. (x-y) (u-v) = xu - ............. - yu + yv

 A) ux B)xy C)yv D) xv

5. \ofw (x+y) Dw hoXn (u+v) Dw BbmÂ NXp-c-¯nsâ ]c-¸-fhv -= ............................

 A) xy B)(x+y) (u+v) C) uv D) xu + yu

6. t{iWn-bnse Hä-bms\ Is­-¯pI.

 A) x2 - y2 B) (x+y) (x-y) C)(x+y) z D) x2+2xy - y2 - 2xy

7. (x+ y) (u + v) = ............... + xv + yu + yv

 A) xu B) xy C) uy D) vy

8. (-4c - 2b) -3c = 12c2 + ........

 A) 8cb B) 12bc C) 6bc D)2bc

9. abc [a - b - c] = a2bc - ab2c - .......

 A) abc B)a2b2c2 C)abc2 D)ab2c

10. (y-q) (d +c) = yd + ....... - qd - qc

 A) yq B) dc C)yc D) yd

11. (2P2 + 3q), (2r + c2) ChbpsS KpW-\-^-e-¯nÂs]Sm-¯- ]-Z-taXv?

 A) 2p2 B) 4p2r C)2p2c2 D)6qr

12. Hcp I¼-\n-bnÂ ‘c’ ]pcp-j-·mcpw ‘d’ kv{XoIfpw tPmen-sN-¿p-¶p-­v. HcmÄ¡v Hcp Znh-k-s¯-Iqen ‘a’ cq]-bm-Wv. F¦nÂ Hcp Znhkw Iqen-bn-\-¯nÂ F{X-cq-]-sIm-Sp-t¡-­n-h-cpw.

 A) a (c+d) B) c(a+d) C) d(c+a) D) c+d)

13. (p-q), (r-s). C-h-bpsS KpW-\-^-e-¯nÂ s]Sm-¯- ]-Z-taXv?

 A) pr B) -ps C) pq D) -qr

14. (20 + 1)2 = 400 + ..... + 1

 A) 200 B) 30 C) 40 D) 440

15. NXp-cm-Ir-Xn-bmb Hcp Ifn Øe-¯n\v 150 ao \ofhpw 100 ao hoXn-bpw D­v. CXn\v Npänepw ]pd-¯mbn 5 ao. hoXnbnÂ \S-¸m-X-bp-­v. \S-¸m-X-bpsS ]c-¸-fhv F{X?

 A) 2600 N.- ao. B) 2500 N.- -ao. C) 2300 N.- -ao. D) 2000 N.- ao.

16. (3a - 5b) (2a - 5c). Ch-bpsS KpW-\-^-e-¯nÂs¸-Sm¯ ]Z-taXv?

 A) 6a2 B) -15ac C) -10ab D) 10ac

17. (100-2)2 = ....... - 400 + 4

 A) 100 B) 10000 C) 1000 D) 10

18. (x + .....) z = xz + yz

 A) x B) z C) y D) W

19. (x+ 1/x) = 2 BbmÂ (x2 + 1/x2) = ......

 A) 4 B) 2x C) x2 D) 2

20. (7-q) (4-q) Ch-bpsS KpW-\^e-¯nÂ s]Sm¯ ]Z-taXv?

 A) 28 B) 11 C) -7q D) -4q

21. x sâ hÀ¤-¯n-t\mSv F{X Iq«n-bmÂ (x+1) sâ hÀ¤w In«pw?

 A) x + 1 B) 2x + 1 C) 2 D) x - 1

22. x, y F¶o c­v kwJy-I-fpsS XpI-bpsS hÀ¤hpw hyXym-k-¯nsâ hÀ¤hpw X½n-epÅ hyXym-k-sa´v?

 A) 2xy B) 4xy C) 2x2 D) 2y2

23. (x+ 2)sâ hÀ¤-¯nÂ s]Sm¯ ]Z-taXv?

 A) x B) x2 C) 4 D) 4x

24. (x - y)2 = x2 - 2xy + ......

 A) x2 B) x2y2 C) y2 D) xy

25. \ofw x+ y Dw hoXn z Dw BbmÂ NXp-c-¯nsâ ]c-¸-f-hnÂ s]Sm-¯-tXXv?

 A) (x+y)z B) xz + yz C) (y+x)z D) x + y2z

26. (5-z) sâ hÀ¤-¯nÂ s]Sm¯ ]Z-taXv?

 A) 25 B) -10z C) 5z D) z2

27. \ofw (x+y) hoXn (x-y) Dw BbmÂ NXp-c-¯nsâ ]c-¸-fhv = ......................

 A) x2 + y2 B) x2 + 2xy + y2 C) x2 - y2 D) (x-y)2

28. (3-5b) bpsS hÀ¤-¯nÂs]Sm¯ ]Z-taXv?

 A) 9 B) 6 C) - 30b D) 25b2

29. Hcp NXp-c-¯nsâ hnIÀ®-¯nsâ \ofw 5sk.-ao Dw \ofw 4 sk.ao Dw BWv. AXnsâ hoXn F{X skâo-ao-ädmWv.

 A) 3cm B)2cm C) 6cm D) 1cm

30. (x-y) bpsS hÀ¤-¯nÂ s]Sm¯ ]Z-taXv?

 A) x2 B) y2 C) -2xy D) xy

31. (a-b)2 hn]p-eo-I-cn-¨mÂ AXnÂ F{X ]Z-§Ä D­m-bn-cn-¡pw?

 A) 2 B) 1 C) 3 D) 4

32. a2 + ab + b2 F¶-Xnsâ IqsS F{X Iq«n-bmÂ (a+b)2 Bbn amdpw?

 A) a2 B) ab C) b2 D) 2ab

33. (m+1/2) sâ hÀ¤-¯nÂ s]Sm¯ ]Z-taXv?

 A)m2 B) 1/m2 C) 1/4 D) m

34. Nn{X-¯nse NXp-c-¯nsâ ]c-¸-f-sh{X?

 y

 x 2

 A) (2+y) B)2x + 2y C) (x+y)2 D) (x+2)y

35. (2p+3q) hnsâ hÀ¤-¯nÂ s]Sm¯ ]Z-taXv?

 A) 2p2 B) 4p2 C) 9q2 D) 12pq

36. \ofw x bqWnäpw hoXn ybqWnäpw Bb NXp-cm-Ir-Xn-bn-epÅ Hcp apä-¯nsâ ]c-¸-fhv xy BWtÃm? F¦nÂ Cu apä-t¯-¡mÄ 2 bqWnäv Ipdhv \ofhpw 1 bqWnäv IqSp-XÂ hoXnbpw DÅ asämcp apä-¯nsâ ]c-¸-f-sh{X?

 A) (x - 2) (y+1) B) (x+ 2 ) (y-1)

 C) (x+2) (y+1) D) (x-2) (y-1)

37. (2x + 5y) (2x - 5y) ChbpsS KpW-\-^-e-¯nÂs]Sm¯ ]Z-taXv?

 A) 4x2 B) 4x C) -25y2 D)22x2

38. 5 (7c + 8) ChbpsS KpW-\-^-e-¯nÂs]-Sm¯ ]Z-taXv?

 A) 40 B) 35C C) 15 D) 5 x 8

39.

a-b

 a+b

 Nn{X-¯nÂ henb ka-N-Xp-c-¯nsâ Hcp hiw (a+b) Dw sNdnb ka-N-Xp-c-¯nsâ Hcp hiw (a-b) bpw BWv F¦nÂ \ndw sImSp¯ `mK-¯nsâ ]c-¸-f-sh{X?

 A) (a+b)2 B) (a-b)2 C) (a+b)2 - (a-b)2 D) (a+b)2+ (a-b)2

40. 2, (2p - 4q + 5 ) ChbpsS KpW-\-^-e-¯nÂs¸Sm¯ ]Z-taXv?

 A) 20 B ) - 8q C) 10 D) 4p

41. (xy -z) (x+yz) = ...... + xy2z - zx - yz2

 A) xyz B) xy2 C) x2y D) 2xy

42. (c+d) (e+f) ChbpsS KpW-\-^-e-¯nÂs]-Sm¯ ]Z-taXv?

 A) cd B) ce C) de D) df

43. (m - 8)2 = m2 - 16m + .....

 A) 64 B) 8m C)49 D)8m2

44. (2x + 5y), (3x + 4z) ChbpsS KpW-^-e-¯nÂs]Sm¯ ]Z-taXv?

 A) 6x2 B) 15xy C) 8xz D) 10yz

45. (3a-bc)2 = ....... – 6abc + b2c2

 A) 3abc B) 3a2 C)9a2 D) 9a

46. (2x+3y) bpsS hÀ¤-¯nÂ hcm¯ ]Z-taXv ?

 A) 4x2 B) 6xy C) 12xy D) 9y2

47. (a+ 11) (a-11) = a2 - ........

 A) 11 B) 121 C) 11a D) 2a

48. (y-g) (w-m) ChbpsS KpW-\-^-e-¯nÂ s]Sm¯ ]Z-taXv?

 A) gm B) yg C) -ym D) yw

49. (6x+y) (2x + 3y) = ..... + 20 xy + 3y2

 A) 12x2 B) 6xy C) 5xy D) x2

50. (2a-b)bpsS hÀ¤-¯nÂ s]Sm¯ ]Z-taXv?

 A) 4a2 B) a2 C) -4ab D) b2

51. 98 x 57 = (100 - 2) (60- .....)

 A) 2 B) 4 C) 5 D) 3

52. (5-7b) bpsS hÀ¤-¯nÂs]Sm¯ ]Z-taXv?

 A) 25b2 B) 49b2 C) 25b D) -70b

53 (10.2)2 = (10 + ....)2

 A) 2 B) 0.2 C) 10 D) 0.3

54. (2m + 3), (4n +5) ChbpsS KpW-\-^-e-¯nÂ s]Sm¯ ]Z-taXv?

 A) 8mn B) 10m C) 12n D) 6

55. (p + q) (....) = p (r+s) + q (r+s)

 A) r + s B) p +r C) p + s D) q + s

56. (x - ......) (x- 12) = x2 - 24x + 144

 A) 11 B) 10 C) 9 D) 12

57. A¦-K-Wn-X-¯n-eqsS Is­-¯n-b XXz-§sf kmam\y hÂI-cn-¡p-¶-Xn\v þþ-þ-þþ D]-tbm-Kn-¡p-¶p.

 A) PymanXn B) \_oP-K-WnXw C) Iq«p-]-eni D) A\p-]mXw

58. (5m + 6n) (5m - 6n) = 25m2 - ......

 A) 30n2 B) n C) 6n2 D) 36n2

59. (7P-2q) (5p - 3q) = 35p2 – 31 pq + ........

 A) 14pq B) 15pq C) 5pq D) 6q2

60. (4x + 12y) (4x - 12y) bpsS KpW-\-^-e-¯nÂs¸Sm¯ ]Z-taXv?

 A) 16x2 B) 16xy C) -144y2 D) 42 x2

**APPENDIX IV E**

**FAROOK TRAINING COLLEGE**

**CALICUT**

**ACHIEVEMENT TEST IN MATHEMATICS**

**FINAL FORM**

**Dr. A. HAMEED DILSHATH. K.**

**Instructions:**

* This is a test on mathematics. Nothing should be written on the question paper. Seperate response sheet is given to mark the answers.
* Each question is given with four options, of which only one is correct. Put a tick mark (🗸) against the right choice from A, B, C and D.
* If you happen to mark a wrong answer, to change the answer, draw a rectangle ⬜ and put a tick mark against the right choice.
* Be careful to answer every question. For rough work, use the additional sheet given.
* Example: Length of a rectangle is ‘x’ and breadth is ‘y’. Then the area = ......

a) xy b) x + y

c) x2 d) x2 + y2

Proper way of marking answer

A🗸 B C D

1. (x+y)2 = x2 + ....... + y2

 a) xy b) xy2 c) x2y d) 2xy

2. (x+y) (x-y) = x2- ..............

 a) y2 b) xy c) x2 d) 2xy

3. (x-y) (u-v) = xu - ....... – yu + yv

 a) ux b) xy c) yv d) xv

4. There are ‘c’ men and ‘d’ women working in a company. If ‘a’ is the daily wage what would be the total amount will paid?

 a) a(c+d) b) c(a+d) c) d(c+a) d) (c+d)

5. It (p-q), (r-s) are multiplied, which of the following is not a term of the answer?

 a) pr b) -ps c) pq d) –qr

6. (20+1)2 = 400 + ...... + 1

 a) 200 b) 30 c) 40 d) 440

7. A rectangular playground has 150 m length and 100 m breadth. It has 5 m wide foot path surrounding it. What would be the area of the footpath?

 a) 2600 m2 b) 2500 m2 c) 2300 m2 d) 2000 m2

8. (x+......) z = xz + yz

 a) x b) z c) y d) w

9. If (7-q) (4-q) are multiplied, which of the following is not a term of the answer?

 a) 28 b) 11 c) -7q d) -4q

10. What should be added to square of x to gets square of x+1?

 a) x+1 b) 2x + 1 c) 2 d) x-1

11. Which of the following is not a term in the square of x + 2

 a) x b) x2 c) 4 d) 4x

12. (x-y)2 = x2 – 2xy + ................

 a) x2 b) x2y2 c) y2 d) xy

13. If the length of a rectangle is x+y and breadth is z then which one is not equal to surface area?

 a) (x+y)z b) xz+yz c) (y+x)z d) x+y2z

14. If length = x+y and breadth = x-y what is the area of a rectangle?

 a) x2 + y2 b) x2 + 2xy + y2 c) x2 – y2 d) (x-y)2

15. Which one is not a term in the square of (x-y)?

 a) x2 b) y2 c) -2xy d) xy

16. How may terms will be there if (a-b)2 is expanded?

 a) 2 b) 1 c) 3 d) 4

17. You know that the area of a rectangular courtyard whose length is x unit and breadth is y unit is xy. Consider another yard of the same shape whose length is 2 unit less than the first one and breadth is one unit greater than the first, what will be its area?

 a) (x-2) (y+1) b) (x+2) (y-1) c) (x+2) (y+1) d) (x-2) (y-1)

18. If 5, (7c+8) are multiplied, which of the following is not a term of the answer?

 a) 40 b) 35c c) 15 d) 5 x 8

19.

a+b

a-b

In the figure the greater square has one side, (a+b) and the small one has side (a-b). What will be the area of a shaded portion?

 a) (a+b)2 b) (a-b)2 c) (a+b)2 – (a-b)2 d) (a+b)2 + (a-b)2

20. If 2, (2p-4q+5) are multiplied, which of the following is not a term of the answer?

 a) 20 b) -8q c) 10 d) 4 p

21. If (c+d), (e+f) are multiplied, which of the following is not a term of the answer?

 a) cd b) ce c) de d) df

22. If (2x + 5y), (3x + 4z) are multiplied, which of the following is not a term of the answer?

 a) 6x2 b) 15xy c) 8xz d) 10yz

23. (a+11) (a-11) = a2 - .............

 a) 11 b) 121 c) 11a d) 2a

24. (6x+y) (2x+3y) = ............... + 20xy + 3y2

 a) 12x2 b) 6xy c) 5xy d) x2

25. If (2m+3), (4n+5) are multiplied, which of the following is not a term of the answer?

 a) 8 mn b) 10m c) 12 n d) 6

26. (p+q) (......) = p (r+s) + q (r+s)

 a) r+s b) p + r c) p + s d) q + s

27. (X - ......) (x-12) = x2 – 24x + 144

 a) 11 b) 10 c) 9 d) 12

28. ......... is used to generalise the principle found through Arithmetic

 a) Geometry b) Algebra c) Compound interest d) Proportion

29. (5m + 6n) (5m – 6n) = 25 m2 - ................

 a) 30n2 b) n c) 6n2 d) 36n2

30. If (4x + 12y) (4x – 12y) are multiplied, which of the following is not a term of the answer

 a) 16x2 b) 16 xy c) -144y2 b) 42x2

**APPENDIX 1A**

**FAROOK TRAINING COLLEGE, CALICUT**

**LESSON TRANSCRIPT FOR COOPERATIVE LEARNING STRATEGY**

**[JIGSAW – II]**

**Dr. A. HAMEED DILSHATH. K.**

Standard : VIII

Subject : Mathematics

Unit : Algebra

Sub units : Identities

 (x+y)z = xy+yz

 (x+y) (u+v) = xu+xv+yu+yv

Learning aids : Chart, paper, scissors, scale, sketch pen, pencil
 etc.

**OBJECTIVES**

1. For knowing new ideas
2. For understanding new ideas
3. For applying the learned knowledge in new context
4. For analysing the idea
5. For learning by synthesizing the ideas
6. For developing the ability of self evaluation
7. For developing cooperative attitude
8. For developing mutual understanding and the ability of sharing the work
9. For developing democratic values
10. For developing creativity.

**Phase 1**

 Students welcome the teacher to the class. The teacher wishes the students.

Teacher : How are you?

Students : We are fine, teacher.

Teacher : Are you interested in studying mathematics?

Students : Yes, we are very interested.

Teacher : Today we are going to learn in a different way. We will be learning each part through a play. For that there should be mutual cooperation among you.

Teacher : We will have to rearrange the seating for the new study style. Arrangement may be done according to your convenience. (Teacher forms seven groups of five members in each. For the purpose, teacher asks them to count from one to seven. Those who have counted one forms the first group, those who have counted two forms the second group. And so on. Thus seven groups are separated. Group leader is selected from every group. Children give names their group.[Teacher makes pupils aware of the benefits of Jigsaw method]

Teacher: Do you know the benefits of Jigsaw Method. They are ..........

1. Learning is through play
2. Learning becomes easy
3. Consideration for the opinion of every one
4. Group members are involving discussions
5. Learning with cooperation
6. Opportunity to ask questions
7. Decision of the group will be the decision of everyone
8. Leadership training is possible
9. Learning becomes more effective from expert groups

 (Students listen carefully)

Teacher : I will ask some questions from the previous class

Students : O. K. teacher

Teacher : What would be the sign of the answer if two positive numbers are multiplied?

Students : positive

Teacher : What would be the sign of the answer if two negative numbers are multiplied ?

Students : Positive

Teacher : What would be the sign of the answer if two different signs are multiplied ?

Students : Negative

Teacher : OK, Congratulation!

Students : Thank you, Teacher!

Teacher : Who will arrange the seats today?

Students : We will (some of the students stand and arrange the seats according to the pattern given below)

Teacher : Very good! What is the convenience of this

 arrangement?

Students : Every one of us can see all of us and the teacher

Teacher : Yes, Let’s start today’s activities.

Teacher : Group leaders come here and distribute these slips is each groups

 (Students distribute the slips)

Teacher : What is there in the slips?

Students : The work for each member

Teacher : What work?

Students : Multiply the sum of two numbers by a third number and to find the product of a sum of two numbers by another sum of two numbers.

Teacher : Yes, Let’s try to find out product of these numbers?

Students : With the help of the text book .......!

Teacher : Of course! for solving these problem let’s read algebra and geometry from the text book. I am here to help you to clear your doubts on the spot. Look for yours study material from page 71 to 73 in your text book.

 (Students take pages concerned and involve individually in the activity).

 (30 min)

**Phase II**

Teacher : Yes, we can stop (Gives a little more time to finish). You are going to form “Expert group” Now, From each group, each member may stand up.

 (one member each from each group stand up)

Teacher : Again stand up each member from each group to form the second ‘Expert’ group.

 (Each one from the groups again stands up)

Teacher : You are the second “Expert Group” and thus form other Expert Groups. (Students again form the expert groups) Why do we form the expert group?

Students : To become experts

Teacher : All right. You can improve your learning in the expert group. Double clearance, discussion and exchange of ideas should be taken place in the expert groups. Further, you can seek the help of your teacher whenever needed.

 (Students are Cooperating in the group work. Teacher takes care to make the group work active)

 (15 minutes)

**Phase III**

Teacher : (After 15 minutes). All right. Now you can return to your base groups.

 (Students rejoin in the base groups)

Teacher : Now each member in the group has to become an expert in his/her own respective area. Each of you should teach your area to your team-mates in turn. Thus the whole group will learn the whole content (to find out the answers from each problem in a paper cuttings)

 (Students engage in peer tutoring and in clear doubts from the teacher).

 (Teacher supervises the whole group work and interfere whenever and wherever needed).

 (30 min)

 **Phase IV**

Teacher : Now you are able to multiply the sum of two number with a third number and multiply the sum of two numbers with sum of other two numbers is’nt it?

Students : Of course, teacher.

Teacher : You may share our ideas now and thus we may find out the best group that worked well. Are you interested?

Students : Yes, teacher

Teacher : It is the quiz time! it is not a competition but?

Students : It is a game!

Teacher : Do you know the rules of the game?

Students : Yes teacher, each member has only one chance. He or she can use it either for asking question or for answering. One point each for a question and an answer

Teacher : The first chance goes to first group

 (First group asks a question)

Teacher : The second group should answer otherwise the chance will go to the third group.

 (Students Engage in the game with great interest and curiosity)

 (Teacher interferes wherever needed.

Teacher : Make sure that group student and each group get equal chances. (Teacher Appreciates and rewards the winning group/groups).

 All right, let’s stop here.

Students : Of course, teacher!

 (15 min)

**APPENDIX 1**

**FAROOK TRAINING COLLEGE, CALICUT**

**LESSON TRANSCRIPT FOR COOPERATIVE LEARNING STRATEGY**

**[JIGSAW – II ]**

**Dr. A. HAMEED DILSHATH K.**

Standard : VIII

Subject : KWnXw

Unit : \_oPKWnXw

Sub units : ka-hm-Iy-§Ä

 (x+y)z = xy+yz

 (x+y) (u+v) = xu+xv+yu+yv

Learning aids : NmÀ«v, IS-em-kv, I{Xn-I, kvsIbnÂ, kvsI¨v
 s]³, s]³knÂ XpS-§n-b-h.

**OBJECTIVES**

1. ka-hm-Iy-§Ä cq]-s¸-Sp-¯p-¶-Xn-\pw Pyman-Xobambn Ahsb hymJym-\n-¡p-¶-Xn\pw
2. ]pXnb Bi-b-§Ä a\-Ên-em-¡m³
3. Adnª hkvXp-¡Ä ]pXnb kµÀ`-¯nÂ {]tbm-Kn-¡m³
4. ]pXnb Bi-b-§Ä A]-{K-Yn-¡m³
5. Bi-b-§sf ka-\z-bn-¸n-¡m³
6. kzbw hne-bn-cp-¯m-\pÅ Ignhv hnI-kn-¸n-¡m³
7. kl-I-cn¨v {]hÀ¯n-¡m-\pÅ at\m-`mhw hnI-kn-¸n-¡m³
8. ]c-kv]c [mcWbpw tPmen ]¦p-sh-s¨-Sp-¡m-\pÅ Ignhpw hnI-kn-¸n-¡m³
9. P\m-[n-]Xy aqey-§Ä hnI-kn-¸n-¡m³
10. kÀ¤ iàn hnI-kn-¸n-¡m³

**Phase I**

 A[ym-]nI ¢mkn-te¡v IS-¶p-h-cp-t¼mÄ Ip«n-IÄ kzmKXw sN¿p-¶p. A[ym-]nI Ip«n-I-sf {]Xy-`n-hmZyw sN¿p-¶p.

A[ym-]nI : kpJw Xs¶-bmtWm ?

Ip«n-IÄ : R§Ä¡v kpJw Xs¶ So¨À

A[ym-]nI : \n§Ä¡v IW¡v ]Tn-¡m³ Xmev]-cy-apt­m?

Ip«n-IÄ : AsX, R§Ä¡v \Ã Xmev]-cy-ap­v

A[ym-]nI : km[m-c-W-bpÅ ]T-\-¯nÂ \n¶pw hyXy-kvX-amb Hcp coXn-bnemWv \mw C¶v ]Tn-¡m³ t]mIp-¶-Xv. ]mT ]pkvX-I-¯nse Hmtcm `mKhpw Ifn-bn-eq-sS-bmWv \mw a\-Ên-em-¡p-¶-Xv. AXn\v th­n \n§-fnÂ ]c-kv]c kl-I-cWw D­m-bn-cn-¡-Ww.

A[ym-]nI : ]pXn-b-co-Xn-bn-epÅ ]T-\-¯n\v th­n \ap¡v ¢mknse Ccn-¸nSw {Iao-I-cn-¡-Ww. {Iao-I-cWw \n§-fpsS kuIcyw A\p-k-cn-¨m-hmw. A[ym-]nI Ip«n-Isf 5 AwK-§-fp-ff 7 {Kq¸pIfmbn Xncn-¡p-¶p. AXn-\p-th-­n Ip«n-ItfmSv 1 apXÂ 7 hsc F®m³ ]d-bp-¶p. "H¶v' F¶v F®n-b-hÀ H¶mw {Kq¸v, c­v F¶v F®n-b-hÀ c­mw {Kq¸v F¶n-§s\ Ggv {Kq¸p-I-fm¡n Xncn-¡p-¶p. XpSÀ¶v Hmtcm {Kq¸nepw {Kq¸v eoUsd sXc-sª-Sp-¡p-¶p. {Kq¸n\v Ip«n-IÄ t]cv \ÂIp-Ibpw sN¿p-¶p.

 ]pXp-Xmbn ]Tn-¡m³ t]mIp¶ Jigsaw Method sâ KpW-§Ä A[ym-]nI Ip«n-Isf ]dªp a\-Ên-em-¡n-¡p-¶p.

A[ym-]nI: Jigsaw Method sâ KpW-§Ä Fs´m-s¡-bm-sW¶v \n§Ä¡-dn-bmtam?

1. Ifn-I-fn-eq-sS-bpÅ ]T\w
2. hfsc Ffp-¸-¯nÂ ]T\w km[y-am-hp¶p
3. FÃm-h-cp-sSbpw A`n-{]m-b-§Ä ]cn-K-Wn-¡p¶p
4. {Kq¸w-K-§Ä NÀ¨-IÄ \S-¯p¶p
5. ]c-kv]c kl-I-c-W-t¯m-Sp-Iq-Sn-bpÅ ]T\w
6. tNmZy-§Ä tNmZn-¡m-\pÅ Ah-kcw e`n-¡p¶p
7. {Kq¸nsâ Xocp-am\w FÃm-h-cp-sSbpw Xocp-am-\-am-bn-cn¡pw
8. t\XrXz ]cn-io-e\w km[y-am-¡p¶p
9. "FIvkvt]À«v {Kq¸n'-eqsS ]T\w H¶p-IqSn ^e-{]-Z-am-hp¶p

 (Ip«n-IÄ {i²-tbmsS tIÄ¡p¶p)

A[ym-]nI : C\n Ignª ¢mÊnÂ ]Tn¨ Ipd¨p Imcy-§Ä tNmZn¡mw

Ip«n-IÄ : icn So¨À

A[ym-]nI : c­v t]mkn-äohv kwJy-I-Ä KpWn-¨mÂ D¯-c-¯nsâ NnÓw F´m-bn-cn-¡pw.

Ip«n-IÄ : t]mkn-äohv

A[ym-]nI : c­v s\K-äohv kwJy-IÄ KpWn-¨mtem?

Ip«n-IÄ : t]mkn-äohv

A[ym-]nI : c­v hyXykvX NnÓ-§-fpÅ kwJy-IÄ KpWn-¨mÂ D¯-c-¯nsâ NnÓw F´m-bn-cn¡pw?

Ip«n-IÄ : s\K-äohv

A[ym-]nI : icn, A`n-\-µ-\§Ä

Ip«n-IÄ : \µn, So¨À

A[ym-]nI : C¶v Ccn-¸nSw Bcv {Iao-I-cn¡pw?

Ip«n-IÄ : R§Ä {Iao-I-cn¡mw So¨À (Ip-d¨p Ip«n-IÄ Fgp-t¶äv Xmsg ImWn¨ coXn A\p-k-cn¨v Ccn-¸nSw {Iao-I-cn-¡p-¶p)

A[ym-]nI : Cu {Iao-I-c-W-¯nsâ kuIcyw F´mWv?

Ip«n-IÄ : FÃm-hÀ¡pw FÃm-h-scbpw, IqSmsX So¨-sdbpw ImWm³ km[n-¡p-¶p.

A[ym-]nI : icn, F¦nÂ \ap¡v C¶s¯ {]hÀ¯\w XpS§mw

A[ym-]nI : {Kq¸v eoUÀ apt¶m«v hcn-I. F¶n«v Cu Én¸p-IÄ Hmtcm {Kq¸n\pw hnX-cWw sN¿p-I.

 (Ip«n-IÄ Én¸p-IÄ hnX-cWw sN¿p¶p)

A[ym-]nI : F´mWv Én¸n-\p-ÅnÂ DÅXv?

Ip«n-IÄ ; Hmtcm AwK-¯n\pw DÅ tPmen

A[ym-]nI : F´v tPmen?

Ip«n-IÄ : c­v kwJy-I-fpsS XpIsb aq¶m-a-sXmcp kwJy sIm­v KpWn-¡p-I, c­v kwJy-I-fpsS XpIsb thsd c­v kwJy-I-fpsS XpI sIm­v KpWn-¡p-I.

A[ym-]nI : icn, CXnsâsbms¡ KpW-\-^ew F§ns\ I­p-]n-Sn-¡mw?

Ip«n-IÄ : ]mT-]p-kvX-I-¯nsâ klm-b-t¯msS.

A[ym-]nI : XoÀ¨-bmbpw! Cu tPmen sN¿m³ th­n ]pkvX-I-¯nse "\_oP-K-Wn-Xhpw Pyman-Xnbpw' F¶ `mKw hmbn¨p t\m¡p-I. IqSmsX \n§-fpsS A[ym-]nI ChnsS Xs¶-bp-­v. \n§-fpsS kwi-b-§Ä A¸-t¸mÄ Xs¶ \nhr¯n hcp-¯m-hp-¶-XmWv. ]mT]pkvX-I-¯nse t]Pv 71, 72, 73 F¶nh t\m¡n \n§-fpsS ]T-\-h-kvXp-¡Ä \n§Ä Xs¶ I­p-]n-Sn-¡p-I.

 (Ip«n-IÄ ]mT-`mKw FSp-¯v {]hÀ¯-\-¯n-Â GÀs¸-Sp-¶p).

 (30 -----an\n«v)

**Phase II**

A[ym-]nI : icn, \½Ä \nÀ¯m³ t]mIp-I-bm-Wv. (Ip-d¨v ka-bhpw IqSn apgp-h-\m-¡m³ \ÂIp¶p) \n§Ä C\n Expert Groups Â Bhm³ t]mhp-I-bmWv C\n, Hmtcm {Kq¸nÂ \n¶pw HcmÄ hoXw Fgp-t¶äv \nÂ¡p-I.

 (Hmtcm {Kq¸nÂ \n¶pw HcmÄ hoXw Fgp-t¶äv \nÂ¡p-¶p).

A[ym-]nI : Ct¸mÄ H¶m-as¯ Expert Group Bbn. ho­pw Hmtcm {Kq¸nÂ \n¶pw HcmÄ hoXw Fgp-t¶äp \nÂ¡p-I. (\n§Ä ]pXn-sbmcp ""-----Expert Group” D­m¡p-I).

 (Hmtcm {Kq¸nÂ \n¶pw ho­pw HcmÄ hoXw Fgp-t¶-ddp \nÂ¡p-¶p).

A[ym-]nI : \n§-fmWv c­m-as¯ ""-----Expert Group” (C-§ns\ ""-----Expert Groups” D­m-¡p-¶p) F´n-\mWv \½Ä ""-----Expert Group” D­m-¡p-¶Xv?

Ip«n-IÄ : Expert BIm³ th­n

A[ym-]nI : icn, ""-----Expert Group” Â \n¶pw \n§Ä \n§-fpsS ]T\w sa¨-s¸-Sp-¯p-I. kwi-b-§Ä \nhm-cWw sN¿p-I. Bi-b-§Ä ssIam-dp-I, AXn-\p-a-¸pdw \n§-fpsS Bh-iym-\p-k-cWw A[ym-]n-Isb kao-]n-¡p-I.

 ({Kq¸v tPmen-bnÂ Ip«n-IÄ kl-I-cn-¡p-¶p. ({Kq¸v tPmen kPo-h-am-hm³ th­n A[ym-]nI {]tXyIw {i² sImSp-¡p-¶p)

**Phase III**

A[ym-]nI : icn, C\n FÃm-hcpw Ah-c-h-cpsS {Kq¸n-te¡v Xncn¨p t]mhpI (15 an\n-«n\v tijw)

 (Ip«n-IÄ B-Zys¯ {Kq¸pIfnÂ h¶p tNcp-¶p)

A[ym-]nI : C\n \n§-fpsS {Kq¸nse Hmtcm-cp-¯cpw \n§-fpsS hnj-b-¯nÂ Expert Bbn amdpw. \n§-fnÂ Hmtcm-cp-¯cpw \n§-fpsS ]mTy-h-kvXp-¡Ä At§m«pw Ct§m«pw ]Tn-¸n-¡-Ww. A§ns\ FÃm {Kq¸w-K-§fpw FÃm `mKhpw Xr]vXn-I-c-ambn ]Tn-¡p-¶p. (FÃm t]¸À IrjvW-§-fn-sebpw apgp-h³ {]iv\-§Ä¡pw Ip«n-IÄ D¯cw I­p]nSn-¡p-¶p).

 (Ip«n-IÄ ""------------Peer tutoring” Â GÀs¸-Sp¶p. FÃmw kwi-b-§fpw A[ym-]n-I-bpsS klm-b-t¯msS \nhm-cWw sN¿p-¶p).

 (A[ym-]nI FÃm {Kq¸v {]hÀ¯-\-§fpw t\m¡n-¡m-Wp-¶p. Bh-iy-amb kµÀ`-§-fnÂ CS-s]-Sp-Ibpw \nÀtZ-i-§Ä \ÂIp-Ibpw sN¿p-¶p).

(30 an\n-«v)

**Phase IV**

A[ym-]nI : c­v kwJy-I-fpsS XpIsb aq¶m-a-sXmcp kwJy sIm­v KpWn-¡m-\pw, c­v kwJy-I-fpsS XpIsb thsd c­v kwJy-I-fpsS XpI-sIm­v KpWn-¡m\pw \n§-sf-Ãm-hcpw ]Tn¨p. AXp-ambn \_Ô-s¸« FÃm {]iv\-§fpw ]cn-l-cn-¡p-hm³ km[n-¡p-¶pt­m?

Ip«n-IÄ : km[n-¡p-¶p­v

A[ym-]nI ; \½psS Bi-b-§Ä ]¦p-sh-¡m\pw ]ns¶ Gähpw \Ã-h®w tPmen sNbvX {Kq¸v GXm-sW¶v I­p-]n-Sn-¡m\pw \n§Ä¡v Xmev]-cy-antÃ?

Ip«n-IÄ : AsX So¨À

A[ym-]nI : C\n Iznkv kabamWv. CsXmcp aÕ-c-a-Ã. ]s£?

Ip«n-IÄ : CsXmcp Ifn-bmWv

A[ym-]nI : Cu Ifn-bpsS \nbaw \n§Ä¡-dn-bmtam?

Ip«n-IÄ : AsX So¨À, Hmtcm AwK-¯n\pw Htc Hcp Ah-kcw Aht\m Ahtfm Cu Ah-kcw D]-tbm-Kn-t¡-­Xv H¶p-In-Â tNmZyw tNmZn-¡m³, AsÃ-¦nÂ D¯cw ]d-bm³. Hmtcm D¯-c-¯n\pw Hcp amÀ¡p hoXw.

A[ym-]nI : BZys¯ Ah-kcw H¶m-as¯ {Kq¸n-\m-Wv.

 (Ip«n-IÄ tNmZyw tNmZn-¡p¶p)

A[ym-]nI : c­m-as¯ {Kq¸v D¯cw ]d-b-Ww. AsÃ-¦nÂ B Ah-kcw aq¶m-as¯ {Kq¸n-\v t]mIpw.

 (Ip«n-IÄ henb Xmev]-cy-t¯mSp IqSnbpw PnÚm-k-tbmSv IqSnbpw Ifn-bnÂ apgp-Ip-¶p).

 (A[ym-]nI Bh-iy-apÅ Øe¯v CS-s]-Sp-¶p. Hmtcm {Kq¸n\pw AXnse Hmtcm Ip«n¡pw Xpey Ah-k-c-§Ä In«p-¶p-sh¶v Dd-¸p-h-cp-¯p-¶p. hnP-bn¨ {Kq¸ns\ A`n-\-µn-¡p-Ibpw k½m-\-§Ä \ÂIp-Ibpw sN¿p-¶p).

A[-t#m-]nI : F¦nÂ \ap¡v ChnsS \nÀ¯mw.

Ip«n-IÄ : \µn So¨À

 (15 an\n-«v)

**APPENDIX IIA**

**FAROOK TRAINING COLLEGE, CALICUT**

**LESSON PLAN FOR EXISTING METHOD OF TEACHING**

**Dr. A. HAMEED DILSHATH. K.**

Name of the Teacher : DILSHATH. K Class : VIII

Name of the School : G.V. H.S.S. Chelari Division : I

Name of the Subject : Mathematics Strength : 35

Name of the Unit : Algebra Duration : 45 min.

Name of the Topic : Identities Date :

 (x+y)z = xz+yz

|  |  |
| --- | --- |
| Issue | Lack of cohesive universal vision |
| Objective | To form equations and represent them geometrically |
| Learning Objective/Theme | To multiply the sum of two numbers with third number. Each one should be multiplied by he third number and added |
| Concepts/ Ideas | Multiplication of the sum of two numbers with the third number |
| Skills/ Resources/Information | \* 11x12, 101x23, 1001x7684 etc are multiplied and their results are charted.\* Change in the area of the rectangle (figure)\* Description of the figure\* Description for proving (x+y)z = xz +yz\* Noting down the pattern of 21 x 25, 41x25, 61x25, 81x25, 101x25 ...... |
| Attitude | Forming concepts from the examples and using them logically in real life situation |
| Pre-requisites | Characteristics of a rectangle, area of a rectangle, binary operations, negative numbers |
| Learning aids | Chart, paper, scissors, scale, sketch pen, pencil etc. |

|  |  |
| --- | --- |
| **Learning Experience** | **Response/Evaluation** |
|  Teacher enters the classroom and makes a friendly talk. Teacher asks children to multiply some single digit, then two digit, three digit and numbers. Children take more time when the numbers become large. Teacher tells how to do the operation easily. 101x23 = (100+1) 23 = 2300+23 = 2323 101x26 = (100+1) 26 = 2600+26 = 2626 | Students find out answer through multiplication |
| **Activity:1** Teacher divides children in to groups. Each group is given a sheet of paper. Children following the example given in the sheet multiply other numbers and identifies the pattern. They try to find out the peculiarity of the pattern. | Students make a number patterns and find out the peculiarity of the pattern. |
| **Activity: 2**Let the children take a piece of paper and let them fold it like in the given figure. The length of the first rectangle is x+y and breadth is z.The area of the rectangle before folding (x+y) z. z z x yArea of the rectangles after folding = xz, yzThat is (x+y)z = xz + yzIn this operation x, y, z are positive numbers. Childrens find out that if x, y, z are negative numbers. Then also the results (x+y)z= xz+yz is true. | It x, y, z are positive or negative numbers then (x+y)z = xz+yz |
| **Conclusion** Instead of multiplying the sum of two numbers with third number we can multiply each number with the third number and add.**Follow up activity**\* Children form a pattern from 21x25, 41x25, 61x25, 81x25, 101x25\* 3x (2x+4) = 6x2+12x. Is this true for all the values of x? Why?\* 105 x 35 = ?\* 201 x 25 = ? |  |

**APPENDIX II**

**FAROOK TRAINING COLLEGE, CALICUT**

**LESSON PLAN FOR EXISTING METHOD OF TEACHING**

**Dr. A. HAMEED DILSHATH. K.**

Name of the Teacher : DILSHATH. K Class : VIII

Name of the School : G.V. H.S.S. Chelari Division : I

Name of the Subject : Mathematics Strength : 35

Name of the Unit : \_oP-K-WnXw Duration : 45 min.

Name of the Topic : ka-hm-Iy-§Ä Date :

 (x+y)z = xz+yz

|  |  |
| --- | --- |
| {]iv\-ta-Je | hniz-am-\-h³ F¶ ImgvN-¸mSv cq]-s¸-Sm¯ AhØ |
| ]T-\-e-£y-§Ä | ka-hm-Iy-§Ä cq]-s¸-Sp-¯p-¶-Xn\pw Pyman-Xo-b-ambn Ahsb hymJym-\n-¡p-¶-Xn\pw |
| ]T-\-{]tabw/]T-\-e-£yw | c­v kwJy-I-fpsS XpIsb aq¶m-a-sXmcp kwJy-sIm­v KpWn-¡p-¶-Xn\v Hmtcm kwJy-tbbpw aq¶m-as¯ kwJy-sIm­v KpWn-¨p-Iq-«Ww |
| Bi-b-§Ä/[mc-W-IÄ | c­v kwJy-I-fpsS XpIsb aq¶m-a-sXmcp kwJy-sIm-­pÅ KpW\w |
| {]{In-bm-ti-jn-IÄ: hnh-c-§Ä/kqN-\-IÄ | \* 11x12, 101x23, 1001x7684 apX-em-bh hnhn[ KpW-\-^-e-§Ä Is­¯n NmÀ«p-IÄ cq]o-I-cn-¡p-¶p\* NXp-c-¯nsâ ]c-¸-f-hn-ep-­m-Ip¶ amäs¯ ImWn-¡p¶ Nn{Xw\* Nn{X-¯nsâ hnh-cWw \* (x+y)z = xz +yz BsW¶v kaÀ°n-¡p-¶-Xn-\pÅ hnh-cWw\* 21 x 25, 41x25, 61x25, 81x25, 101x25 ...... XpS-§nb KpWn-X-§-fpsS ]mtä¬ X¿m-dm-¡Â |
| at\m-`mhw | Nne DZm-l-c-W-§-fnÂ Is­-¯nb {]tXy-I-X-Isf XXz-§-fm¡n amäp-¶-Xn\pw bpà-ambn {]tbm-Kn-¡p-¶-Xn-\p-apÅ at\m-`mhw |
| ap¶-dn-hp-IÄ | NXp-c-¯nsâ {]tXy-I-X, NXp-c-¯nsâ hnkvXoÀ®w, NXpjv {Inb-IÄ, \yq\kwJy-IÄ |
| ]T-\-km-a-{Kn-IÄ | t]¸À, s]³knÂ, kvsIbnÂ, t]\ apX-em-b-h. |

|  |  |
| --- | --- |
| **Learning Experience** | **Response/Evaluation** |
| A[ym-]nI ¢mknÂ {]th-in¨v Ip«n-I-tfmSv kulr-Z-kw-`m-jWw \S-¯p-¶p. A[ym-]nI Ip«n-I-tfmSv sNdnb kwJy-I-fpsS KpW-\-^ew a\-:¡-W-¡mbn tNmZn-¡p-¶p. Ip«n-IÄ s]s«¶v D¯cw ]d-bp-¶p. ]ns¶ Hc-¡-kw-Jy-bnÂ\n¶v c­-¡ -kw-Jy-bm-bn, AXnÂ\n¶pw aq¶-¡- kw-Jy-bmbn ... At¸mÄ Ip«n-IÄ¡v KpWn-¡m³ IqSp-XÂ kabw FSp-t¡-­-Xmbn h¶p. CXns\ Ffp-¸-h-gn-bnÂ F§s\ {Inb sN¿mw? 101x23 = (100+1) 23 = 2300+23 = 2323 101x26 = (100+1) 26 = 2600+26 = 2626 | Ip«n-IÄ KpWn-¨p-t\m¡n D¯cw Is­-¯p-¶p. |
| **Activity:1** A[ym-]nI Ip«n-Isf {Kq¸mbn amäp-¶p. Ip«n-I-fpsS Hmtcm {Kq¸n\pw Hmtcm t]¸À joäv A[ym-]-I³ \ÂIp-¶p. joänÂ Fgp-Xn-b-Xp-t]m-se-bpÅ thsdbpw Nne kwJy-IÄ FgpXn KpWn¨v Hmtcm {Kq¸pw Hmtcm kwJym-]m-tä¬ X¿m-dm-¡p-¶p. kwJym-]m-tä-Wnsâ {]tXy-IX Ip«n-IÄ Is­-¯p-¶p. | Ip«n-IÄ kwJym-]m-tä¬ D­m¡n AXnsâ {]tXy-IX Is­-¯p-¶p. |
| **Activity: 2**Ip«n-IÄ NXp-cm-Ir-Xn-bnÂ Hcp t]¸Àjoäv sh«n-sb-Sp-¡-s«. AXv Nn{X-¯nÂ ImWn¨ Ip¯n« hc-bn-eqsS aS-¡p-I. BZys¯ NXp-c-¯nsâ \ofw (x+y) Dw hoXn z Dw BWv. aS-¡p-¶-Xn\v ap¼v NXp-c-¯nsâ ]c-¸-fhv (x+y) z. z z x yaS¡n-b-Xn\p tijw In«nb NXp-c-§-fpsS ]c-¸-f-hp-I-fpsS XpI = xz, yzAXm-bXv (x+y)z = xz + yzCu {]hÀ¯-\-¯nÂ x, y, z F¶nh A[n-kw-Jy-bm-Wv. Ah \yq\-kw-Jy-I-fmbmepw (x+y)z= xz+yz F¶p Xs¶ In«p-¶p-sh¶v Ip«n-IÄ {]hÀ¯-\-¯n-eqsS I­p-]n-Sn-¡p-¶p. | x, y, z F¶nh A[n-kw-Jy-bm-bmepw (x+y)z = xz+yz F¶p-Xs¶ In«p-¶p. |
| **Conclusion** c­p-kw-Jy-I-fpsS XpIsb asämcp kwJy-sIm­v KpWn-¡p-¶-Xn\p ]Icw Hmtcm kwJy-tbbpw B kwJy-sIm­p shtÆsd KpWn¨v In«p¶ KpW-\-^-e-§Ä Iq«n-bmÂ aXn.**Follow up activity**\* 21x25, 41x25, 61x25, 81x25, 101x25 Ch-bpsS KpW-\-^-e-¯nsâ ]mtä¬ D­m-¡p-¶p.\* 3x (2x+4) = 6x2+12x F¶Xv x sâ FÃm hne-IÄ¡pw icn-bmtWm? F´p-sIm­v?\* 105 x 35 = ?\* 201 x 25 = ? |  |

**APPENDIX IVD**

**FAROOK TRAINING COLLEGE, CALICUT**

**ACHIEVEMENT TEST IN MATHEMATICS (FOR STANDARD VIII STUDENTS)**

**FINAL FORM**

**Dr. A. HAMEED DILSHATH. K.**

**\nÀt±-i-§Ä :**

 CsXmcp KWnX ]co-£-bmWv. tNmZy-¡-S-em-knÂ H¶pw Fgp-X-cp-Xv. D¯-c-§Ä AS-bmfs¸-Sp-¯p-¶-Xn\v {]tXyIw joäv X¶n-cn-¡p-¶p.

 FÃm tNmZy-§Ä¡pw A,B,C,D F¶n-§s\ \mev D¯-c-§Ä hoXw sImSp-¯n-cn-¡p-¶p. Ah-bnÂ H¶p-am-{X-amWv icn. D¯-c-¡-S-em-knÂ Hmtcm tNmZy \¼-dn\p t\scbpw A,B,C,D F¶n-§s\ tcJ-s¸-Sp-¯n-bn-cn-¡p-¶p. icn-bp-¯cw I­p-]n-Sn-¨-tijw D¯-c-¡-S-em-knÂ icn-bp-¯-cs¯ kqNn-¸n-¡p¶ A£-c-¯nÂ ‘’AS-bmfw tcJ-s¸-Sp-¯p-I.

 \n§Ä BZyw AS-bm-f-s¸-Sp-¯nb NnÓw sXämb Øm\-¯m-sW-¦nÂ, Øm\w amäp-¶-Xn\v AXn\p Npäpw Hcp ka-N-Xpcw () hc-bv¡p-Ibpw icn-bmb Øm\¯v ‘’NnÓw tcJ-s¸-Sp-¯p-Ibpw sN¿p-I.

 FÃm tNmZy-§Ä¡pw D¯cw tcJ-s¸-Sp-¯m³ {i²n¡p-I. Bh-iy-amb IW¡p Iq«-ep-IÄ sN¿m³ {]tXyIw joäv D]-tbm-Kn-¡p-I.

 amXrI : \ofw x Dw hoXn y Dw Bb NXp-c-¯nsâ ]c-¸-fhv = \_\_\_\_\_\_\_\_

 A) xy B ) x + y C) x2 D) x2 + y2

 D¯cw AS-bm-f-s¸-Sp-¯p¶ coXn

 A  B C D

1. (x+y)2 = x2 + ....... + y2

 A) xy B) xy2 C) x2y D)2xy

2. (x + y) (x-y) = x2 - ................

 A) y2 B) xy C) x2 D) 2xy

3. (x-y) (u-v) = xu - ............. - yu + yv

 A) ux B)xy C)yv D) xv

4. Hcp I¼-\n-bnÂ ‘c’ ]pcp-j-·mcpw ‘d’ kv{XoIfpw tPmen-sN-¿p-¶p-­v. HcmÄ¡v Hcp Znh-k-s¯-Iqen ‘a’ cq]-bm-Wv. F¦nÂ Hcp Znhkw Iqen-bn-\-¯nÂ F{X-cq-]-sIm-Sp-t¡-­n-h-cpw.

 A) a (c+d) B) c(a+d) C) d(c+a) D) c+d)

5. (p-q), (r-s). C-h-bpsS KpW-\-^-e-¯nÂ s]Sm-¯- ]-Z-taXv?

 A) pr B) -ps C) pq D) -qr

6. (20 + 1)2 = 400 + ..... + 1

 A) 200 B) 30 C) 40 D) 440

7. NXp-cm-Ir-Xn-bmb Hcp Ifn Øe-¯n\v 150 ao \ofhpw 100 ao hoXn-bpw D­v. CXn\v Npänepw ]pd-¯mbn 5 ao. hoXnbnÂ \S-¸m-X-bp-­v. \S-¸m-X-bpsS ]c-¸-fhv F{X?

 A) 2600 N.- ao. B) 2500 N.- -ao. C) 2300 N.- -ao. D) 2000 N.- ao.

8. (x + .....) z = xz + yz

 A) x B) z C) y D) W

9. (7-q), (4-q) Ch-bpsS KpW-\^e-¯nÂ s]Sm¯ ]Z-taXv?

 A) 28 B) 11 C) -7q D) -4q

10. x sâ hÀ¤-¯n-t\mSv F{X Iq«n-bmÂ (x+1) sâ hÀ¤w In«pw?

 A) x + 1 B) 2x + 1 C) 2 D) x - 1

11. (x+ 2)sâ hÀ¤-¯nÂ s]Sm¯ ]Z-taXv?

 A) x B) x2 C) 4 D) 4x

12. (x - y)2 = x2 - 2xy + ......

 A) x2 B) x2y2 C) y2 D) xy

13. \ofw x+ y Dw hoXn z Dw BbmÂ NXp-c-¯nsâ ]c-¸-f-hnÂ s]Sm-¯-tXXv?

 A) (x+y)z B) xz + yz C) (y+x)z D) x + y2z

14. \ofw (x+y) hoXn (x-y) Dw BbmÂ NXp-c-¯nsâ ]c-¸-fhv = ......................

 A) x2 + y2 B) x2 + 2xy + y2 C) x2 - y2 D) (x-y)2

15. (x-y) bpsS hÀ¤-¯nÂ s]Sm¯ ]Z-taXv?

 A) x2 B) y2 C) -2xy D) xy

16. (a-b)2 hn]p-eo-I-cn-¨mÂ AXnÂ F{X ]Z-§Ä D­m-bn-cn-¡pw?

 A) 2 B) 1 C) 3 D) 4

17. \ofw x bqWnäpw hoXn ybqWnäpw Bb NXp-cm-Ir-Xn-bn-epÅ Hcp apä-¯nsâ ]c-¸-fhv xy BWtÃm? F¦nÂ Cu apä-t¯-¡mÄ 2 bqWnäv Ipdhv \ofhpw 1 bqWnäv IqSp-XÂ hoXnbpw DÅ asämcp apä-¯nsâ ]c-¸-f-sh{X?

 A) (x - 2) (y+1) B) (x+ 2 ) (y-1)

 C) (x+2) (y+1) D) (x-2) (y-1)

18. 5, (7c + 8) ChbpsS KpW-\-^-e-¯nÂs]-Sm¯ ]Z-taXv?

 A) 40 B) 35C C) 15 D) 5 x 8

19.

a+b

a-b

 Nn{X-¯nÂ henb ka-N-Xp-c-¯nsâ Hcp hiw (a+b) Dw sNdnb ka-N-Xp-c-¯nsâ Hcp hiw (a-b) bpw BWv F¦nÂ \ndw sImSp¯ `mK-¯nsâ ]c-¸-f-sh{X?

 A) (a+b)2 B) (a-b)2 C) (a+b)2 - (a-b)2 D) (a+b)2+ (a-b)2

20. 2, (2p - 4q + 5 ) ChbpsS KpW-\-^-e-¯nÂs¸Sm¯ ]Z-taXv?

 A) 20 B ) - 8q C) 10 D) 4p

21. (c+d), (e+f) ChbpsS KpW-\-^-e-¯nÂs]-Sm¯ ]Z-taXv?

 A) cd B) ce C) de D) df

22. (2x + 5y), (3x + 4z) ChbpsS KpW-^-e-¯nÂs]Sm¯ ]Z-taXv?

 A) 6x2 B) 15xy C) 8xz D) 10yz

23. (a+ 11) (a-11) = a2 - ........

 A) 11 B) 121 C) 11a D) 2a

24. (6x+y) (2x + 3y) = ..... + 20 xy + 3y2

 A) 12x2 B) 6xy C) 5xy D) x2

25. (2m + 3), (4n +5) ChbpsS KpW-\-^-e-¯nÂ s]Sm¯ ]Z-taXv?

 A) 8mn B) 10m C) 12n D) 6

26. (p + q) (....) = p (r+s) + q (r+s)

 A) r + s B) p +r C) p + s D) q + s

27. (x - ......) (x- 12) = x2 - 24x + 144

 A) 11 B) 10 C) 9 D) 12

28. A¦-K-Wn-X-¯n-eqsS Is­-¯n-b XXz-§sf kmam\y hÂI-cn-¡p-¶-Xn\v \_\_\_\_\_ D]-tbm-Kn-¡p-¶p.

 A) PymanXn B) \_oP-K-WnXw C) Iq«p-]-eni D) A\p-]mXw

29. (5m + 6n) (5m - 6n) = 25m2 - ......

 A) 30n2 B) n C) 6n2 D) 36n2

30. (4x + 12y) (4x - 12y) bpsS KpW-\-^-e-¯nÂs¸Sm¯ ]Z-taXv?

 A) 16x2 B) 16xy C) -144y2 D) 42 x2

**APPENDIX IV C**

**FAROOK TRAINING COLLEGE, CALICUT**

**ACHIEVEMENT TEST IN MATHEMATICS**

**(Draft Form)**

**SCORING KEY**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.No.** | **Answers** |  | **Sl.No.** | **Answers** |  | **Sl.No.** | **Answers** |
| 1 | B | 21 | B | 41 | C |
| 2 | D | 22 | B | 42 | A |
| 3 | A | 23 | A | 43 | A |
| 4 | D | 24 | C | 44 | D |
| 5 | B | 25 | D | 45 | C |
| 6 | C | 26 | C | 46 | B |
| 7 | A | 27 | C | 47 | B |
| 8 | C | 28 | B | 48 | B |
| 9 | C | 29 | A | 49 | A |
| 10 | C | 30 | D | 50 | B |
| 11 | A | 31 | C | 51 | D |
| 12 | A | 32 | B | 52 | C |
| 13 | C | 33 | B | 53 | B |
| 14 | C | 34 | D | 54 | D |
| 15 | A | 35 | A | 55 | A |
| 16 | D | 36 | A | 56 | D |
| 17 | B | 37 | B | 57 | B |
| 18 | C | 38 | C | 58 | D |
| 19 | D | 39 | C | 59 | D |
| 20 | B | 40 | A | 60 | B |

**APPENDIX IVG**

**FAROOK TRAINING COLLEGE, CALICUT**

**ACHIEVEMENT TEST IN MATHEMATICS**

**(Final Form)**

**SCORING KEY**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl.No.** | **Answers** |  | **Sl.No.** | **Answers** |  |
| 1 | D | 16 | C |
| 2 | A | 17 | A |
| 3 | D | 18 | C |
| 4 | A | 19 | C |
| 5 | C | 20 | A |
| 6 | C | 21 | A |
| 7 | A | 22 | D |
| 8 | C | 23 | B |
| 9 | B | 24 | D |
| 10 | B | 25 | B |
| 11 | A | 26 | A |
| 12 | C | 27 | B |
| 13 | D | 28 | B |
| 14 | C | 29 | D |
| 15 | D | 30 | B |