

**EFFECTIVENESS OF PEER TUTORING AND EXISTING METHOD
OF TEACHING ON ACHIEVEMENT AND RETENTION
IN BIOLOGY OF STANDARD VIII PUPILS**

RESHMA P.T.

Thesis
submitted to the University of Calicut
for the Degree of
DOCTOR OF PHILOSOPHY IN EDUCATION

**DEPARTMENT OF EDUCATION
UNIVERSITY OF CALICUT**

2006

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DECLARATION

I, Reshma P.T., do hereby declare that this report *Effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology of Standard VIII Pupils* has not been submitted by me for the award of a Degree, Diploma, Title or Recognition before.

C.U. Campus,
Date: 01.06. 2006



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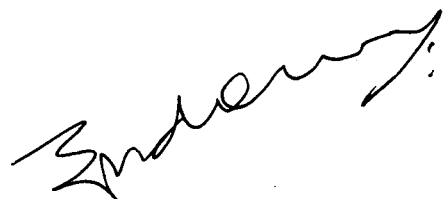
Dr. P.K. Sudheesh Kumar

**Reader in Education
Department of Education
University of Calicut.**

CERTIFICATE

I, Dr. P.K. Sudheesh Kumar, do hereby certify that this report *Effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology of Standard VIII Pupils* submitted for the Degree of Doctor of Philosophy in Education is a record of *bonafide study* and *research* carried out by Mrs. Reshma P.T., under my supervision and guidance. The report has not been submitted by her for the award of a Degree, Diploma, Title or Recognition before.

C.U. Campus,
Date: 01. 06. 2006


Dr. P.K. Sudheesh Kumar
(Supervising Teacher)

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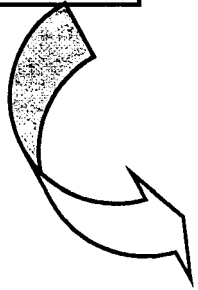
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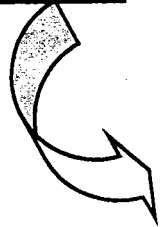
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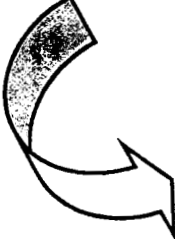
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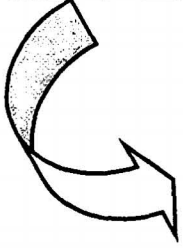
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ABSTRACT

The present study was conducted to identify the effectiveness of two Instructional Procedures, Peer Tutoring and Existing Method of Teaching. Effectiveness was measured on the Achievement and Retention in Biology of Standard VIII pupils. The study was carried out as a controlled experiment using the Solomon Four-Group True - Experimental Design. The sample selected for the study were four intact classroom groups from four schools of Kozhikode and Malappuram districts. Out of this, two groups were treated as experimental groups and two as control groups. Experimental groups were taught through Peer Tutoring and Control groups through Existing Method of Teaching. After the Experimental and Control treatment, the data gathered was analysed and interpreted. It was found that pupils taught through Peer Tutoring outperformed the pupils taught through Existing Method of Teaching. But both the instructional procedures were found to be equally effective in retaining the acquired knowledge.

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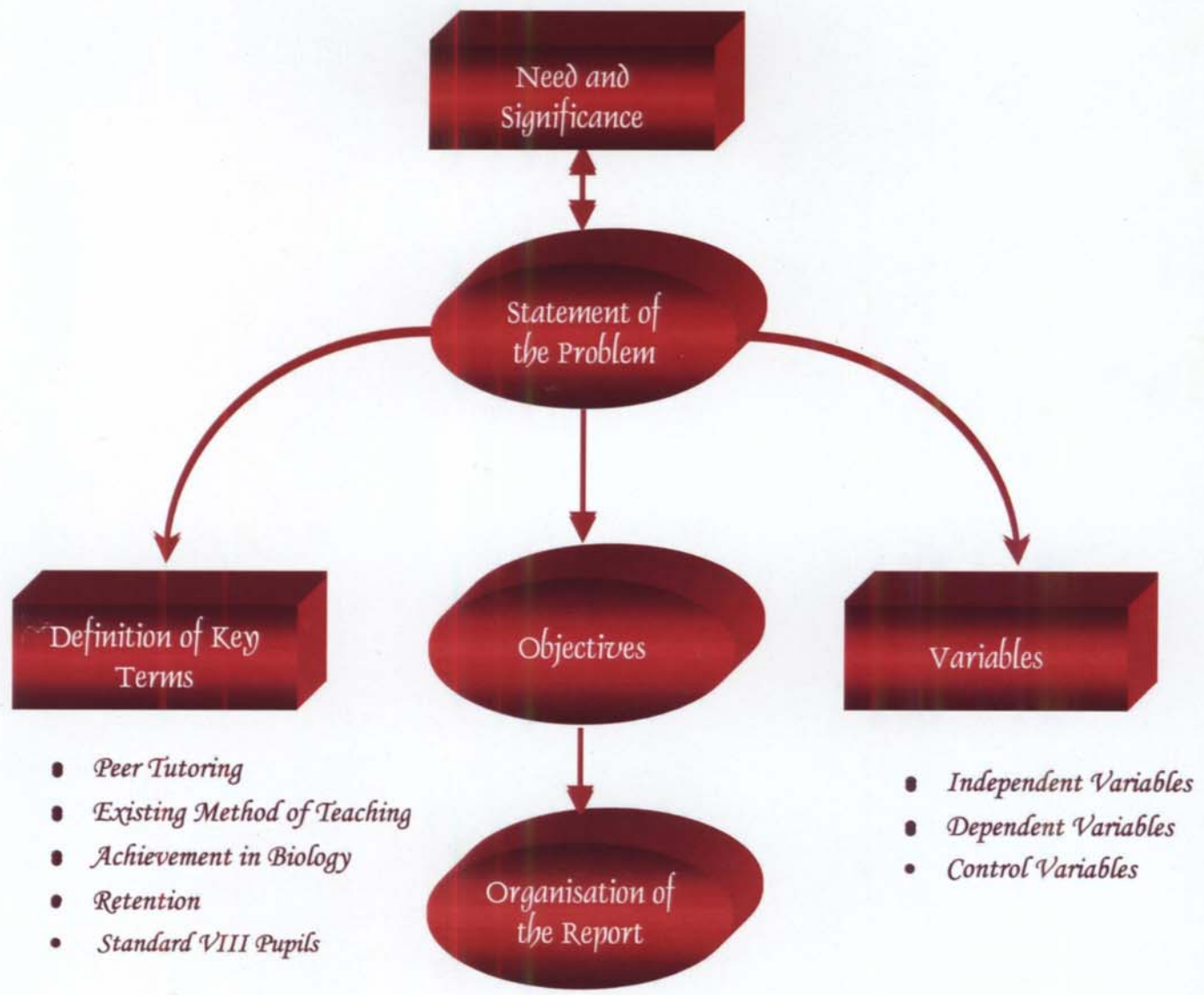
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Introduction

CHAPTER
One



CHAPTER

One

Education is a *unique* and *great investment* in human capital for the present and the future. Education is an important factor for *progress* and the development of a country. It plays a vital role in economic and social development and national integration. The prime aim of education is the *qualitative change* of educant and the society. While being educated, man is also involved as an agent of change in the structure of education. The progress of education is the result of human endeavour. It is the rational being, who decides the standards and aims of education.

Students in ancient India used to receive education far away from their parental influence under the guidance of *Gurus*. In the early nineteenth century, there was prevalence of indigenous system of education. By the end of nineteenth century, the old indigenous system of education almost completely disappeared and a new system of education developed. In this system *text book approach* is practiced where completing of syllabus is important ignoring the individual needs and pace of children. Classroom success is measured by the amount of notes the students take and by the ability to repeat and relate this material in subsequent examinations.

In the traditional competitive classroom, the purpose of learning process and its evaluation is to *rank* students from the *best* to the *worst*. In most of the classrooms, fairly stable pattern of achievement exist, so that the majority of students always *lose* and a few students always *win*. Thus a student may spend ten to twelve years in schools being carried the complex of a loser. It would lead to a sense of *worthlessness, helplessness* and *incompetence* (Bindhu, 1999; Golda, 1999; Hameed, 1997; Sasidharan, 1997).

In a traditional classroom, teaching any subject is perceived to be the passing on of knowledge from an 'expert' to a 'novice'. School experiences consists of teachers holding those 'right' answers and waiting for pupils to guess what was in their heads and pages - with their subsequent approval or dismissal of pupil's answer. Information is held like a valuable commodity by the teacher, passed to students in lectures and via textbooks, and then redeposited by students on multiple-choice and short-answer exams (Gillespie & Lerner, 2000).

Secondary education is, perhaps, the *weakest* link in the educational set up. Two major evils that afflict our secondary educational system are *low standard* and *imbalances*. Low standards are due to the inadequacy of the curriculum and syllabus, the inefficiency in teaching and poor academic discipline in the schools (Rao, 1999). The curriculum of the average secondary schools in India is still pedantic and dominated by *examination*.

So, in order to reform the secondary school education, Government has implemented a new curriculum which is giving importance to both scholastic and co-scholastic areas. The new curriculum is *open ended, process oriented, learner centered* and laying emphasis on the all round development of the individual.

This curriculum is an extension of the District Primary Education Programme (DPEP) procedures, followed in the primary classes. Here, students themselves *construct* knowledge, and the teacher is only a *facilitator*. But still a confusion exists in the part of teachers about how to transact the reformed curricular materials. Holt (1964) said,

Only few children in school ever become good at learning in the way teachers try to make them learn. Most of them got humiliated, frightened and discouraged. They use their minds, not to learn, but to get out of doing the things teachers tell them to do, make them learn. In the long run these strategies are

*self- defeating and destroy both character and intelligence.
This is the real failure that has taken place in school; hardly
any children escape.*

To avoid these inherent problems in the traditional classrooms, a variety of new instructional strategies like *learning in groups, paired reading, collaborative teaching, companion study* etc. have been developed. *Peer Tutoring* is one among them.

Students as teachers is a new approach which will lead to *joyful learning* in the classrooms. Students who are advanced in learning than their peers, act as teachers to them. If the classmate becomes a teacher, the children will be *more interested* in learning. The student acting as a teacher will be more able to understand the students as he/she is also one among them. Children will feel a democratic atmosphere in the classroom and this will make learning joyful. In the traditional set up, the teacher *transmits* the bits of information to those passive students in the class. They have not given any chance to *involve* in the teaching- learning situation. To the students the teacher figure is a fear and *tension* creating object. Ultimately classroom learning is predominant with *fear, tension* and *losers complex*. When students are placed as teachers all these pitfalls will be automatically out of the classroom.

1.1. NEED AND SIGNIFICANCE

For many centuries education meant people talking and listening: teachers talking to students, students listening to teachers, sometimes teachers listening to students. Educating means *more than* teaching people to read and write. It means *empowering* people with knowledge, skills and dispositions to participate actively in the developmental process (Rao, 2003). Here lies the importance of Peer Tutoring. Collaboration of this type can help, facilitate pupil's personal, social, as well as their academic competencies. Social interaction of this type is essential for the healthy development of learning.

There are three main ways in which the instructional process may be structured: *cooperatively*, *competitively* and *individualistically*. In a cooperative structure, as one pupil achieves, others automatically achieve also. In a competitive structure, when one achieves, the others automatically do not achieve. In an individualistic structure, pupil's goals are unrelated and independent. Johnson and Johnson (1983) made an experimental comparison of the effects of cooperative, competitive and individualistic learning experiences and the results indicated that cooperative learning experiences, as compared with competitive or individualistic ones, promoted more *interpersonal attraction* and promoted *higher self-esteem* and greater *empathy* on the part of all children. McKellar (1986) reported that the use of Peer Tutoring is appealing to educators because of the potentials for increasing the total amount of teaching in the school, for shifting the school climate from competitiveness to cooperation and for emotional benefits to the participants from the individualized situation.

Glynn (1985) argues that in many classrooms at all levels of education, individual learners have minimal control over learning interactions and hence, are excessively dependent on *external control* by teachers. The four major characteristics of the environments conducive to responsive and independent learning are: (1) the learner must be able to initiate rather than merely react to stimuli controlled by another, (2) the sharing of activity between less skilled and more skilled performers, between whom there is a positive social relationship, (3) reciprocity or mutual influence, with each participant in the interaction modifying the behaviour of the other and (4) learning context relates to the amount and type of feed back provided for the initiation of the learner. Peer Tutoring satisfies all of these characteristics.

The only context in which children can reverse interactional roles with the same intellectual content, giving directions as well as following them, and asking questions as well as answering them, is with their peers (Cazden, 1998). Vygotsky (1978) states that learning awakens a variety of internal developmental processes that

are able to operate only when the child is interacting with people in his environment and co-operation with his peers. Problem solving in collaboration with more capable peers could enable children to enter into new areas of potential.

Student's cognitive progress depends on their psychological predispositions such as their interest, confidence, sense of progress and achievement as well as on social interactions with their peers who provide them with both cognitive and emotional support (Frasson, *et al.*, 2004).

Considerable research indicated that many students may learn better from their peers than from adults. Being closer in knowledge and status, the tutee in a peer relation feels freer to express opinions, ask questions, and risk untested solutions. The interaction between instructor and pupils is more balanced and more lively when the tutor is a peer. So many studies were conducted in order to find out the relationship between Peer Tutoring and Achievement and they consistently highlight positive results (Graetz, 2004; Mastropieri, 2003; Mastropieri, *et al.*, 2005; McMaster, *et al.*, 2006; Shinn, *et al.*, 2002).

Graetz (2004) noted that strategies like Peer Tutoring are useful in enhancing the performance of Autism Spectrum Disorder students. Schleyer, *et al.* (2005) reported that in a Peer Tutoring programme for second year undergraduate students, results indicated that Peer Tutoring was effective and students developed problem-solving skills. Peer Assisted Learning Strategies (PALS) and Classwide Peer Tutoring (CWPT) are potentially effective tools in the fight to prevent/remediate reading failure particularly among the most fragile learners. (Maheady, *et al.*, 2006)

Social improvement was noted for both tutors and tutees in many of the Peer Tutoring programmes conducted. James, *et al.* (1991) reported that in a peer support programme, apart from gains in spelling and reading, improvement in self-confidence, attitudes to study, personal cleanliness and social interactions were noted. Tutors gain self-esteem and are able to contribute positively to the school community, learn early

the sense of achievement which can be gained through helping others (Sharp, *et al.*, 1994). Different types of co-operative interactions were highlighted among the students in Peer Tutoring Programmes (Duran & Monereo, 2005). Dennison (2002) reported that a Peer Tutoring project was successfully implemented for preventing school dropout, increasing youth's interest in volunteerism and expanding real-world learning experiences for students.

Research works showed that even tutors and teachers benefit academically from the Peer Tutoring programme. Tutors gain from learning by *teaching*. Their *involvement* helps to improve their own academic competence (Thomas, 1994). Tutors improve their communication and leadership skills and become more responsible and employable (Schleyer, *et al.*, 2005). Olmscheid (1999) reported that by utilizing Peer Tutoring, teachers can teach more effectively, it enables teachers to focus on new materials. Peer Tutoring programmes have achieved positive effects for both tutors and tutees of minority disadvantaged status (Greenwood, *et al.*, 1989), developmentally delayed status (Osguthorpe & Scruggs, 1986) and low-achieving status in regular classroom (Polirstok, 1986). Peer Tutoring procedures have been well developed and are valuable resources for facilitating the *academic* and *social growth* of regular and special education students (Husen & Postlethwaite, 1994). Peer Tutoring is an effective tool to improve the academic behaviours of students with disabilities, students with special needs and students from poverty and abuse (Heron, *et al.*, 2006; Maheady, *et al.*, 2006; Mastropieri, *et al.*, 2005).

The pace and complexity of life can make it difficult for adults, as well as children, to find someone who genuinely wants to – and is available to – listen and help. In this sense peer support is an invaluable and available *aid to learning* (Jones & Charlton, 1996). Many studies conducted in developed countries have pointed out that Peer Tutoring is a better strategy for academic achievement and retention of the materials studied.

Stauf (1999) reported a Peer Tutoring programme started by Bainbridge College. Peer support lead to personal *academic accomplishment*, increased *self-esteem, rewards* and *recognition*. Because of the programme it was noted that student retention was up by five percent. Platt (2001) described a Peer Tutoring programme conducted by the South Plains College Teaching and Learning Centre. It was noted that total retention rates for students completing specific exit-level reading courses was 75 percentage compared with 73 percentage previous year. Through the review of literature, reports of research treating Peer Tutoring in conjunction with other instructional strategies were found (Bindhu, 1999).

In Jigsaw learning developed by Aronson, *et al.* (1978) Peer Tutoring procedure is the *central tactic*, but *not independent* and known in the label of Jigsaw learning and process. Independent studies on Peer Tutoring in Indian context are rare. These facts enabled the investigator to conduct a study of this kind as *Effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology of Standard VIII Pupils*.

1.2. STATEMENT OF THE PROBLEM

The problem of the study is to investigate the effectiveness of two types of Instructional Procedures namely Peer Tutoring and Existing Method of Teaching. Effectiveness is measured on Achievement and Retention in Biology of Standard VIII pupils. Further, through an experiment the two Instructional Procedures are compared, to know whether there is any significant difference between the pupils taught through Peer Tutoring and Existing Method of Teaching.

1.3. DEFINITION OF KEY TERMS

The definitions of the important terms used in the title of the problem are presented as follows.

1.3.1. PEER TUTORING

Peer Tutoring is an *instructional arrangement* in which able pupils work with pupils of lesser ability in a carefully organised way, helping each other rather than being directed exclusively by a teacher (Topping, 1988).

Peer Tutoring is an instructional arrangement in which *students teach* their peers. In this approach a child trains another child in *skills* and *subject matter* that the first child has mastered. Because the first child has greater information or competence than the second child, the two do not begin the relationship with equal status, rather, the first child is considered as an expert and the second child a relative novice.

1.3.2. EXISTING METHOD OF TEACHING

Existing Method of Teaching means the method of teaching utilized for transacting the new curriculum implemented by Kerala Government in the secondary schools from the year 2002-2003 and onwards.

1.3.3. ACHIEVEMENT IN BIOLOGY

In the present study, Achievement in Biology is the accomplishment of proficiency of performance in Biology as measured by a standardised test.

1.3.4. RETENTION

Good (1973) described Retention as the result of an *excitation, experience of response*, occurring as a persisting after effect, that may serve as the basis for *future modification* of response or experience.

In the present study, Retention is considered as the *amount of the learned material that can be correctly remembered* after a fixed interval of time. Retention can be categorised into two, short-term Retention and long-term Retention (Deese & Hulse, 1967). In short-term Retention, the retention period will be a few seconds, in long-term Retention, it may be days, months or years. In the present study *long-term Retention* was considered. The Retention interval was fixed for *one month*.

A baseline should be needed from which to measure Retention (Deese & Hulse, 1967). The actual quantity of the learned material existed immediately after the learning is over, can be considered as the base line. In the present study, an Achievement test was conducted, immediately after the completion of treatment, for this purpose. After the Retention interval (one month), the same Achievement test (Retention test) was conducted again, in which the subjects reproduced the learned material by *recall*, *recognition* and *reconstruction*. Thus the amount of learned material forgotten after one month was measured. $Amount\ forgotten = Amount\ learned - Amount\ retained$ (Deese & Hulse, 1967). The amount of Retention was calculated by subtracting the amount forgotten from the amount learned.

1.3.5. STANDARD VIII PUPILS

The term standard VIII pupils is used in the present study to denote pupils attending instruction in standard VIII classes in any of the recognised schools of Kerala state.

1.4. VARIABLES

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

Rationale for selecting Variables

Former researches on classroom and learning process revealed that *Instructional Procedures* influences the outcomes of learning tremendously (Olsen & Kagan, 1992). The investigator examined many cooperative/collaborative learning strategies like Learning Together (Johnson & Johnson, 1975), Group Investigation (Sharan & Sharan, 1976), Jigsaw Learning - I (Aronson, *et al.*, 1978) and Jigsaw II- (Slavin, 1980). Small group instruction incorporating cooperative strategies was found to have a number of advantages over whole - class instruction (Farrant, 1980). Hence Peer Tutoring, a relevant and important instructional procedure in which *students teach students*, is selected as the Experimental variable. In Peer Tutoring,

students acts as teachers to their peers and many researches in this area confirmed the effectiveness of Peer Tutoring in boosting up student *achievement* and *retention* along with the development of *Socio Psychological effects* like increase in *social behaviours, positive attitude* towards handicapped peers, decrease in *aggressive behaviour*, improvement in *discipline*, attainment of *self-esteem* and *self confidence* (Topping, 1988).

The experts have further reported that Peer Tutoring with its unlimited advantage in student *achievement, retention* and *personality development* can be used to overcome the drawbacks of conventional teacher centered instructions.

This is an Experimental study and therefore the effect of a particular treatment should be compared with that of a group without experimental treatment. The Experiment was to be conducted on standard VIII pupils of Kerala and therefore the present procedure of instruction in the secondary school classes, i.e., the *Existing Method of Teaching* was treated as the second level of Independent variable, the Instructional Procedure and the variable for control treatment.

Dependent variables are the measured changes in pupil's performance attributable to the influence of the Independent variable. Former researches have shown that Peer Tutoring had remarkable influence on the performance of pupils in terms of Achievement and Retention (Chugh, 2002; Coenen, 2002; Mastropieri, *et al.*, 2003; Platt, 2001). Student *achievement* will only be meaningful if it is *retained* for a considerable period of time. So the investigator selected *Achievement* and *Retention* as the Dependent variables with its corresponding objective-wise components.

1.4.1. INDEPENDENT VARIABLE

In the present study two *Instructional Procedures* are utilised. *Peer Tutoring* and *Existing Method of Teaching* are generally considered as two levels of instructional procedures. Hence *Instructional Procedure* is treated as the Independent variable.

1.4.2 DEPENDENT VARIABLES

Dependent variables selected for the present study are the following:

- 1.4.2.1. **Achievement in Biology** – (A Total achievement score and six Objective-wise scores namely Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation).
- 1.4.2.2. **Retention in Biology** - (A Total retention score and six Objective-wise scores namely Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation).

1.4.3. CONTROL VARIABLES

In an Experimental study, certain aspects of the study or sample might influence the *Dependent variables* and will *confuse* with the effects of the Independent variables. These variables should be controlled otherwise they will significantly influence the results of the study. For the present study, from the numerous variables which might *intervene* in the experimental situation, Previous knowledge of the student, Intelligence (Verbal and Non-verbal), Learning Strategies and Socio-Economic Status were selected for controlling. These variables were selected because all of them strongly influence both the Independent and Dependent variables. Bindhu and Kumar (2001) suggest that the familiarity of students with the topics used for experiment will have an additive effect in the expected change produced by the Independent variables. Intelligence (Verbal and Non-verbal) has a remarkable influence on the Achievement of students. Learning Strategies improve the comprehension, learning, retention and retrieval of information (Reshma, 2000). Morse and Wingo (1962) reported that unsatisfied basic needs interfere with achievement. Hungry pupils have difficulty in learning.

The following are the Control variables selected for the study.

1.4.3.1. **Pre-test Score** (Previous knowledge of the subject matter).

This is the initial academic status of the students regarding the topics for experimental and control treatment. It may have profound influence on final accomplishment.

1.4.3.2. **Intelligence** (Verbal and Non-verbal).

In academic achievement, Intelligence (Verbal and Non-verbal) has considerable effects. Any change in the Dependent variables after treatments may be due to the effect of Intelligence.

1.4.3.3. **Learning Strategies** (Metacognitive, Cognitive and Socio-affective).

Learning Strategies are individual's way of reorganizing and using a particular set of skills in order to learn content or accomplish other tasks more effectively and efficiently. It may also produce considerable change in the Dependent variables.

1.4.3.4. **Socio-Economic Status**

The Socio-Economic status of the family directly influences the academic benefits of schooling. In the present study change in the Dependent variables may also be due to high socio-economic status of the family.

1.5. OBJECTIVES

The following are the objectives of the present study.

1.5.1. To compare the mean *Pre-test scores* of the Experimental Group I and Control Group II, Boys and Girls.

1.5.2. To compare the mean *Post-test scores* (Objective-wise and Total) of the Experimental and Control Groups, Boys and Girls.

- 1.5.3. To compare the mean *Gain scores* of the Experimental Group I and Control Group II, Boys and Girls.
- 1.5.4. To compare the mean *Retention scores* (Objective-wise and Total) of the Experimental and Control Groups, Boys and Girls.
- 1.5.5. To study the *effectiveness* of Peer Tutoring and Existing Method of Teaching on Achievement in Biology of Pre-test received Experimental and Control group pupils.
- 1.5.6. To study the effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement in Biology of Pre-test non received Experimental and Control group pupils.
- 1.5.7. To study the *effectiveness* of Peer Tutoring and Existing Method of Teaching on Retention in Biology of Pre-test received Experimental and Control group pupils.
- 1.5.8. To study the *effectiveness* of Peer Tutoring and Existing Method of Teaching on Retention in Biology of Pre-test non received Experimental and Control group pupils.

1.6. ORGANISATION OF THE REPORT

The present research report is organised through six chapters. The six chapters are named as *Introduction, Theoretical Perspectives, Literature Scanning, Modus Operandi, Analysis and Hypotheses Testing* and *Findings and Implications*.

The *Introduction* gives a general background of the study, indicating the potential importance and need of the research. It summarises the intentions of the study along with a statement of the research problem. In *Theoretical Perspectives*, history, meaning, concept, types and characteristics of the variables are presented.

This gives a clear understanding of the theoretical nature of the variables. In *Literature Scanning*, a search for studies conducted in relation with the problem are given. This chapter summarises and analyses previous researches and show how the present study is related with the previous related works. *Modus Operandi* gives the method of conduct of the study. The research design, instruments and data collection procedures are presented in detail. In *Analysis and Hypotheses Testing*, a summary of the analysis of the data collected is reported. Along with the analysis, hypotheses testing is also done. In the last chapter, *Findings and Implications*, the major findings evolved from the study and how these findings are related to the hypotheses are discussed. Implications of the study for future research and practical applications are also included.

**EFFECTIVENESS OF PEER TUTORING AND EXISTING METHOD
OF TEACHING ON ACHIEVEMENT AND RETENTION
IN BIOLOGY OF STANDARD VIII PUPILS**

RESHMA P.T.

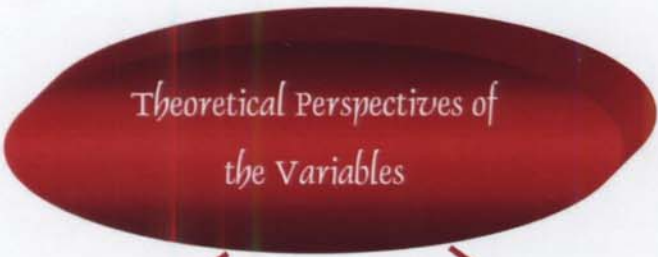
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UNIVERSITY OF CALICUT**

2006

Theoretical Perspectives

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CHAPTER



Theoretical Perspectives

By the present study, it is intended to examine the *relative effectiveness* of two instructional procedures namely *Peer Tutoring* and *Existing Method of Teaching* on *Achievement* and *Retention* in Biology of standard VIII pupils. To understand the present theoretical status of the variables under consideration the investigator reviewed the available literature in this area. The reviewed literature is classified and presented under the following headings.

2.1. THEORETICAL PERSPECTIVES OF THE VARIABLES

2.1.1. PEER TUTORING

2.1.2. EXISTING METHOD OF TEACHING

2.1. THEORETICAL PERSPECTIVES OF THE VARIABLES

A theoretical overview regarding *Peer Tutoring* and *Existing Method of Teaching* is presented in this section.

2.1.1. PEER TUTORING

In this subsection the detailed theoretical outline of Peer Tutoring explored by the investigator is given with a view to conceptualize the Peer Tutoring Programme.

2.1.1.1. Tutoring

Tutoring is a strategy for strengthening learner's study skills and ability to learn. Consciously tailored to the learning style and intellectual background of the individual, tutoring is *empowerment*. It builds confidence, teaches new strategies for grappling with content and help refine a student's thinking process.

Tutoring is a *method of teaching* in which one student receives personalized and individualized instruction. The person doing the teaching is called a *tutor*, while the student is called a *tutee*. Tutoring is defined as the process of helping a learner acquire the tools he/she needs to be successful with academic assignments.

Tutoring can be of different types. Tutoring given to students to supplement classroom instruction, tutoring to those students who have difficulty on learning and require remedial help and tutoring for students with special needs or life circumstances who are unable to participate in regular instructional programme.

Tutoring is widely used with learners of all age. It is used in primary and elementary school settings, secondary education, higher education, adult education and vocational education settings. Tutoring may not be provided by a student's regular teacher. Tutor may be a paid private instructor, a volunteer, a school aid, a parent or guardian, another student, or a computer or other teaching machine. In Tutoring, tutor may not be similar to the learner in age, ability, background or personal characteristics.

The techniques involved in tutoring are *Explaining* and *Lecturing*, *Questioning*, *Listening*, *Asking for tutee summaries*, *Silence*, *Drawings* and *Diagrams*, Use of *Reinforcement* etc.

- Explaining and Lecturing is necessary to clarify a piece of information that is necessary to understand the concept.
- Questioning will reinforce learning for the tutee and help the tutor identify problem areas.

- Listening is slowing down and concentrating on what the tutee is saying. In order to check whether the tutee is grasping concept, careful listening and purposeful observation is necessary.
- Tutee must be asked to present a summary of the portion covered. This will help the tutor to determine whether to move on to another topic or to stay with the present.
- Keeping silence and being patient while waiting for a response will yield results. Tutee tries to think critically.
- Drawings and diagrams are best way to convey information for visual learners, tactile learners or for certain types of content fields.
- Reinforcement help the tutee to have a sense of accomplishment and an incentive to do more.

From the modalities of tutoring, Peer Tutoring evolved, adopting peers as tutors instead of a trained person.

2.1.1.2. History of Peer Tutoring

The first systematic use of Peer Tutoring in the world is associated with the name of *Andrew Bell*, who was appointed as superintendent in a charity school in Madras. When the school teachers were found resistant to some of the new educational ideas he wished to introduce, he turned to experimenting with *monitors* or *peer tutors* using the new ideas. He rapidly became aware that the use of children to teach other children was an innovation of greater significance (Topping, 1988).

Joseph Lancaster opened a school in 1801 (Borough Road School) for 350 boys in London. He arranged classrooms on the basis of attainment and deployed monitors and assistant monitors to teach class to ensure that the pupils helped each other. Lancaster was a vigorous publicist of this method and it would be accurate to say that

Bell was the innovator and Lancaster the developer and disseminator of the Peer Tutoring system.

The popularity of the Peer Tutoring system gradually waned over the years because the state began to provide money for public education and teaching became increasingly professionalized. Another main reason for the decline of the system was the inadequacy of specific tutor training.

During 1960's when individualization of instruction became a common slogan, educationists developed the possible solutions based on the old ideas of Bell and Lancaster. Peer Tutoring originally arose because of stark economic necessity, there were not enough teachers to go round. The system was found to have virtues and qualities which professional teachers could not replicate and has thus become popular in modern times when teachers are plentiful.

2.1.1.3. Definition and the Concept

The various definitions of Peer Tutoring given by experts in this area is compiled and consolidated.

Peer Tutoring refers to *children teach other children* of their age who cannot gain an average level of learning outcomes (Allen, 1976; Ehly & Larsen, 1980).

According to Farrant (1980) Peer Tutoring is also called as *monitorial system* in which pupils supplement the work of the teacher by communicating to other pupils, those lessons they have been taught by the master teacher. It is a way of multiplying the person and skill of the teacher and encouraging bright pupils to exercise their gift.

Peer Tutoring is an approach in which one child instructs another child in material on which the first is an expert and the second is a novice (Damon & Phelps, 1989).

Husen and Postlethwaite (1994) describes that Peer Tutoring is an *instructional arrangement* in which students teach their peers. Student participants serve as tutors, providing individualized instruction to other students for skill remediation or supplement instruction. In this approach a child *trains* another child in skills and subject matter that the first child has mastered. Because the first child has greater information or competence than the second child, the two do not begin the relationship with equal status, rather, the first child is considered as an expert and the second child a relative novice.

Topping (1988) defines Peer Tutoring as an instructional arrangement in which able pupils work with pupils of lesser ability in a carefully organized way, *helping each other* rather than being directed exclusively by a teacher.

According to Dueck (1993) Peer Tutoring refers to the process of having *learners help* each other on a one-to-one basis.

Peer Tutoring is defined as those *planned practices* when children are designated with, and are often equipped to assume, a defined responsibility to offer a learning experience to one or more of their peers (Jones & Charlton, 1996).

Goyal (1996) suggests that Peer Tutoring is spontaneous tutoring in *one-to-one* or even *one-to-several* pupils teaching situations, ie., in small group work. A peer tutor could help his classmates with devotion and attention, as he is a co-learner.

Tutoring is the process of helping a learner acquire the tools he or she needs to be successful with academic assignments. Tutoring is usually characterized by careful *matching of tutor and tutee*, specification of frequent and regular contact times, training in some form of tutoring technique, clear specification of curriculum content and possibly materials, a system for monitoring and supervision, and possibly some form of evaluation (Topping, 1988).

From these definitions it can be inferred that Peer Tutoring is a system in which *children teach children* or *help each other*. The student who is rendering tutoring is called the *tutor* and the student receiving information is called the *tutee*. The tutor will be a member of the same class or another class who is having the same age as the tutee or an age difference of few years. The tutor will be an expert having greater information or competence as compared to the tutee and tutee is a student having difficulties in learning situation. Tutees are those who cannot gain an average level in the classrooms.

Tutoring supplements teacher's work and multiplies the person and skill of teacher. Tutoring is done to strengthen learner's study skill and ability to learn, to help students to acquire the tools to be successful for academic assignments and for skill remediation. Tutoring is an individualized instruction including planned practices.

Tutoring is effective because it builds *confidence* among tutors and give a chance for the bright students to *exercise their gifts*. Tutees benefit from learning in a non threatened and joyful atmosphere. Inherent in the concept of Peer Tutoring are careful *organization* and definite *purpose*. The term Peer Tutoring implies a well developed and better *articulated system* (Topping, 1988).

Terms like *Partner Learning* (Dueck, 1993) and *Peer Teaching* (Whitman, 1988) have been used to describe the concept of Peer Tutoring. In Partner Learning the student is learning with the help of his/her partner or in cooperation with his/her partner. Partner may be a friend, a classmate or a student of another class. In Peer Teaching, peers are teaching each other or one is exclusively directed by the other, who is an expert.

Peer Tutoring also go by the names of Peer Education, Peer Learning, Child-Teach-Child, Learning Through Teaching and Mutual Instruction (Britz, et al., 1989).

Students as Teachers

In the traditional classroom, the classroom processes are planned and directed by the teacher and all the classroom activities are teacher centered. Teachers teach the students to learn or study. But students as *teachers* is a newer approach in which students act as teachers in the classrooms. They teach their peers and at the same time they themselves learn.

When students are placed in the position of teachers, it will definitely change the classroom atmosphere. As the teacher is a member of their own class, the pupils would be more interested in learning and this will certainly add joy to all classroom processes. Making *learning joyful* is a great thing because most of the school children feel that learning in the classroom is a *burden*. This is due to the fact that most of the schools and teachers utterly failed to attract and retain the learner mind in the classroom learning processes.

The new approach, students as teachers, is very much relevant to the existing classroom situation. In the existing method, child is the centre of education and children themselves *construct knowledge* through different activities. For this, the whole class is assigned to basic groups and instantaneous groups. Peer Tutoring is one of the technique used in group method, so that students will share the work and learn from each other. When students are working as teachers, their self-confidence will increase and they become independent learners, which are the aims of existing curriculum.

Peer Tutoring ensures a more cooperative, pleasant classroom atmosphere and promising future teachers into the profession (Hedin, 1987).

2.1.1.4. Why Peer Tutoring

Briggs (1975) commented that, to teach is to learn twice. This holds true for Peer Tutoring and is one of the basis for using this approach. Although a teacher can

anticipate problems, questions, and concerns, no teacher can learn for another individual. Thus when Peer Tutoring is adapted, learning becomes much more effective because learners are teaching *themselves* (Whitman, 1988).

Scientific studies have proved that peer relations can greatly benefit children's social and intellectual development. Repeated studies have shown that peer interaction is conducive, perhaps even essential, to a host of important early achievements: children's understanding of fairness, their self-esteem, their proclivities toward sharing and kindness, their mastery of symbolic expression, their acquisition of role taking and communication skills, and their development of creative and critical thinking (Damon & Phelps, 1989).

Another reason for the introduction of Peer Tutoring was due to the evil effects of conventional method of teaching. In conventional class rooms there is a clear dominance of the teacher in all classroom activities. Here, education is *teacher centered* and teacher decides the learning experiences for the pupils. Students are *passive listeners* and are not able to express their opinions. This will make the learning situation a burden to the pupils.

The nature of transaction prevailing in the conventional classroom is Lecture method. This method have many drawbacks. It creates a *monotonous atmosphere* in the classroom and does not satisfy the sense of vision and touch. Lecture method is not suitable for all topics.

The traditional curriculum is teacher centered and importance is given only to the *scholastic areas* of pupils. Importance is given to *whole class* instruction and small group instruction is never practiced. The main aim of the curriculum is the attainment of knowledge. The classroom success is measured by the amount of notes the students take and by the ability to repeat and relate this material in subsequent examination. The completing of syllabus is important, ignoring the individual needs and pace of children.

In the conventional classrooms, there is no chance for students to take part in the teaching – learning processes. The teacher *constructs* the knowledge for students. Here learning is *product oriented* and therefore activities are not encouraged. Competition is the base value in the conventional classrooms. Students are *competing* with each other to get a high position in the rank order. The only aim of education is to rank students from the highest to the lowest.

In order to overcome these traditional obstacles in conventional classroom a variety of learning strategies have been developed. Most of the strategies make use of cooperation rather than competition among learners. These strategies are termed as *Cooperative/Collaborative* learning strategies. Cooperative learning is any learning activity in which students of diverse backgrounds work together in group towards a specific goal. They include learning in groups, paired reading, companion study etc. Peer Tutoring is one among them. Peer Tutoring can enhance learning by enabling learners to take responsibility for *reviewing, organizing* and *consolidating* existing knowledge and material; *understanding* its basic structure, *filling in the gaps*; finding *additional meanings*; and *reformulating knowledge* into new conceptual frameworks (Dueck, 1993).

Unlike adult-child instruction, in Peer Tutoring the expert party is not very far removed from the novice party in authority or knowledge; nor has the expert party any special claims to instructional competence. Such differences affect the nature of discourse between tutor and tutee, because they place the tutee in a less passive role than does the adult/child instructional relation (Damon & Phelps, 1989). Peer Tutoring works because the tutors and tutees speak a more similar language than do teachers and students (Hedin, 1987).

Children learn considerably better if they have the *opportunity* to learn from their peers. Communication may be more *effective*, amount of reinforcement may *increase*, and peer group encouragement may be more *motivating* when students teach each other (Johnson & Johnson, 1975). Support received from other pupils can be

equally effective than that provided by adults. This may be due to pupil's tendency to be more directive, their familiarity with the material being taught, their understandings of other student's frustrations, or because of their use of more meaningful and age-appropriate vocabulary and examples (UNESCO, 1993).

If administered appropriately and carefully, peer support practices can offer opportunities for pupils to experience individualized classroom support of a degree and type which is not always as readily available as they should and could be.

Through peer support, peers can provide a *sympathetic ear* for fellow pupils to share and help, resolve their concerns and feeling (James, *et al.*, 1991). Peer support can help pupils to voice their views and opinions about school-related matters and aid pupils with disabilities to function more fully in school life (Blatchford & Sharpe, 1994). Peer Tutoring can be implemented in an attempt to cross language and cultural barriers with older students tutoring younger students in their native languages (Olmscheid, 1999).

The work of Peer Tutoring, in its collaborative approach to learning, in its student-centered values, and its emphasis on finding meaning and fostering communication, is quite unlike anything else that happens at school or college (Gillespie & Lerner, 2000).

To *teach* is to *learn*, this is one of the basic reason for the implementation of Peer Tutoring systems. The literature describing Peer Tutoring (Ender & Newton, 2000; Gillespie & Lerner, 2000; Samway, *et al.*, 1995) shows that the gains for tutors often outdistance those of the students receiving help. This is because in order to teach the tutors must really know. So if each pupil is given a chance to be a tutor, it will enable them to refine their academic skills.

Teachers might consider using Peer Tutoring as an integral part of daily instruction, and should let everyone a chance to be the tutor. Those that tutor will be reviewing materials already learned. So if a five-year implementation period is

possible, the young pupils in the pilot session can themselves graduate into a peer leader role and benefit from being in that role.

If every student is given a chance to be a tutor, this will remove the negativity frequently associated with receiving help, since all students can participate in giving and receiving help. Pupils in the role of tutors develop self confidence and self-esteem and even show improvement in their social behaviour.

Reciprocal Peer Tutoring programme give all students the opportunity to be tutors and thereby learn through teaching. Children are appointed as tutors even in subjects, where they have problems. They will learn from tutoring other students and they will gain more confidence in their abilities in that area (DuPaul, 1998).

The most significant effect resulting from the experience of being a peer tutor is the impact on the tutor's own life. One of the most important outcome is the enhancement of tutor's own growth in both knowledge and personal attributes. As tutor help others solve problems, their ability to resolve complex issues increases, as they demonstrate empathy and compassion for others, their sense of emotional well-being is heightened, as they work to assist others, their own sense of contribution and personal esteem will grow (Ender & Newton, 2000).

2.1.1.5. Peer Tutoring – Types and Techniques

Peer Tutoring is of *several types*. Different authors describe different types of Peer Tutoring.

Topping (1988) identified three types of Peer Tutoring. *Cross-age tutoring*, *True-age tutoring* and *Reciprocal Peer Tutoring*. In Cross-age tutoring, tutor is several years older than the student being taught, ie., students in higher grade levels work with younger students. In True-age Peer Tutoring, one student tutors a classmate. In Reciprocal tutoring, the roles of tutor and tutee are alternated in a situation where there is a little differential between their abilities.

Whitman (1988) described two types of Peer Tutoring. *Near-peer tutoring* and *Co-peer tutoring*. In Near-peer tutoring, one learner is more advanced than the other. Near peer pairings include more academically capable learners working with those experiencing difficulty. In Co-peer tutoring, learners are fairly well matched in skill level. Here learners are able to work together as equals and gain a better understanding of the materials by learning from each other.

McAllister (1990) identified four types of Peer Tutoring programmes.

- i) **Resource Tutoring:** Where three or four pairs are scheduled together in the resource room.
- ii) **Classroom Tutoring:** Where teachers in two grades set aside a particular time and place for the tutoring.
- iii) **Tailored Tutoring:** Where a teacher chooses a criterion – such as vocabulary or fractions – by which to pair students.
- iv) **Ripple Tutoring:** Where a school begins slowly with only a few groups and gradually expands until all students and teachers are involved.

Goyal (1996) explained *three types* of Peer Tutoring. In the first type, two learners are helping each other. A second type in which in a group a learner who is high achiever in one subject leads others and like that seeks help from others. And a third type in which, a peer tutor may be self appointed to his co-learners.

DuPaul (1998) reported Classwide Peer Tutoring in which every student in the class is paired with another. One student teaches or tutors another, the lessons written by teacher. Classwide Peer Tutoring is a way for all students to get one-on-one help and enough time to practice and learn.

There are a number of techniques for Peer Tutoring which have been *carefully* and *coherently* organized. There are many easily deliverable packages like *Paired*

Reading, Pause Prompt Praise, Programmed Tutoring, Companion Study and SWRL Programme etc. (Topping, 1988).

Paired Reading

Paired reading is a technique intended to *accelerate the reading development* of children with reading disability. The tutors and tutees are paired and they read out loud together or the tutee alone, the tutor adapting to the tutee's natural speed.

Pause, Prompt and Praise

It is a semi-structured technique of *para-professional tutoring in reading*. It is simple yet effective, can be easily trained and could be applied without any need for specialized structured material.

Programmed Tutoring

It is a highly structured *Peer Tutoring* system, initially designed for use by para-professional tutors. The programmed tutoring covers children aged six to nine years.

Companion Study

It is an individualized programme originally intended for reading and arithmetic tutoring on a cross-age basis. It can be also extended to true age-peer tutoring.

SWRL Programme

SWRL Programme is a Peer Tutoring programme for tutoring English as second language. The programme included nine to ten year-old tutoring five year olds.

Precision Teaching

Another technique is *Precision Teaching*, which is a framework wherein which teaching objectives can be delivered and their achievement systematically evaluated. In the behavioural method, a detailed checking of achievement of objectives and the

dispensation of tangible or token reinforcement for achievement of those objectives is possible.

Writing Centre

Writing centres are Peer Tutoring institutions in which, tutors work with students in basic writing courses. Their goal is to help undergraduate students grow and mature as writers by providing help with difficulties, situation or otherwise, they may have in academic writing. Here individual tutorials are conducted, in which a student works one-on-one with a graduate or undergraduate writing consultant. Tutors teach students how to edit and proofread their own work more accurately and efficiently.

On-Line Tutoring

Technology and its rapid changes has also affected the modes of tutoring. Peer Tutoring is now available on-line as videoconferencing. Advantage of on-line tutoring is that students about thirty miles away can also be tutored, and it is more advantageous for students who can't schedule a regular appointment. E-mail is easy and reliable to use, and it allows tutor plenty of time to formulate good questions. Gillespie & Lerner (2000) reported that students E-tutored responded very positively about the tutoring exchange they had.

2.1.1.6. Critical Ingredients of Peer Tutoring

Certain ingredients appear essential for creating effective Peer Tutoring (Benard, 1990; Goldgrab, 1992). They are the following.

In Peer Tutoring, the tutors and tutees should *relate to one another*. There should be a oneness and feel for others. They should share their works to achieve common goals. A positive interdependence must exist between the group members. In such a closely related group, much of the works will get done easily. And such Peer Tutoring groups will generate themselves if given proper classroom environment.

In a Peer Tutoring group, the students must be personally accountable for mastering the material and for helping each other. Every group member is responsible for mastering the assigned material, and the purpose of learning situation is to maximize the achievement of each individual student. Each one of the group should be able and willing to provide appropriate support and assistance to one another. All the members should understand that it is to their advantage if other students learn, ie., all of them are involved in activities for achieving the common goal. If any one member of the group does not attain the expected level, it will affect the whole group.

Working cooperatively with peers, resolving conflicts constructively and internalizing prosocial values are experiences that all students need. For working in a Peer Tutoring system, the children should practice collaborative relationships. Therefore it is necessary that the students must be trained to build and maintain collaboration. They should be trained for incorporating *communication skills*, *active participation* in group work, *peer esteem* and *peer challenge*, *probing themselves* and others, *interacting with others* and *observation*.

To teach is to learn twice. In Peer Tutoring programmes, the tutors benefit by teaching their fellow class members and thereby refining their academic skills. So each and everyone of the group should get a chance to be the helper, tutor, or the leader of a learning group, and thus all of them will be able to refine their skills. The tutors develop *confidence*, *self-esteem* and *improved social behaviours* after their tutoring sessions, therefore given an opportunity to each one of the group, they will also benefit.

In Peer Tutoring, while grouping for the tutoring session, it should be noted that the groups are as *heterogeneous* as possible. Difference must be there in the case of academic ability, ethnicity and physical disabilities. The bright, average and weak students are grouped *together*, so that the brighter child will bring the weak and average learners upto the level of minimum competencies. If a minimal difference in ability is not maintained, then very little gain in attainment can be expected. Heterogeneity must be kept also in the case of ethnicity and physical disabilities, because this will enable

for a social contact between children who might otherwise avoid each other due to unreasonable assumptions or anxieties. Peer Tutoring groups should be social aggregates involving mutual awareness and mutual interaction. Heterogeneity will provide diversity of opinions, informations and points of view.

The teacher should have a *positive attitude* towards Peer Tutoring. Teacher should be committed to encourage Peer Tutoring and must be well versed in the methods to be used. Peer Tutoring system will be more successful where the teacher shows skill in handling and understanding groups, gives a positive lead before the group work begins and follows up the group work by pooling the discussion and giving feedback on the work produced. Teachers should act as *models* by demonstrating active listening, responding to new ideas, questioning, exploring and sharing with their pupils.

The teacher should understand the limits of the learners. Teachers must always keep in mind that they are children till the time unaware of the teaching processes. Students showing difficulty during the programme should not be underestimated. They must be given extra individual attention. Teachers will have to reinforce the need for pupils to listen to one another, and to respect one another's view.

2.1.1.7. Characteristics of Peer Tutoring

The following are the characteristics of Peer Tutoring

Collaborative Setup

Peer Tutoring depends crucially upon *collaboration* and *friendship*. The tutor and tutees in the tutoring group should collaborate with each other to achieve the common goal. They relate with each other and share their works. Peer Tutoring is a *collaborative set up* between the teacher, tutor and the tutee.

Non-threatened Atmosphere

Peer Tutoring offers learning in an non-threatening atmosphere. There is no fear for teacher as teacher is in the role of a facilitator or guide. Tutees can freely express opinions and ask questions, which they will hesitate to do in the presence of a teacher.

Joyful Learning

When the tutor is a peer, instruction becomes more balanced and more lively. Student teachers have a sharper feel for the group as they are more aware of the likes and dislikes of peer group. Learning therefore becomes *more joyful*. Relationship between tutors and tutees seem to be good and both of them enjoy the working atmosphere in the classroom.

Self Learning

In Peer Tutoring, students work together to maximize their own and each other's learning and encourages learners to develop the appropriate cognitive structures to understand and solve problems. *Self learning* is important because attainment of learning skills is at child's pace. Supporting learning materials are provided. Self-learning is recommended because it builds children's *self-confidence* and also ensures that they become *independent learners*.

2.1.1.8. Tutors

Tutors are students who have been selected and trained to offer educational services to their peers. These services are intentionally designed to assist in the adjustment, satisfaction, and persistence of students toward attainment of their educational goals (Ender & Newton, 2000).

According to Ender and Newton (2000) to be effective as a peer tutor, it is necessary that one should examine one's own personal strength and weaknesses as a

helping person, know problem solving strategies, and learn and practice specific helping skills.

Over time, there have been two major shifts in the use of students as peer tutors. First, there has been a substantial increase in the variety of positions now filled by peer tutors, increasing from the more limited use of peers as tutors to the now extensive use of peer helpers in all major services and educational departments. Secondly, the primary manner in which peer tutors are working with students have changed. There is a growing preference for assisting students in groups rather than the more traditional one-to-one individual approach (Ender & Newton, 2000).

Qualities of the Tutor

Tutoring involves helping someone become a better learner and therefore the tutor should possess certain qualities which will help him/her in successful tutoring.

The rapport that the tutors can create with tutees is one of the best assets of a tutor. According to Gillespie and Lerner (2000), Tutors must be experts to set a good tone for the conference and making the tutee feel comfortable; knowing which kinds of issues to address first; being patient and listening to the tutee; knowing how to ask questions which are open-ended; knowing techniques that let the writer make the decisions; and knowing that sometimes tutor's questions take time to answer and having the patience to wait for the tutee to come up with a reply.

Ethical Tutors are reflective, questioning, and constantly learning.

Tutor Responsibilities

Peer Tutors help others through functions such as assisting, coaching, tutoring and supporting rather than the professional roles of teaching, training, interpreting and counseling (Ender & Newton, 2000). Peer Tutoring demands heavy responsibilities on the part of the tutor and they include;

- ❖ Tutors should complete a developmental plan for each tutee and keep a record of the progress of their tutee.
- ❖ Tutors should schedule weekly or monthly meetings with the course instructor.
- ❖ Tutors must create an atmosphere of trust for the tutees who seek their help. In that environment tutors and tutees can accomplish truly important work.
- ❖ Try to simplify the problem and help them to think how they can solve it on their own.
- ❖ Help someone else to be proud of the work, that they have done without feeling that unnecessary struggle is required.
- ❖ Realize that tutor's duty is not to offer a strategy as a sure-fire solution; instead, help tutees develop their strategic repertoires.
- ❖ Allow tutees to explain what they think they are doing wrong.
- ❖ Tutors should avoid creating clones of themselves, and teaching their processes as if they are the tried and true methods of approaching any task.

2.1.1.9. Tutor Training

Wiederholt, *et al.* (1983) reported that simply putting two students together, one who has information and skill and the other who does not, probably will not result in significant improvement of the one needing help. Any effective Peer Tutoring programme must have tutor training components. Youngsters who are helped to become familiar with the tutoring aims become better equipped to undertake the task (Barron & Foot, 1991).

Research works has also indicated that trained tutors show outstanding performance compared to those untrained. A study was conducted by Legrain, *et al.* (2003) in which effect of trained tutors and untrained tutors were compared. The

results demonstrated that the Peer Tutoring programme with trained tutors resulted in higher scores for coaching skills.

Historically it has been acknowledged that students can provide effective instruction for their peers. The academic performance of tutees significantly improved in structured programmes that involved tutor training, compared to unstructured formats (Husen & Postlethwaite, 1994).

Training is given to the tutors because they are also students till now unaware of the methods, skills and techniques of teaching. Training is given to make the tutors able to clarify the required tasks and delineate the required behaviours. Tutors are providing help and assistance to their peers. For providing help and assistance to fellow cooperators tutor need to learn, how to recognize that the tutee needs help, how to ask others for help, how to search for others who may need assistance and how to provide instruction, feedback and reinforcement for other students.

If training is not given to the tutors, the tutoring programme will not be effective to the expected level. Tutor will not be able to provide appropriate learning experiences for the tutees. As the tutor is a novice in the field, he is not aware of the techniques to be used during tutoring. Though they may be successful in transacting the subject matter, the tutors will face difficulty in meeting the needs of tutees and understanding their problems.

Training as preparation for the helping role is not the end of skill development, it is more like a basis starting point. Tutors need to continue to learn and enhance their knowledge and skills.

Cho, *et al.* (2005) described the design and implementation of a computer peer tutee, KORI- two. Human student tutors are motivated to learn domain knowledge effectively while tutoring a machine tutee. In this tutoring process, KORI-two actively initiates and guides tutoring interactions by raising questions or refuting tutor's explanations.

Tutor Selection

Students are selected as tutors on the basis of *aptitude, potential ability* and *desire*. They are not restricted because of grades (Canobi, 1971). In some cases peer tutors are recommended by their instructors. Smart and helpful students who are having status among their peers are considered. They should be understanding and not bossing and should be natural and friendly. While selecting students to become tutors, certain personal qualities as follows are considered.

- ❖ Being genuine persons
- ❖ Being real in their own right
- ❖ Being capable of communicating feelings to others
- ❖ Being able to care for, and accept, the other persons in a non-judgemental way.
- ❖ Possessing an empathic understanding of the other's point of view.

According to Ender and Newton (2000) there are three key components in preparation of students to become a peer tutor: knowledge, skills and personal integration. Knowledge includes the major concepts that will be useful in tutor's conceptualization and understanding of the helping function. The core knowledge base for helping others combines elements of psychology, sociology, cultural anthropology and education.

Even with a base of knowledge about any subject, tutor must have sufficient skills to communicate successfully and work productively with others. These skills include the ability to listen, communicate accurately, show intercultural sensitivity, apply problem solving strategies, lead groups, assess environments and make referrals.

The most important variable in the helping process is personal integration. The most significant ingredients of effectiveness are personal qualities that include such features as self-awareness, accurate self-concept, confidence, commitment to others, motivation and warmth.

Conducting Training Sessions

Once a student has been recommended as a tutor, then he attends the training sessions before being assigned as tutor. The tutors are informed in advance the date, place, time, frequency and duration of training sessions. The project organizer, the subject teacher or any other expert from the field will give training to the students. In the training session, all tutors involved in a particular course meet together. The teacher gives an initial briefing about the study materials, gives full set of study materials together with a set of all items of stationery, including the relevant data concerning the learners and a student's handbook which highlights the processes and procedures of the system.

In the next face-to-face session the teacher develops the concepts among the tutors on the selected content. Along with this teaching session, techniques to be incorporated while tutoring are also demonstrated and explained. In the final counselling session, help is given how to go about training and discuss ideas, approaches, goals, grading or anything else tutor need or want to cover. Johnson and Johnson (1975) recommends that, given practice and reinforcement for effective tutoring, most children can become rather good teachers.

For rendering effective training for tutors, the teacher can include following tips;

- Videotape a successful tutoring situation for prospective tutors to view.
- Explain the value of waiting for the reluctant learner to respond and how to give hints without actually giving the answer.
- Teach tutors how to follow a lesson plan that the teacher will prepare for the tutoring session.
- The lesson plan should be simple but easy to follow with the following components – Review of previously learned material, Presentation of assignment and the purpose of the work to be completed, Review of work completed with a reward of praise.

- To insure that tutors follow the lesson plan, show tutor how to complete a checklist or leave the tutor write or tape record what transpired during the session.
- Explain the importance of following the lesson plan.
- The teacher needs to meet with the tutor at set time intervals to provide assistance.
- Model the pause, prompt and praise method to be used during tutoring session.

Strategies for Successful Tutoring

All strategies will not necessarily work for everyone. The tutor should be flexible about what strategies to use in specific situations. To be effective in the helping role, peer tutors must learn and demonstrate appropriate skills and techniques as follows.

Observation

Good tutoring starts with good observation. Before the real Peer Tutoring session, tutors should observe different tutors and their tutoring programmes. This will enable them to know rich range of tutorial strategies and see how an individual tutor vary his style or approach depending on the tutee. Learning to observe takes time and patience.

Explaining and Lecturing

It is necessary to clarify and explain a topic if the tutor finds that a tutee has not been introduced to a key point that is necessary to understand the concept. The same information may need different explanations depending on the tutee the tutor is dealing with. Tutors should work hard to ensure that they do not over or underestimate the capacity of the receiver to understand what tutor have to say.

Listening

It is an acquired skill. For effective tutoring, the tutor have to slow down and concentrate on what the tutee is saying. The tutor must listen carefully and observe purposefully, so that the tutees can explore their own problems. External as well as internal distractions can undercut effective listening. External distractions can be avoided by moving to another location. Internal distractions include thoughts that interfere with listening, these should be shut down and allow the entire message of the tutee to enter tutor's world.

Posing Questions

By posing questions the tutee is encouraged to start thinking. It takes a minute to process a good question and think of a good answer, so the tutees should be given time to answer a question. Questioning will reinforce learning for the tutee and help the tutor identify problems. Tutors can also repeat and rephrase the questions once posed.

Tutee Summaries

To communicate effectively, tutor must be aware of how the receiver is interpreting and processing their messages. The tutee should be asked for giving summaries of what has been covered. It will help to determine whether to move on to another topic or need to stay with the present one.

Silence

This technique is often uncomfortable for both tutor and tutee and is a difficult tool to be implemented. But keeping silence and being patient while waiting for a response will yield results. If used sparingly and appropriately the tutee learns to think critically and become more independent.

Drawings and Diagrams

For a visual learner, tactile learners or for certain types of content fields like science, a drawing or diagram is the best way to convey information.

It is also important that tutors should make learners aware of their strengths and weaknesses and that tutors help them rely on their strengths and overcome their weaknesses. Tutors should genuinely desire to assist the students seeking help. The following positive components of helping must occur within a tutoring relationship.

Using Reinforcements

Reinforcements help the tutee have a sense of accomplishment. Tutee will need tutors to notice their success as well as their mistakes. Tutees will be more involved in the learning process when they see that tutors are interested in what they say and do. Both verbal and nonverbal reinforcements can be given, but tutors should know when and how to use these. Communication problems will occur when verbal and nonverbal messages are contradictory.

Trust

Trust is essential in the tutoring process. Tutors should create an atmosphere of *trust* for their tutees. In such an environment, the tutors and tutees can accomplish truly important work. It is also essential that the tutors should trust themselves-as a tutor and as a peer.

Respect and Warmth

Respect and warmth are two important psychological dimensions of helping. Respect is the belief in the capacity of the pupils seeking help to help themselves and can be demonstrated by good attending behaviour, refraining from doing anything for pupils that they could do for themselves, and supporting tutees in their efforts (Gazda,

et al., 1977). Warmth is primarily communicated through non-verbal signals, which may include a touch or hug, or a smile or other facial expression.

Empathic Understanding

To be empathic is to understand the other's world through their frame of reference. The ability to communicate empathy is a powerful helping tool. When tutors demonstrate this skill, the tutee will realize that tutors are truly listening to their concerns and understanding them.

For successful tutoring tutor should be able to communicate effectively with the tutees. Communication skills include :

- Being able to send messages that correctly represent his ideas, beliefs, feelings, opinions, reactions, needs, goals, interests, resources and a lot of other things.
- Being able to receive messages accurately to understand other persons ideas, beliefs and so on.
- Being able to clarify their mutual goals, plan how they are going to proceed to accomplish their goals, provide relevant information and intuitions to each other, reason together, coordinate their behaviour, share their resources, give help and assistance to each other and speak each others creativity.

Six conditions have been identified which may be needed for effectively transmitting knowledge through Peer Tutoring:

- (1) The tutor must provide relevant help which is (2) appropriately elaborated, (3) timely, and (4) understandable to the target student; (5) the tutor must provide an opportunity for the tutee to use the new information; and (6) the tutee must take advantage of that opportunity (Webb, 1989).

2.1.1.10. Principles of Tutor Training

Perlstein (1971), Ehly and Larsen (1980), Barron and Foot (1991), James, *et al.* (1991) and Rings and Sheets (1991) suggested the following principles which must be strictly observed during a Peer Tutoring session.

- i) Training for mastery of the subject being taught.
- ii) Training to select the specific items and tasks for use in tutoring.
- iii) Training to direct practice of the techniques to be utilized.
- iv) Trained in the appropriate use of forms, worksheets, marking or recording responses and tutor logs.
- v) Trained in the use of both verbal and tangible rewards.
- vi) Trained to help the tutor to learn ways to show the tutee how to verify answers.
- vii) Training to teach the tutor to avoid any form of punishment.
- viii) Training the tutor to put the tutee at ease.
- ix) Training so that they can meet the challenge, assume different roles, and be able to understand the various needs of learners and provide required support of a high standard.
- x) Prepare the tutors for the new role, so that they are equipped with essential skills which help them in delivering effective tutorials.

2.1.1.11. Organising a Peer Tutoring Programme

All Peer Tutoring projects have certain *common* elements, but each must be designed to fit comfortably within the ecology of a particular school at a particular time in its development. Before starting the project it should be kept in mind that Peer

Tutoring is not used to *compensate* for the fundamental weaknesses in the professional teaching or organizational infrastructure within a school.

Objectives

Specify exactly what the project organizer hope to achieve by conducting the project and write this down in observable, operational terms. Objectives need to be realistic and it is not reasonable to expect a brief project to make a major impact on a longstanding and widespread problem in the school.

Selection and Matching of Participants

It is usually wisest to start with a small pilot project with a few of those students most in need and eager to participate. The organizer must decide whether to conduct true age – peer tutoring involving a whole class or cross-age peer tutoring with a group of volunteers. Further it must be decided whether the tutoring will occur in small groups or in a one-to-one situation. It is always well to start with a small number of children in first instance.

Selection of Tutors

Tutors are selected on the basis of *aptitude, potential ability* and *desire*. They are not restricted because of grades. Qualities of the tutors on the basis of which they are selected are given as following.

- Status among their peers
- A sense that all wasn't right with education.
- A desire to make positive improvement
- An intuitive understanding or feeling for others who were experiencing difficulties.
- Should be natural and friendly
- Should be regular and punctual
- Should be understanding and not bossing others.
- Should be smart and helpful.

Matching

Range of ability is a critical factor in matching tutors and tutees. A minimal differential in ability should be at least maintained. Pre-existing social relationships and individual preferences of participants are also considered.

Standby Tutors

Supply tutors or standby tutors are appointed to ensure that absence of regular tutor from school can be covered. Children acting as spare tutors need to be particularly stable, sociable and competent in the curriculum area of the project.

Curriculum Area

The curriculum area and the topics are selected in prior. An area which is suitable for teaching through Peer Tutoring system is to be selected. Another major decision to be taken is that whether Peer Tutoring curriculum is to be a part of mainstream curriculum of the school or not.

Selection of Materials

It is evidenced that Peer Tutoring is more effective in raising attainment when structured materials are used. If such structured materials are not available the project organizer should design a tutoring lesson. The teaching and learning aids which is to be used during the tutoring sessions should also be planned and prepared. Some form of records will be kept of the tutoring process by the project organizer, the tutors and the tutees. Clear specification is necessary of what recording materials are needed, who is responsible for keeping the record and complete them.

Contact

A basic decision of whether the tutoring is to occur wholly in class time, or in break time or in a combination of both, should be decided. Some time-tabling is necessary for this purpose. A positive social atmosphere is more likely to be fostered

if the children have adequate personal space and are comfortable during their tutoring. The physical space to accommodate the pairs should be decided earlier. Each individual tutoring period should last for a minimum of 15 minutes. It is advantageous to fix the tutoring time to 20 or 30 minutes. It is better to leave the tutoring pairs less than exhausted at the end of their joint experience, in order that they will come to their next session with positive attitudes and high energy levels. The frequency of the tutorial contact needs to be at least three times per week. The greater the frequency of tutoring sessions, the more impact a project is likely to have. The project should be launched with reference to an initial fixed period of commitment.

Technique

For conducting the programme, the teacher can use packaged techniques including Paired Reading, Pause Prompt Praise, Programmed Tutoring, Companion Study etc. The teachers can also use general teaching skills and train tutors to present a task, how to give clear explanations, how to demonstrate certain tasks and skills, how to prompt or lead pupils into imitating those skills, how to check on tutee performance, how to give feedback on performance, how to identify problem in tutee responses and how to develop more intensive remedial procedures for those problems.

Participant Training

It is essential that before the initial launch of the project, a training should be given to both *tutors* and *tutees*. This should be given as two separate groups. The date, time, place, and the length and frequency of the training should be specified in advance. The training place must have the facility for all the participants to sit in a large group and listen to talk and watch demonstration. If audio-visual equipments are to be used in training session, they must be arranged in advance.

A verbal explanation of the overall structure and purpose of the project should be given by way of instruction. Detailed explanation of the material and techniques to

be used, is also explained. Written instructions about the do's and don't's of the participants in the form of pamphlets can be given to them.

Do's and Don't's for Tutees

The following are the do's and don'ts for tutees in a Peer Tutoring session

- Come prepared with the course material for each session and be ready to work for the grade you want.
- Cooperate with the tutor to participate in the sessions.
- Meet with the tutor for a minimum of one hour per week.
- Read assigned text and attempt all home works before Peer Tutoring session.
- Never expect the tutor to do homework and write papers for the tutees.
- Keep a record of the tasks completed, books read, materials completed, date and so on.

Do's and Don't's for Tutors

Tutors are expected to observe the following do's and don'ts:

- Should attend with interest to what pupils have to say.
- Should be friendly always.
- Avoid any form of punishments.
- Use both verbal and tangible reward.
- Complete a developmental plan for each tutee that details when each session occurred and what materials and study skills were reviewed.
- Meet the course instructor frequently.
- Never use harsh criticizing remarks.
- Keep a record of the progress of your tutee.

Demonstration and Guided Practice

Demonstration of the required behaviour is done with the help of videotapes or the teacher herself can demonstrate it with the help of a previous tutee or another teacher. Immediate practice of tutoring techniques follows the demonstration. Feedback should be given as soon as possible.

Monitoring and Evaluation

Tutorial pairs need monitoring during practice sessions, those pairs that have learned the procedures can be praised and left to continue. Those pairs struggling need immediate extra individual attention. Observations inform about students and guide teachers in making further instructional decisions. The observational notes provide authentic feedback to the children, and make feedback more meaningful and useful (Samway, *et al.*, 1995).

During and at the end of the programme progress is measured and evaluated. Bourgault (1991) suggests three essential needs for successful establishment of Peer Tutoring Programme.

There should be a desire on the side of staff and administrators to establish peer support programme. Without this desire and support it is not possible to operate Peer Tutoring project. All of them should feel that this new venture will contribute to the success of the school. There should be a positive attitude on their part and would encourage the project verbally and practically.

For the successful establishment of the programme, it is necessary that the teacher themselves are well versed in the methods to be used. They should be fully conversant with the techniques and materials to be used. Teachers should be given training with the help of persons with previous experience.

Faculty Involvement in Peer Tutoring Programme

Though the faculty members are not directly involved in the Peer Tutoring programme, they can encourage the programme and render necessary helps. They can recommend the best students to work as tutors and can participate in tutor training programmes. They can invite tutors to have a meeting with them or invite them to attend one of their classes. Teachers can forward old tests, handouts and worksheets to the Peer Tutoring centre. Teachers can schedule an, in-class introduction to tutoring and call upon department heads to discuss how to help students to achieve academic goals.

Teacher's Role in Peer Tutoring

Teachers play an important role in conducting a Peer Tutoring programme. It is their commitment and cooperative work, their vision and philosophy of teaching which underlies the success of a programme. Teacher's planning, sharing, insight, observation, discussion and feedback are very crucial in Peer Tutoring. What teachers can do for organizing a successful programme include;

- Explain and demonstrate Peer Tutoring and give time to practice tutoring before they do it for real and can give feedback while children practice.
- Teach children what good tutor and tutee behaviour are, before starting the programme.
- Teach children how to keep track of their partners right answers or their own.
- Make sure that children are tutoring with materials that are matched with abilities.
- Have children tutor with new information as soon as they have learned the old material.

- Give all children opportunities to be the tutor, so that they will learn from tutoring other students.
- Make Peer Tutoring fun-like a game. Tutors can reward their classmates with points for giving right answers (DuPaul, 1998).

Family involvement in Peer Tutoring

Though parents do not have a direct role in Peer Tutoring, DuPaul (1998) suggests that parents can encourage Peer Tutoring programmes in the following different ways.

- Parents can share the idea of Peer Tutoring with the class teacher, if he/she is not using it.
- Speak with child's teacher about tutoring behaviours that parents can practice with the child, such as how to tell a partner in a respectful way when he or she is wrong and how not to get angry when the other child make a mistake.
- Let the child to practice how to be a good tutor by explaining assignments and maths problems to parents.
- Encourage child to talk about how tutoring is going on in school. Ask whether he or she was a tutor or tutee that day and encourage the child in tutoring practices.

Barriers in the Implementation of Peer Tutoring Programme

Barriers to the implementation and maintenance of effective Peer Tutoring programme include incomplete implementation, lack of adherence to protocols by teachers, lack of administrative support for teachers and heavy teacher workload (Olmscheid, 1999). It is also difficult to develop the study skill materials for a large number of students. If minor disputes occur in the class during the session, it will negatively influence the success of the programme.

All schooling is structured around the traditional belief that knowledge is best transmitted from adults to child in linear fashion. Tradition, teacher resistance, possible disadvantages accruing to the tutor, possible tutor impatience, implications of tutor selection, parent cautiousness, implications for school organization, variable suitability of different subjects for Peer Tutoring and possible lack of expertise on tutor's parts acts as barriers against the implementation of Peer Tutoring programme (Damon & Phelps, 1989).

According to Giesecke, *et al.* (1993) Peer Tutoring is not widely used partly because of the demands placed on teacher time. Teachers may lack the skill to train their students properly to be tutors, they may be concerned about possible disruptive behaviour in tutoring pairs and they may question the quality of instruction offered by students.

2.1.1.12. Effect of Peer Tutoring

The notion of helping others and feeling that their help is valued, becomes a commendable practice. Peer Tutoring offers important *Classroom opportunities* to promote the development of healthy *prosocial attitudes* (Jones & Charlton, 1996).

Peer Tutoring give provision for students to have someone to sit next to them and personally explain the work in a way that is just right for them- not too slow and not too fast. Children have more opportunities to talk about what they are learning, to practice what they are learning, to read aloud, and to write. Peer Tutoring ensures more opportunities for children to ask questions when they are confused, without fear of being embarrassed in front of the whole class. Through Peer Tutoring children get someone who can tell them right away whether their answers are right or wrong and someone to help and encourage them to finish assignments (DuPaul, 1998).

Peer support practices produce benefits to both students giving and receiving instruction, include *learning gains*, the development of *positive social interaction skills* with another student and *heightened self-esteem* (Thousand & Villa, 1988). By utilizing

Peer Tutoring, teachers can teach *more effectively*. Peer Tutoring enables teachers to focus on new materials as peer tutors reinforce materials already covered and give help to students in need (Olmscheid, 1999).

Peer support has been shown consistently to be of value in terms of producing *social, personal and instructional gains* as well as improving cost effectiveness (Gartner & Lipsky, 1990).

Peer Tutoring offers students opportunities to use and improve upon their ability to share, successfully interact, and work cooperatively with each other. In most schools, the day and grade levels are so compartmentalized that students have few opportunities to develop these human qualities and skills (Samway, *et al.*, 1995).

Specific benefits of tutoring programmes for tutees include;

- ❖ Students benefit by receiving immediate clarification of information they do not understand and feedback in a non-threatening environment.
- ❖ Improves the attainment in the tutored subject area.
- ❖ Given one-to-one attention, individualization of learning is possible.
- ❖ Opportunity for demonstration of behaviour.
- ❖ Close monitoring
- ❖ Verbal and social reinforcement readily available, which is powerful and particularly personal (Topping, 1988 & Olmschied, 1999).

Specific benefits of tutoring programmes for tutors include;

- ❖ By working with other students, there is continuous review and practice of academic skills.
- ❖ Tutors learn effective communication skills and their interpersonal skills get enhanced.
- ❖ Tutors build their self-confidence and develop a sense of responsibility.
- ❖ Tutoring help gifted students who need to be challenged.

- ❖ Tutors learn to be nurturant towards the tutees.
- ❖ The tutors benefit by learning to teach a general skill that can be very useful in an adult society.
- ❖ Tutors will learn, from tutees, strategies that they (tutors) had never considered before.
- ❖ They gain a new appreciation for the role of a teacher and relate these skills to their future lives as parents.

Specific benefits of tutoring programmes for teachers include;

- ❖ It frees teacher's time. So they can be more watchful over and more supportive to individual's learning tasks and outcomes.
- ❖ Reduce teacher's stress levels as classroom duties are more manageable.
- ❖ Peer Tutoring enables teachers to focus on new materials as peer tutors reinforce materials already covered and give help to students in need.
- ❖ For teachers, Peer Tutoring programmes are additional classroom resources (Perlstein, 1971; Topping, 1988, & Jones & Charlton, 1996).

Effect of Peer Tutoring on Learning Outcome

Former researches have shown that Peer Tutoring influences the learning outcomes of pupils to a great extent (Coenen, 2002; Dixon & Gudan, 2000; Graetz, 2004; Mastropieri, *et al.*, 2005; McMaster, *et al.*, 2006). It is evidenced that Peer Tutoring can influence learning outcomes in a wide range of area including, Reading, Spelling, English, Mathematics, Hand writing, Sign Language, Computer and Physiology.

In a study conducted by Cardona (2002) the effectiveness of two grouping adaptation strategies (heterogeneous small groups versus Peer Tutoring) to accommodate individual and group differences on mathematics learning of 19 low achieving first graders were investigated. Results revealed a significant increase in number sense and arithmetic skills when pupils worked in pairs.

Mastropieri, *et al.*(2003) compared the reading fluency, comprehension strategies and content test scores of 16 students in world history class taught using Peer Tutoring and students taught through teacher directed guided notes. Students participated in Peer Tutoring significantly outperformed the other students on content area tests.

Graetz (2004) noted that strategies like Peer Tutoring are useful in enhancing the performance of Autism Spectrum Disorder students. Schleyer, *et al.* (2005) reported that in a Peer Tutoring programme for second year undergraduate students, results indicated that Peer Tutoring was effective and students developed problem-solving skills. Peer Assisted Learning Strategies (PALS) and Classwide Peer Tutoring (CWPT) are potentially effective tools in the fight to prevent/remediate reading failure particularly among the most fragile learners. (Maheady, *et al.*, 2006).

Effect of Peer Tutoring on Retention

Retention is remembering over an extended period of time, what has been previously taught. Researches evidenced that Peer Tutoring has a remarkable influence on retention of the studied matter (Smith, 1994; Smith, *et al.*, 1957; Stauf, 1999; Weinsheimer, 1998).

Weinsheimer (1998) reported that a three year longitudinal study of student support service programme indicated that Peer Tutoring during the first year of college has a positive and statistically significant impact on students retention. Stauf (1999) reported that out of a need for students to find a sense of belonging, Bainbridge college started a Peer Tutoring programme for four years. It was noted that student retention is up by five percent over the last three years.

Unless there is a degree of retention there is little justification for learning. Memorization and retrieval of information from one's memory is often required in classroom learning. It was evidenced that cooperative group discussions are superior to competitive group discussions in facilitating individual memory of what was discussed.

Interaction among students affects retention of materials learned and if the children were provided with greater friendly space to learning through joyous activities and free interaction with peers, the retention rate would greatly improve.

Peer Tutoring and Cooperative/Collaborative Learning

Peer Tutoring and Cooperative Learning, both promote *Cooperation* among students in the learning process. Cooperative learning is any learning activity in which students of diverse backgrounds work together in group towards a specific goal. Peer Tutoring also involves cooperation where, a student teaches his peers. Because of the diversity of academic skills found within any regular classroom, small-group instruction is more appropriate than whole-group instruction for basic academic subjects (Affleck, *et al.*, 1980). Peer Tutoring as well as Cooperative Learning advocates small group instruction.

In Cooperative Learning strategy students work together in small groups to achieve team success in a manner that promotes student's responsibility for their own learning as well as the learning of others. Groups allow for greater participation and involvement by the student. In Cooperative Learning, students work together in small groups to achieve team success in a manner that promotes student responsibility for their own learning as well as the learning of others. In Peer Tutoring students work together in a group or on a one-to-one basis and one student who have received prior training and tutoring and is an expert, will teach the other children for achieving the common goal.

Both Peer Tutoring and Cooperative Learning are characterized by elements like Cooperative or Collaborative set up, small group instruction, joyful learning, non-threatened atmosphere etc. (Johnson & Johnson, 1975; Kumar & Bindhu, 2002; Slavin, 1985; Topping, 1988).

Review of research reports on the influence of Cooperative Learning and Peer Tutoring on Academic Achievement have evidenced positive relationships. Both Peer

Tutoring and Cooperative Learning promotes self-esteem, inter-ethnic relations, collaborative work, inter-group relations, positive interdependence etc. (Slavin, 1985; Topping, 1988).

Peer Tutoring differs from Peer collaboration in that, in Peer collaboration children begin at roughly the same levels of competence when they collaborate to solve tasks that neither could do previously but in Peer Tutoring one is an expert and the other is a novice (Damon & Phelps, 1989).

2.1.2. EXISTING METHOD OF TEACHING

The transaction of the syllabi is the most important function of a school and the prime task of teachers (Vernal, 2001). Existing Method of Teaching refers to the methods of teaching utilized for transacting the new curriculum introduced by the Government of Kerala in the high school classes in the year 2002-2003. The new curriculum gives emphasis on *activities*, use of *materials* other than text books, use of *local contexts*, space for the child to *articulate himself*, a closing of the gap between teacher and the child, innovative and efficient classroom organization and opportunity for *peer learning*. The salient features of the new curriculum are briefly described in the following section.

2.1.2.1. Theoretical Basis

New curriculum is based on modern pedagogical concepts with roots in *Philosophy, Psychology, Sociology* and *Anthropology*. The new approach envisages a pupil centered, activity oriented and democratic classroom environment. Traditional instructional concepts are based on behavioural psychology which explains learning on the basis of stimulus response theories, which were questioned throughout the world.

Human intelligence was acknowledged to have more powers than just remembering and reproducing. Information processing, reasoning, analysis, problem solving, attention, anticipation etc. were also attributed to the learning process. The cognitive abilities of the learner makes him capable of constructing knowledge by

assimilating new experiences with the past. Piaget, Bruner, Nom Chosmski, Schemp, Vygotski etc. are the main proponents of *constructivism*.

Constructivism says learner is the constructor of knowledge. Learner interacts with his environment and assimilates and combines experiences to develop his cognitive structure. Constructivism is categorized into two; (1) Cognitive constructivism and (2) Social constructivism.

Cognitive Constructivism

According to Cognitive Constructivism, intellectual growth is a natural process, and it takes place in stages. Learning is based on teacher-learner relationship. Student is a lonely researcher and he/she interacts with environment and assimilates experiences which leads to learning. The cognitive structure develops as the learner passes through specific developmental stages.

Social Constructivism

According to Social Constructivism, the mere biological aspects of learning of man does not limit him in intellectual growth. Social relation, civilization, history, literature etc. influence the intellectual growth of man. Here, learning occurs through social interactions and debates. Debates cause disequilibrium in the cognitive structure which leads to learning.

The new curriculum is based on the theory of constructivism. The group learning styles of cooperative learning or collaborative learning are advocated in the new curriculum.

2.1.2.2. Learner Centered Approach

Learner centered instruction encourages learners to develop the appropriate cognitive structures to understand and solve problems in a particular knowledge domain. Learning is not only about solving problems but is also about *meaning-making* (Chugh, 2002).

In this approach, attainment of learning skills, *at child's* pace is the main focus. Each child has a different pace of learning. The teachers focus on the learner and not on the *whole class*. The focus shifts from the content of what is to be learned to the learner *who* is to do learning.

Since the new pedagogy focuses on the centrality of the child in the teaching-learning processes, the role of teacher has also changed, bringing changes in teacher-child relationship. In the present educational system the teacher is perceived more as a *facilitator* rather than as a proactive. This will help to create a learning environment.

Benett, *et al.* (1996) described that it is the responsibility of the facilitator to set the initial mood or climate of the group within which the developmental process can occur. He must be able to advice students on how to access information they need or on how to conduct it. According to Farrant (1980) Learner Centered education tries to:

- acknowledge that children's needs should determine what they learn at school.
- train children in skills that are within the capabilities of their stage of development.
- recognize and respond to the changing characteristics that distinguish children of different ages.
- select what is taught and the methods used so that they are appropriate to the comprehension and experience of the children.
- apply knowledge of child psychology and child development to the content and methods of learning and teaching.

In the present curriculum, importance is for the learner and teacher shifts her position from a leader to that of a *facilitator*. Teacher facilitates the learning atmosphere for the pupils. Teacher is a mediator and organizes learning experiences so as to suit the development of the learner. Teacher acts as a co-learner and provides a democratic atmosphere in the classroom. The new pedagogy includes the following aspects of collaborative teaching and learning

- Based on cognitive constructivism.
- Acknowledges the innate talents of the learner.
- Emphasis on interactions.
- Emphasis on self as well as peer evaluation
- Learner learns themselves; teacher does mainly scaffolding.
- Learners may form heterogeneous groups
- Class arrangement is rather flexible.

2.1.2.3. Activity Based Classes

Activities when carried out, can teach pupils a lot of human values like team spirit, curiosity, quest for knowledge, devotion, sincerity, integrity, honesty, truthfulness and so on, which are so vital for the citizens of the world (Parida & Goswami, 2001).

Deep learning occurs when learners are actively engaged in the construction of knowledge for themselves (Chugh, 2002). In the existing curriculum, there is an extensive use of *activity based* learning as a means to interact with children. The teacher appears to be moving away from the traditional lecture based teaching into more open and exploratory ways of learning. The activity oriented teaching is helpful in building children's *self-confidence* and also ensures that they become *independent learners*. When a child gains self confidence, he is able to do more, try more and have more success. According to Farrant (1980), the features of good activity are,

- It is well within the competence of the age and ability of the children using it.
- It does not attract attention to itself at the expense of what is being learned.
- It is enjoyable for those taking part.
- It can sustain the interest of the pupils involved for as long as it takes them to succeed in what they are learning.

- It allows ample freedom for the child to express himself.
- It does not make the consequences of initial failure too serious or disturbing.
- It helps the child to gain a firmer grasp of what is learned by leading to a deeper understanding.

2.1.2.4. Change in Text books

Text books play a critical role in the nature of classroom transaction (Chadha, 2000). Change in text books has been an important part of changing the teaching-learning process. The quality of text book is important and so is the rigidity or flexibility in its use. Because of the changes in teaching – learning processes text books also underwent changes. Text books are so prepared that no answer statements are included. Content is open ended. The way through which the learner should proceed will be given. With teacher's help learner should reach at his own findings.

Text books appeared to be just a beginning on initiation point leading to the use of a variety of texts from journals, magazines, dreams of children and so on.

2.1.2.5. Group Method

Groups are those *social aggregates* that involve mutual awareness and potential mutual interaction. Groups are the instruments through which much works get done. They are also the contexts that pattern and shape many other kinds of activities. Moreover, groups are instruments for influencing, shaping and changing the individual who are their members (McGrath, 1984).

Groups offer a convenient way to provide information and education to several people at the same time. Groups serve as places where opinions can be shared, ideas collected, and problem solved. Groups concentrate the collective energy of several people, allowing them to pool resources and complete a desired task (Ender & Newton, 2000).

The new curriculum gives importance to the assignment of *basic groups* and *instantaneous groups* in the classroom. Group method reorganize the class into a feasible number of smaller units. Changing the group members will help them to stick on to healthy competition of groups. By group method, teachers are putting into practice the most advanced and highly valued principle of teaching – the *learner involvement* in the learning experiences.

Mukalel (1998) described different techniques in group method like Interquestioning, Dramatisation, Role play, Picture description, Developing written discourses, Project preparation and Outdoor activities. Any technique used should;

- enable the whole group to work as a team.
- help every individual student to have a share of the work.
- generate activity.
- have a fundamental link to other techniques that precede or follow.
- be one suitable for practice.

Johnson & Johnson (1975) identifies five different types of grouping.

- Ability grouping to form competitive clusters.
- Random assignment by count off procedure.
- Asking students to find two other students with whom to work.
- Sociometric device: Writing in a card the name of two persons with whom she would like to work.
- Interest grouping: Grouping student with the topic they are most interested.

All groups go through different stages of maturation that influence the way they operate, and will in many ways determine the group needs and behaviours that are foremost at any given time. Newton (1980) generalizes some of the common characteristics noted in groups at key stages and are presented in Table 2.1.

TABLE 2.1

Stages of Group Development

Stage	Characteristics	Behaviours for Group
1. Entering	Acquainting, Orienting, Exploring, Testing	<ul style="list-style-type: none"> • Make relevant self disclosure • Establish positive atmosphere • Determine initial norms • Link interactions of members
2. Sorting	Initiating, Disagreeing, Compromising	<ul style="list-style-type: none"> • Recognize individual differences • Overcome dependence • Develop acceptance of conflict • Resolve doubts and difference
3. Cohesiveness	Identification, Organizing, Harmonizing	<ul style="list-style-type: none"> • Acceptance of group identity • Establish individual roles • Develop commitment and involvement • Determine procedures of operation
4. Working	Resolving, Doing, Achieving	<ul style="list-style-type: none"> • Make group decisions • Coordinate efforts • Disseminate leadership • Resolve problems • Achieve designated goals
5. Renewal	Maintaining, Evaluating, Restoring, Changing	<ul style="list-style-type: none"> • Reassess group purpose • Renew commitment • Confront new issues • Resist stagnation, invigorate • Consider dissolution and termination

Managing Group Work

Groups may be formed to provide opportunities for discussion. General instructions may be provided before grouping. Each group is provided with points of discussion to facilitate discussion.

Teacher should ensure participation of all members in group activity and a new leader should be selected each time. Fixed time should be enforced for completion of work. Appreciation can be given for the best performing group. After the discussions are read out, teacher can comprehend the conclusions of group wise discussion.

While group work is going on, teacher must evaluate the group as well as individual performance and give necessary help. Inactive students can be made leaders. Teacher must encourage student work and try to foster healthy competition among groups using quiz, reverse quiz etc. Groups can be named each time in relation to the subject matter presented and care should be taken to ensure that each group is a mix of slow as well as fast learners.

2.1.2.6. Based on Multiple Intelligences Theory

According to the new curriculum there is no average student in the class. Each differ in their intelligence as well as learning speed. Multiple Intelligences Theory (Gardner, 1985) is accepted instead of traditional IQ concept.

Gardner identified the following eleven areas of intelligences.

a. Linguistic Intelligence

The ability to use words effectively both orally and in writing. Students can be helped to develop Linguistic Intelligence by creating a rich environment, by providing things to look at, listen to and write about; and by creating many opportunities for interaction among students and between the teacher and the students.

b. Logical – Mathematical Intelligence

The ability to use number effectively and reason well. Students can be encouraged to develop Logical – Mathematical Intelligence by providing manipulative for experimentation with numbers and by using simple machines or computer programmes to help children think about cause and effect.

c. Spatial Intelligence

The ability to sense form, space, colour, line and shape. It includes the ability to graphically represent visual or spatial ideas. Help can be rendered to students to develop Spatial/Visual Intelligence by providing opportunities for visual mapping activities and encouraging students to vary the arrangements of material in space, such as by creating charts and bulletin boards.

d. Bodily-kinesthetic Intelligence

The ability to use the body to express idea and feeling and to solve problems. This includes such physical skills as coordination, flexibility, speed and balance.

e. Musical Intelligence

The ability to sense rhythm, pitch, and melody. Students develop Musical Intelligence by using tape recorder for listening, singing along, and learning new songs.

f. Interpersonal Intelligence

The ability to understand another person's moods, feelings, motivations and intentions. Students develop Interpersonal Intelligence through activities that involve them in solving problem and resolving conflict.

g. Intrapersonal Intelligence

The ability to understand ourself-our strengths, weaknesses, moods, desires and intentions. Help students develop Intrapersonal Intelligence by letting them express their own preference and help them understand their own styles of learning.

h. Naturalistic Intelligence

The ability and interest to understand the natural phenomena and the flora and fauna around the individual. The ability to recognize and classify plants, minerals, and animals, including rocks and grass, and all variety of flora and fauna. It is also the ability to recognize cultural artifacts like cars or sneakers.

i. Existential Intelligence

The ability to understand the individual existence as a part of the existence of universe. The ability to sense the meaningful and meaningless nature of life .

j. Spiritual Intelligence

The ability to sense and recognize the spiritual nature in every individual.

k. Moral Intelligence

The ability to deal with moral matters and engage in moral activities.

In each individual the eleven intelligences function together in unique ways. No intelligence really exists by itself in life. Intelligences are always interacting with each other.

Gardner (1985) suggests that everyone has the capacity to develop all these intelligences to a reasonably high level of performance with appropriate encouragement, enrichment and instruction. Individuals differ in the particular intelligence profiles with which they are born and the way in which they develop them.

With respect to the Intelligence theory, the new curriculum gives importance to each and every learner and accepts that there is no average learner in the classroom. Each individual may be intelligent in any of the ways as mentioned by Gardner (1985). So in order to increase the intelligence of pupils, the new curriculum designed many activities for children. By participating in these activities and interacting with the society the individual may be able to improve the cognitive abilities.

Society and culture is the part of the environment of the individual and it is meaningless to talk about human intelligence without considering the social and cultural experiences of the individual (Kumar & Bindhu, 2002). The new curriculum emphasises on the interactions of the child with the society.

2.1.2.7. Continuous Evaluation

The evaluation system in the present curriculum is continuous and comprehensive. Importance is given to both *scholastic* and *co-scholastic* areas. The co-scholastic areas include Arts, Sports, Work experience, Communication, Conduct, Group activities, Punctuality, Leadership, Collection, Responsibility, Project, NCC/Scouts/Guides/School clubs etc. The teacher is free to watch the student during the class time as well as outside the class and guide wherever necessary. Students will be given grades instead of marks on the basis of term end evaluation and continuous evaluation.

For the term end evaluation the student will be tested on the basis of the content to be studied. A written test will be administered with a proper blue print giving weightage to content, objectives, type of questions and level of questions. Bloom's taxonomy is the best known system for classifying educational objectives as well as classroom questions. Hence questions will be formulated on these educational objectives.

**EFFECTIVENESS OF PEER TUTORING AND EXISTING METHOD
OF TEACHING ON ACHIEVEMENT AND RETENTION
IN BIOLOGY OF STANDARD VIII PUPILS**

RESHMA P.T.

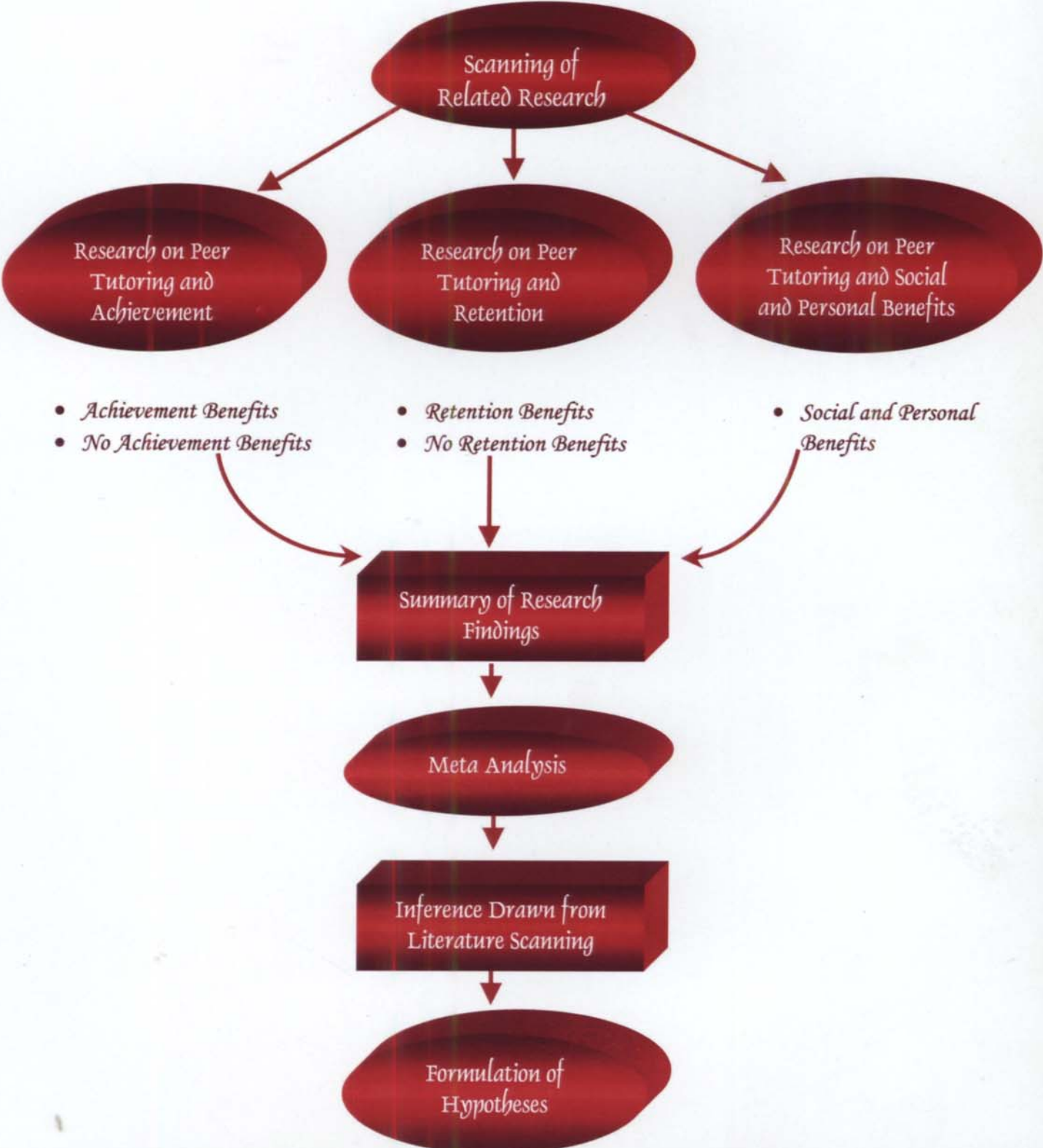
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UNIVERSITY OF CALICUT**

2006

Literature Scanning

CHAPTER
Three



CHAPTER



Literature Scanning

Independent studies on Peer Tutoring in Indian context is rare. But researches conducted in developed countries have pointed out the effectiveness of Peer Tutoring as a better strategy for academic Achievement and Retention of the materials studied. The investigator reviewed these researches, classified and presented them under the following headings.

3.1. SCANNING OF RELATED RESEARCHES

3.1.1. RESEARCH ON PEER TUTORING AND ACHIEVEMENT

3.1.2. RESEARCH ON PEER TUTORING AND RETENTION

3.1.3. RESEARCH ON PEER TUTORING AND SOCIAL AND PERSONAL BENEFITS

3.1.4. SUMMARY OF RESEARCH FINDINGS

3.2. META ANALYSIS

3.3. FORMULATION OF HYPOTHESES

3.1. SCANNING OF RELATED RESEARCHES

In this section, it is aimed to present review of research findings which relates Peer Tutoring with Achievement, Retention and Social and Personal benefits of Peer

Tutoring . The related researches are categorized into three and presented under the following headings.

3.1.1. RESEARCH ON PEER TUTORING AND ACHIEVEMENT

Review of related literature exposed a number of studies on *Peer Tutoring* and its effect on *Achievement*. The relevant aspects of the studies relating with Peer Tutoring and Achievement are classified as in the following.

3.1.1.1. Research Showing Achievement Benefits

Research showing Achievement benefits with Peer Tutoring are presented in this section.

Sherman and *Harris (1975)* conducted a series of studies suggesting that assigning time for independent study had a small impact on subsequent classroom performance, while *Peer Tutoring had the most substantial and most consistent effect on classroom performance.*

Allen (1976) noted that *Peer Tutoring had proved effective across barriers of gender, race, and social class.* More studies reported *positive effects for tutors than for tutees.*

Hill and *Tanveer (1981)* experimented a Peer Tutoring programme in Mathematics. Eighty-eight percentage of tutees evidenced *considerable improvements.* They also showed *greater confidence, more motivation to work and an improved attitude to mathematics.* *Tutors were found to have gained in their own self-assurance as well as their willingness to assume responsibility.*

Sharpley and *Sharpley (1981)* reviewed 82 peer tutor studies concluding that *same-age tutors were as effective as cross-age tutors in inducing cognitive advances in tutees* and also that *same age tutors were themselves more likely to derive cognitive benefits as a result of their tutoring experiences.*

Russell and Ford (1983) reported that a few studies have found that cooperative learning methods – usually *one-to-one Peer Tutoring* – had greater effects than supplementary instruction by a resource teacher in a small group setting.

In a classic study of **Maier (1984)** high school behaviour difficulty students were appointed as cross-age tutors for elementary school pupils with learning difficulties in reading, language and mathematics. *Gains in attainment for both tutors and tutees were reported.*

Wheldall and Mettem (1985) experimented a cross-age Peer Tutoring in reading. Sixteen -year-old students were selected for tutoring 12-year-old remedial readers. Two training sessions of 30 minutes duration each was given for the tutors. The tutoring period lasted for eight weeks of 24 sessions. *The experimental group was found to have made significantly greater gains in reading than control group.*

Cook, et al. (1986) carried out a meta-analysis of studies of special need students as tutors of others. Over 19 studies evidenced that involvement in tutoring *raised the performance of tutors and tutees as compared to that of controls, with tutees usually achieving greater gains than tutors.*

Osguthorpe and Scruggs (1986) reported that Peer Tutoring programmes have *achieved positive effects for both tutors and tutees* of developmentally delayed status.

X **Pigott, et al. (1986)** reported on reciprocal Peer Tutoring in terms of four elementary school children working on routine arithmetic drill. *Under-achieving pupils improved their performance to a level indistinguishable from that of their classmates.*

Polirstok (1986) reported that Peer Tutoring programmes have *achieved positive effects for both tutors and tutees* of low-achieving status in regular classrooms.

Top and Osguthorpe (1987) found that Peer Tutoring is often used as much to improve the achievement of low-achieving older students as to improve that of the students being tutored.

Balais (1988) through his research shows that students gain more self-confidence, autonomy, and academic independence and excellence when allowed to work in collaboration.

Atherley (1989) conducted a Peer Tutoring programme in reading for a group of senior primary school pupils. The programme lasted for 12 weeks. After the programme, significant reading gains were found for the experimental group compared to that of a control group.

Bland and Harris (1989) experimented age-to-age Peer Tutoring in Chemistry. More able pupils were paired with less able peers. Peer Tutoring of this type encouraged more on-task work among pupils and encouraged a non-threatening atmosphere for pupils to experiment within.

Brierley, et al. (1989) described dyadic class wide reciprocal Peer Tutoring of spelling on a large scale. Results suggested generalized improvement in spelling and skills.

Benard (1990) described a peer resource model of education in which school and classrooms are restructured so that youth – from early childhood through late adolescence – have ongoing, continuous opportunities to be resources to each other. Improved academic achievement was noted.

Fantuzzo, et al. (1990) reported a dyadic reciprocal Peer Tutoring involving peer-managed group contingencies. Consistent increase in rate of accurate arithmetic performance to a level significantly above the rates of untreated controls were found.

Osguthorpe and Scruggs (1990) reviewed 26 studies deploying special education students as tutors and noted that in 23 studies, *tutors and/or tutees performed better on outcome measures.*

Negroni (1990) reviewed successful initiatives and unforeseen problems that have arisen in Massachusetts public education. *Peer Tutoring was suggested as a method for basic skills education and advanced training for employees to address Latino needs.*

Malette (1991) in a study of peer mediated instructional procedure (class wide Peer Tutoring) with nine students classified as mildly mentally retarded *found that daily practice of spelling words using the procedure resulted in 95 percent correct on weekly tests.*

Mohr (1991) described a national study conducted by the League for innovation in the Community College to examine the nature and extend of Peer Tutoring and tutor training at community colleges. *The Study reported academic achievement and the tutors ranked knowledge of subject and interpersonal skills high.*

Warger (1991) reviewed that when Peer Tutoring is used as an instructional procedure, *student test scores increase and failure is rare.*

Curtis and West (1992) reported a study conducted by the borough of Manhattan Community College for working adult nursing students in fall. In the three year, part-time programme, *Peer Tutoring was also used as a support mechanism.*

In a study conducted by *Fantuzzo, et al. (1992)* it was found that class-wide *Peer Tutoring helped African American fourth and fifth grade students in maths.*

Hoover (1992) reported that inappropriate behaviours, family crisis, medical traumas, and poor grades affected the potential academic achievement. Two-fold intervention programme was developed to help these students. Adult and Peer Tutoring programme were established to support academic progress. *Results indicated that the*

group of at-risk sixth graders met or exceeded the project's goals for attendance, academic achievement and discipline.

Cline and McLaughlin (1993) used two versions of class wide Peer Tutoring in spelling on fourth grade students. Both *experiments demonstrated moderate to substantial improvement in two Peer Tutoring conditions* and only slightly better performance in paired tutoring using the language master.

Dupaul and Henningson (1993) in their research showed that class-wide Peer Tutoring *helped students with Attention Deficit Hyperactivity Disorder pay attention longer and stay in their seats to finish assignments.*

Gartner and Riessman (1993) conducted a cross-age Peer Tutoring programme. High school students with community service credit were appointed for tutoring elementary/junior high school students. Tutors were recruited from high, middle and low achieving levels. *The effectiveness was consistent across the programme.*

Greenwood (1993) conducted a trial Peer Tutoring programme on one to four grades. Reported changes in classroom processes produced by class-wide Peer Tutoring programme varied with statistically and educationally *significant levels of growth in at-risk students academic achievement.* Investigated *follow-up outcomes at end of sixth grade. Found continued improved academic outcomes in students at risk for academic delay resulting from sustained use of class-wide Peer Tutoring in early grades.*

Houghton and Bain (1993) described a study in which a multiple baseline research design across subjects (pairs) was used to examine the effectiveness of a Peer Tutoring reading intervention which involved the systematic use of delayed attention, prompting and praise. Eight, 14 year old, below average readers were trained to tutor eight students of similar age for whom English was a second language (ESL). Continuous data collection indicated that peers were effective in their use of the tutoring behaviours while *both peer tutors and ESL readers made statistically*

significant gain in reading accuracy and comprehension over the course of the intervention.

Sherwood (1993) reviewed that in Florida, a number of approaches for improving student achievement were proposed. Tutorial programmes, including Peer Tutoring and cross-age tutoring were among them. *Achievement was reported.*

Ezell, et al. (1994) conducted Peer Tutoring interventions to improve the reading accuracy, fluency, comprehension and vocabulary of 14 children (age six to 11 years) with special needs. Interventions were conducted in four settings and nine target children and 26 of their typical peers participated as tutors. The result showed that reading post-test scores exceeded pre-test scores across all children and interventions. *Children's academic responding was greater during Peer Tutoring than during routine classroom instruction.*

Fasko (1994) described a study which used multiple – baseline – across – subjects design to assess the effectiveness of Peer Tutoring intervention for fluency in basic math facts. Eight fourth and fifth graders were involved in the Peer Tutoring session occurred two to three times a week for about 15-20 minutes at a time. *Data indicated improvement in fluency for six of eight students and all students showed some degree of improvement on worksheets during intervention.*

Fuchs (1994) studied the effects of previous training and experience in Peer Tutoring on student interactions for 16 elementary school classes. *Student dyads with experience and training in Peer Tutoring provided more interactional explanations and incorporated sounder instructional principles.*

Hunt, et al. (1994) investigated the extent to which three second graders with multiple severe disabilities acquired basic communication and motor skills within Cooperative Learning activities conducted in their general education class rooms, with gradually finding assistance from the instructor, the non disabled members provided cues, prompts and consequences to promote the disabled member's learning. Results

indicate that the *subjects independently promote targeted basic skills within cooperative academic activities.*

Martino (1994) reviewed a high school Peer Tutoring programme on empowerment, self-evaluation and interpersonal skills. It was noted that at risk young people *improved their grade point averages, literacy and study skills, reading comprehension, ability to identify long-range goals and self-confidence.*

Pagett (1994) conducted an age-to-age tutoring with eight year old students in reading. One-to-one pairing was done. Less able readers were paired with more able readers. Each day half an hour was spend for the tutoring session. The programme *empowered children with additional control over their own learning and helped to make reading interesting and enjoyable.*

Riggio, et al. (1994) examined the effect of student academic ability on the cognitive gains achieved through a Reciprocal Peer Tutoring (RPT) instructional strategy in which students prepare to teach a peer, actually teach a peer and maintain accountability for the process. Two hundred and six undergraduates were assigned to one of four different ability pairing based on College Grade Point Average (GPA). The result by ANOVA demonstrated that all ability pairs achieved approximately the same cognitive gains over the course. *All subjects using RPT exhibited significantly higher cognitive gains than subjects who were not using RPT strategies.*

Simmons, et al. (1994) examined the effect of instructional complexity and role reciprocity within Class-wide Peer Tutoring (CWPT) on the reading of hearing disabled (n=58), non-disabled low performing (n=27) and average achieving students (n=33). Twenty three teachers and their students were assigned randomly to one of the four CWPT conditions (standard CWPT with role reciprocity, standard CWPT without role reciprocity, modified CWPT with role reciprocity and modified CWPT without role reciprocity) Eight teachers and their students were controls. The results pointed out that students in CWPT conditions significantly outperformed controls on a reading

fluency measure. *The group with modified CWPT with role reciprocity showed significantly greater achievement in comprehension than controls.*

Allen (1995) discussed ways to improve Post Secondary Library Instruction based on theories of active learning. The instructional techniques included Peer Tutoring. *Improvement was noted.*

Collopy and Green (1995) reported a programme conducted in an economically disadvantaged school, in which achievement – goal theory was used to create a learner centered school. Peer Tutoring was used in the learning focussed classrooms. *Individual accomplishment was noted.*

Durrer and McLaughlin (1995) discussed the different formats of Peer Tutoring like cross - age, small group, one-to-one, class-wide and reverse role Peer Tutoring focusing on uses of Peer Tutoring on students with behaviour disorders. All formats of *Peer Tutoring have been found to produce social and academic benefits.*

According to *Enright and Arelrod (1995)* Peer Tutoring programmes with applied behavioural analysis techniques *increase the academic success of a large number of students most effectively.*

Fantuzzo, et al. (1995) conducted a study on the effects of parent involvement in isolation or in combination with Peer Tutoring on student self-concept and Mathematics achievement. The sample has 72, fourth and fifth grade students evidencing difficulties in Maths. The results showed that students with parental involvement with reciprocal *Peer Tutoring intervention displayed higher level of accurate Mathematics computations than students with parental involvement or reciprocal peer tutoring alone.*

Greenwood and Delquadri (1995) conducted a study on class-wide Peer Tutoring and the prevention of school failure and reported that *Class wide Peer*

Tutoring (CWPT) is a potential tool for preventing early school failure and highlights CWPT has long term positive effects on academic outcome.

Kurian (1995) conducted a study to explore the effect of Peer Teaching on Achievement Motivation and Mathematics achievement on 60 students of standard VII. Experimental design was adopted. The post-test results pointed out that the ***experimental group showed improved achievement in Mathematics along with improved level of achievement motivation.***

Lumpe and Staver (1995) examined the effect of peer collaboration on 25 high school Biology student's acquisition of concepts related to photosynthesis and interactions in Collaboration Peer Group (CPG) situation to determine how their interactions relate to the development of concepts associated with photosynthesis. The results suggested that subjects working in peer group situations developed more scientifically correct concepts of photosynthesis than subjects working alone. ***Two types of peer interactions consonant and dissonant were identified as enhancing concept development.***

In a Cross-Age Tutoring programme conducted by ***Samway, et al. (1995)*** fifth graders were paired with first graders in order to improve the reading ability of fifth graders. Results showed a very ***positive influence on the older children's reading development.***

Simmons (1995) examined effects of explicit teaching and Peer Tutoring on reading achievement of learning disabled students and non-disabled, low performing readers in academically integrated classrooms. ***Students in the explicit teaching plus Peer Tutoring condition scored higher on reading fluency and comprehension*** than did explicit teaching or control students.

Wright, et al. (1995) described a Spanish vocabulary Peer Tutoring programme for students with learning disabilities in foreign language study. Sixteen high school students enrolled in a modified Spanish 11 class participated. Results indicate that in

reciprocal Peer Tutoring sessions, subjects changed roles as tutor and tutees during practice of individualized lists of vocabulary and idioms. ***High cumulative daily levels of Spanish words learned by all of the tutees.***

Berliner and Casanova (1996) reviewed that in an aim to present the recent research that can be immediately applied by the teacher in the classroom, the themes presented in six sections were (1) teaching, (2) instructional strategies, (3) learning, (4) motivation, (5) school and society and (6) testing. The contents showed that ***Peer Tutoring and cross-age tutoring were found to improve student achievement and participation.***

Fager (1996) reported that when educators build on informal tutoring processes and create organized processes of tutoring, it can become powerful tool for learning. ***Suggested that tutoring whether it is Peer Tutoring, cross age tutoring or parent/volunteer tutoring – benefit students, who receive individual instruction tailored to the skills they need to master,*** it benefit tutors who have increased a sense of pride, accomplishment, and self-esteem and ***may develop increased academic mastery themselves.***

Fuchs (1996) conducted a Peer Tutoring study to know the quality and effectiveness of student's mathematical explanations as a function of the ability of the tutor on dyads from 20 classrooms. ***Tutees of high – achieving peer tutors offered better explanations.***

Moore (1996) investigated the effectiveness of an after-school programme to improve and accelerate the academic achievement and English oral language proficiency of limited – English – proficient (LEP) fifth-grade children at one school. The programme offered one hour of after-school academic instruction designed to expand on student's existing knowledge and experience, promote Peer Tutoring and interaction and use active learning concepts. Result showed that ***all experimental group children had increased their scores on standardized oral proficiency and basic***

skill tests. It was concluded that this approach is an effective strategy for improving LEP student achievement.

Robinson (1996) discussed the remedial help given to the academically under prepared students. Student skill courses, free Peer Tutoring and tutorials on video tapes and the computer were conducted. *The under-prepared students were prepared for success in college.*

Wynn and Cadet (1996) reviewed the use of six collaborative writing teaching methods at the post-secondary level. Disclosure, Peer writing, Peer Tutoring, Workshopping, Co-authoring, and Knowledge making were the six features of the collaborative methods used. *It was noted that these techniques suggests their effectiveness in improving student writing.*

Brady (1997) reported that four pre-school children with disabilities and four peers were taught to take turns tutoring each other on academic skills. *All subject's academic responses increased after Peer Tutoring.*

Ediger (1997) suggested that classrooms should be organized for optimal pupil achievement. An area in the classroom should be designated for small group endeavours. *Peer Tutoring was recommended as one of the ways of student grouping.*

A report by *Feng (1997)* provided information to teachers to gain a better understanding of Asian – American children and identify culturally appropriate educational practices to use with these children. *Peer Tutoring was suggested as a method when developing curriculum and instruction that is culturally sensitive and methodologically adaptable to the needs of Asian – American students.*

Fuchs (1997) studied effectiveness of class-wide Peer Tutoring programme for low achievers with and without learning disabilities and average achievers in 20 elementary school intervention classes and 20 control classes. *All types of learners in*

Peer Tutoring classrooms demonstrated greater reading progress regardless of which of three measures was used.

Ginsburg and Fantuzzo (1997) investigated the relationship between Peer Tutoring interactions of dyads and experience in a Reciprocal Peer Tutoring (RPT) programme in mathematics. Analysis of 40 at-risk fourth – and fifth – grade students indicated that ***RPT participants displayed significantly higher rates of mathematics achievement, social acceptance and other favourable measures when compared to a control group.***

Griffin and Griffin (1997) conducted two experiments involving 131 graduate students to determine effects of reciprocal Peer Tutoring on graduate student's academic achievement, test anxiety and academic self-efficacy. ***Results suggested that reciprocal Peer Tutoring help students to achieve learning objectives.***

Kraft and Billig (1997) reviewed a study which was conducted to create a model linking Title One and service learning. Six schools from urban, rural and suburban schools were included in the programme. Common programme components included motivating learning environments, an accelerated reading programme, Peer Tutoring and professional development. ***Findings suggested that schools had varying success.***

Lane (1997) examined whether cross-grade Peer Tutoring increased student performance on weekly spelling tests. Experimental group used cross-grade Peer Tutoring and the control group used traditional method. ***Results indicated that weekly spelling test scores were substantially higher for those students using cross-grade Peer Tutoring and students appeared to enjoy the procedure, grades improved.***

Madrid, et al. (1997) implemented the mathematics teaching and learning practices of Jaime Escalante, in two high schools and three middle schools. The objectives were condensed into restructuring the curriculum, improving student performance in maths and replicating the programme. Peer Tutoring was one of the

programme component. It was *noted that the programme accelerated and improved student mathematic achievement.*

Morrow (1997) conducted a study to determine the impact of a literacy programme including social cooperative literacy experiences on literacy achievement of first, second and third grade children. Social behaviours included Peer Tutoring, Peer collaboration, and conflicts. *Result indicated that children in the experimental groups scored significantly better on tests of comprehension, story retelling and rewriting.*

Rominski and Vazquez (1997) conducted a programme to support English-as-a-second-language (ESL) student's achievement. Study was conducted for eighth graders in a suburban school for 15 weeks. Peer Tutoring and classroom teacher assistance were provided. Results showed *significant improvement in the class and facilitation of the transition of ESL students into regular instruction. Improvement was shown in writing process, confidence in class discussion, and listening and recall skills.*

Sideridis, et al. (1997) investigated the effectiveness of Class-wide Peer Tutoring (CWPT) to enhance the spelling performance and social interactions of three typical students and three students with mild disabilities. Spelling performance was measured by weekly pre-post tests. Using an ABAB single subject design, results indicated that *CWPT resulted in gains in the spelling accuracy of all students.*

Sills and Soden(1997) conducted a study to assess the effectiveness of a computer training programme for fifth graders to increase their awareness of and comfort level on Macintosh and IBM computers in their classroom. Eight students were selected and trained and then they tutored their classmates. Results showed that *over 87 percent of the students felt extremely comfortable on both computer systems after being trained and rated the programme as excellent.*

Thorkildsen and Schmahl (1997) reported that African American and Latin American elementary students (age six - 12) from low-income, urban neighbourhoods

were interviewed about the fairness of four teaching practices. Five conceptions of fairness, identified in previous studies with Caucasian students, were evident. Consistent with previous study, *most children rated Peer Tutoring as fairest.*

Utley (1997) in a study discussed the components of peer-mediated instruction and interventions and instructional systems that incorporate peer mediated instruction and intervention components with other elements of effective instruction. The study *explored implications for students with disabilities.*

Zukowski (1997) followed the development of a Peer Tutoring programme involving third- and fifth- grade study partners. The cross-age tutors included students representing diverse learning styles and academic achievement. *Cross-age tutoring was judged to be good for all the students.*

Beachler and Glycer (1998) described an annual report designed to provide new ideas for faculty. Document reviewed innovative instructional techniques and presented an overview of classroom – based assessment and cooperative – collaborative learning. Principles of cooperative and collaborative learning were given and suggested that cooperative learning approaches such as partnered learning and *Peer Tutoring helped students to become experts on selected course material.*

Cardona and Artilles (1998) reported a study that assessed the effect of two classwide instructional grouping adaptation strategies on math performance of English – language Latino learners in an urban public school. An ABAB within – case design was implemented over a 12 week period on 19 low, average and high achieving first grade students. In phase A, students worked independently in small heterogeneous group. In Phase B, Peer Tutoring was used. *Results indicated that student's math performance was significantly higher during the Peer Tutoring phases than when in heterogeneous small groups.*

DuPaul, et al., (1998) investigated effects of class-wide Peer Tutoring on classroom behaviour and academic performance of 18 students with attention deficit

hyperactivity disorder. *Class-wide Peer Tutoring led to improvements in performance in math or spelling for 50 percentage of students.*

DuPaul and *Eckert (1998)* reviewed empirical studies that have reported the effects of academic interventions with students with attention-deficit hyperactivity disorder (ADHD). Reviewed interventions in the general categories of Peer Tutoring, computer assisted instruction, task and instructional modifications and strategy training. *Found Peer Tutoring and task modifications appeared to enhance both academic performance and attentional behaviour.*

Geimer, et al. (1998) described a programme of Peer Tutoring using specific learning and metacognitive strategies to increase reading comprehension. The targeted population consisted of first through fourth grade students in self-contained regular education classrooms. *Post intervention data indicated an increase in student's reading comprehension.*

King (1998) described about an “ASK to THINK- TEL WHY ® ©” model, which is an inquiry-based model of mutual Peer Tutoring in which tutoring partners mediate each other’s learning in a transactive manner. This tutorial model is designed as a “person-plus” cognitive partnership that supports the distribution of cognition and metacognition in order to promote complex, higher-level learning. Results of research on the effectiveness of using this model in classroom contexts have shown that *the model promotes students construction of new knowledge.*

King, et al. (1998) in a study, demonstrated that tutorial interaction can be structured so that same ability age mates can scaffold each others higher order thinking and learning. Seventh graders were assigned in pairs to three mutual Peer Tutoring conditions: explanation only (E), inquiry plus explanation (IE) and sequenced inquiry plus explanation (SIE). Tutorial sessions followed teacher-led science lessons over a five week treatment. IE and SIE students were trained to ask comprehension and thought provoking questions on the material when in the tutor role and to explain

material to partners when acting as tutee. SIE students received additional training in asking their questions in a particular sequence. E students explained material to each other. ***SIE students outperformed IE and E students on ability to construct knowledge both during their tutorial interaction and on written measures.***

Longwill and Kleinert (1998) described how high school Peer Tutoring programmes can enhance educational outcomes including increased academic performance, for students with and without moderate and severe disabilities. ***It was noted that Peer Tutoring promoted general education, class participation and community inclusion for students with significant disabilities.***

Parsons and Weldon (1998) conducted a project in an adult literacy and basic education programme using small group interaction to increase weekly attendance, students input into the learning process and develop better tools for learning environment. ***It was noted that through Peer Tutoring, student's self-esteem and educational progress were increased.***

In a Peer Tutoring programme conducted by ***Rafoth (1998)*** peer tutors were taught also to be study- skills coaches sharing the secrets of learning and studying that allowed them to succeed. These tutors then tutored high- risk students during the tutoring sessions. Evaluation indicated that the ***study-skills component positively impacted student achievement and attitude.***

Shastri (1998) reviewed that Peer Tutoring increases achievement scores for both the tutors and the students being tutored. ***Consistent gains in factual knowledge have been found*** when measuring the kind of information students are most likely to encounter in their field experiences.

Weinsheimer (1998) conducted a three year longitudinal study of student support service programmes. ***Indicated that Peer Tutoring during the first year of college has a positive and statistically significant impact on student's grades.***

In a study conducted by *Bindhu (1999)* Peer Tutoring was used as a built-in-procedure along with learning together model of Cooperative learning for standard VI pupils . Results revealed that ***Peer Tutoring is an effective strategy for improving achievement in language.***

Chemidlin (1999) conducted a study to determine if Peer Tutoring of fifth grade and kindergarten students affected reading achievement. For eight weeks, one group of fifth-graders and kindergartners paired together four times a week and another group was not cross age paired. Both groups were given a Reading Interview Survey of attitudes towards reading before and after the project period. ***The average gain of fifth graders was significant when compared with those of the non-paired group of fifth graders.***

Elbaum, et al. (1999) conducted a study of reading research for elementary school students with disabilities. Use of instructional grouping format, ***especially student pairing, had more positive effects on student's reading than whole class instruction.***

Farrington, et al. (1999) reported a programme conducted to improve equity of access and participation for Aboriginal and Torres strait Islander students. ***The programme offered Peer Tutoring and it was indicated that Peer Tutoring provided academic support.***

Kamps, et al. (1999) in a study, formed peer networks consisting of students with autism and fourth grade peers. They were trained to tutor first grade students on, sight word recognition. The purpose of the study was to determine if the target students could be trained effectively as tutors, to determine outcomes for the first graders, and to determine effects on social integration of network students. Effects were measured for implementation of tutoring steps, increase in sight words learned on a weekly basis for the tutees and social interaction among network students during free time activities. Using a reversal design, with a multiple baseline component, ***results demonstrated***

higher gains on weekly pre-tests and post- tests for first graders than control students who received classroom instruction only.

Lake (1999) reported that in a Peer Tutoring system developed for an advanced physiology course, *results showed that Peer Tutoring was effective in enhancing student performance and was perceived as beneficial by students.*

Olmscheid (1999) reported that peer tutors has been used as educational tools for centuries. It was suggested that Peer Tutoring can be used to reinforce the knowledge and skills of tutors. *Peer Tutoring has the potential to increase academic engagement.*

Platt (1999) reviewed a report providing an overview of the Learning Center at South Plain College during 1998-99 academic year. Developmental courses including Peer Tutoring were offered for students and prospective students. *A progress was reported on goals for the 1998-99 academic year.*

Rathvon (1999) described about a book of empirically based interventions that have been adapted to the realities of the regular classroom environment. Explained different interventions to improve academic performance including class-wide Peer Tutoring and self monitoring. It was *suggested that these interventions help children with learning and behaviour problems achieve success in the regular classroom.*

Santiago (1999) a special education teacher, took her students outdoors to stimulate their interest in learning. School yard nature study and environmental field trips were conducted. *Peer Tutoring was an important learning strategy. These students outperformed mainstream classes in areas of science achievement.*

Stauf (1999) reviewed a Peer Tutoring programme conducted out of a need for students to find a sense of belonging. *It was noted that peer support lead to personal academic accomplishment.*

Telecsan, et al.(1999) in a study evaluated the effectiveness of a peer mediated constant time delay procedure for teaching written spelling to fourth and fifth grade students identified as learning disabled. The six peer tutors (each with learning disabilities) taught each other to produce the written spelling for 15 five-to- eight visual model prompt. A multiple probe design across behaviours (word sets) was used to evaluate the procedure. Data were collected on the number of sessions to criterion, trials to criterion, number and percent of errors, and direct instructional time. The classroom teacher prepared students to serve as tutors using a describe-model-guided practice-feedback sequence. Pre and post measures were conducted of generalization of the tutoring procedure as well as observational learning by the tutors. ***Results indicated that (a) peer tutors reliably implemented the time delay procedure, and (b) the tutor-implemented time delay procedure was effective in teaching written spelling to students identified as learning disables.***

Dixon and Gudan (2000) conducted a study to measure the impact of peer-assisted learning programme on student academic performance. The study reported that ***peer-assisted learning participants had a significantly higher course success rate than non- participants and a significantly lower withdrawal rate compared with non-participants.***

Fotoples (2000) described math anxiety among students and suggested that strategies like ***Peer Tutoring, parent involvement and teacher sensitivity helped in overcoming anxiety and influenced learning styles on mathematics achievement.***

Genesmer (2000) implemented peer mentoring programmes to help ease the transition level from one level of schooling to the next. ***Reciprocal Peer Tutoring has proven beneficial to both tutors and tutees.*** Low achieving older students and mainstreamed special education students can benefit from reciprocal Peer Tutoring programmes.

Luis and Kathryn (2000) reviewed symposium 38, Advances in Distance Learning, of the Academy of Human Resource Development 2000 Conference Proceedings. Teaching strategies in a Synchronous Learning Environment for Adult students reported the responses of intact cohort groups enrolled in spring semester 1999 of two learning style instruments and *results indicated preference for use of discussion, Peer Tutoring, independent study and lecture.*

Schniedewind and Davidson (2000) suggested that *effective heterogeneous cooperative learning helps students grow academically, socially and emotionally.* In heterogeneous groups, teachers differentiate tasks *by incorporating challenging Peer Tutoring assignments.*

Wynn, et al. (2000) described a design and orientation of a collaborative writing model for culturally diverse students. Collaborative writing approaches included Peer Tutoring, peer editing and co-authoring. *Concluded results concerning the benefits of peer response groups. Noted that collaborative writing engaged diverse students more fully in writing process.*

Bindhu and Kumar (2001) in an article on Peer Tutoring highlighted the *effectiveness of this strategy to make classroom learning a joyful event.*

Bromfield, et al.(2001) described a study in which computing skills were introduced to girls in their English classes using three different styles: Peer Tutoring, Cross-age tutoring and Teacher instruction (control). The sample comprised 136 girls from years eight and 10 from a single-sex government school. A pre-test post-test quantitative design was used. To describe the students perspectives, qualitative data were collected from six focus groups conducted with eight -10 students-one from each of six classes. It was predicted that *cross-age tutoring will yield more positive effects than Peer Tutoring which in turn would yield more positive effects than traditional teacher instruction* as assessed by achievement on class tests and attitude towards computing.

Collins and Onwuegbuzie (2001) examined the extent to which an After – School Peer Tutoring (ASPT) programme in a rural south eastern school was effective in elevating achievement level of 89 at-risk middle school students for one semester. End-of-semester grade was used as a measure of performance. *Findings indicated increase in academic performance among the majority of attendees.*

A Peer Tutoring approach was taken by *Evans and Flower (2001)* for part of the teaching of mathematics to two different classes. From qualitative evidence, *the experiment appears to have been successful.*

Greenwood, et al. (2001) conducted a Class-Wide Peer Tutoring Learning Management System, in which five English language learners (ELL) teachers and 117 elementary students, including students with disabilities participated. *Students made considerable progress in mastering the curriculum over periods ranging from 15 to 21 weeks of school and students and teachers were satisfied with the programme.*

Nugent (2001) described a cross-age Peer Tutoring Programme in reading developed and implemented at a special school for student with moderate learning difficulties in Ireland. Evaluation studies *indicated multiple benefits to both the learners and the helpers including progress in reading, enhanced feelings of self-worth and more positive attitudes towards school.*

It was reported by *Solomon and Crowe (2001)* that the use of student peer tutor is an *attractive and affordable alternative in a problem-based programme.*

Sutherland and MacMillan (2001) reviewed researches on best practices for preventing students with mild disabilities from dropping out of school. It was indicated that warning sign for school dropout include: poor attendance, academic difficulties, behavioural problems, and social alienation. Positive correlation between particular interventions and these variables were noted. In an effort to *build affiliation between student and school, Peer Tutoring was the instrument used and success was noted.*

Berry (2002) reported a Peer Tutoring programme in which elementary students are paired with sixth or seventh graders who have been carefully selected and trained to be tutors. Tutors guide younger students through their homework and help them with reading. *Benefits have been identified for both the younger and older students. Improvements in the student's achievement on Math and English tests over the preceding two years.*

Brock (2002) suggested that class-wide *Peer Tutoring provides many of the instructional variables known to be important in working with students with attention problems for success.* It provides frequent and immediate feedback.

Cardona (2002) conducted a study with 19 low achieving first-graders to investigate the effectiveness of two grouping adaptation strategies (heterogeneous small-groups versus Peer Tutoring) to accommodate individual and group difference in mathematics learning. *Results revealed a significant increase in number sense and arithmetic skills when pupils worked in pairs.*

Coenen (2002) implemented an after school Peer Tutoring programme, in a school. The gifted middle school students were selected as the tutors for those children who needed additional outside help and support. *This homework helpers programme showed positive outcomes throughout the programme.*

In an exploratory study conducted by **Kowalski and Fresko (2002)**, Peer Tutoring in higher education was examined for students with visual impairment and students with learning disability. Data were collected by means of interviews and focus groups. *Findings indicate academic benefits for tutees and tutors.*

Kumar and Bindhu (2002) reported a study conducted on standard VII pupil's academic achievement in Malayalam language. The result showed that *Peer Tutoring along with learning together model of Cooperative learning is effective for language attainment.*

Perkins, et al. (2002) conducted a study to determine the efficacy of a peer-led tuition model for training health-care students in basic life support compared to tuition delivered by clinical tutors. One twenty two first year medical, dental, nursing and physiotherapy students were randomized to receive basic life support tuition from either second-year student instructors or from experienced clinical staff. Student's practical skills, knowledge and satisfaction were tested at the end of the course. Instructor reliability was assessed throughout the course. ***Students taught by their peers were significantly more likely to be successful in the end-of-course practical CPR test than those taught by clinical staff.***

Shinn, et al. (2002) in a book discussed training and knowledge for school psychologists on how to apply the intervention skills needed to solve problems. ***Peer Tutoring was suggested as a method to increase achievement in mathematics.***

Wilson (2002) reviewed the effect of class size on styles of teaching practice and on pupil behaviour and attainment. Sufficient ***evidences showed that class-size reduction as in Peer Tutoring is associated with improvement in pupil achievement.***

Hoysniemi, et al. (2003) presented a study in which Peer Tutoring was used to teach the use of a software. The Peer Tutoring approach provided information software and it also promoted communication in the test situation, compared to a test person communicating with an adult instructor. The approach has been applied to the development of a perceptually interactive user interface in QuiQui's Giant Bounce, a physically and vocally interactive computer game for four-nine year old children. ***The results and experiences of using Peer Tutoring were promising and it has proved to be effective in detecting inability flaws and in improving the design of the game.***

Mastropieri, et al. (2003) compared the reading fluency, comprehension strategies, and content test scores of 16 students with mild disabilities who participated in a nine-week world history class taught using Peer Tutoring or teacher-directed

guided notes. *Students participated in Peer Tutoring significantly outperformed the other students on content-area tests*

In a study, *Mckinstery and Topping (2003)*, evaluated Peer Tutoring in thinking skills in a high school setting. *A substantial gain in reading comprehension was found for tutees and development of thinking skills was also indicated.*

In a project conducted by *Nestel and Kidd (2003)*, the impact of Peer Tutoring on first year medical students in patient centered interviewing were analysed. After attending a preparatory workshop, third year students co-facilitated their first year colleagues in a session. Results showed *eight learning objectives were completely met by 56 percentage of students. Peer tutors can support the acquisition of basic patient-centered interviewing skills in first year students.*

Graetz (2004) noted that strategies like *Peer Tutoring are useful in enhancing the performance of Autism Spectrum Disorder (ASD) students in high school level.*

Medcalf, et al. (2004) conducted a study in which 10 year old -11 year old students peer-tutored seven six year old students in writing over a 10 week period. Results indicated *gains in terms of writing rate, accuracy and enjoyment of writing.*

In an experimental study, *Topping and Bryce (2004)* evaluated the effect of Peer Tutoring in thinking skills. Study aimed to partial the impact on quality of thinking of peer tutored thinking intervention from that of peer tutored reading intervention. In phase one, a paired reading intervention was implemented for six weeks for all groups. In phase two, the experimental classes of tutors and tutees engaged in paired thinking, while control group continued with paired reading. *Post-test assessment indicated significantly better performance in thinking skills for experimental tutees than comparison tutees.*

Topping, et al. (2004) in an experimental study, evaluated the cognitive and affective gains from cross-age Peer Tutoring. A Peer Tutoring paired science

intervention was implemented for two 30 minutes sessions per week for eight weeks. *The experimental group made significant gains in understanding of scientific concepts and key words. It was concluded that cross-age Peer Tutoring of Science using the paired science programme offers an effective pedagogical strategy for both tutors and tutees.*

Crespo, et al. (2005) in a paper presented an effective matching algorithm in the context of peer reviewing applied to an educational setting. The problem is formulated as an optimisation problem to search a solution that satisfies a set of given criteria modelled as profiles. The proposed technique was deployed in a first semester computer engineering course and *proved to be both effective and well received by the students.*

A study was conducted by *Kassab, et al. (2005)* to examine the effectiveness of using students as tutors in a problem based learning. Ninety-one third year students were divided into 10 tutorial groups and were randomly allocated into student-led tutorials and faculty-led tutorials. *Student tutors were perceived better in providing feedback and in understanding the difficulties students face in tutorials. Tutorial atmosphere was found better in student led tutorial groups.*

Mastropieri, et al. (2005) compared outcomes associated with Peer Tutoring versus teacher -directed instruction for secondary level students, with mild disabilities. Same co-teachers including one chemistry and one special education teacher during the regularly assigned chemistry classes, taught both classes. *Students in experimental condition participated in Class-wide Peer Tutoring. Post-tests revealed that students in the tutoring condition outperformed students in traditional conditions.*

In a paper, *Nestel and Kidd (2005)* reported the evaluation of a peer assisted learning project on student tutors. The methodology included direct and indirect measures of student tutor's skills in facilitation and patient- centered interviewing.

Study concluded that *formalizing peer assisted learning is a valuable resource within the medical school and provide benefits for student tutors.*

Page, et al. (2005) in an article described the development of a uniquely African tutor/mentor system which not only *serves the student who is most at risk of failing, but also enhances the level of achievement of gifted students.*

A Peer Tutoring Programme has been introduced by *Schleyer, et al. (2005)*, to help second year undergraduate students tackle conceptual design problems. Peer tutors were trained to facilitate group sessions. *The students developed problem-solving skills and the tutors deepened their own understanding of design as a result of the Peer Tutoring experience.*

Heron, et al. (2006) reported that peer mediated approaches have been used for years to improve the academic behaviours of students, especially those with disabilities. *The most systematized and well researched of the peer mediated approaches relates to Peer Tutoring systems, which includes specific elements of training, implementation and evaluation.*

McMaster, et al. (2006) in a paper evaluated the effectiveness of peer assisted learning strategies for reading. Research demonstrated the *effectiveness of Class-wide Peer Tutoring Programme in improving the performance of high, average, and low performing students, including students with disabilities, from kindergarten through high school.*

Maheady, et al. (2006) introduced three powerful evidence-based instructional practices that hold great promise for ameliorating many of the reading difficulties encountered by pupils of 21st century classrooms. *Peer Assisted Learning Strategies (PALS), Class-wide Peer Tutoring (CWPT), and START tutoring have emerged from as potentially effective tools in the fight to prevent/remediate reading failure particularly among the most fragile learners.*

3.1.1.2. Research Showing No Achievement Benefits

Findings showing negative relationship between Peer Tutoring and Achievement are presented in this section.

Buskist, et al. (1991) in a paper described the essential features of the Personalized System of Instruction (PSI). The paper concludes that the *use of student proctors as peer tutors do not appear to be vital to student success in PSI courses.*

Torres (1993) explained a project investigating the effects of Peer Tutoring on student's academic achievement on under-achieving, limited-English-speaking 11th and 12th graders. Eighteen students attended tutorial sessions which lasted for 12 weeks. Though an improvement in students pass rate on high school competency test was aimed, *the objective was not met.*

In a study conducted by *Schmidt, et al. (1994)* academic achievement of 334 tutorial groups guided by staff tutors was compared with achievement of 400 groups guided by student tutors. Overall, *students guided by a staff tutor achieved some what better. Difference was however fairly small.*

Ziegler (1997) reported a study conducted to know whether reduced class sizes result in higher achievement levels. One-to-one tutoring by certified teacher, Peer Tutoring and Cooperative learning were practiced in small classes. *Research has shown that decreasing class sizes is not an efficient way of improving achievement.*

Griffin and Griffin (1998) investigated the effects of Reciprocal Peer Tutoring (RPT) on the academic achievement, academic self-efficacy and test anxiety of undergraduate students. Undergraduate educational majors enrolled in either human growth and development or educational psychology participated in the study. Students developed a series of test questions to quiz each other prior to unit examination, and provided corrective feedback to the questions. Statistically significant finding were

inconsistent across the experiment. In short, *RPT appears to have, inconsistent effects on achievement, test anxiety and academic self-efficacy.*

Solomon and Crowe (2001) examined a Peer Tutoring model from the perspective of the student tutor. *Reported that students struggled with basic facilitation skills and had difficulty in separating the role of student from that of tutor.*

3.1.2. RESEARCH ON PEER TUTORING AND RETENTION

Review of related literature exposed a few researches directly related with Peer Tutoring and Retention which are presented in the following.

3.1.2.1. Research showing Retention Benefits

The reviewed research findings, showing positive relationship between Peer Tutoring and Retention are presented as follows.

Smith, et al. (1957) recommended that cooperative group discussions are superior to competitive group discussions in *facilitating individual memory of what was discussed.*

Malette (1991) in a study of peer mediated instructional procedure (Class-wide Peer Tutoring) with nine students classified as mildly mentally retarded, found that daily practice of spelling words using the procedure resulted in 95 percent correct on weekly tests, and *about 90 percent correct on tests of long-term retention.*

Platt (1992) described the scope of learning centre's operations including Peer Tutoring for the students of the college. *In an assessment of programme effectiveness at reading remediation retention rates were noted.*

Harper, et al. (1993) in an investigation evaluated the retention and generalization of words learned using Class-wide Peer Tutoring (CWPT). Students classified as mildly handicapped participated in daily practice of 10 spelling words

using CWPT for 10 weeks. Short and long term retention of words practiced was assessed. Results indicated that the students average post-test score was over 84 percentage correct on weekly tests, replicating previous results. When included in a dictation task the following week, 76.2 percentage of previously tutored words were correctly spelled. *Short and long term retention measured on post-test was 72 percentage and 69 percentage correct respectively.*

Fasko (1994) described a study which used multiple-baseline-across-subjects design to assess the effectiveness of Peer Tutoring intervention for fluency in basic math facts. Eight fourth and fifth graders were involved in the Peer Tutoring sessions occurred two to three times a week for about 15-20 minutes at a time. *Data indicated that retention was promoted for several weeks time.*

Smith (1994) suggested that interaction among students in a Peer Tutoring session affects levels of learning, motivation to learn, and *retention of materials learned* among college students.

Kamps, et al. (1996) conducted class-wide Peer Tutoring for elementary grade students at-risk and with mild disabilities. Tutoring was in multiple subject areas. Students *acquire literacy skills faster, retain more of what they learn and make greater advances in academic achievement* when compared to traditional instructional methods.

Rominski and Vazquez (1997) conducted a programme to support English-as-a-second-language (ESL) student's achievement. Study was conducted for eighth graders in a suburban school for 15 weeks. Peer Tutoring and Classroom teacher assistance were provided. Results showed significant improvement in the class and facilitation of the transition of ESL students into regular instruction. *Improvement was shown in recall skills.*

Weinsheimer (1998) conducted a three year longitudinal study of student support service programmes. Indicated *that Peer Tutoring during the first year of college has a positive and statistically significant impact on student's retention.*

Bindhu (1999) conducted a study in order to find out the interaction effect of cooperative learning, peer teaching, and cognitive entry behaviour of standard VI pupils on achievement in Malayalam language skills. In the results a *positive relation was found between peer teaching and retention in Malayalam language skills.*

Greenwood, et al. (1999) conducted a class-wide Peer Tutoring programme. The tutors and tutees were paired into two competing teams. *Significant academic gain in content area, memorization and drill.*

Stauf (1999) reviewed a Peer Tutoring programme conducted out of a need for students to find a sense of belonging. *It was noted, because of the programme, student retention is up by five percent over last three years.*

Bindhu and Kumar (2001) reported in an article that *Peer teaching is effective for better retention* of the materials learned by the students.

Platt (2001) discussed the South Plains College Teaching and Learning Center's collegiate instruction including Peer Tutoring. It was noted *that total retention rates for students completing specific exit-level reading course was 75 percent compared with 73 percent the previous year.*

According to *Chugh (2002)*, if the children were provided with greater friendly space to learning through joyous activities, attractive texts and materials and free interaction with the teacher and their peer group, *the retention rate would greatly improve.*

In an experiment conducted by *Kumar and Bindhu (2002)* using Peer teaching as a built-in-strategy along with Co-operative learning (Learning Together), *found improved retention due to Peer teaching in case of standard VII pupils.*

3.1.2.2. Research Showing No/Weak Retention Benefits

In this part, one research finding showing weak Retention benefit with Peer Tutoring is presented.

Dill and Boykin (2000) examined the effect of communal learning, Peer Tutoring and individual learning on the text recall of African American fifth graders. Students completed surveys assessing their preference for communal beliefs and behaviours, *participated in groups, and recalled text. Communal learning group students recalled the most text.*

3.1.3. RESEARCH ON PEER TUTORING AND SOCIAL AND PERSONAL BENEFITS

Research findings showing social and personal benefits with Peer Tutoring are presented in this section.

Devin, et al. (1976) reviewed that low achievers *benefit from tutoring younger students both academically and socially.*

Yogev and Ronen (1982) reported that cross-age tutoring *significantly increases the tutor's empathy, altruism and self-esteem.*

Custer and Osguthorpe (1983) arranged four mentally handicapped pupils to tutor their non-handicapped peers in sign language. The results showed that *sign language competence of both tutors and tutees improved and social interaction between the two groups improved even more.*

Winter (1986) implemented a Peer Tutoring programme among those children who are aggressive and argumentative in their behaviour towards their peers. Social improvement were noted among them. *The tutors showed remarkable patience and commitment after their teaching role in the programme.*

Bourgault (1991) demonstrated a Peer Tutoring programme of high school students in which training was given in the skills of active listening, assertiveness and leadership. *Personal growth of the peer leaders were observed during their training as well as during their tutorship of the pupils.*

In a peer support programme, conducted by **James, et al. (1991)** apart from gains in spelling and reading, *improvement in motivation and effort, handwriting, oral English, self-confidence, attitudes to study, personal cleanliness and social interactions* were also observed.

Harper, et al. (1993) in an investigation evaluated the retention and generalization of words learned using Class-wide Peer Tutoring (CWPT). Students classified as mildly handicapped participated in the programme. Students *reported positive evaluation of CWPT and perceived positive social and self esteem outcomes.*

Fuchs (1994) studied the effects of previous teaching and experience in Peer Tutoring on student interactions, for 16 elementary school classes. *Student dyads with experience and training in Peer Tutoring provided more interactional explanations and incorporated sounder instructional principles.*

Sharp, et al. (1994) described a Peer Counselling – Alcoholics counselling and Bereavement counselling – service programme. *Reported that counsellors gain self-esteem and are able to contribute positively to the school community. Gain skills which will be of benefit to them throughout their school lives and learn early the sense of achievement which can be gained through helping others.*

Fantuzzo, et al. (1995) in a study examined the effects of a home-based, parent involvement (PI) intervention on the self-concept and mathematics achievement of academically at-risk urban elementary school students. Seventy-two fourth and fifth grade students evidencing difficulties in mathematics were selected. Students were assigned randomly to three conditions: PI + RPT, PI and practice control (PC). Students self-concept reports showed that students in the PI +RPT and PI conditions

reported higher ratings of scholastic and behaviour conduct than the controls. *Students in the PI + RPT conditions perceived themselves as more socially confident than did PI or PC students.*

Sideridis, et al. (1997) investigated the effectiveness of Class-wide Peer Tutoring (CWPT) to enhance the spelling performance and social interactions of three typical students and three students with mild disabilities. Social interactions were assessed using the Multiple Option Observation System for Experimental Studies (M.O.O.S.E.S). Using an ABAB single subject design, results indicated that *CWPT resulted in increase of students duration of positive social interactions.*

Utay and Utay (1997) examined effects of combining cross-age tutoring, Peer Tutoring, cooperative learning, and computer mediated writing in a peer assisted learning package on writing skills of second through sixth graders with learning disabilities. Found that the *treatment group enjoyed working with partners, asked each other for help, had friendships extending outside the treatment setting and had improved attitudes towards writing.*

Gumpel and Frank (1999) in a study, examined the effects of a cross-age Peer Tutoring programme on the social skills of two sixth grade and two socially rejected and isolated kindergarten boys. Peer Tutoring consisted of the older boys conducting social skills training with their younger tutees. *The frequency of positive social interactions increased for all four boys.*

Harper, et al. (1999) conducted two Peer Tutoring programmes – class wide Peer Tutoring and class-wide student tutoring teams – for minority children with disabilities. *The Peer Tutoring programmes were used effectively to promote the academic and social integration of minority children with disabilities into general education settings.*

Kreuger and Braun (1999) used a Peer Tutoring programme in grades two and three of a school where the majority of children entering school do not speak English as

their first language. The programme *shows impressive gains made by the children in reading fluency, comprehension, and in spelling*. Noted the programme's *positive effects on reading attitudes, positive social skills, and self-esteem*.

Kamps, et al. (1999) in an investigation, formed peer networks consisting of students with autism and fourth grade peers. They were trained to tutor first grade students, in, sight word recognition. The purpose of the study was to determine if the target students could be trained effectively as tutors, to determine outcomes for the first graders, and to determine effects on social integration of network students. Effects were measured for implementation of tutoring steps, increase in sight words learned on a weekly basis for the tutees and social interactions among network students during free time activities. *Results demonstrated increased duration of social interaction time for the target students with autism and network companions*.

Presley and Hughes (2000) conducted a Peer Tutoring programme to teach social skills and anger control to high school students with emotional and behavioural problems. Students were taught social skills through Peer Tutoring. Results indicated that *students showed less intense anger in situations that happened during the rest of the school day*.

Dennison (2000) reported that a Big Buddies Program, which is a unique peer mentoring and tutoring project, was used as an *innovative approach for preventing school dropout, increasing youth's interest in volunteerism and expanding real-world learning experiences for university* undergraduate students in social work.

Rogers (2000) stated that peer mediated approaches and Peer Tutoring are *successful strategies in improving social functioning for children with autism*.

In a study reported by *Collins, et al. (2001)* an English teacher and peer tutors used a system of least prompt procedure to teach four secondary students with moderate disabilities to write letters within a secondary composition class setting. Students without disabilities simultaneously worked on composition assignments and taught

students with disabilities to write letters. The teacher collected data as to the attitudes of the students toward the students with disabilities. Results indicate that *it is possible to reliably incorporate direct instruction on functional academic skills within an inclusive setting.*

Kowalski and Fresko (2002) examined Peer Tutoring in higher education for students with visual impairment and students with learning disability. *Findings indicated social benefits for tutees and tutors.*

Mckinstery and Topping (2003) conducted a study which evaluated Peer Tutoring in thinking skills in a high school setting. Results indicated *development of self-esteem and social skills for tutees and tutors.*

Duran and Monereo (2005) analysed the process of interaction in pairs of students, organized into fixed and reciprocal tutoring. Emergence of two patterns-tutor's active pattern and tutee's reactive pattern, as well as *different styles of co-operative interaction were highlighted*

Peer scaffolding was examined by *Fair, et al. (2005)* in the context of an ongoing community outreach programme, in which children in the third grade were partnered with preschool aged children once a month to do crafts and other activities. Finally showed that *children did provide age-appropriate and task-appropriate scaffolding in the craft activities.*

Schleyer, et al. (2005) introduced a Peer Tutoring programme to help second year under graduate students tackle conceptual design problems. Peer tutors were trained to facilitate group sessions. *Students became more confident and more responsible for their own learning. Tutors improved their communication and leadership skills and became more responsible and employable.*

3.1.4. SUMMARY OF RESEARCH FINDINGS

Researches reviewed on Peer Tutoring with Achievement benefits (from the year 1975 to 2006) and no Achievement benefits (from the year 1991 to 2001), Retention benefits (from the year 1957 to 2002) and no/weak Retention benefits (2000) and researches showing social and personal benefits (from the year 1976 to 2005) are summarised as follows for an easy grasping.

RESEARCH SHOWING ACHIEVEMENT BENEFITS		
Year	Author	Result
1975	Sherman & Harris	Most substantial and consistent effect on classroom performance.
1976	Allen	Positive effects for tutors than for tutees.
1981	Hill & Tanveer	Considerable improvement and an improved attitude to mathematics.
1981	Sharpley & Sharpley	Same-age tutors were as effective as cross-age tutors in inducing cognitive advances in tutees.
1983	Russell & Ford	Had greater effects than supplementary instruction.
1984	Maher	Gains in attainment for both tutors and tutees .
1985	Wheldall & Mettem	Experimental group made significantly greater gains in reading.
1986	Cook, <i>et al.</i>	Raised the performance of tutors and tutees.
1986	Osguthorpe & Scruggs	Achieved positive effects for both tutors and tutees.
1986	Pigott, <i>et al.</i>	Under-achieving pupils improved their performance.
1986	Polirstok	Achieved positive effects for both tutors and tutees.
1987	Top & Osguthorpe	Improved the achievement of low-achieving older students.
1988	Balais	Gain more self-confidence, autonomy and academic independence and excellence.
1989	Atherly	Significant reading gains for the experimental group.

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1989	Bland & Harris	Encourage more on-task work among pupils.
1989	Brierley, <i>et al.</i>	Results suggested generalised improvement in spelling and skills.
1990	Benard	Improved academic achievement was noted.
1990	Fantuzzo, <i>et al.</i>	Consistent increase in rate of accurate arithmetic performance.
1990	Osguthorpe & Scruggs	Tutors and tutees performed better on outcome measures.
1990	Negroni	Peer Tutoring was suggested as a method for basic skills education.
1991	Malette	Daily practice of spelling words resulted in 95 percent correct on weekly tests.
1991	Mohr	Study reported academic achievement.
1991	Warger	Student test scores increased and failure was rare.
1992	Curtis & West	Peer Tutoring was used as a support mechanism.
1992	Fantuzzo, <i>et al.</i>	Peer Tutoring helped fourth and fifth grade students in maths
1992	Hoover	At-risk sixth graders met or exceeded project goals for academic achievement.
1993	Cline & McLaughlin	Moderate to substantial improvement in two Peer Tutoring conditions.
1993	DuPaul & Henningson	Helped students with attention deficit hyperactivity disorder.
1993	Gartner & Riessman	Effectiveness was consistent across the programme.
1993	Greenwood	Significant levels of growth in at-risk student's academic achievement.
1993	Houghton & Bain	Readers made significant gain in reading accuracy and comprehension.
1993	Sherwood	Achievement was reported.

1994	Ezell, <i>et al.</i>	Children's academic responding was greater during Peer Tutoring.
1994	Fasko	Improvement on work sheets during intervention.
1994	Fuchs	Student dyads provided more interactional explanations and sounder instructional principles.
1994	Hunt, <i>et al.</i>	Subjects independently promoted targeted basic skills.
1994	Martino	At-risk young people improved grade point averages and reading comprehension.
1994	Pagett	Empowered children with additional control over their own learning and made reading interesting and enjoyable.
1994	Riggio, <i>et al.</i>	All subjects exhibited significantly higher cognitive gains.
1994	Simmons, <i>et al.</i>	Significantly greater achievement in comprehension.
1995	Allen	Improvement was noted.
1995	Collopy & Green	Individual accomplishment was noted.
1995	Durrer & McLaughlin	Produced social and academic benefits.
1995	Enright & Arelrod	Increase the academic success most effectively.
1995	Fantuzzo, <i>et al.</i>	Higher level of accurate mathematics computations.
1995	Greenwood & Delquadri	Prevented early school failure and long term positive effects on academic outcomes.
1995	Kurian	Improved achievement in mathematics.
1995	Lumpe & Staver	Enhanced concept development.
1995	Samway, <i>et al.</i>	Positive influence on tutor's reading development.
1995	Simmons	Scored higher on reading fluency and comprehension.
1995	Wright, <i>et al.</i>	High cumulative daily levels of Spanish words learned by all of the tutees
1996	Berliner & Casanova	Improved student achievement and participation.
1996	Fager	Increased academic mastery themselves.

1996	Fuchs	Tutees of high-achieving tutors offered better explanations.
1996	Moore	Increased scores on standardized oral proficiency and basic skill tests.
1996	Robinson	Under prepared students were prepared for success in college.
1996	Wyann & Cadet	Improved student writing.
1997	Brady	All subject's academic responses increased.
1997	Ediger	Peer Tutoring was recommended as one of the ways of student grouping.
1997	Feng	Suggested as a method while developing curriculum and instruction for Asian-American students.
1997	Fuchs	Demonstrated greater reading progress.
1997	Ginsburg & Fantuzzo	Displayed significantly higher rates of mathematics achievement.
1997	Griffin & Griffin	Reciprocal Peer Tutoring help students to achieve learning objectives.
1997	Kraft & Billig	Suggested that schools had varying success.
1997	Lane	Weekly spelling test scores were substantially higher.
1997	Madrid, <i>et al.</i>	Programme accelerated and improved student mathematics achievement.
1997	Morrow	Children scored significantly better on tests of comprehension
1997	Rominski & Vazquez	Significant improvement in class. Improvement in writing process.
1997	Sideridis, <i>et al.</i>	CWPT resulted in gains in spelling accuracy of all students.
1997	Sills & Soden	Students felt extremely comfortable on both computer systems after training .
1997	Thorkildsen & Schmahl	Children rated Peer Tutoring as fairest.
1997	Utley	Study explored implications for students with disabilities.

1997	Zukowski	Cross-age tutoring was judged to be good for all students.
1998	Beachler & Glycer	Helped students to become experts on selected course material.
1998	Cardona & Artiles	Student's math performance was significantly higher.
1998	Dupaul, <i>et al.</i>	Improvement in performance in math and spelling.
1998	Dupaul & Eckert	Enhanced both academic performance and attentional behaviour.
1998	Geimer, <i>et al.</i>	Increase in student's reading comprehension.
1998	King	Peer Tutoring model promotes student's construction of new knowledge.
1998	King, <i>et al.</i>	Students constructed knowledge during tutorial interaction
1998	Longwill & Kleinert	Promoted general education, class participation and community inclusion.
1998	Parsons & Weldon	Student's self-esteem and educational progress were increased.
1998	Rafoth	Study-skills component positively impacted student's achievement and attitude.
1998	Shastri	Consistent gains in factual knowledge have been found.
1998	Weinsheimer	Positive and statistically significant impact on student's grades.
1999	Bindhu	Improved achievement in language.
1999	Chemidlin	Significant gain of fifth graders.
1999	Elbaum, <i>et al.</i>	Positive effects on student's reading.
1999	Farrington, <i>et al.</i>	Provided academic support.
1999	Kamps, <i>et al.</i>	Higher gains on weekly pre-tests for first graders than control students.
1999	Lake	Enhanced student performance.
1999	Olmscheid	Increased academic engagement.
1999	Platt	Progress on goals for the 1998-99 academic year

1999	Rathvon	Help children with learning and behaviour problems to achieve success.
1999	Santiago	Students outperformed mainstream classes in science achievement.
1999	Stauf	Peer support lead to personal academic accomplishment.
1999	Telecsan, <i>et al.</i>	Peer tutors reliably implemented the time delay procedure.
2000	Dixon & Gudan	Significantly higher course success.
2000	Fotoples	Helped in overcoming anxiety and influenced learning styles on mathematics achievement.
2000	Genesmer	Proved beneficial to both tutors and tutees.
2000	Luis & Kathryn	Indicated preference for use of discussion and Peer Tutoring.
2000	Schniedewind & Davidson	Helped students grow academically.
2000	Wynn, <i>et al.</i>	Engaged diverse students more fully in writing process.
2001	Bindhu & Kumar	Effective in making class room learning a joyful event.
2001	Bromfield, <i>et al.</i>	Cross-age tutoring will yield more positive effects.
2001	Collins & Onwuegbuzie	Indicated increase in academic performance.
2001	Evans & Flower	Peer Tutoring experiment was successful
2001	Greenwood, <i>et al.</i>	Students made considerable progress in mastering the curriculum.
2001	Nugent	Indicated progress in reading and positive attitude towards school.
2001	Solomon & Crowe	Use of peer tutor is an attractive and affordable alternative
2001	Sutherland & MacMillan	Peer tutoring was used as an instrument for success.
2002	Berry	Improvement in student achievement on Math and English.

2002	Brock	Peer Tutoring is important in working with students with attention problems for success.
2002	Cardona	Significant increase in number sense and arithmetic skills.
2002	Coenen	Showed positive outcomes throughout the programme.
2002	Kowalski and Fresko	Academic benefits for tutees and tutors
2002	Kumar & Bindhu	Effective for language attainment
2002	Perkins, <i>et al.</i>	Students taught by peers were more successful.
2002	Shinn, <i>et al.</i>	Suggested as a method to increase achievement in mathematics.
2002	Wilson	Class-size education is associated with improvement in pupil achievement.
2003	Hoysniemi, <i>et al.</i>	Results and experiences of using Peer Tutoring were promising.
2003	Mastropieri, <i>et al.</i>	Students significantly outperformed other students on content area tests.
2003	Mckinstery & Topping	Substantial gain in reading comprehension and development of thinking skills for tutees.
2003	Nestel & Kidd	Learning objectives were completely met
2004	Graetz	Peer Tutoring enhances the performance of Autism Spectrum Disorder students.
2004	Medcalf, <i>et al.</i>	Gains in terms of writing rate, accuracy and enjoyment of writing.
2004	Topping & Bryce	Better performance in thinking skills
2004	Topping, <i>et al.</i>	Effective pedagogical strategy for both tutors and tutees
2005	Crespo, <i>et al.</i>	The technique was proved to be both effective and well received by students
2005	Kassab, <i>et al.</i>	Tutors were perceived better in providing feedback.

2005	Mastropieri, <i>et al.</i>	Students in the tutoring condition outperformed students in traditional condition
2005	Nestel & Kidd	Formalizing peer assisted learning is a valuable resource
2005	Page, <i>et al.</i>	Tutoring system serves the student who is at risk of failing
2005	Schleyer, <i>et al.</i>	Students developed problem solving skills
2006	Heron, <i>et al.</i>	Most systematized and well researched of the peer mediated approaches relates to Peer Tutoring
2006	McMaster, <i>et al.</i>	Class-wide Peer Tutoring is effective in improving the reading performance
2006	Maheady, <i>et al.</i>	Class-wide Peer Tutoring is an effective tool to prevent reading failure.
RESEARCH SHOWING NO ACHIEVEMENT BENEFITS		
1991	Buskist, <i>et al.</i>	Use of peer tutors is not vital for student success.
1993	Torres	Objective of academic achievement was not met.
1994	Schmidt, <i>et al.</i>	Students guided by staff tutors achieved better.
1997	Ziegler	Decrease in class-size is not an efficient way of improving achievement.
1998	Griffin & Griffin	RPT have inconsistent effects on achievement, test anxiety and academic self-efficacy.
2001	Solomon & Crowe	Students struggled with basic facilitation skills and had difficulty.
RESEARCH SHOWING RETENTION BENEFITS		
1957	Smith, <i>et al.</i>	Cooperative group discussion facilitated individual memory of what was discussed.
1991	Malette	Ninety percent correct on spelling tests of long-term retention.
1992	Platt	Retention rates were noted for reading remediation.
1993	Harper, <i>et al.</i>	Short and long term retention was 72 percentage and 69 percentage correct respectively.

1994	Fasko	Data indicated that retention was promoted for several weeks time.
1994	Smith	Interaction among students effects retention of materials learned
1996	Kamps, <i>et al.</i>	Students acquire literary skills faster and retain more of what they learn.
1997	Rominski & Vazquez	Improvement was shown in recall skills.
1998	Weinsheimer	Noted positive and statistically significant impact on student's retention .
1999	Bindhu	Positive relation was found between peer teaching and retention in Malayalam language skills.
1999	Greenwood, <i>et al.</i>	Significant academic gain in content area, memorization and drill.
1999	Stauf	Noted student retention is up by five percent during the programme.
2001	Bindhu & Kumar	Effective for better retention .
2001	Platt	Total retention rates for students was 75 percent compared with 73 percent in the previous year.
2002	Chugh	If provided learning through joyous activities, retention rate would greatly improve.
2002	Kumar & Bindhu	Improved retention due to Peer teaching .
RESEARCH SHOWING NO/WEAK RETENTION BENEFITS		
2000	Dill & Boykin	Communal learning group students recalled most than Peer Tutoring students.
RESEARCH SHOWING SOCIAL AND PERSONAL BENEFITS		
1976	Devin, <i>et al.</i>	Low achievers benefit from tutoring younger students both academically and socially.
1982	Yogev & Ronen	Cross-age tutoring significantly increases the tutor's empathy, altruism and self esteem.

1983	Custer & Osguthorpe	Social interaction between tutors and tutees improved.
1986	Winter	Tutors showed remarkable patience and commitment after their teaching role in the programme.
1991	Bourgault	Personal growth of peer leaders were observed.
1991	James, <i>et al.</i>	Improvement in social interaction were observed.
1993	Harper, <i>et al.</i>	Students perceived positive social and self esteem outcomes.
1994	Fuchs	Student dyads provided more interactional explanations and incorporated sounder instructional principles.
1994	Sharp, <i>et al.</i>	Counsellors contributed positively to school community and learned the sense of achievement which can be gained through helping others.
1995	Fantuzzo, <i>et al.</i>	Students perceived themselves as more socially confident.
1997	Sideridis, <i>et al.</i>	CWPT resulted in increased positive social interactions.
1997	Utay & Utay	Treatment groups enjoyed working with partners and asked each other for help.
1999	Gumpel & Frank	Frequency of positive social interactions increased.
1999	Harper, <i>et al.</i>	Promoted the academic and social interaction of minority children.
1999	Kreuger & Braun	Noted positive social skills.
1999	Kamps, <i>et al.</i>	Results demonstrated increased duration of social interaction.
2000	Presley & Hughes	Students showed less intense anger.
2000	Dennison	Increased youth's interest in volunteerism.
2000	Rogers	Successful strategy in improving social functioning

2001	Collins, <i>et al.</i>	Possible to reliably incorporate direct instruction on functional academic skills within an inclusive setting.
2002	Kowalski & Fresko	Social benefits for tutees and tutors
2003	Mckinstery & Topping	Development of self-esteem and social skills for tutees and tutors
2005	Duran & Monereo	Different styles of co-operative interactions were highlighted
2005	Fair, <i>et al.</i>	Children provided age appropriate and task appropriate scaffolding
2005	Schleyer, <i>et al.</i>	Tutors improved their communication and leadership skills.

3.2. META ANALYSIS

Meta analysis is the *statistical summary* of the results of all the studies on a topic (Glass, *et al.*, 1981). The term is used to describe any *quantitative integration* of empirical research studies. It involves both the aggregation of effect size estimates across studies and the analysis of their covariation with features of the studies. According to McGaw (1988) Meta analysis is advantageous because with the separate study findings quantified and the study characteristics classified, the meta analyst does not have to hold the complex pattern of study variations in memory for integration as the narrative reviewer does. The pattern is captured and preserved in an explicit fashion, open to both checks and challenges.

Among the advantages of using Meta analysis, Fitz (1985) cites the following:

- Because educational research will need to proceed with considerable reliance on the use of small experiments, humble, small scale reports which have simply been gathering dust may now become useful.

- Small-scale research conducted by individual students and lecturers will be valuable since meta-analysis provided a way of coordinating results drawn from many studies without having to coordinate the studies themselves.
- For historians, a whole new genre of studies is created – the study of how effect size vary over time, relating this to historical changes.

In this part of the chapter, the investigator attempts to present the meta analysis of the researches reviewed in respect of Peer Tutoring with Achievement, Retention and Social and Personal Benefits. This is done with a view to examine statistically the underlying trends of the variable, Peer Tutoring in relation to student Achievement, Retention, Social and Personal benefits. For this purpose, researches relating to Peer Tutoring and Achievement, Peer Tutoring and Retention, Peer Tutoring and Social and Personal benefits were analysed based on the positive and negative nature of the results. Result of meta-analysis ie., percentage of studies on Peer Tutoring and Achievement, Peer Tutoring and Retention, Peer Tutoring and Social and Personal benefits both in positive and negative nature were computed. They are presented in Table 3.1.

TABLE 3.1

Result of Meta Analysis

Variables	No. of Positive Studies	Percentage	No. of Negative Studies	Percentage	No. of Total Studies
Peer Tutoring and Achievement	137 (1975-2006)	95.8	6 (1991-2001)	4.1	143
Peer Tutoring and Retention	16 (1957-2002)	94	1 (2000)	6	17
Peer Tutoring and Social and Personal benefits	25 (1976-2005)	100	--	--	25

The Meta analysis indicates that Peer Tutoring have *strong positive influence* on *Achievement*. 95.8 percentage of researches on Peer Tutoring and Achievement, ie.,

137 researches out of 143 reviewed yield Achievement benefits to the sample. But 4.1 percentage of researches yield no Achievement benefits. 94 percentage of researches on Peer Tutoring and Retention, ie., 16 researches out of 17 researches show positive relationship between Peer Tutoring and Retention. But six percentage of the researches yield weak Retention benefits with Peer Tutoring. 100 percentage of researches on Peer Tutoring and Social and Personal benefits, ie., 25 researches out of 25 show positive relationship between Peer Tutoring and Social and Personal benefits.

The percentage analysis indicates the growing trend in research on Peer Tutoring and Achievement, Peer Tutoring and Retention, Peer Tutoring and Social and Personal benefits in the positive direction.

3.2.1 INFERENCE DRAWN FROM LITERATURE SCANNING

From the literature scanning done, it was found that a number of studies were conducted in Western countries on Peer Tutoring in relation with Achievement, Retention, Social and Personal benefits. And nearly all of the studies (96 percentage) have proved that Peer Tutoring have consistent and most substantial effect on academic as well as non academic gains. Most of the studies conducted were in Reading, Writing, Vocabulary, Spelling and Arithmetics. It was revealed by the studies that Peer Tutoring is a promising Instructional Procedure and can be used from primary classes to post-graduation levels. Peer Tutoring was found equally effective in medical as well as computer fields.

A reasonable number of studies were conducted for low-achieving, learning disabled, attention deficit and behaviour disorder students. Studies have evidenced that Peer Tutoring can enhance educational outcomes and a sense of belonging for students with moderate and severe disabilities. Positive benefits were noted for all the participants involved in Peer Tutoring procedure - tutees and tutors. Considerable studies have highlighted greater gains on the part of tutors.

Studies on Peer Tutoring with Retention shows that Peer Tutoring has positive and significant impact on student's Retention. But as compared with Achievement, studies on Retention were few.

Effect of Peer Tutoring on Social and Personal benefits were also reviewed. Studies indicated that Peer Tutoring is the most effective tool to promote social interaction among children. Tutors exhibited remarkable patience and commitment. Personal growth of tutors was also noted. They became socially confident, more responsible and employable. In the studies, Peer Tutoring is viewed as an innovative approach for preventing school drop-out and bringing minority children with disabilities into general educational settings.

Though a thorough review was conducted in the field of studies on Peer Tutoring, the investigator sensed some gaps in the areas of research. Altogether 185 studies were collected from the area, out of which only five were from Indian context. Importance was given to English language reading and writing. Studies on Science subjects were very few, only two studies were conducted in Biology. So these gaps in the field of research on Peer Tutoring inspired the investigator to conduct the present study.

3.3 FORMULATION OF HYPOTHESES

On the light of the scanning of literature conducted and the inference drawn, the investigator formulated the following null hypotheses. Hypotheses were formulated on the basis of the objectives framed in chapter One. Formulation of hypotheses clarify the nature of the problem and the logic underlying the investigation and gives direction to the data-gathering process.

3.3.1. HYPOTHESES

The hypotheses formulated and tested for the study are the following:

- 3.3.1.1. There will be no significant difference in the mean *Pre-test scores* of the Experimental Group I and Control Group II, Boys and Girls
- 3.3.1.2. There will be no significant difference in the mean *Post-test scores* (Objective-wise and Total) of the Experimental and Control Groups, Boys and Girls.
- 3.3.1.3. There will be no significant difference in the mean *Gain scores* of the Experimental Group I and Control Group II, Boys and Girls.
- 3.3.1.4. There will be no significant difference in the mean *Retention scores* (Objective-wise and Total) of the Experimental and Control Groups, Boys and Girls.
- 3.3.1.5. In Pre-test received Experimental and Control groups, pupils taught through *Peer Tutoring* will not significantly differ in Achievement in Biology, than pupils taught through *Existing Method of Teaching*.
- 3.3.1.6. In Pre-test non received Experimental and Control groups, pupils taught through *Peer Tutoring* will not significantly differ in Achievement in Biology, than pupils taught through *Existing Method of Teaching*.
- 3.3.1.7. In Pre-test received Experimental and Control groups, pupils taught through *Peer Tutoring* will not significantly differ in Retention in Biology, than pupils taught through *Existing Method of Teaching*.
- 3.3.1.8. In Pre-test non received Experimental and Control groups, pupils taught through *Peer Tutoring* will not significantly differ in Retention in Biology, than pupils taught through *Existing Method of Teaching*.

**EFFECTIVENESS OF PEER TUTORING AND EXISTING METHOD
OF TEACHING ON ACHIEVEMENT AND RETENTION
IN BIOLOGY OF STANDARD VIII PUPILS**

RESHMA P.T.

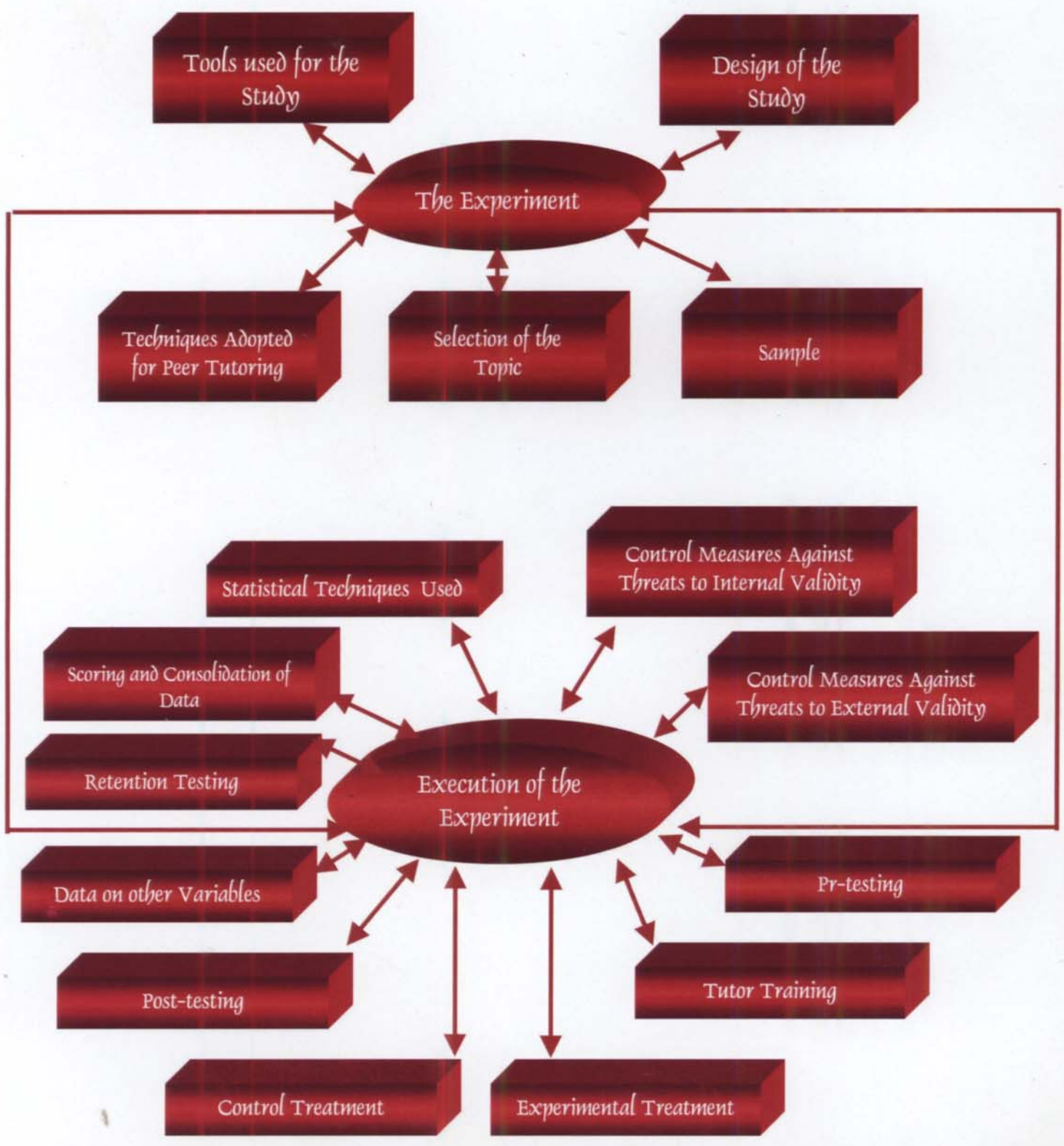
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2006

Modus Operandi

CHAPTER Four



CHAPTER

Four

Modus Operandi

The present study was intended to find out the *Effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology of Standard VIII pupils*. The study was conducted as a controlled Experiment. In this chapter the methodology of the study is presented under two major sections as the Experiment and Execution of Experiment. The major and sub-sections are given as follows.

4.1 THE EXPERIMENT

4.1.1 DESIGN OF THE STUDY

4.1.2. SAMPLE

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4.1. THE EXPERIMENT

In this section, the investigator explains how the experiment was conducted.

Planning the experiment

The major objective of the study was to find out the effectiveness of two Instructional Procedures (Peer Tutoring and Existing Method of Teaching) on Achievement and Retention in Biology. The study was planned to do as an experiment because, to know the effectiveness of an instructional procedure, Peer Tutoring, in relation with the Existing Method of Teaching, the effect should be compared. Since Peer Tutoring was not used as a teaching method in the present day classrooms, the investigator had to introduce the procedure in the classrooms and do experimentation.

Since the effect of two levels of Instructional Procedures namely Peer Tutoring and Existing Method of Teaching were to be known, Instructional Procedure was considered as the Independent Variable. Effectiveness can be assured only by measuring the outcome, therefore *Achievement* and *Retention* in Biology were considered as Dependent Variables.

Since Achievement and Retention of pupils were to be measured, it was decided to treat Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status as Control variables. It was noted that these variables had profound influence on final accomplishment.

For the Experiment, the investigator planned to select Experimental groups for applying Peer Tutoring and Control Group for applying Existing Method of Teaching. Based on the design of the experiment, two intact Experimental groups and two Control groups were selected.

4.1.1. DESIGN OF THE STUDY

The true Experimental Design has been selected as the design for the present study which is explained as follows.

4.1.1.1 Design selected

The *Solomon Four-Group Design* has been selected as the particular experimental design for the study. In this design, there will be *two Experimental groups* and *two Control groups*. Out of the four groups, only one Experimental group and one Control group will receive Pre-test. But all the four groups will receive Post-test.

With Solomon Four-Group Design, an Experimenter can test decisively whether the post-test differences were caused by the treatment, the pre-test, or the combination of treatment-plus-pre-test. This is an expensive design because it requires four groups of subjects to test the effects of only two levels of a treatment. The four groups are

needed because in addition to the treatment and no-treatment groups, there is pre-tested and non-pre-tested groups.

Solomon Four Group Design is really a combination of the *Post-test only* and the *Pre-test Post-test Equivalent Groups Design*. This design offers the separate advantages of Post-test only, Equivalent -Group Design (no interference from Pre-testing effects) and Pre-test Post-test Equivalent - Groups Design (greater precision from the Pre-test score as baselines against which to measure the effects of the treatment). In addition, it enables the experimenter to see whether the combination of pre-testing plus treatment produces an interaction effect. (Kidder, 1981).

Solomon Four - Group Design provides for *two simultaneous experiments* and therefore the advantages of *a replication* are incorporated. A major difficulty is finding enough subjects to assign randomly to four equivalent groups. But when ANCOVA is used, the experimenter can *statistically control for differences on the pre-test or other variables* so that post-test differences would not be due to initial differences prior to training (Best & Kahn, 2006).

The design is illustrated as follows

<i>R</i>	<i>O₁</i>	<i>X</i>	<i>O₃</i>
<i>R</i>	<i>O₂</i>	<i>C</i>	<i>O₄</i>
<i>R</i>		<i>X</i>	<i>O₅</i>
<i>R</i>		<i>C</i>	<i>O₆</i>

Where,

- R* : Random assignment of subject to groups
- X* : Exposure of a group to Experimental Treatment
- C* : Exposure of a group to the Control Condition
- O₁* : One Experimental group, receiving Pre-test
- O₂* : One Control group, receiving Pre-test

$$\left. \begin{array}{l} O_3 \\ O_4 \\ O_5 \\ O_6 \end{array} \right\} \text{All four groups, receiving Post-test}$$

$$\left. \begin{array}{l} O_3 - O_1 : \\ O_4 - O_2 : \end{array} \right\} \text{Gain score}$$

4.1.2 SAMPLE

Standard VIII pupils of secondary schools of Kerala State were considered as the population for the present study. As it is an experimental study, it was difficult to collect data from a large sample. Therefore, four schools, of reasonable physical distance were selected for treatment. Two of these schools were treated as the Experimental groups and the other two as the control groups by tossing the coin. Certain aspects of these four schools were considered in the selection to ensure the equivalence of the groups. These aspects are described as follows.

4.1.2.1 Rural-Urban Locality

The four schools selected were situated in semi-urban areas of Kozhikode and Malappuram districts.

4.1.2.2. Sex

All the four schools selected for Experimental and Control groups were co-educational institutions.

The convenience of the schools to conduct the experiment and the physical distance between the four schools (so that the students of these four groups cannot mingle mutually) were also considered in the selection of the sample. The study was conducted using a *True Experimental Design*, and therefore the equivalence of the

Experimental and Control groups was to be established by randomly assigning the subjects to Experimental and Control treatments. But in the present study random assignment of subjects was not possible *as four intact classroom groups* from four different schools were assigned as Experimental and Control groups. Anyway random assignment was done while classifying classroom groups to Experimental and Control treatments by tossing the coins.

Investigator, though not necessary, used ANCOVA for group comparisons, because ANCOVA can be used, if, even with random assignment the groups are not exactly equal. ANCOVA permits to *statistically control* for differences on the pre-test and other variables so that post-test differences would not be due to initial differences prior to treatment. So the four class groups were *equated* in their Previous knowledge of the subject matter (Pre-test score), Verbal Intelligence, Non- verbal Intelligence, Learning Strategies and Socio-Economic Status. Appropriate tools were used for this purpose.

4.1.2.3 Allocation of Experimental and Control Groups

Four intact class groups of standard VIII students from four schools in Kozhikode and Malappuram districts were selected for the experiment. These schools were allocated as Experimental and Control groups by the toss of a coin.

Details of the schools are given as follows

Sl. No.	Name of School	Nature of Group
1.	RHS, Vaidyarangadi	Control
2.	NNMHSS, Chelembra	Control
3.	GMHSS, University Campus	Experimental
4.	GHSS, Narikkuni	Experimental

Actual number of subjects in the Experimental and Control groups at the entry stage of the experiment are shown in the break-up.

Sample	Experimental Group	Control Group	Total
Boys	48	53	101
Girls	56	49	105
Total	104	102	206

The Experimental groups were taught through Peer Tutoring and the Control groups were taught through Existing Method of Teaching.

4.1.3. SELECTION OF THE TOPIC

The topic for treatment in the present study have been selected from the syllabus prescribed for standard VIII pupils of Kerala State for the academic year 2004-2005. The investigator thoroughly reviewed the Biology text book of standard VIII for selecting the topics. Three units were selected which were found suitable for teaching through Peer Tutoring and Existing Method of Teaching. They are *Interdependence in the Living World, The Cell* and *Excretion*.

4.1.4 TECHNIQUES ADOPTED FOR PEER TUTORING

While conducting Peer Tutoring and Tutor Training, investigator followed certain techniques which are described in the following section .

4.1.4.1. Tutor Training

Tutor training is the training given to the student tutors by the investigator. Training was given to the tutor because they are also students unaware of the methods, skills and techniques involved in teaching. Research (Legrain, *et al.*, 2003) has also indicated that trained tutors have higher scores on coaching skills than the untrained tutors. Training was given to *prepare the tutors* for the new role. Training for the mastery of the subject being taught, to direct practice of the techniques to be utilized and to put the tutee at ease.

Training was given to the tutors by the investigator and guided the tutors throughout the programme. Training was mainly in the form of *verbal instructions* and wherever necessary the investigator incorporated techniques like role playing and

demonstration of desired behaviour. The content or the subject matter was conveyed to the tutors in the form of concepts.

Topping (1988) suggests that specific training meetings must always lead on immediately to direct practice of the techniques to be utilised. The investigator conducted tutor training reasonably earlier to the Peer Tutoring session, so that the tutors can practice and refine the techniques and subject matter. The investigator specified in advance the date, time, place, length and frequency of training sessions.

4.1.4.2. Peer Tutoring Sessions

In the present study, Peer Tutoring was conducted for a whole class as small *group instruction*. That is, the whole class was divided into several groups of five to six members. A tutor was allotted for each group. Tutors are the members of the same class. Tutors were selected with the help of their subject teacher on the basis of the efficiency of student in the particular subject. Students who are *smart* and *helpful* and having a certain degree of *status* among their peers were selected. The investigator monitored the tutoring sessions.

All tutoring sessions were pre-scheduled between the *investigator*, *the tutor* and *the tutee*. Peer tutoring was conducted at least three hours per week. Each session was of approximately 45 minutes duration, ie., Peer Tutoring was conducted mainly in student's class hours.

4.1.5. TOOLS USED FOR THE STUDY

Descriptions of the tools used for the study are presented in this section.

4.1.5.1. Training Module for Tutor Training (TMTT)

Literature regarding different types of tutoring and tutor training procedures were reviewed by the investigator (Barron & Foot, 1991; Canobi, 1971; Ehly & Larsen, 1980; James, *et al.*, 1991; Johnson & Johnson, 1975; Lippitt & Lippitt, 1973; Perlstein, 1971; Rings & Sheets, 1991; Topping, 1988; Widerholt, *et al.*, 1983; Wright, 1971) From the reviewed literature it was clear that, simply putting two students

together, one who has information and skill and the other who does not, probably will not result in significant improvement of the one needing help. Any effective Peer Tutoring programme must have tutor training components.

Based on the reviewed literature the investigator prepared Training Module for Tutor Training. The topics selected for treatment were thoroughly analysed by the investigator and the major concepts and minor concepts identified. The three units, were again divided into lessons. Training Module was prepared for each lesson based on the major and minor concepts. Altogether 25 Training Modules were prepared and each Module was of one and a half hours duration.

The Training Module was in the form of a script with *three phases*. The phases are sequential and progressive in nature. In the first phase, *introductory phase*, the teacher introduce the concept of Peer Tutoring to the students. Second phase is the *teaching phase* in which the teacher introduces the topic and develops the concepts among the tutors. In the third phase, *training phase*, teacher trains the tutors to convey the concepts to the tutees.

Model Training Module both in Malayalam and English are presented in Appendix IA and I B.

4.1.5.2. Peer Tutoring Module (PTM)

Peer Tutoring is a specialised strategy of learning in which pupils teach their peers themselves. Peer Tutoring sessions were carried out on the basis of a Tutoring Module prepared in the subject Biology. The Peer Tutoring Module have been prepared by the investigator as per the suggestions of Topping (1988).

The three units in the Biology text book of standard VIII have been selected as the topics for treatment. These units were further divided into sub-units or lessons. Peer Tutoring Module have been prepared for each lesson. Twentyfive Peer Tutoring Modules were prepared and each Module was of 45 minutes duration.

As a first step in the preparation of Module, the objectives behind teaching each lesson have been specified. The Peer Tutoring Module is in the form of a script containing *three phases*. The phases are in a sequential order. In the *first phase*, the teacher introduces the concept of Peer Tutoring to the students. Then the whole class is divided into five or six groups containing five to six members depending upon the class size. Seating order of the class is rearranged to a *horse shoe* shaped model so as to facilitate Peer Tutoring. By such an arrangement teacher can watch all the groups at the same time. Each group has its own working space without disturbing each other. The diagrammatic representation of seating arrangement is shown in Figure 4-1.

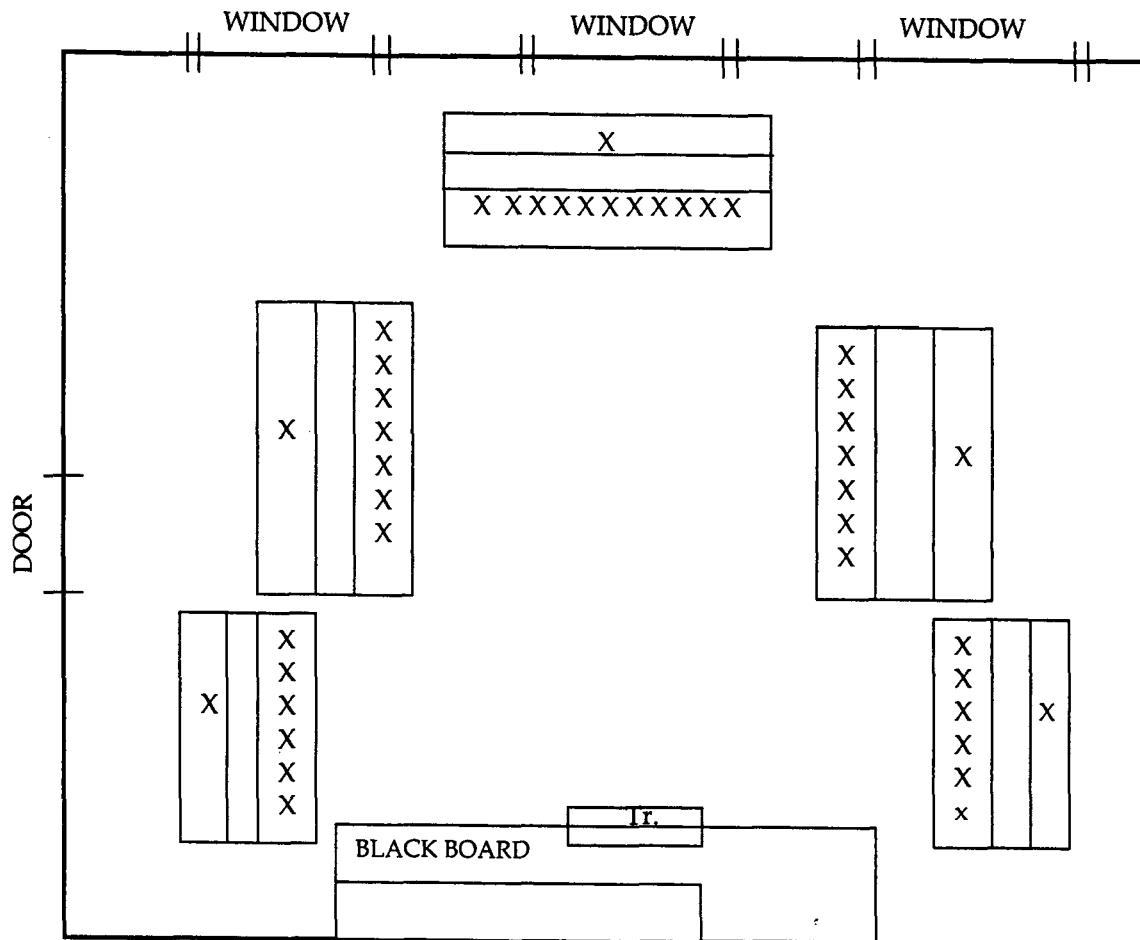


FIGURE 4 - 1 Classroom Seating Arrangement

In the *second phase* following the first phase, the trained tutors, tutor the tutees on the prescribed content area. Children learn considerably better if they have the opportunity to learn from their peers. During the tutoring phases, both the tutors and tutees enjoy the working atmosphere in the classroom and valid experience are gained by both of them. In the *third phase*, the tutor- tutee groups are dispersed and the teacher gives a conclusion as an end of Peer Tutoring sessions.

The Try out

After preparation, the draft training and Peer Tutoring Modules have been presented to a panel of experts for scrutiny. The training and tutoring modules after scrutiny have been tried out by the investigator. The Tutor Training Modules were tried out on six to eight tutors selected from a school to examine whether the training modules are efficient to impart training to the tutors.

The Peer Tutoring Modules were also subjected to try out on a class of standard VIII students adopting the *trained tutors* as instructors. This is done with a view to work out, its application in the experimental situation. After try out necessary changes were made and the modules have been finalised.

The Peer Tutoring Modules in Malayalam and English are presented in Appendix IIA and II B.

4.1.5.3. Lesson format for Existing Method of Teaching

The investigator has prepared Lesson Format for Existing Method of Teaching, for the control groups, on the basis of new curriculum introduced to secondary school classes in the year 2002-2003, in Kerala State. The different steps included in the Lesson Format are described as follows.

- I. Curriculum Objectives*** : It includes the objectives to be attained among the pupils by teaching the particular lesson.
- II. Learning Materials*** : It consists of all the teaching/learning support materials which could be used by the teacher while teaching the content.

III. Development : It includes the presentation of content, presentation of the behavioural specifications, presentation of appropriate activities and evaluation techniques.

IV Follow up Activities : It consists of the future activities to be carried out by the pupils for ascertaining the knowledge gained.

Lesson Formats have been prepared by giving importance to the competencies that should be developed among the students rather than for the coverage of portions. Twentyfive Lesson Formats of 45 minutes duration were prepared.

Model Lesson Formats in Malayalam and English are presented in Appendix III A and III B.

4.1.5.4. Achievement Test in Biology (ATB)

Measure on criterion tests are necessary for determining the effectiveness of Instructional Procedures (Peer tutoring and Existing Method of Teaching). So an Achievement Test in Biology has been prepared by the investigator on the topics selected for treatment. The present test is based on the Taxonomy of Educational Objectives suggested by Bloom (1979). This test was used as the *Pre-test*, the *Post-test* and *Retention test* in this study. The procedure adopted for the construction of *Achievement Test in Biology* is described in the following section.

a. Planning of the Test

The curriculum, syllabus and text book of Biology for standard VIII pupils for the academic year 2004-2005 have been thoroughly studied by the investigator. Also, the investigator consulted with experienced teachers in Biology for guidance. Moreover, following books have been referred for framing items for the test.

1. *Testing and Evaluation in the Biological Science* (Commission of Undergraduate Education in the Biological Sciences, 1967)
2. *Constructing Achievement Tests* (Gronlund, 1968)
3. *Measurement and Evaluation in Teaching* (Gronlund, 1976).

4. *Taxonomy of Educational Objectives* (Bloom, 1979).
5. *Essentials of Educational Measurement* (Ebel & Frisbie, 1991).

It was decided that the test will consist of 50 multiple choice items. The duration of the test has been fixed for 50 minutes. The maximum marks fixed for the test is 50.

b. Preparation of the Test

Items for the Achievement Test in Biology have been prepared on the basis of the major Objectives in the cognitive domain namely *Knowledge, Comprehension, Application, Analysis, Synthesis* and *Evaluation*.

In the preparation of the test, due weightage have been given to the Objectives, Content and Difficulty level.

1. Weightage to Objectives

The weightage given to different objectives for the Achievement Test is given in Table 4.1.

TABLE 4.1
Weightage to Objectives

Sl. No.	Objectives	No. of Questions	Marks	Percentage
1	Knowledge	15	15	30
2	Comprehension	18	18	36
3	Application	7	7	14
4	Analysis	6	6	12
5	Synthesis	1	1	2
6	Evaluation	3	3	6
	Total	50	50	100

2. Weightage to Content

After a thorough analysis, of the three units, adequate weightage have been given for each units. The weightage given is presented in Table 4.2.

TABLE 4.2

Weightage to Content

Sl. No.	Content	No. of Questions	Marks	Percentage
1	Interdependence in the Living World	18	18	36
2	Cell	17	17	34
3	Excretion	15	15	30
	Total	50	50	100

3. Weightage to Difficulty Level

The weightage given to the three levels of difficulty for the Achievement Test is given in Table 4.3

TABLE 4.3

Weightage to Difficulty Level

Sl. No.	Difficulty Level	No. of Questions	Marks	Percentage
1	Easy	14	14	28
2	Average	29	29	58
3	Difficult	7	7	14
	Total	50	50	100

4. Blue Print

A blue print specifying the content covered by the test in relation to the weightage assigned for different objectives has been prepared by the investigator. The items for the draft test have been prepared on the basis of this blue print. The blue print for the final test is presented in Table 4.4.

TABLE 4.4

Blue Print for Achievement Test in Biology

Objectives Content	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total No. of Questions	Total marks
1. Inter dependence in the living world	(5) ⁵	(6) ⁶	(4) ⁴	(2) ²	-	(1) ¹	18	18
2. Cell	(5) ⁵	(7) ⁷	(1) ¹	(2) ²	(1) ¹	(1) ¹	17	17
3. Excretion	(5) ⁵	(5) ⁵	(2) ²	(2) ²	-	(1) ¹	15	15
Total No. of Questions	15	18	7	6	1	3	50	
Total Marks	15	18	7	6	1	3		50

Note : Figure in brackets indicate marks and those outside the bracket indicate number of questions.

Based on the blue print, triple times (150) of the number of items have been prepared by the investigator. All items were prepared, giving due weightages to six *instructional objectives*. The answers for the objective type items should be in one word or one sentence, which can be selected from the given four alternatives, separate response sheets were given to the students. Standardisation of the Achievement Test in Biology was done by the investigator, before final data collection. Examples of items are given as follows.

Example for Knowledge item

1. Name of the blood vessel which bring blood to the kidney?
- A) Renal vein B) Aorta
C) Posterior Venacava D) Renal artery.

Example for Comprehension item

2. If the number of large fishes in a river increases beyond limits, what will happen to the number of small fishes?
- A) Will increase B) Will decrease
C) Same as before D) Increase or continue as same

Example for Application item

- 3) What will be the most holistic comment which could be given to a child who is about to prepare a balanced aquarium using water, aquatic plants and tadpole.
- A) To construct a balanced aquarium bacteria is necessary
B) Aquarium should be kept in sunlight
C) Plants should always be more in number than animals
D) Man could never create a completely balanced aquarium

Example for Analysis item

4. A Crocodile eat a lamb. Soon after that, a plover bird enters the mouth of crocodile and picks up the food particles. According to the concept of food chain, which of the trophic level does the Plover bird belongs to ?
- A) Producer B) Primary consumer

- C) Secondary Consumer D) Tertiary consumer

Example for Synthesis item

5. A Biologist classified chemical substances according to their contribution towards the existence of a cell. To which among the following will be chlorophyll most suitable.
- A) Nutrition B) Movement
C) Reproduction D) Energy exchange

Example for Evaluation Item

6. In Vertebrates, more amount of energy is required for the activities of heart than those required for brain. Which among the following is the reason for this?
- A) A muscle cell is longer than a nerve cell.
B) Muscle contraction is a rigorous action than nerve impulses.
C) Muscular activities need more movements than nervous activities.
D) Muscles have more lipid deposit than in nerves.

5. The Try out

The draft test with 150 multiple choice items was tried out by the investigator on a representative sample of 150 students in four class divisions of standard VIII in a school other than the Experimental and Control Subjects were selected. Before the administration of the test, the purpose of the test was made clear to the subjects. The draft test material and response sheets in sufficient numbers were provided to the students. The test material included all the necessary guidelines about the test and additional informations needed were given by the investigator. All the 150 response sheets were scored with the help of a window screen prepared as per the scoring key.

Incomplete response sheets were deleted and 142 response sheets were selected for item analysis.

6. Item Analysis

The procedure suggested by Ebel and Frisbie (1991) was employed for item analysis. The selected response sheets were arranged in the descending order of the magnitude of scores. The scores obtained by the upper 38 subjects (27%) and lower 38 subjects (27%) 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 was found out.

7. Difficulty Index

The difficulty index of an item is considered as the percentage of the group to which the subjects have given the correct response, that is, the larger the index, the easier the item. The following formula suggested by Ebel and Frisbie (1991) was employed to calculate the difficulty index of each item.

$$\text{Difficulty Index} = \frac{U + L}{2 N}$$

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

8. Discriminating Power

The higher the average discrimination index for items in a test, the more variables the scores are likely to be and the more reliable the scores are expected to be

(Ebel & Frisbie, 1991). Formula used for calculating the discriminating power of each item is as follows.

$$\text{Discriminating Power} = \frac{U - L}{N}$$

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 4.5.

TABLE 4.5

**Difficulty Index and Discriminating Power of
150 items of Achievement Test in Biology for Standard VIII Pupils**

Item No.	U	L	DI	DP	Item Selected	Item No.	U	L	DI	DP	Item selected
1	50	41	0.86	0.17		31	50	36	0.81	0.26	
2	40	24	0.6	0.3	✓	32	38	18	0.53	0.38	✓
3	47	31	0.73	0.3		33	26	14	0.38	0.23	
4	42	24	0.62	0.34	✓	34	26	23	0.46	0.06	
5	29	14	0.41	0.28		35	41	22	0.6	0.36	✓
6	52	38	0.85	0.26		36	25	9	0.32	0.30	
7	48	31	0.74	0.32		37	28	20	0.45	0.15	
8	42	24	0.62	0.34	✓	38	23	12	0.33	0.21	
9	47	34	0.76	0.25		39	27	9	0.34	0.34	✓
10	13	15	0.26	-0.04		40	35	11	0.43	0.45	✓
11	43	21	0.6	0.42	✓	41	21	9	0.28	0.23	
12	34	26	0.56	0.15		42	19	9	0.26	0.19	
13	13	8	0.2	0.1		43	30	12	0.4	0.34	✓
14	42	18	0.57	0.45	✓	44	23	12	0.33	0.21	
15	25	6	0.29	0.36		45	16	9	0.24	0.13	
16	47	30	0.72	0.32	✓	46	24	19	0.40	0.09	
17	29	14	0.41	0.28		47	34	17	0.48	0.32	✓
18	32	7	0.37	0.47	✓	48	42	27	0.65	0.28	✓
19	39	24	0.59	0.28		49	20	13	0.31	0.13	
20	25	19	0.42	0.11		50	35	13	0.45	0.42	✓
21	42	24	0.62	0.34	✓	51	39	17	0.52	0.42	✓
22	33	13	0.43	0.38	✓	52	26	13	0.37	0.25	
23	25	9	0.32	0.30		53	28	15	0.41	0.25	
24	29	11	0.38	0.34	✓	54	24	13	0.35	0.21	
25	20	12	0.30	0.15		55	37	11	0.45	0.49	✓
26	27	11	0.36	0.30		56	17	7	0.23	0.19	
27	22	3	0.24	0.36		57	22	21	0.4	0.02	
28	14	11	0.24	0.06		58	18	17	0.17	0.02	
29	23	9	0.3	0.26		59	7	11	0.17	-0.08	
30	21	6	0.25	0.28		60	18	7	0.24	0.20	

Contd. . .

61	23	15	0.36	0.15	
62	18	10	0.26	0.15	
63	17	7	0.23	0.19	
64	41	14	0.52	0.5	✓
65	16	10	0.25	0.11	
66	10	8	0.92	0.04	
67	26	23	0.46	0.06	
68	20	13	0.31	0.13	
69	13	9	0.21	0.08	
70	23	14	0.35	0.17	
71	9	15	0.23	-0.11	
72	42	20	0.58	0.41	✓
73	31	19	0.47	0.23	
74	35	12	0.44	0.43	✓
75	34	21	0.52	0.25	
76	23	9	0.3	0.26	✓
77	16	11	0.25	0.09	
78	27	9	0.34	0.34	✓
79	31	12	0.40	0.36	✓
80	22	8	0.28	0.26	✓
81	34	20	0.51	0.26	✓
82	24	12	0.34	0.23	
83	26	15	0.39	0.21	
84	31	13	0.42	0.34	✓
85	6	9	0.14	-0.06	
86	42	21	0.59	0.4	✓
87	24	8	0.30	0.30	✓
88	25	22	0.44	0.04	
89	25	12	0.35	0.25	
90	23	7	0.26	0.30	✓
91	14	13	0.25	0.01	
92	10	7	0.16	0.06	
93	7	6	0.12	0.02	
94	23	14	0.35	0.17	
95	23	10	0.31	0.25	
96	16	17	0.31	-0.02	
97	33	18	0.48	0.6	✓

98	18	7	0.24	0.21	
99	11	10	0.2	0.02	
100	7	14	0.2	-0.13	
101	24	15	0.37	0.17	
102	8	11	0.10	-0.06	
103	38	12	0.47	.49	✓
104	5	8	0.12	-0.06	
105	31	13	0.42	0.34	✓
106	30	14	0.42	0.30	✓
107	18	16	0.02	0.04	
108	21	9	0.28	0.23	✓
109	14	7	0.4	0.13	
110	17	9	0.25	0.15	
111	11	9	0.19	0.03	
112	31	15	0.43	0.30	✓
113	16	10	0.25	0.11	
114	29	15	0.42	0.26	✓
115	24	17	0.39	0.13	
116	30	19	0.46	0.21	
117	27	17	0.42	0.19	
118	33	14	0.44	0.36	✓
119	26	16	0.39	0.19	
120	20	8	0.26	0.23	
121	10	10	0.19	0	
122	20	12	0.3	0.15	✓
123	26	10	0.34	0.3	✓
124	20	15	0.33	0.09	
125	18	11	0.27	0.13	
126	10	8	0.17	0.03	
127	26	13	0.37	0.25	✓
128	16	10	0.25	0.11	
129	18	8	0.25	0.19	✓
130	22	14	0.34	0.15	
131	31	16	0.44	0.28	✓
132	11	11	0.21	0	
133	12	11	0.22	0.02	
134	9	9	0.17	0	

Contd. . .

135	12	18	0.28	-0.11		143	29	9	0.36	0.38	✓
136	32	9	0.39	0.43	✓	144	21	15	0.34	0.11	
137	15	13	0.26	0.04		145	27	11	0.36	0.30	
138	7	12	0.18	-0.09		146	13	10	0.22	0.06	
139	23	10	0.31	0.25		147	23	11	0.32	0.23	
140	29	11	0.38	0.34	✓	148	27	8	0.33	0.36	✓
141	24	11	0.33	0.25		149	9	10	0.18	-0.02	
142	32	6	0.36	0.5	✓	150	3	17	0.19	-0.26	

U - Number of correct responses in upper group

L - Number of correct responses in lower group

DI - Difficulty Index of the item

DP - Discriminating power of the item.

The investigator decided to select from the total items of draft test, items having discriminating power more than 0.4 and difficulty index between 0.4 and 0.6 initially. When adequate number of items were not available, the investigator decided to make some adjustments in this limit. Some items having discriminating power 0.27 and above with difficulty index in between 0.29 and 0.72 were selected. There were 50 items in the final test. The time duration fixed for the test was 60 minutes, and the maximum score was 50.

c. Validity of the Test

There are various methods of estimating the validity of a measuring instrument. The following types of validity were established for the Achievement Test.

1. Content Validity

Content validity was estimated by evaluating the relevance of the test item individually and as a whole (Freeman, 1976). Content validity is most appropriately applied only to tests of proficiency and educational achievement. This type of test is

designed to measure how well the individual has mastered a specific skill or course of the study. The investigator subjected the test items *for expert's* evaluation. As per the expert's evaluation, the test content covers the significant concepts and is comprehensive enough in terms of the instructional objectives. Thus the content validity of the Achievement Test in Biology was established.

2. Face Validity

To establish face validity, items of the Achievement Test was subjected to expert's evaluation. The experts confirmed that the items were *able to measure* Achievement in Biology of standard VIII pupils.

3. Criterion Related Validity

To estimate the criterion related validity of the test, criterion related technique was used. The final test was administered on a representative sample of 48 students in one class division of standard VIII in a school other than the Experimental and Control subjects were selected. The response sheets were collected and scored. The second term examination marks in the same subject (Biology) of the same sample were collected. Then the Pearson's Product Moment Correlation Coefficient of the two sets of scores was calculated to find out the validity of the Achievement Test. The coefficient of correlation was found to be **0.65**. It indicates that the test is a substantially valid tool to measure the Achievement in Biology.

d. Reliability of the Test

Split-half method was applied to calculate the reliability of the Achievement Test. The scores of the odd and even numbered items were correlated using Pearson's formula of Product Moment Correlation (Garrett, 2004). There were 25 items in each half. For this purpose the Achievement Test was administered on a representative sample of 50 students and the scores thus obtained were utilized for studying the reliability of the test.

The formula to find the Product Moment Correlation is

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{N \sum X^2 - (\sum X)^2 N \sum Y^2 - (\sum Y)^2}}$$

where,

$\sum X$ = Total score for first half items. .

$\sum Y$ = Total score for second half items.

N = Number of students.

This gave the reliability of the half test. The reliability of the half test thus was 0.69. This was corrected for full length of the test by using Spearman Brown Prophecy formula (Best & Kahn, 2006)

$$r = \frac{2r}{1+r}$$

The reliability thus obtained was **0.82**. The final Achievement Test in Biology, and its response sheets both in Malayalam and in English and scoring key are presented in Appendix IV A, IV B, IV C, IV D, and IV E.

4.1.5.5 Retention Test

Retention is remembering over an extended period of time what has been previously taught. (Wood, 1984). A Retention test was conducted *one month* after the treatment to measure the memorization and the retrieval of information. The Achievement Test in Biology was used as the *Retention Test* because the information to be retrieved from the memory of pupils is the content in Biology taught during treatment. The procedure undertaken in the preparation of Achievement Test in Biology is described in section 4.1.5.4.

A baseline should be needed from which to measure Retention (Deese & Hulse, 1967). The actual quantity of the learned material existed immediately after the learning is over, can be considered as the baseline. In the present study, an Achievement Test (Post test) was conducted, immediately after the completion of the treatment, for this purpose. After the Retention interval (one month), the same test (Retention test) was conducted again, in which the subject has to reproduce the learned material by *recall*, *recognition* and *reconstruction*. Then the amount of learned material forgotten after one month is measured. $Amount\ forgotten = Amount\ learned - Amount\ retained$ (Deese & Hulse, 1967). The amount of Retention is calculated by subtracting the amount forgotten from the amount learned.

4.1.5.6. Pre - Test

The Achievement Test in Biology (ATB) for standard VIII pupils, prepared by the investigator was used as the Pre-test. The procedure undertaken in the preparation of Achievement Test in Biology is described in section 4.1.5.4. Before the treatment, the subjects in one Experimental group and one Control group was given the same Pre-test in order to measure the *initial status* of the students in terms of the Achievement in Biology. A Post - test was conducted in order to measure the final status of the students in terms of Achievement in Biology. The Achievement Test in Biology was used as the Post-test. Post - test was conducted for all four groups. (Two Experimental and two Control groups).

4.1.5.7. Verbal Group Test of Intelligence (VGTI)

Verbal Group Test of Intelligence was used in this study, for measuring the Control variable Intelligence (Verbal). The test was developed and standardized by Kumar, *et al.* (1997). The test battery consists of five sub tests, namely, *Verbal Analogy*, *Verbal Classification*, *Numerical Reasoning*, *Verbal Reasoning* and *Comprehension*. Each sub test consists of 20 items. The duration of the test is one hour. Detail of the subtests are given in the following section.

Test I - Verbal Analogy

In this test, two sets of words are given in each item. One set consists of two related words and in the next set one word is missing. The subject has to find out the relationship between the two words in the first set and then apply this relationship to find out the missing word in the next, from the four alternatives given.

Example :

1. Thirst : Water : : Hunger :

- A. meat B. Leisure C. Food D. Weariness

A	B	C✓	D
---	---	----	---

Test II - Verbal Classification

In this test, four words are given under each item. Among these, three words can be grouped together and the fourth one is an odd one. The subject has to choose the odd one from the four words.

Example :

1. A. Teacher B. Principal C. Student D. Professor

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.

Example for Series type

1. 0, 2, 4, --, 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
---	----	---	---

Example 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, & 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 reestablished using criterion related techniques. The validity coefficients obtained (Sub test - wise and Total test) are given in Table 4.6.

TABLE 4.6
**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 adapted 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 reestablished by the investigator using the split-half method and the reliability coefficient has been corrected using Spearman Brown Prophecy Formula. The reliability coefficients of the five sub tests and the total test are given in Table 4.7.

TABLE 4.7

Reliability Coefficients 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 Intelligence (Verbal). The internal structure of the VGTI has been reexamined by the investigator correlating the Component- wise score with Total score on the VGTI. The inter correlation matrix is presented in Table 4.8.

TABLE 4.8

**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 (Total)
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, its English version, its Response sheets and the scoring key are presented in Appendix VA, VB, VC, VD and VE.

4.1.5.8. Standard Progressive Matrices Test (SPM)

Standard Progressive Matrices Test developed by Raven (1958) was used to measure the Control variable Intelligence (Non-verbal) in the present study. This test was used to estimate the subject's ability to perceive a logical relationship among the presented non-verbal materials. The test consists of five sub-test of 12 items each. In each item a part of the geometrical design is missing. Six or eight alternatives are given for each design. All of those fit the missing part, but only one logically belongs to it. The subject should choose the correct answer from the alternatives given.

Validity of the test has been estimated in a variety of usual ways. When Stanford – Binet Test was used as the criterion, correlation varied from *0.50* to *0.86*. The reliability coefficients of the test vary from *0.80* to *0.90* as reported by Raven. In

a Kerala study (Nair, 1972) the reliability coefficients were found vary from *0.70* to *0.86* by split - half method and from *0.84* to *0.91* by test - retest method.

4.1.5.9 Learning Strategy Scale (LSS)

In the present study, the Control variable, Learning Strategies was measured using the *Learning Strategy Scale* which has been prepared and standardised by the investigator. The procedure adopted for the construction of the tool is described in the following section.

a. Planning of the Scale

It was planned to prepare a rating scale to measure the Learning Strategies adopted by the pupils. Rating scale involves qualitative description of a limited number of aspects of a thing or of traits of a person. (Best & Kahn, 2006). It was decided to adopt the Likert - type format with five responses, for preparing the scale.

For the selection of areas to be included in the scale, the investigator reviewed many books on Psychology of Learning and consulted research reports. The scale was based on a model prepared by Oxford (1990). This model included three major strategy areas, namely, *Metacognitive*, *Cognitive* and *Socio-affective*. Each strategy areas have five, seven and three strategy components respectively. It was decided to include two items each from each strategy components in the Learning Strategy Scale. The details of areas and components selected for preparing the Learning Strategy Scale are given in Table 4.9.

TABLE 4.9

Areas and Components of Learning Strategy Scale

Strategy Area		Strategy Components	
I	Metacognitive	1	Metacognitive Planning
		2	Advance Organization
		3	Selective Attention
		4	Self Monitoring
		5	Self Evaluation
II	Cognitive	6	Resourcing
		7	Grouping
		8	Inferencing
		9	Reasoning
		10	Elaboration
		11	Note-taking
		12	Visualizing
III	Socio-affective	13	Lowering anxiety
		14	Asking questions
		15	Co-operation

b. Preparation of the Scale

The investigator prepared a pool of 95 items in Malayalam, representing 32 items from Metacognitive area, 41 items from Cognitive area and 20 items from Socio-affective area. Each item is in the form of brief and specific statements which described the pupils learning behaviours. The pupil should decide to what extent each statement is correct according to them. Their decision can be marked on five point

scale such as (1) *Always correct*, (2) *Correct* (3) *Undecided*, (4) *Incorrect* and (5) *Always Incorrect*. The 95 items include both positive and negative statements. Fifty three items are positive and 42 items negative. The Likert scaling technique assigns a scale value to each of the five responses. Scoring of the responses is done accordingly to the scale value.

The positive items were scored as shown in the following :

<i>Response</i>	<i>Scale Value</i>
Always correct	5
Correct	4
Undecided	3
Incorrect	2
Always Incorrect	1

The negative items were scored in the opposite order:

<i>Response</i>	<i>Scale Value</i>
Always correct	1
Correct	2
Undecided	3
Incorrect	4
Always Incorrect	5

Illustrative items are given as follows:

Strategy area : Metacognitive

1. I usually do not think about the objectives behind studying a particular thing.

Always correct	Correct	Undecided	Incorrect	Always Incorrect
		X		

Strategy area : Cognitive

2. I do not watch educational programmes in television because of their low standard.

Always correct	Correct	Undecided	Incorrect	Always Incorrect
X				

Strategy area : Socio-affective

3. Watching television after continuous hours of study is my habit.

Always correct	Correct	Undecided	Incorrect	Always Incorrect
	X			

C. The Tryout

The draft scale with 95 items was tried out by the investigator on a representative sample of 106 students in two class divisions of standard VIII in a school other than the Experimental and Control subjects were selected. The draft scale material and response sheets in sufficient numbers were provided. Necessary guidelines about the scale and additional informations needed were given by the investigator. All the 106 response sheets were scored by giving a sequence of five, four, three, two, one scores for positive items and one, two, three, four, five scores for negative items. Incomplete response sheets were discarded and 98 response sheets were selected for item analysis.

Try out was to analyse each item statistically by determining the discriminating power of the item to be included in the final scale. Since it is a Likert type scale, only discriminating power was calculated.

Item Analysis

For item analysis, the procedure suggested by Edward (1957) was utilized. The response sheets of 98 subjects were arranged in the descending order of the magnitude of scores obtained by them. The scores obtained by the top 26 subjects (27%) and bottom 26 subjects (27%) were taken as the high group and low group respectively. Then the 't' values for each item was calculated using the formula,

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum(X_H - \bar{X}_H)^2 + \sum(X_L - \bar{X}_L)^2}{n(n-1)}}$$

where,

\bar{X}_H = Arithmetic mean of the given item for high group

\bar{X}_L = Arithmetic mean of the given item for low group

X_H = Score of high group

X_L = Score of low group

n = Number of subject in the group.

't' value of 95 items were calculated and is given in Table 4.10.

TABLE 4.10

t-values for 95 items of Learning Strategy Scale

Item No.	t-value	+ve/ -ve	Item selected	Item No.	t-value	+ve/ -ve	Item selected	Item No.	t-value	+ve/ -ve	Item selected
1	3.66	-ve	✓	33	3.2			65	7.25	+ve	✓
2	0.75			34	2.93			66	2.05		
3	4.8	+ve	✓	35	4.98	-ve	✓	67	5.21	-ve	✓
4	5.14			36	4.75	+ve	✓	68	8.96		
5	3.25			37	3.85			69	6.83	+ve	✓
6	4.8			38	6.14			70	5.87		
7	4.25			39	7.13	+ve	✓	71	5.85		
8	2.1			40	6.76	-ve	✓	72	5.75		
9	6.31	+ve	✓	41	5.27			73	6.15		
10	4.73	-ve	✓	42	3.11			74	6.45	-ve	✓
11	2.81			43	5.46			75	1.40		
12	5.2			44	7.91			76	2.76		
13	6.06	+ve	✓	45	4.64			77	4	+ve	✓
14	4.95			46	7.75	-ve	✓	78	3.18		
15	7.26	-ve	✓	47	7.83			79	3.29	-ve	✓
16	9			48	5.01	+ve	✓	80	0.68		
17	3.92			49	5.82			81	3.09		
18	0.47			50	2.67			82	3.5		
19	4.41			51	6.27			83	8.82		
20	4.56			52	7.34			84	7.5	+ve	✓
21	5.49	-ve	✓	53	4.88	+ve	✓	85	0.38		
22	5.70	+ve	✓	54	6.97	-ve	✓	86	7.05	-ve	✓
23	4.44			55	2.21			87	4.17		
24	4.86			56	6.13			88	5.9		
25	7			57	7.61			89	4.82		
26	7.6	+ve	✓	58	7.41			90	4.6		
27	6.2			59	7.82			91	2		
28	8.42			60	5.56	+ve	✓	92	6.02	+ve	✓
29	6.66	-ve	✓	61	8.26	-ve	✓	93	5.23	-ve	✓
30	4.75			62	8.38			94	7.53		
31	5.68			63	2.45			95	4.55		
32	6.13			64	5.17						

From the total items, the investigator selected items having t-value 2.58 and above with an inference that such items discriminate the high group of students from low group. Thus the final scale consists of 30 items, out of which 15 items are positive

and 15 items, negative. The number of selected items for the final scale which falls in the 3 strategy areas are given in the following.

Strategy Area	No. of Items
Metacognitive Strategy	10
Cognitive Strategy	14
Socio-affective Strategy	6

Validity of the Learning Strategy Scale

The validity of the Learning Strategy Scale was estimated by criterion related technique. The external criterion selected was the scores of Learning Style Inventory (Kumar *et al.*, 1996) because, Learning Style as well as Learning Strategies contributes to the Achievement in Biology of secondary school pupils. The final Learning Strategy Scale was administered on a representative sample of 50 students. The response sheets were collected and scored. Learning Style Inventory was also administered on the same sample and the response sheets were collected and scored. The Pearson's Product Moment Correlation Coefficient of the two sets of scores were calculated. The correlation coefficient was found to be 0.74. It indicates that the Learning Strategy Scale is a substantially valid tool to measure the Learning Strategies of secondary school pupils.

Face Validity

To establish face validity, items of the Learning Strategy Scale were subjected to expert's evaluation. The experts confirmed that the items were able to identify the Learning Strategies of secondary school pupils.

Reliability of the Learning Strategy Scale

The reliability of Learning Strategy Scale was calculated using the split-half method. The scores of the odd and even numbered items were correlated using Pearson's formula of Product Moment Correlation (Garrett, 2004). There were 15 items in each half. For this purpose, the final scale was administered on a representative sample of 50 students and the scores thus obtained were utilized for studying the reliability of the scale.

The formula to find out the Product Moment Correlation is

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{N \sum X^2 - (\sum X)^2} \sqrt{N \sum Y^2 - (\sum Y)^2}}$$

where,

$\sum X$ = Total score for first half items

$\sum Y$ = Total score for second half items

N = Number of students.

This gave the reliability of the half test as 0.61. This was corrected for full length of the test by using Spearman Brown Prophecy formula (Best & Kahn, 2006).

$$r = \frac{2r}{1+r}$$

The reliability thus obtained was **0.76**. The final Learning Strategy Scale and its response sheets both in Malayalam and English are presented in Appendix VI A, VI B, VI C and VI D.

4.1.5.10. Socio-Economic Status Scale (SESS)

A Socio Economic Status Scale was used to assess the Socio-Economic Status (SES) of the subjects of the Experimental and Control groups. The informations regarding the *Education*, *Occupation* and *Income* of parents were collected through the nine columns included separately for father and mother.

The subdivision and weightages of each category are as follows:

<i>Income Level of Parents</i>	<i>Weightage</i>
Rs. 1000	5
Between 1001 - 2000	10
Between 2001 - 3000	15
Between 3001 - 4000	20
Between 4001 - 5000	25
Above 5000	30
<i>Parental Education</i>	<i>Weightage</i>
Not receive formal schooling	5
Standard I - IV	10
Standard V - VII	15
Standard VIII - X	20
PDC, TTC	25
B.A/B.Sc/B.Com	30
MBBS/M.Ed /B.Sc/ (Engg.)	33
MA/ M.Sc/MBA/.Ph.D./CA etc.	

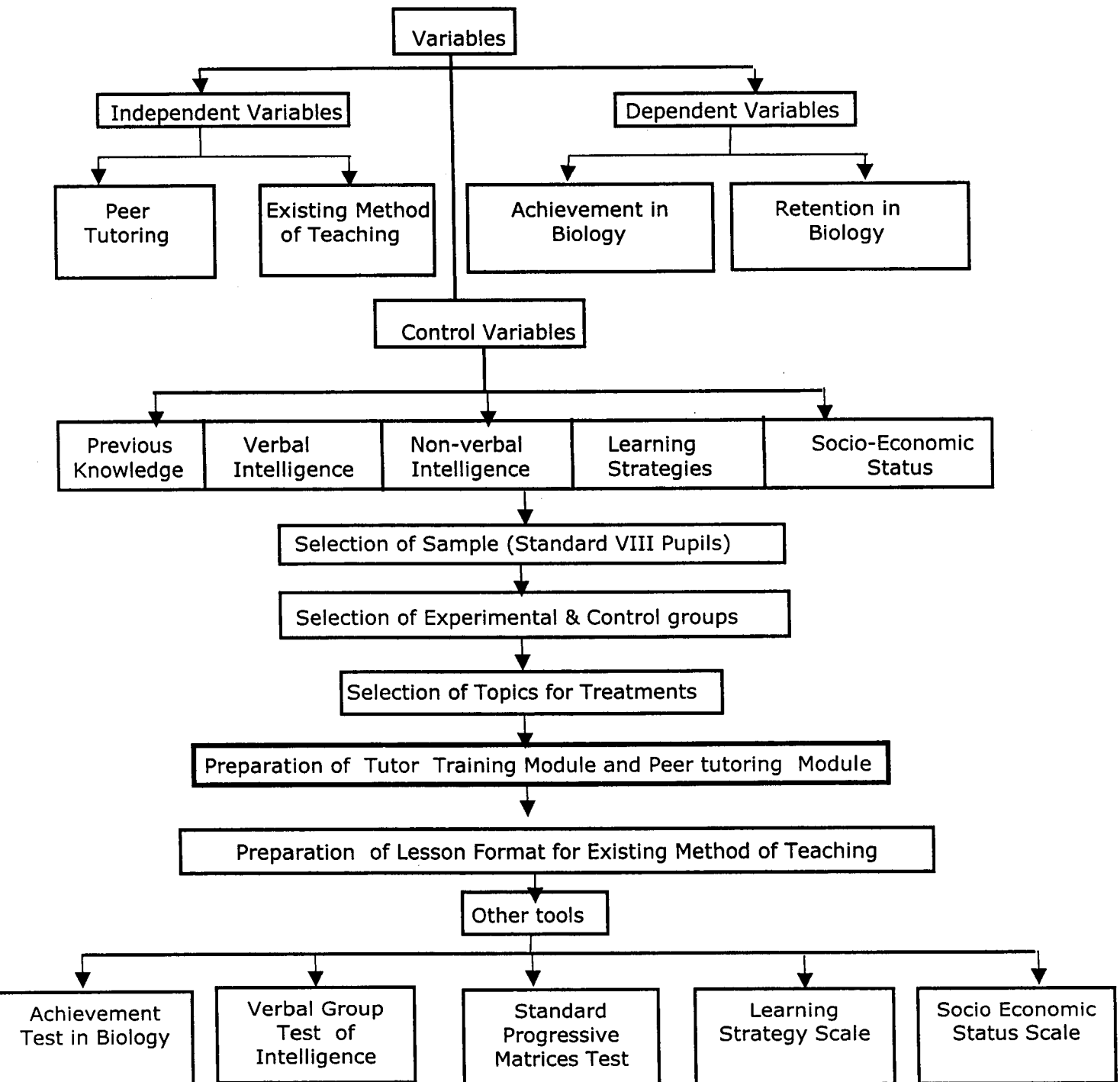
<i>Parental Occupation</i>	<i>Weightage</i>
Unemployed	5
Unskilled	10
Semiskilled	15
Skilled	20
Semi professional	25
Professional	30
Highly Professional	35

Copy of Socio Economic Status Scale in Malayalam and English is presented in Appendix VII A and VII B.

4.1.6 SUMMARY OF THE EXPERIMENT

The whole procedure adopted in the planning of the experiment is summarised and presented in the following flow chart.

FLOW CHART SHOWING THE SUMMARY OF THE EXPERIMENT



4.2. EXECUTION OF THE EXPERIMENT

To make a significant contribution to the development of knowledge, an experiment must be valid. So, before executing the experiment, the investigator tried to assure the internal and external experimental validity.

4.2.1 CONTROL MEASURES AGAINST THREATS TO INTERNAL VALIDITY

As the study conducted was an educational experiment, a number of extraneous variables present in the situation influence the results of the experiment. Though these extraneous variables cannot be completely eliminated, the investigator took precautions to minimise their influence through sound experimental design and execution.

4.2.1.1. Maturation, History, Pre-testing and Experimenter Characteristics

The threats of Maturation, History, Pre-testing and Experimenter Characteristics were controlled by the use of the particular design of experiment, the *Solomon Four - Group Design*. In this design there are two experimental groups and two control groups, therefore the experimental groups as well as the control groups will be affected by maturation, history, pre-testing and experimenter characteristics equally.

4.2.1.2. Instrument Decay

Tools used for data collection were standardized tools and were of objective type tests or scales. They were used to elicit a particular answer or specified behaviour from the pupil. All of these tools were scored using appropriate scoring keys or scoring procedures. So, the error due to instrument decay was eliminated.

4.2.1.3. Unstable Instrumentation

Valid and reliable techniques were used by the investigator for the treatment of pupils. The investigator herself collected the data from all the four groups and has taken adequate measures for minimising affects due to unstable instrumentation.

4.2.1.4. Statistical Regression

Subjects of the study were not selected on the basis of high or low Pre-test scores and therefore statistical regression was not a threat factor.

4.2.1.5. Interaction of Selection and Maturation

Subjects were not allowed to select their treatment group and hence there was no interaction of selection and maturation.

4.2.1.6. Selection Bias

Selection bias may be introduced when intact classes are used as experimental and control groups. But ANCOVA was used for Post-test comparisons because ANCOVA will statistically control for differences due to non equivalence of experimental and control groups.

4.2.1.7. Diffusion of Treatment

As the four schools selected for experimental and control treatments were reasonably far apart, there was no diffusion of treatment.

4.2.1.8. Subject Effects

For reducing subject effects, a detailed description of the study was not given to the students. Only the objective of the study was revealed.

4.2.1.9. Experimental Mortality

Experimental mortality was not a major threat because the experimentation lasted only for a short term of three and a half months.

4.2.1.10. Experimenter Bias

The class room groups selected for experimental and control treatment were from four different schools of two districts. The researcher had little knowledge about the subjects involved in the experiment. Groups were assigned as experimental and control by the toss of a coin. Again, the investigator has taken all efforts to consider the four treatment groups in equal manner. So the threat of experimenter bias was minimised as possible.

4.2.1.11. Implementation

The whole experiment was implemented by the investigator herself. The treatment was administered as intended and described. So the threat of implementation due to the use of other persons for data collection was reduced.

4.2.2. CONTROL MEASURES AGAINST THREATS TO EXTERNAL VALIDITY

External validity is the extend to which the *variable relationships can be generalized* to other settings, persons, variables and measurement instruments. For ensuring external validity, the researcher tried to control the factors which are a threat to the validity.

4.2.2.1 Population and Ecological External Validity

The investigator was careful to generalize the results of the study only to the referred population and did not conclude the results of the group to subgroups also. Doing so will minimise the threats of population external validity and ecological external validity.

4.2.2.2. Artificiality of the Experimental Setting

The investigator has conducted the whole experiment in real classroom situations. So the Artificiality of the experimental setting was avoided.

As a first step of the experimentation, the investigator contacted with the Heads of the schools which were selected for the Experimental and Control treatment and fixed a schedule. The experiment was executed according to the following pattern.

4.2.3. ADMINISTRATION OF THE PRE-TEST

Before starting the treatment, one group each from two Experimental groups and two Control groups were given the same Achievement Test in Biology as Pre-test and response sheets were collected. This was done with a view to *measure the Pre-experimental status* of the pupils with regard to the Achievement in Biology. Only one group each from two Experimental groups and two Control groups were given Pre-test with a view to know the difference between the two Experimental groups (one receiving Pre-test and the other not receiving Pre-test) and between the two Control groups (one receiving Pre-test and the other not receiving Pre-test).

4.2.4. TUTOR TRAINING

A training was given to the tutors before starting the Experimental treatment. For this, the investigator with the help of the Biology teachers of the Experimental classes of the two schools, selected six students each from two groups on the basis of aptitude, potential ability and desire. Stand-by tutors were also appointed. Training was mainly in the form of verbal instructions and techniques like demonstration of desired behaviour, effective listening and questioning were incorporated wherever necessary. The subject matter was conveyed to the tutors in the form of concepts. Extract from the videography of Tutor training is as follows .



Tutor Training

**Tutor Training**

Each Tutor Training session was succeeded by the Peer Tutoring Session. Each Training Session's time duration was one to two hours and was conducted during the break times of the school. Altogether 25 tutor training sessions were conducted for each Experimental group.

4.2.5 EXPERIMENTAL TREATMENT

Experimental classes were conducted after each tutor training sessions. Before treatment, the seating arrangement of the classrooms of the Experimental groups were changed to the horse-shoe format. This arrangement ensured better tutoring environment. The whole class was divided into six groups and a peer tutor was assigned for each group. The three units were taught in 25 peer tutoring sessions. The duration of each peer tutoring session was 45 minutes. Thus a total time duration of 18 hours and 45 minutes were utilized for Experimental treatment. The investigator was present throughout all the peer tutoring sessions and ensured that tutoring activities were going on in all the groups. The following extracts from the videography shows the experimental treatment.



Peer Tutoring



Peer Tutoring



Teacher Interaction in Peer Tutoring



Student Interaction in Peer Tutoring

4.2.6. CONTROL TREATMENT

For treatment in the control groups, the investigator used Existing Method of Teaching and the topics selected were the same for the Experimental and Control groups. The three units were taught in 25 periods using different classroom activities which the Existing Method of Teaching insisted. The activities included grouping, discussions, demonstrations etc. The time duration of a period was 45 minutes. Thus the total time duration for the Control treatment was kept equal to that of Experimental treatment (18 hours and 45 minutes)

4.2.7. ADMINISTRATION OF THE POST TEST

The Post test data were collected from the subjects in both the Experimental and Control groups the next day after the completion of the treatments. This was done to measure the post-treatment status of the subjects in terms of Achievement in Biology. The Achievement Test in Biology prepared by the investigator, which was already used as the Pre test, was utilized for this purpose. All necessary guidelines were given to the subjects, before administering the test. And the purpose of the test was made clear to them. The time duration of the post test was 60 minutes.

4.2.8. DATA ON OTHER VARIABLES

During the treatment period, the data on the Control variables, viz., Verbal Intelligence, Non verbal Intelligence, Learning Strategies and Socio-Economic Status were collected from both the Experimental and Control groups. Learning Strategy Scale was administered during the first week of the treatment. In the second week, the Verbal Group Test of Intelligence was administered. Non-verbal Intelligence Test was given towards the end of the treatment. The socio-economic status scale was also given to the subjects with a view to quantify the socio-economic status.

4.2.9. ADMINISTRATION OF THE RETENTION TEST

The same Achievement test (which was already used as the Pretest and the Post test) was administered again as the Retention test in the Experimental and Control groups after one month of the completion of the treatment. This was done to measure the quantity of Retention in Biology existing one month after the completion of the treatment.

4.2.10. SCORING AND CONSOLIDATION OF DATA

Before scoring, incomplete response sheets were rejected. Response sheets complete in all respects only were considered. Specific directions given in the respective test manuals were followed for scoring the response sheets. Answer sheets of Achievement Test in Biology were scored on the basis of the scoring key. Response sheets for the Learning Strategy Scale were scored by giving a sequence of *five, four, three, two, one* scores for positive items and *one, two, three, four, five* scores for negative items. Punched scoring keys were used for the verbal and Non-verbal Intelligence tests. Socio Economic Status was quantified by giving appropriate weightages assigned to each aspect in the Socio-Economic Status Scale. After scoring the response sheets, the scores were tabulated separately for Experimental and Control groups. Actual number of the subjects included in the final sample is given as follows.

SAMPLE	EXPERIMENTAL GROUP	CONTROL GROUP	TOTAL
Boys	46	51	97
Girls	55	43	98
Total	101	94	195

4.2.11. STATISTICAL TECHNIQUES USED

The present study demanded the use of following statistical techniques to realize the objectives set for the investigation.

4.2.11.1 Test of Significance of Difference between Means for large and small Independent Samples

Test of Significance of Difference between Means was used to compare the relevant variables between the Experimental and Control groups. For large sample the following formula suggested by Garrett (2004) was used.

$$t = \frac{M_1 - M_2}{\sqrt{\left(\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2} \right)}}$$

Here M_1, M_2 are the means, σ_1, σ_2 are the standard deviations, and N_1, N_2 are sample size of the groups.

For small sample, the following formula suggested by Garrett (2004) was used

$$t = \frac{(M_1 - M_2) - 0}{SE_D}$$

$$SE_D = SD \sqrt{\frac{N_1 + N_2}{N_1 N_2}}$$

$$SD = \sqrt{\frac{\sum (X_1 - M_1)^2 + \sum (X_2 - M_2)^2}{(N_1 - 1) + (N_2 - 1)}}$$

In these formulae, M_1, M_2 are the means, N_1, N_2 are the sample size of the groups, X_1, X_2 are the scores of the groups, SE_D is the standard error and SD is the standard deviation.

4.2.11.2. Analysis of Covariance (ANCOVA)

In the present study, single factor ANCOVA employing five covariates (Separately and in combination) was used to confirm the effectiveness of Peer Tutoring and Existing Method of Teaching. Through Analysis of Covariance the investigator can control or adjust the effects of one or more uncontrolled variables and thereby permit 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 observations on **K** groups of the experimental subjects. The number of pairs of observations in the **K** groups is denoted by N_1, N_2, \dots, N_K . The paired observations are assumed to be paired samples drawn from **K** populations. The data may be represented as follows in Table 4.11 (Ferguson & Takane, 1989).

TABLE 4.11

Representation of Data for ANCOVA

Group 1	Group 2	Group K
$Y_{11} X_{11}$	$Y_{12} X_{12}$	$Y_{1k} X_{1k}$
$Y_{21} X_{21}$	$Y_{22} X_{22}$	$Y_{2k} X_{2k}$
$Y_{31} X_{31}$	$Y_{32} X_{32}$	$Y_{3k} X_{3k}$
....
$Y_{N1} X_{N1}$	$Y_{N2} X_{N2}$	$Y_{Nk} X_{Nk}$
Mean $\bar{Y}_1 \bar{X}_1$	$\bar{Y}_2 \bar{X}_2$	$\bar{Y}_k \bar{X}_k$

In this notation X is the variable under study, the Dependent variable, Where Y is the uncontrolled variable, or Covariate.

In the Analysis of Covariance, sums of products for the observations in the j^{th} group is denoted by

$$\sum_{i=1}^{N_j} (X_{ij} - \bar{X}_j) (Y_{ij} - \bar{Y}_j)$$

The sum of products for all observations in the K groups, that is, the total sum of products is,

$$\sum_{j=1}^k \sum_{i=1}^{N_j} (X_{ij} - \bar{X}) (Y_{ij} - \bar{Y})$$

The computation formula for the total sum of products is,

$$\sum_{j=1}^k \sum_{i=1}^{N_j} (X_{ij} - \bar{X}) (Y_{ij} - \bar{Y}) = T_{XY} - \frac{T_X T_Y}{N}$$

The within-groups sums of products may be obtained by,

$$\sum_{j=1}^k \sum_{i=1}^{N_j} (X_{ij} - \bar{X}_j) (Y_{ij} - \bar{Y}_j) = T_{XY} - \sum_{j=1}^k \frac{T_{Xj} T_{Yj}}{N_j}$$

The between-groups sums of products is ,

$$\sum_{j=1}^k N_j (\bar{X}_j - \bar{X}) (\bar{Y}_j - \bar{Y}) = \sum_{j=1}^k \frac{T_{Xj} T_{Yj}}{N_j} - \frac{T_X T_Y}{N}$$

These formulae are applicable to groups of unequal or equal size.

The calculation of the required sums of squares may be simplified by the use of computation formula. The formula for the total sum of squares is ,

$$\sum_{j=1}^k \sum_{i=1}^{N_j} (X_{ij} - \bar{X})^2 = \sum_{j=1}^k \sum_{i=1}^{N_j} X_{ij}^2 - T^2/N$$

The within-groups sum of squares is,

$$\sum_{j=1}^k \sum_{i=1}^{N_j} (X_{ij} - \bar{X}_j)^2 = \sum_{j=1}^k \sum_{i=1}^{N_j} X_{ij}^2 - \sum_{j=1}^k (T_j^2/N_j)$$

The between-groups sum of squares is,

$$\sum_{j=1}^k N_j (\bar{X}_j - \bar{X})^2 = \sum_{j=1}^k (T_j^2 / N_j) - T^2/N$$

These formulae are generally applicable to groups of unequal or equal size.

To assist in the interpretation of the results, the adjusted group means will be calculated. This computation requires the pooled within class regression coefficients.

$$b_w = E_{XY} / E_{XX}$$

The adjusted group means will be calculated using the following formulae.

The adjusted group mean for the Experimental group is,

$$Y_{1(adj)} = \bar{Y}_1 - b_w (\bar{X}_1 - \bar{X})$$

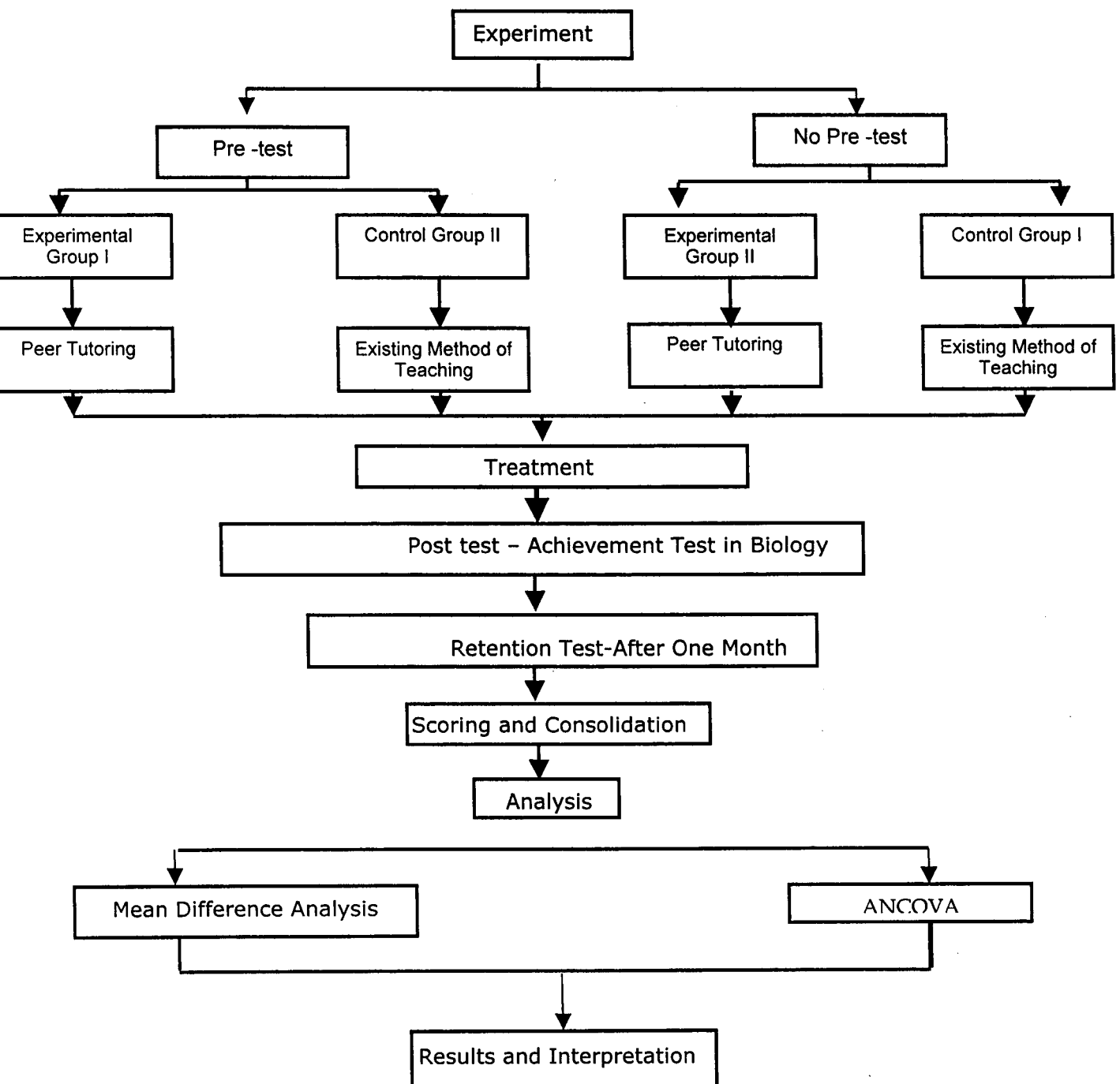
The adjusted group mean for the Control group is ,

$$Y_{2(\text{adj})} = \bar{Y}_2 - b_w (\bar{X}_2 - \bar{X})$$

4.2.12. SUMMARY OF THE EXECUTION OF EXPERIMENT

The entire procedure adopted in the execution of the experiment is summarised and presented in the following flow chart.

FLOW CHART SHOWING THE SUMMARY OF THE EXECUTION OF EXPERIMENT



**EFFECTIVENESS OF PEER TUTORING AND EXISTING METHOD
OF TEACHING ON ACHIEVEMENT AND RETENTION
IN BIOLOGY OF STANDARD VIII PUPILS**

RESHMA P.T.

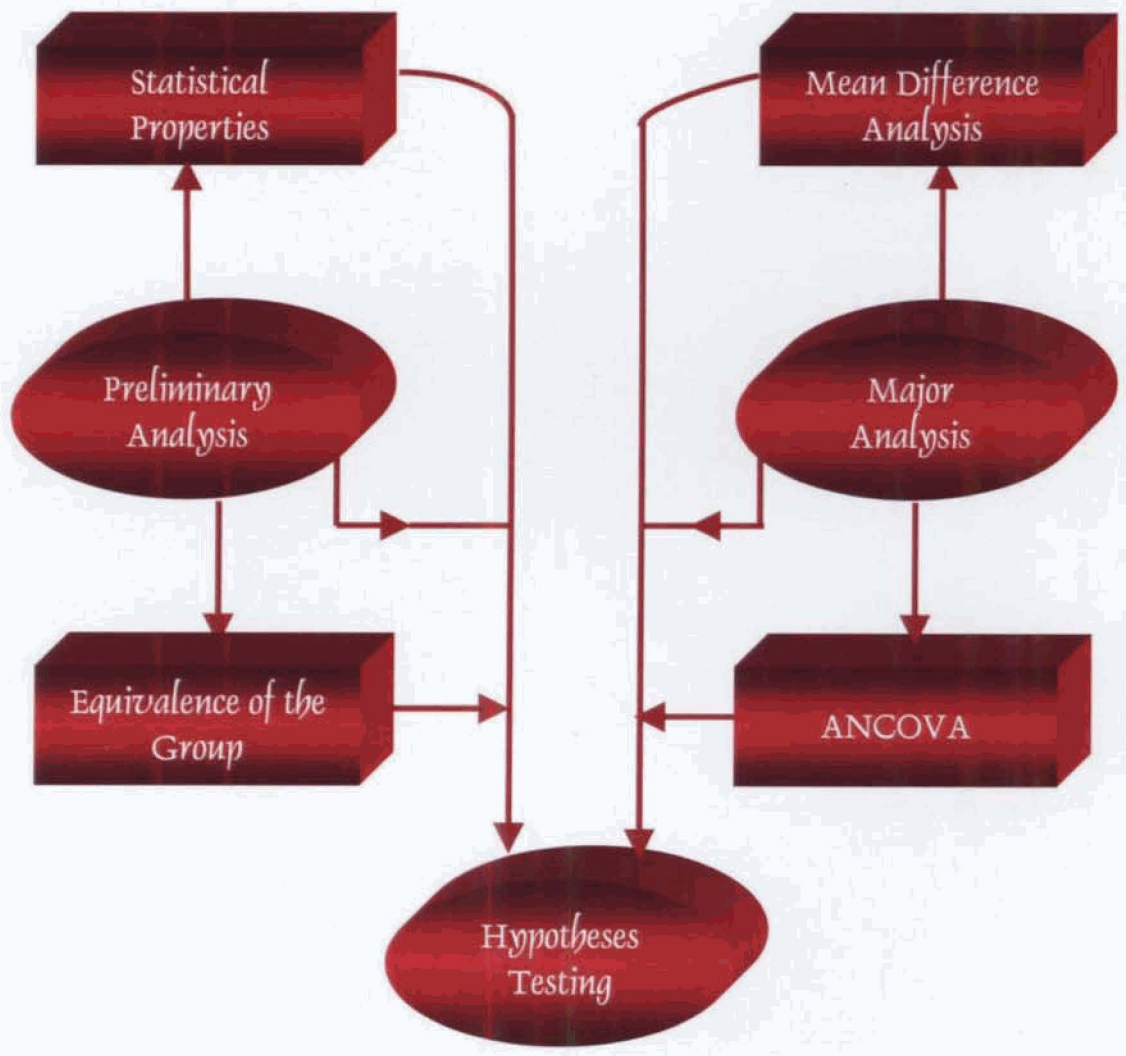
Thesis
submitted to the University of Calicut
for the Degree of
DOCTOR OF PHILOSOPHY IN EDUCATION

**DEPARTMENT OF EDUCATION
UNIVERSITY OF CALICUT**

2006

Analysis and Hypotheses Testing

CHAPTER
Five



CHAPTER



Analysis and Hypotheses Testing

To examine the effectiveness of *Peer Tutoring* and *Existing Method of Teaching* on *Achievement* and *Retention* in Biology of standard VIII pupils, the investigator analysed the collected data. For the analysis of the present Experimental data, relevant statistical techniques such as Test of Significance of Difference between Means, Single Factor ANCOVA employing five Covariates - separately and in combination of five at a time (for Pre-test received groups) and Single Factor ANCOVA employing four Covariates - separately and in combination of four at a time (for Pre-test non received groups). On the basis of the results of statistical processing, the investigator tested the hypotheses formulated.

The statistical analysis was done based on the objectives set for the study. The whole analysis done for the present study is described in the following order.

5.1. PRELIMINARY ANALYSIS

5.1.1. IMPORTANT STATISTICAL PROPERTIES

5.1.2. EQUIVALENCE OF THE GROUPS

5.2. MAJOR ANALYSIS

5.2.1. MEAN DIFFERENCE ANALYSIS

5.2.2. ANALYSIS OF COVARIANCE FOR ACHIEVEMENT AND RETENTION

5.1. PRELIMINARY ANALYSIS

A preliminary analysis was done as a first step to find out the important *statistical properties* of the variables and to examine the *equivalence of the Experimental and Control groups* in terms of the mean scores of the relevant variables (Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status). The preliminary analysis done is presented in the following sub-sections.

5.1.1. IMPORTANT STATISTICAL PROPERTIES

The important statistical properties such as mean, median, mode, standard deviation, skewness and kurtosis were computed for the scores on the Pre-test, Achievement, Gain, Retention, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status of the pupils. The Experimental design used for the study was *Solomon Four-Group design*, in which there are two Experimental groups and two Control groups. So the statistical properties were computed separately for each Experimental group and each Control Group (Group total, Boys and Girls). These are presented in Table 5.1, 5.2, 5.3 and 5.4.

Table 5.1

Important Statistical Properties of the Variables for the Experimental Group I

		PRE-TEST SCORE	ACHIEVEMENT SCORE	GAIN SCORE	RETENTION SCORE	VERBAL INTELLIGENCE	NON-VERBAL INTELLIGENCE	LEARNING STRATEGIES	SOCIO- ECONOMI C STATUS
EXPERIMENTAL GROUP I N= 48	MEAN	16.042	26.188	10.125	19.375	43.500	30.958	102.333	68.333
	MEDIAN	16.500	25.000	10.000	18.000	43.000	35.000	100.000	62.500
	MODE	18.000	20.000	10.000	14.000	48.000	41.000	92.000	60.000
	STANDARD DEVIATION	4.247	8.700	7.174	7.362	12.971	11.669	10.018	24.196
	SKEWNESS	0.067	0.408	-0.002	0.980	0.410	-0.708	0.480	1.842
	KURTOSIS	-0.248	-0.369	-0.654	0.579	-0.107	-0.639	-0.565	4.575
BOYS N=21	MEAN	15.667	25.429	9.714	18.048	44.476	32.714	103.190	69.286
	MEDIAN	16.000	25.000	10.000	16.000	43.000	37.000	104.000	65.000
	MODE	12.000	25.000	14.000	14.000	34.000	41.000	93.000	55.000
	STANDARD DEVIATION	3.877	6.867	6.776	6.727	11.316	12.207	9.862	25.509
	SKEWNESS	0.109	0.217	0.554	0.628	0.544	-0.849	-0.071	2.246
	KURTOSIS	-1.130	-1.276	-0.173	-0.589	0.471	-0.433	-1.174	8.103
GIRLS N= 27	MEAN	16.333	26.778	10.444	20.407	42.741	29.593	101.667	67.593
	MEDIAN	17.000	27.000	11.000	19.000	43.000	33.000	99.000	60.000
	MODE	17.000	11.000	0.000	21.000	25.000	33.000	92.000	60.000
	STANDARD DEVIATION	4.566	9.986	7.582	7.787	14.293	11.274	10.273	23.590
	SKEWNESS	-0.010	0.350	-0.330	1.134	0.436	-0.723	0.898	1.568
	KURTOSIS	0.130	-0.587	-0.699	0.787	-0.288	-0.615	0.196	2.292

Table 5.2

Important Statistical Properties of the Variables for the Experimental Group II

		PRE-TEST SCORE	ACHIEVEMENT SCORE	GAIN SCORE	RETENTION SCORE	VERBAL INTELLIGENCE	NON-VERBAL INTELLIGENCE	LEARNING STRATEGIES	SOCIO-ECONOMIC STATUS
EXPERIMENTAL GROUP II N= 53	MEAN	Nil	22.057	Nil	19.755	47.792	30.547	98.189	62.547
	MEDIAN	Nil	21.000	Nil	19.000	48.000	31.000	100.000	60.000
	MODE	Nil	17.000	Nil	17.000	50.000	24.000	94.000	55.000
	STANDARD DEVIATION	Nil	7.260	Nil	6.858	13.456	9.750	9.257	15.462
	SKEWNESS	Nil	0.536	Nil	0.468	-0.138	-0.567	-0.460	1.280
	KURTOSIS	Nil	-0.356	Nil	0.392	-0.337	-0.420	-0.273	1.711
BOYS N=34	MEAN	Nil	20.324	Nil	18.029	46.294	28.618	96.088	62.059
	MEDIAN	Nil	19.000	Nil	18.000	46.000	30.000	98.000	55.000
	MODE	Nil	17.000	Nil	20.000	41.000	24.000	83.000	55.000
	STANDARD DEVIATION	Nil	6.988	Nil	6.235	14.459	9.779	9.520	15.281
	SKEWNESS	Nil	0.714	Nil	0.047	0.012	-0.443	-0.386	0.836
	KURTOSIS	Nil	0.022	Nil	-0.723	-0.289	-0.474	-0.478	-0.037
GIRLS N= 19	MEAN	Nil	25.158	Nil	22.842	50.474	34.000	101.947	63.421
	MEDIAN	Nil	23.000	Nil	19.000	51.000	38.000	103.000	60.000
	MODE	Nil	17.000	Nil	19.000	63.000	23.000	98.000	55.000
	STANDARD DEVIATION	Nil	6.850	Nil	6.994	11.311	8.926	7.627	16.163
	SKEWNESS	Nil	0.548	Nil	0.963	-0.243	-0.923	-0.219	2.104
	KURTOSIS	Nil	-0.626	Nil	0.350	-0.814	0.303	-0.876	5.202

Table 5.3

Important Statistical Properties of the Variables for the Control Group I

		PRE-TEST SCORE	ACHIEVEMENT SCORE	GAIN SCORE	RETENTION SCORE	VERBAL INTELLIGENCE	NON-VERBAL INTELLIGENCE	LEARNING STRATEGIES	SOCIO- ECONOMI C STATUS
CONTROL GROUP I N= 46	MEAN	Nil	18.196	Nil	21.696	56.196	34.457	98.435	61.413
	MEDIAN	Nil	18.000	Nil	21.000	57.500	36.500	98.000	60.000
	MODE	Nil	15.000	Nil	19.000	57.000	42.000	92.000	55.000
	STANDARD DEVIATION	Nil	4.764	Nil	5.378	9.325	8.596	8.988	13.361
	SKEWNESS	Nil	0.087	Nil	0.503	-0.328	-0.978	0.403	1.159
	KURTOSIS	Nil	-0.765	Nil	0.277	-0.169	0.164	-0.440	1.143
BOYS N=20	MEAN	Nil	15.650	Nil	19.500	56.500	38.450	95.350	67.750
	MEDIAN	Nil	15.000	Nil	19.000	58.000	39.000	95.000	67.000
	MODE	Nil	17.000	Nil	19.000	57.000	41.000	96.000	60.000
	STANDARD DEVIATION	Nil	3.829	Nil	3.832	7.452	4.478	7.836	13.026
	SKEWNESS	Nil	0.017	Nil	-0.371	-0.838	-0.158	1.562	0.612
	KURTOSIS	Nil	-0.558	Nil	-0.061	-0.045	0.118	4.217	0.012
GIRLS N= 26	MEAN	Nil	20.154	Nil	23.385	55.962	31.385	100.808	56.538
	MEDIAN	Nil	20.500	Nil	22.500	56.500	33.500	102.000	55.000
	MODE	Nil	15.000	Nil	21.000	51.000	34.000	106.000	50.000
	STANDARD DEVIATION	Nil	4.532	Nil	5.838	10.686	5.062	9.235	11.642
	SKEWNESS	Nil	-0.170	Nil	0.289	-0.159	-0.050	-0.242	2.252
	KURTOSIS	Nil	-0.997	Nil	-0.371	-0.439	0.317	-0.835	7.003

Table 5.4

Important Statistical Properties of the Variables for the Control Group II

		PRE-TEST SCORE	ACHIEVEMENT SCORE	GAIN SCORE	RETENTION SCORE	VERBAL INTELLIGENCE	NON-VERBAL INTELLIGENCE	LEARNING STRATEGIES	SOCIO- ECONOMI C STATUS
CONTROL GROUP II N= 48	MEAN	16.167	18.958	2.792	21.500	45.729	36.875	102.854	69.958
	MEDIAN	16.500	18.500	2.000	20.000	43.500	39.500	104.500	65.000
	MODE	17.000	20.000	1.000	18.000	39.000	42.000	110.000	60.000
	STANDARD DEVIATION	5.365	6.766	5.720	7.729	13.405	9.387	9.798	20.682
	SKEWNESS	0.906	0.715	0.459	0.668	0.338	-1.071	-0.835	1.165
	KURTOSIS	1.752	0.156	-0.321	-0.299	-0.374	1.507	0.522	1.390
BOYS N=23	MEAN	14.304	15.000	0.696	20.087	41.087	36.174	98.826	78.826
	MEDIAN	13.000	14.000	1.000	18.000	39.000	37.000	98.000	75.000
	MODE	13.000	10.000	1.000	15.000	26.000	32.000	94.000	65.000
	STANDARD DEVIATION	4.626	4.710	5.514	7.141	12.856	9.866	11.696	22.601
	SKEWNESS	1.154	0.975	0.894	0.945	0.186	-0.508	-0.221	0.856
	KURTOSIS	2.445	0.931	1.261	0.102	-1.387	-0.365	-0.599	0.372
GIRLS N= 25	MEAN	17.880	22.600	4.720	22.800	50.000	37.520	106.560	61.800
	MEDIAN	17.000	21.000	4.000	23.000	46.000	41.000	108.000	60.000
	MODE	17.000	18.000	2.000	30.000	39.000	41.000	110.000	60.000
	STANDARD DEVIATION	5.510	6.364	5.303	8.160	12.679	9.079	5.723	14.992
	SKEWNESS	0.790	0.584	0.363	0.461	0.672	-1.780	-0.104	1.295
	KURTOSIS	2.301	0.034	-0.905	-0.347	-0.206	4.928	-1.020	3.386

5.1.2. EQUIVALENCE OF THE GROUPS

The Experiment was conducted using a true Experimental design, the Solomon Four-Group Design. In a true experiment, the equivalence of the Experimental and Control groups is provided by random assignment of subjects to Experimental and Control treatments. But in the present study random assignment of subjects was not possible as four intact classroom groups from four different schools were assigned as Experimental and Control groups. Random assignment was done while classifying classroom groups to Experimental and Control treatments.

In Solomon Four-Group Design, the major difficulty is finding enough subjects to assign randomly to four equivalent groups. But ANCOVA can be used, if, even with random assignment, the groups are not exactly equal. ANCOVA permits to statistically control for differences on the Pre-test so that Post-test differences would not be due to initial differences prior to treatment (Best & Kahn, 2006).

So the investigator, though not necessary, used ANCOVA for comparing the Post-test scores, so that the differences on the Pre-test and other Control variables namely, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status can be statistically controlled so that Post-test differences would not be due to initial difference prior to treatment.

In Solomon Four-Group Design, there are four groups, two Experimental groups and two Control groups. In the present study, the four groups are classified as Experimental group I, Experimental group II, Control group I and Control group II. Out of these, only one Experimental group (Experimental group I) and one Control group (Control group II) received Pre-test. But all the four groups received Post-test.

However, the investigator tried to establish the equivalence of the Experimental and Control groups which received Pre-test and Post-test, using the test of Significance of Difference between Means with regard to the factors like Pre-test score, Verbal

Analogy, Verbal Classification, Numerical Reasoning, Verbal Reasoning, Comprehension, Verbal Intelligence Total, Metacognitive Strategy, Cognitive Strategy, Socio-affective Strategy, Learning Strategy Total and Socio-Economic Status (except Non verbal Intelligence). Data and results of the t-test is presented in Table 5.5.

Table 5.5

**Data and Results of the t-test for the Scores on Pre-test, Verbal Intelligence,
Learning Strategies and Socio-Economic Status between the Experimental Group I and Control Group II**

Variables	Groups compared	M	SD	N	t VALUE	LEVEL OF SIGNIFICANCE
Pre-test score	EXPERIMENTAL I	16.0417	4.247	48	0.13	NS
	CONTROL II	16.1667	5.365	48		
Verbal analogy	EXPERIMENTAL I	11.0625	4.148	48	1.36	NS
	CONTROL II	12.2292	4.249	48		
Verbal classification	EXPERIMENTAL I	10.4375	3.548	48	0.34	NS
	CONTROL II	10.1667	4.133	48		
Numerical reasoning	EXPERIMENTAL I	9.5833	3.596	48	0.72	NS
	CONTROL II	10.1042	3.538	48		
Verbal reasoning	EXPERIMENTAL I	6.1875	2.294	48	1.67	NS
	CONTROL II	6.9583	2.221	48		
Comprehension	EXPERIMENTAL I	6.3333	3.429	48	0.09	NS
	CONTROL II	6.2708	3.266	48		
Verbal intelligence total	EXPERIMENTAL I	43.5	12.971	48	0.83	NS
	CONTROL II	45.7292	13.405	48		
Metacognitive strategy	EXPERIMENTAL I	32.9792	4.055	48	1.32	NS
	CONTROL II	34.0833	4.156	48		
Cognitive strategy	EXPERIMENTAL I	47.6458	5.541	48	0.47	NS
	CONTROL II	47.1042	5.817	48		
Socio-affective strategy	EXPERIMENTAL I	21.5	2.917	48	0.31	NS
	CONTROL II	21.6667	2.300	48		
Learning strategy total	EXPERIMENTAL I	102.3333	10.018	48	0.26	NS
	CONTROL II	102.8542	9.798	48		
Socio-economic status	EXPERIMENTAL I	68.3333	24.196	48	0.35	NS
	CONTROL II	69.9583	20.682	48		

As per Table 5.5, Experimental group I and Control group II pupils (two groups which received Pre-test) does not significantly differ in their scores of Pre-test, Verbal Intelligence Total (and it's component-wise scores namely Verbal Analogy, Verbal Classification, Numerical Reasoning, Verbal Reasoning and Comprehension), Learning Strategy Total (and it's component-wise scores namely Metacognitive Strategy, Cognitive Strategy and Socio-affective Strategy) and Socio-Economic Status. But they differ in Non-verbal Intelligence scores. So it can be concluded that, the groups which received Pre-test, Experimental group I and Control group II are equivalent with regard to the relevant variables as explained earlier.

5.2. MAJOR ANALYSIS

In the present Experimental study, two statistical techniques were employed majorly for analysis of data and testing the hypotheses. They are, the Mean Difference Analysis and Analysis of Covariance. Each of these techniques was used for complying with the objectives set for the Experiment. Mean Difference Analysis was employed to know whether the two Experimental groups and two Control groups differ in Pre-test score, Achievement, Gain score and Retention or not, *without controlling* the Control Variables. Analysis of Covariance was used to examine whether the two Experimental groups and two Control groups differ in Achievement and Retention or not, *after controlling* the Control variables or Covariates.

As the Experimental design used was Solomon Four-Group Design, the difference between Experimental group and Control group as well as the difference between the groups received Pre-test and the groups which has not received Pre-test can be investigated. Only two groups, Experimental group I and Control group II has received Pre-test and therefore Pre-test comparison and Gain score comparison can be done only for these groups.

5.2.1. MEAN DIFFERENCE ANALYSIS

Difference in Pre-test score, Achievement, Gain score and Retention, if any, between the two Experimental and two Control groups was investigated *before controlling* the Covariates using the Mean Difference Analysis. This technique was used to compare the Experimental and Control groups with regard to Pre-test score, Achievement (Objective-wise and Total score), Gain score and Retention (Objective-wise and Total score) without controlling the effects of the Covariates. All comparisons were done in between the Experimental and Control groups as well as in between the two Experimental groups and two Control groups to facilitate testing the appropriate hypotheses.

5.2.1.1. COMPARISON OF PRE-TEST SCORES BEFORE CONTROL

Hypothesis :There will be no significant difference in the mean Pre-test scores of Experimental group I and Control group II, Boys and Girls.

Comparisons of Pre-test scores made in between the two Pre-test received groups (Experimental group I and control group II) are discussed in this section. Group comparison as well as sex-wise comparison was made in between the two groups.

5.2.1.1a. Comparison of Mean Pre-test Scores Between the Experimental Group I and Control Group II

To study whether the Experimental group I and control group II differ significantly in terms of mean Pre-test score, test of significance of difference between means was utilised.

The means and standard deviations of the Pre-test scores were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.6.

TABLE 5.6

**Data and Results of the t-test for the Mean
Pre-test Scores between the Experimental Group I and Control Group II**

Variable \ Group	Experimental Group I			Control Group II			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Pre-test Total	16.042	4.247	48	16.167	5.365	48	0.13	NS

Table 5.6 shows that the obtained t-value for Pretest score is not significant. The result indicates that Experimental group I and control group II does not differ in their mean Pre-test score. This indicate that the pre-experimental status of the subjects in the Experimental group I and Control group II is found to be the same.

5.2.1.1b. Comparison of Mean Pre-test Scores Between the Experimental Group I Boys and Control Group II Boys

To study whether the Experimental group I Boys and control group II Boys differ significantly in terms of mean Pre-test score, test of significance of difference between means was utilised.

The means and standard deviations of the Pre-test scores were subjected to the Mean Difference Analysis. Data and result of the t-test are presented in Table 5.7.

TABLE 5.7

**Data and Results of the t-test for
the Mean Pre-test Scores between the
Experimental Group I Boys and Control Group II Boys**

Variable \ Group	Experimental Group I Boys			Control Group II Boys			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Pre-test Total	15.667	3.877	21	14.304	4.626	23	1.06	NS

Table 5.7 shows that the obtained t-value is not significant. The result indicates that Experimental group I Boys and Control group II Boys does not differ in their mean Pre-test Score. Their performance in the Pre-test is the same.

The individual performance of the Experimental group I Boys and Control group II Boys on Pre-test was graphically examined and presented in Figure 5-1.

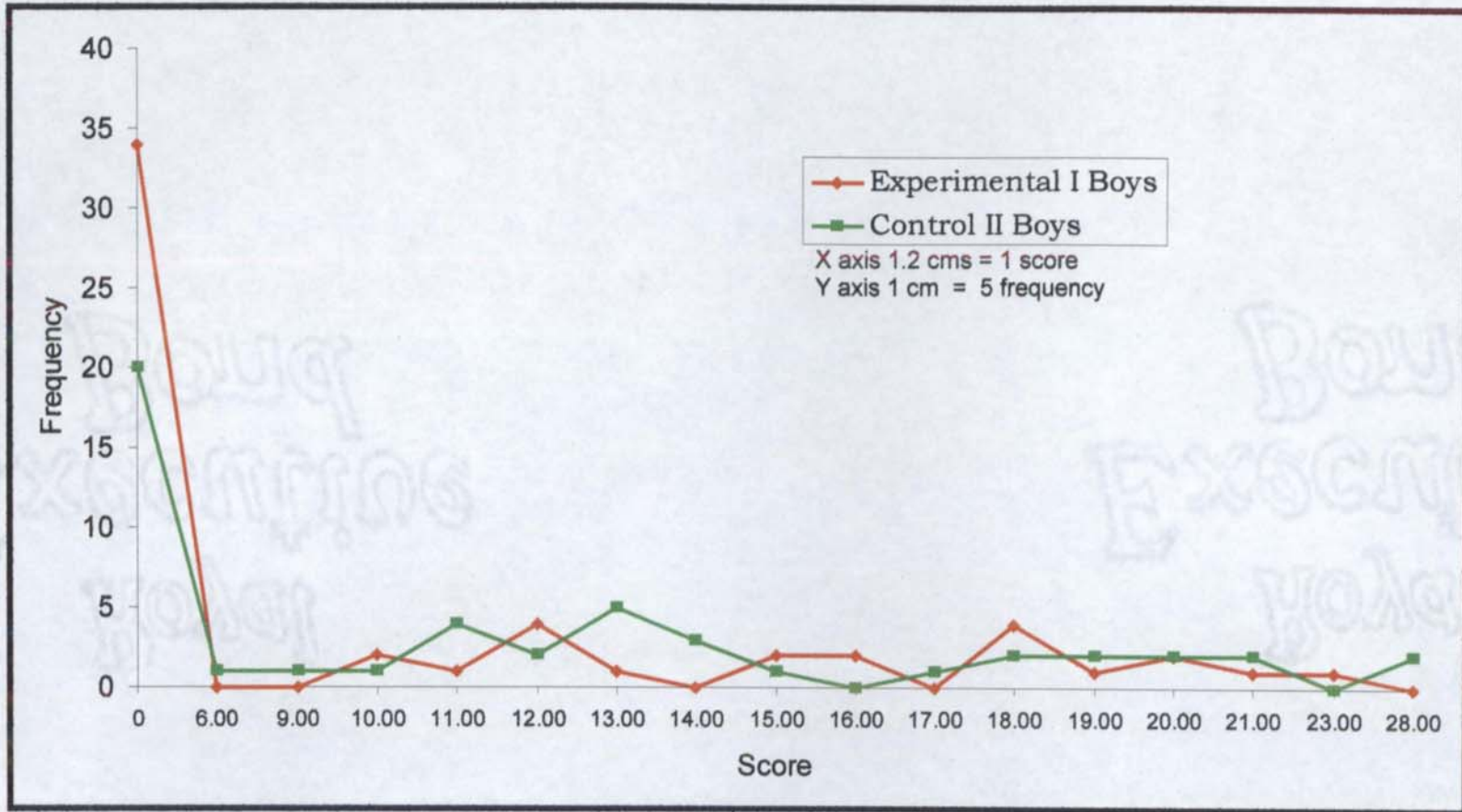


FIGURE 5-1 Comparison of the Individual Pre-test Scores of the Experimental Group I Boys and Control Group II Boys

A visual examination of the graphical representation of individual pre-test scores between the Experimental group I Boys and Control group II Boys points that the individual performance of the Boys of these two groups is similar to a certain extent. Statistically significant difference was not observed through the Mean Difference Analysis. The graphical observation confirms the *results of Mean Difference Analysis*.

5.2.1.1c. Comparison of Mean Pre-test Scores Between the Experimental Group I Girls and Control Group II Girls

To study whether the Experimental group I Girls and Control group II Girls differ significantly in terms of mean Pre-test score, test of significance of difference between means was utilised.

The means and standard deviations of the Pre-test scores were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.8.

TABLE 5.8

**Data and Results of the t-test
for the Mean Pre-test Scores between the
Experimental Group I Girls and Control Group II Girls**

Variable \ Group	Experimental Group I Girls			Control Group II Girls			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Pre-test Total	16.33	4.566	27	17.880	5.510	25	1.10	NS

Table 5.8 shows that the obtained t-value is not significant. The result indicates that Experimental group I Girls and Control Group II Girls does not differ in their mean Pre-test score.

The individual performance of the Experimental group I Girls and Control group II Girls on Pre-test was graphically examined and presented in Figure 5-2.

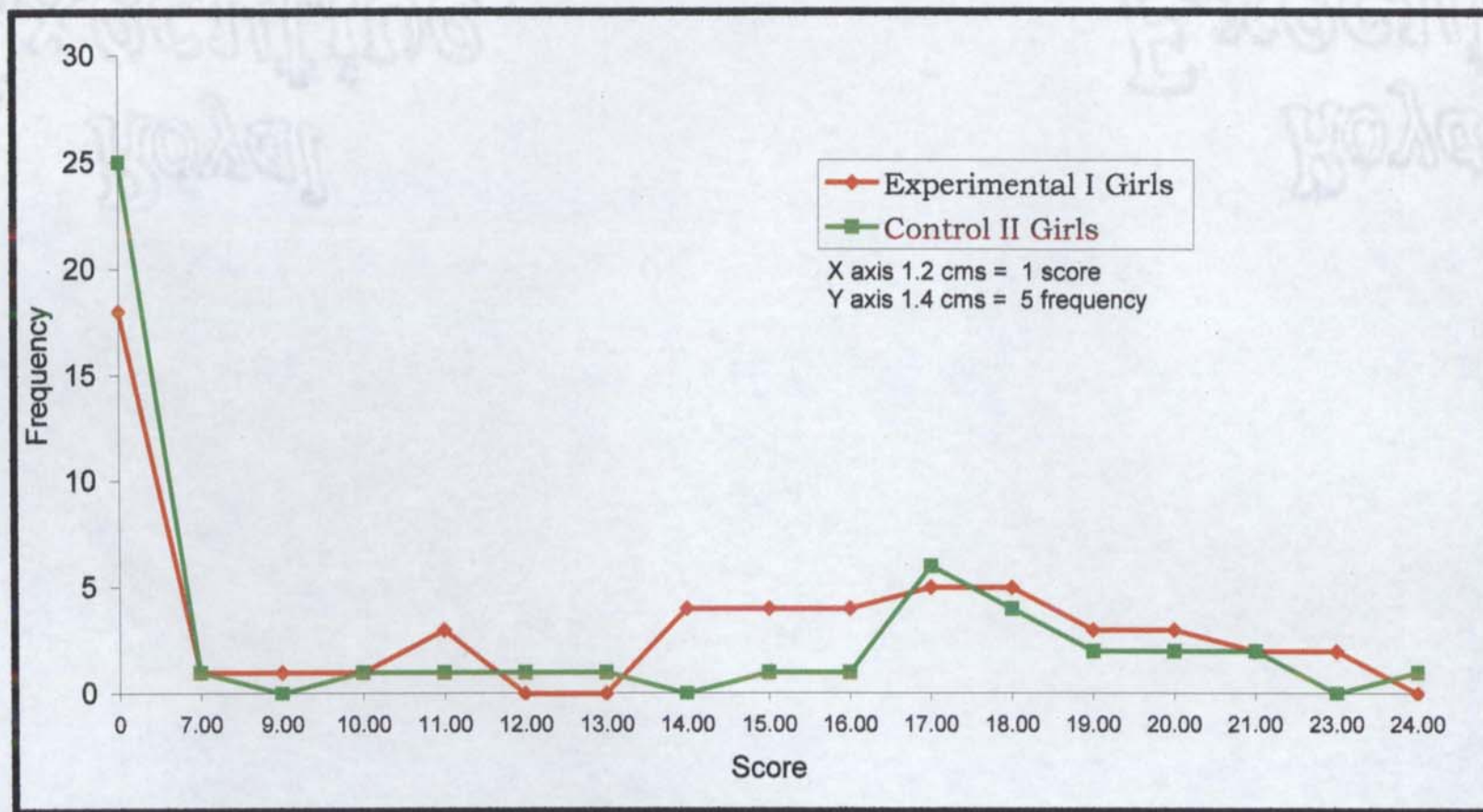


FIGURE 5-2 Comparison of the Individual Pre-test Scores of the Experimental Group I Girls and Control Group II Girls

A visual examination of the graphical representation of individual Pre-test scores between the Experimental group I Girls and Control group II girls points that the individual performance of the girls of these two groups is similar. Statistically significant difference was not observed through the Mean Difference Analysis. The graphical observation confirms the results of Mean Difference Analysis.

Hypothesis Testing : It was found that significant difference does not exist in the mean Pre-test scores between the Experimental group I and Control group II. Experimental group I Boys and Girls does not significantly differ from Control group II Boys and Girls. Therefore the first hypothesis is accepted.

5.2.1.2. COMPARISON OF ACHIEVEMENT SCORES BEFORE CONTROL

Hypothesis : There will be no significant difference in the mean Post-test scores (Objective-wise and Total) of the Experimental and Control groups, Boys and Girls.

Difference in Achievement (Objective-wise and Total score) was investigated between the two Experimental groups and Control groups to test this hypothesis. Comparison was made in between each Experimental and each Control group, between Experimental group total and Control group total and also in between the Boys and Girls of Experimental group total and control group total. In all these comparisons, the Control variables were not considered.

5.2.1.2a. Comparison of Mean Achievement Scores (Objective-wise and Total) Between the Experimental Group I and Control Group I

To study whether the Experimental group I and Control group I differ significantly in terms of mean Achievement scores (Objective-wise and Total), test of significance of difference between mean was utilised.

The means and standard deviations of the Achievement scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.9.

TABLE 5.9

Data and Results of the t-test for the Mean Achievement (Objective-wise and Total) Scores between the Experimental Group I and Control Group I

Variable \ Group	Experimental Group I			Control Group I			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	8.686	2.983	48	7.435	2.029	46	2.39	0.05
Comprehension	9.833	3.509	48	6.348	2.806	46	5.33	0.01
Application	3.563	1.737	48	1.609	1.164	46	6.43	0.01
Analysis	2.438	1.253	48	1.957	1.154	46	1.94	NS
Synthesis	0.375	0.489	48	0.196	0.401	46	1.95	NS
Evaluation	1.292	1.010	48	0.565	0.834	46	3.81	0.01
Achievement Total	26.188	8.700	48	18.196	4.764	46	5.55	0.01

Table 5.9 shows that the obtained t-values for Achievement Total and Objective-wise scores in Comprehension, Application, and Evaluation are significant at 0.01 level and for the objective Knowledge, the t-value is found significant at 0.05 level. For objective wise achievement in Analysis and Synthesis, t-value is found to be not significant.

The results indicate that the mean Achievement scores of the Experimental group I and Control group I (Objective-wise and Total scores except Analysis and Synthesis) are significantly different. Higher mean Achievement score associated with the Experimental group shows its advantage over the control group.

5.2.1.2b. Comparison of Mean Achievement Scores (Objective-wise and Total) Between the Experimental Group I and Control Group II

To study whether the Experimental group I and Control group II differ significantly in terms of mean Achievement scores (Objective-wise and Total) after the experiment, test of significance of difference between means was used.

The means and standard deviations of the Achievement scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.10.

TABLE 5.10
Data and Results of the t-test
for the Mean Achievement (Objective-wise and Total)
Scores between the Experimental Group I and Control Group II

Variable \ Group	Experimental Group I			Control Group II			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	8.688	2.983	48	6.979	2.914	48	2.84	0.01
Comprehension	9.833	3.509	48	6.813	3.057	48	4.50	0.01
Application	3.563	1.737	48	2.354	1.360	48	3.79	0.01
Analysis	2.438	1.253	48	1.667	1.191	48	3.09	0.01
Synthesis	0.375	0.489	48	0.375	0.489	48	0.00	NS
Evaluation	1.292	1.010	48	0.771	0.857	48	2.73	0.01
Achievement Total	26.188	8.700	48	18.958	6.766	48	4.54	0.01

Table 5.10 shows that the obtained t-values for Achievement-Total and Objective-wise scores in Knowledge, Comprehension, Application, Analysis and Evaluation are significant at 0.01 level and for the objective Synthesis, the t-value is found to be not significant.

The results indicate that the mean Achievement Scores of the Experimental group I and Control group II (Objective-wise and Total scores except Synthesis) are significantly different. Higher mean Achievement scores associated with the Experimental group shows its advantage over the control group.

5.2.1.2c. Comparison of Mean Achievement Scores (Objective-wise and Total) Between the Experimental Group II and Control Group I

To study whether the Experimental group II and Control group I differ significantly in terms of mean Achievement scores (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Achievement scores (Objective-wise and Total) were subjected to the mean difference analysis. Data and results of the t-test are presented in Table 5.11.

TABLE 5.11

Data and Results of the t-test for the Mean Achievement (Objective-wise and Total) Scores between the Experimental Group II and Control Group I

Variable \ Group	Experimental Group II			Control Group I			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	8.698	3.141	53	7.435	2.029	46	2.41	0.05
Comprehension	7.547	3.111	53	6.348	2.806	46	2.02	0.05
Application	2.226	1.502	53	1.609	1.164	46	2.30	0.05
Analysis	2.113	1.281	53	1.957	1.54	46	0.64	NS
Synthesis	0.396	0.494	53	0.196	0.401	46	2.23	0.05
Evaluation	1.019	0.951	53	0.565	0.834	46	2.53	0.05
Achievement Total	22.057	7.260	53	18.196	4.764	46	3.17	0.01

Table 5.11 shows that the obtained t-values for Achievement-Total is significant at 0.01 level and Objective-wise achievement in Knowledge, Comprehension, Application, Synthesis and Evaluation are significant at 0.05 level. Objective wise achievement in Analysis is found to be not significant.

The results indicate that the mean Achievement scores of the Experimental group II and Control group I (Objective-wise and Total scores except Analysis) are significantly different. Higher mean Achievement scores associated with the Experimental group show its advantage over the Control group after the experiment without controlling the relevant extraneous variables.

5.2.1.2d. Comparison of Mean Achievement Scores (Objective-wise and Total) Between the Experimental Group II and Control Group II

To study whether the Experimental group II and Control group II differ significantly in terms of mean Achievement scores (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Achievement scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.12.

TABLE 5.12

**Data and Results of the t-test
for the Mean Achievement (Objective-wise and Total)
Scores between the Experimental Group II and Control Group II**

Variable	Experimental Group II			Control Group II			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	8.698	3.141	53	6.979	2.914	48	2.85	0.01
Comprehension	7.547	3.111	53	6.813	3.057	48	1.20	NS
Application	2.226	1.502	53	2.354	1.360	48	0.45	NS
Analysis	2.113	1.281	53	1.667	1.191	48	1.82	NS
Synthesis	0.396	0.494	53	0.375	0.489	48	0.22	NS
Evaluation	1.019	0.951	53	0.771	0.857	48	1.38	NS
Achievement Total	22.057	7.260	53	18.958	6.766	48	2.22	0.05

Table 5.12 shows that the obtained t-value for Achievement total is significant at 0.05 level and Objective-wise achievement in Knowledge is significant at 0.01 level. Other Objective-wise achievement in Comprehension, Application, Analysis, Synthesis and Evaluation are found to be not significant.

The results indicate that the mean Achievement scores of the Experimental group II and Control group II (Objective-wise achievement in Knowledge and Total) are significantly different. Higher mean Achievement scores associated with the Experimental group show its advantage over the control group.

**5.2.1.2e. Comparison of Mean Achievement Scores (Objective-wise and Total)
Between the Experimental Group Boys and Control Group Boys**

To study whether the Experimental group Boys and Control group Boys differ significantly in terms of mean Achievement scores (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Achievement scores (Objective-wise

and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.13.

TABLE 5.13

**Data and Results of the t-test
for the Mean Achievement (Objective-wise and Total)
Scores between the Experimental Group Boys and Control Group Boys**

Variable	Experimental Group Boys			Control Group Boys			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	8.2727	3.124	55	6.4884	2.604	43	3.08	0.01
Comprehension	7.9818	3.274	55	4.8605	1.794	43	6.01	0.01
Application	2.6182	1.581	55	1.7442	0.978	43	3.36	0.01
Analysis	2.0182	1.130	55	1.2326	0.996	43	3.65	0.01
Synthesis	0.3273	0.474	55	0.3488	0.482	43	0.22	NS
Evaluation	1.0727	0.959	55	0.5349	0.735	43	3.14	0.01
Achievement Total	22.2727	7.319	55	15.3023	4.285	43	5.89	0.01

Table 5.13 shows that the obtained t-values for Achievement Total and Objective-wise scores in Knowledge, Comprehension, Application, Analysis and Evaluation are significant at 0.01 level. Objective-wise achievement in Synthesis is found to be not significantly different.

Results indicate that the mean Achievement scores of the Experimental group Boys and Control group Boys (Objective-wise and Total scores except Synthesis) are significantly different. Higher mean Achievement scores associated with the Experimental Group Boys show their advantage of experimental treatment over the Control Group Boys.

The individual performance of the Boys in the Experimental and Control group on Achievement scores (Total) was graphically examined and presented in Figure 5-3.

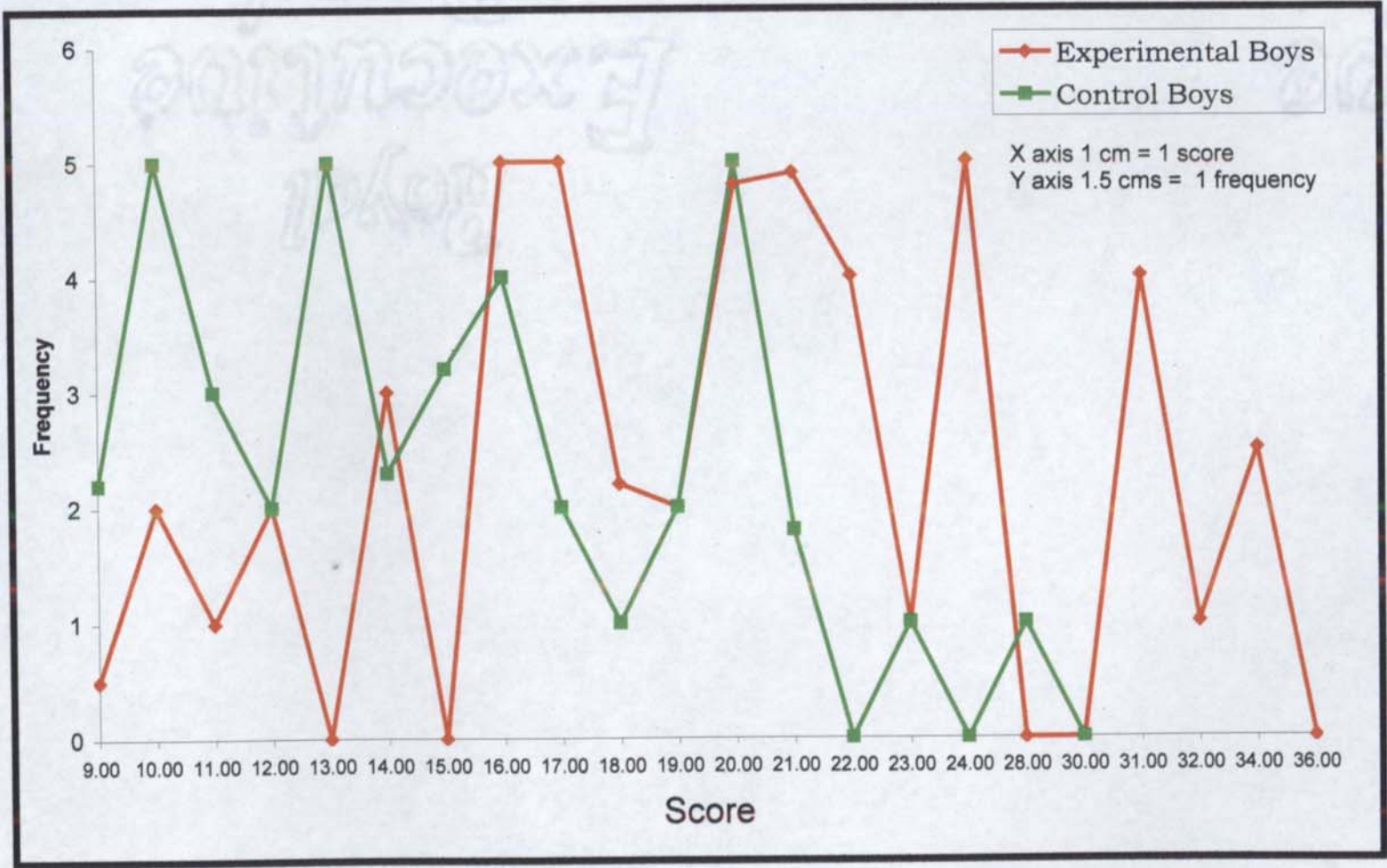


FIGURE 5-3 Comparison of the Individual Achievement Scores (Total) of the Experimental Group Boys and Control Group Boys

A visual examination of the graphical representation of individual Achievement scores between the Boys of Experimental and Control group points that the performance of Boys in the two groups are dissimilar. Statistically significant difference was observed through the Mean Difference Analysis also. Performance of Experimental Boys is better than that of Control Boys due to the effect of treatment. Thus graphical observation confirms the result of Mean Difference Analysis.

5.2.1.2f. Comparison of Mean Achievement Scores (Objective-wise and Total) Between the Experimental Group Girls and Control Group Girls

To study whether the Experimental group Girls and Control group Girls differ significantly in terms of mean Achievement scores (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Achievement scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.14.

TABLE 5.14

Data and Results of the t-test for the Mean Achievement (Objective-wise and Total) Scores between the Experimental Group Girls and Control Group Girls

Variable \ Group	Experimental Group Girls			Control Group Girls			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₁	N ₂		
Knowledge	9.1957	2.918	46	7.8039	2.298	51	2.59	0.01
Comprehension	9.4130	3.600	46	8.0392	2.925	51	2.05	0.05
Application	3.1522	1.897	46	2.1961	1.523	51	2.72	0.01
Analysis	2.5652	1.377	46	2.2941	1.101	51	1.06	NS
Synthesis	0.4565	0.504	46	0.2353	0.428	51	2.32	0.05
Evaluation	1.2391	1.015	46	0.7843	0.923	51	2.30	0.05
Achievement Total	26.1087	8.777	46	21.3529	5.589	51	3.14	0.01

Table 5.14 shows that the obtained t-values for Achievement Total and Objective-wise achievement in Knowledge and Application are significant at 0.01 level and the t-values for Objective-wise achievement in Comprehension, Synthesis and Evaluation are significant at 0.05 level. Objective-wise achievement in Analysis is found to be not significant.

Results indicate that the mean Achievement scores of the Experimental group Girls and Control group Girls (Objective-wise and Total scores except Analysis) are significantly different. Higher mean Achievement scores associated with the Experimental group Girls show their superiority over the Control group Girls due to experimental treatment.

The individual performance of the Girls in the Experimental and Control group on Achievement scores (Total) was graphically examined and presented in Figure 5-4.



FIGURE 5-4 Comparison of the Individual Achievement Scores (Total) of the Experimental Group Girls and Control Group Girls

Visual examination of the graphical representation of individual Achievement scores between the Girls of Experimental and Control Group points that the performance of Girls in the two groups are dissimilar. Statistically significant difference was observed through the Mean Difference Analysis also. Performance of Experimental Girls is better than that of Control Girls. Thus graphical observation confirms the result of Mean Difference Analysis.

5.2.1.2g. Comparison of Mean Achievement Scores (Objective-wise and Total) Between the Experimental Group Total and Control Group Total

To study whether the Experimental group Total and Control group Total differ significantly in terms of mean Achievement scores (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Achievement scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.15.

TABLE 5.15

Data and Results of the t-test for the Mean Achievement (Objective-wise and Total) Scores between the Experimental Group Total and Control Group Total

Variable \ Group	Experimental Group Total			Control Group Total			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	8.6931	3.052	101	7.2021	2.517	94	3.73	0.01
Comprehension	8.6337	3.483	101	6.5851	2.931	94	4.45	0.01
Application	2.8614	1.744	101	1.9894	1.316	94	3.96	0.01
Analysis	2.2673	1.272	101	1.8085	1.176	94	2.62	0.01
Synthesis	0.3861	0.489	101	0.2872	0.455	94	1.46	NS
Evaluation	1.1485	0.984	101	0.6702	0.847	94	3.64	0.01
Achievement Total	24.0198	8.202	101	18.5851	5.854	94	5.35	0.01

Table 5.15 shows that the obtained t-values for the comparison of Achievement Total and Objective wise Achievement in Knowledge, Comprehension, Application, Analysis and Evaluation are significant at 0.01 level except Synthesis.

Results indicate that the mean Achievement Scores of the Experimental group Total and Control group Total (Objective-wise and Total scores except Synthesis) are significantly different. Higher mean Achievement scores associated with the Experimental Group show their superiority over the Control Group due to the overall effect of treatment.

Hypothesis testing: Significant difference was noted in the mean Achievement scores between the Experimental groups and Control groups. Advantage was noted for Experimental group to which high mean Achievement score was associated. Experimental group Boys and Girls were found to be superior over Control group Boys and Girls. Thus the second hypothesis is rejected.

5.2.1.3. COMPARISON OF GAIN SCORES

Hypothesis : There will be no significant difference in the mean Gain scores of the Experimental group I and Control group II, Boys and Girls.

Gain scores of the Pre-test received groups (Experimental Group I and Control Group II) were compared and discussed in this section. Gain scores were compared in between the groups as well as in between the Boys and Girls of the two groups.

5.2.1.3a. Comparison of Mean Gain Scores Between the Experimental Group I and Control Group II

To study whether the Experimental group I and Control group II differ

significantly in terms of Gain scores, test of significance of difference between means was used.

The means and standard deviations of the Gain scores were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.16.

TABLE 5.16

**Data and Results of the t-test
for the Mean Gain Scores between the
Experimental Group I and Control Group II**

Group Variable	Experimental Group I			Control Group II			t- value	Level of Signi- ficance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Gain Score	10.125	7.174	48	2.792	5.720	48	5.54	0.01

Table 5.16 shows that the obtained t-value for Gain score is found to be significant at 0.01 level.

The result indicate that the mean Gain score of the Experimental group I and Control group II is significantly different. Higher mean Gain score associated with Experimental group show its advantage over the Control group and highlighted the effect of treatment (Peer Tutoring procedure) before controlling the appropriate factors.

5.2.1.3b. Comparison of Mean Gain Scores Between Experimental Group I Boys and Control Group II Boys

To study whether there exists significant difference in the mean Gain scores of Experimental group I Boys and Control group II Boys, test of significance of difference between means was used.

The means and standard deviations of the Gain scores were subjected to the Mean Difference Analysis. Data and results of the t-test are given in Table 5.17.

TABLE 5.17

**Data and Results of the t-test
for the Mean Gain Scores between the
Experimental Group I Boys and Control Group II Boys**

Variable	Experimental Group I Boys			Control Group II Boys			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Gain Score	9.7143	6.776	21	0.6957	5.514	23	4.81	0.01

Table 5.17 shows that the obtained t-value for Gain score is found to be significant at 0.01 level. Result indicates that the mean Gain scores of the Experimental group I Boys and Control group II Boys are significantly different. Higher mean Gain score associated with the Experimental Group Boys show their superiority over the Control group Boys after experiment without controlling the relevant variables.

The individual performance of the Boys in Experimental and Control groups on Gain score was graphically examined and presented in Figure 5-5.

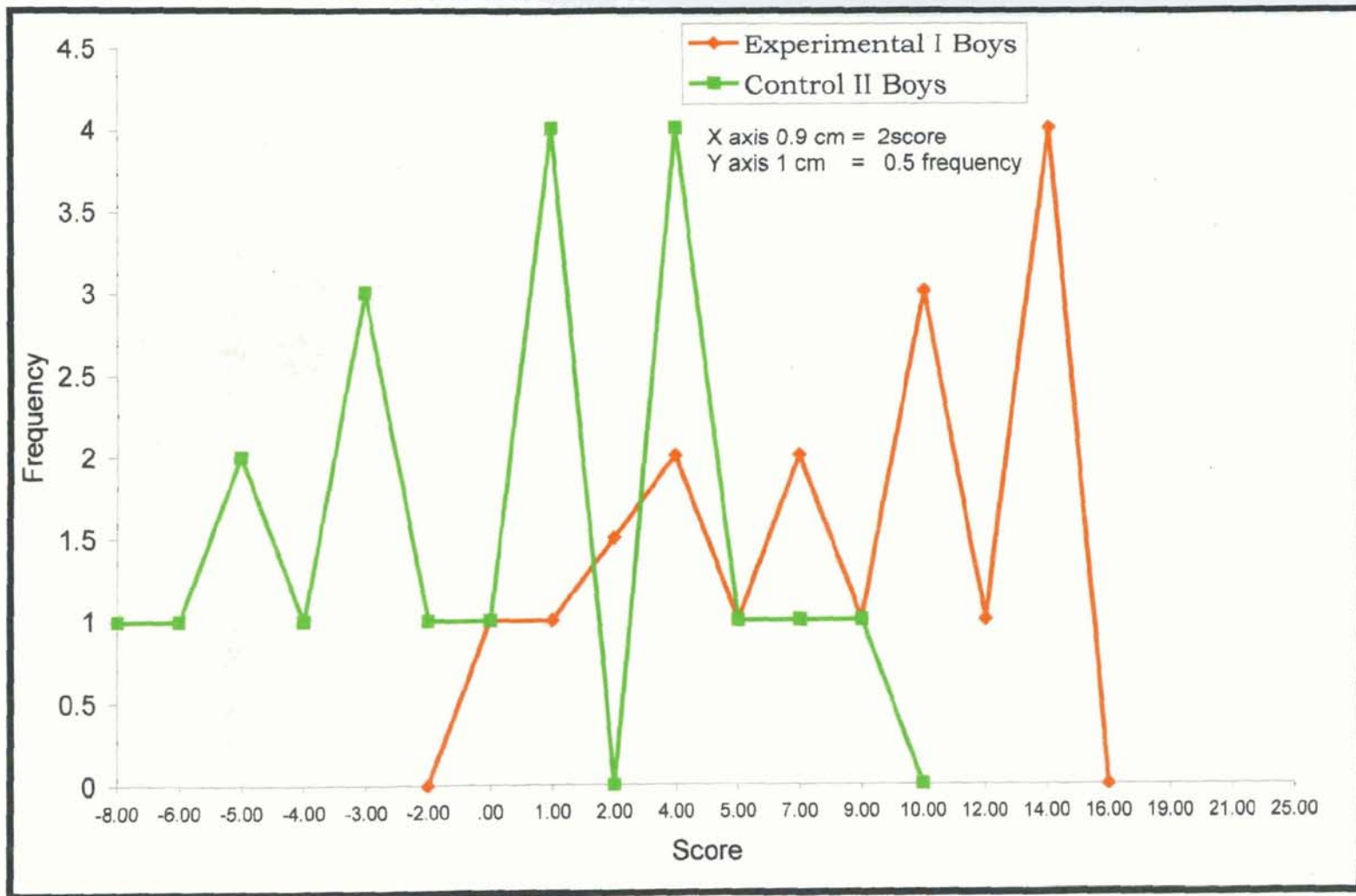


FIGURE 5-5 Comparison of the Individual Gain Scores of the Experimental Group I Boys and Control Group II Boys

A Visual examination of the graphical representation of individual Gain scores between the Boys of Experimental group I and Control group II indicates that the performance of these two groups are dissimilar. Mean Difference Analysis also indicated statistically significant difference. Performance of Experimental Boys is higher than that of Control Boys. So graphical observation confirms the result of Mean Difference Analysis.

5.2.1.3c. Comparison of Mean Gain Scores Between Experimental Group I Girls and Control Group II Girls

To study whether there exists significant difference in mean Gain scores of Experiment group I Girls and Control group II Girls, test of significance of difference between means was used.

The means and standard deviations of the Gain scores were subjected to Mean Difference Analysis. Data and results of the t-test are given in Table 5.18.

TABLE 5.18

**Data and Results of the t-test
for the Mean Gain Scores between the
Experimental Group I Girls and Control Group II Girls**

Group Variable	Experimental Group I Girls			Control Group II Girls			t- value	Level of Signi- ficance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Gain Score	10.4444	7.582	27	4.7200	5.303	25	3.17	0.01

Table 5.18 shows that the obtained t-value for Gain score is found to be significant at 0.01 level. Result indicates that the mean Gain scores of the Experimental group I Girls and Control group II Girls are significantly different. Higher mean Gain score associated with the Experimental group Girls show their superiority over the Control group Girls.

The individual performance of the Girls in Experimental and Control groups on Gain score was graphically examined and presented in Figure 5-6.

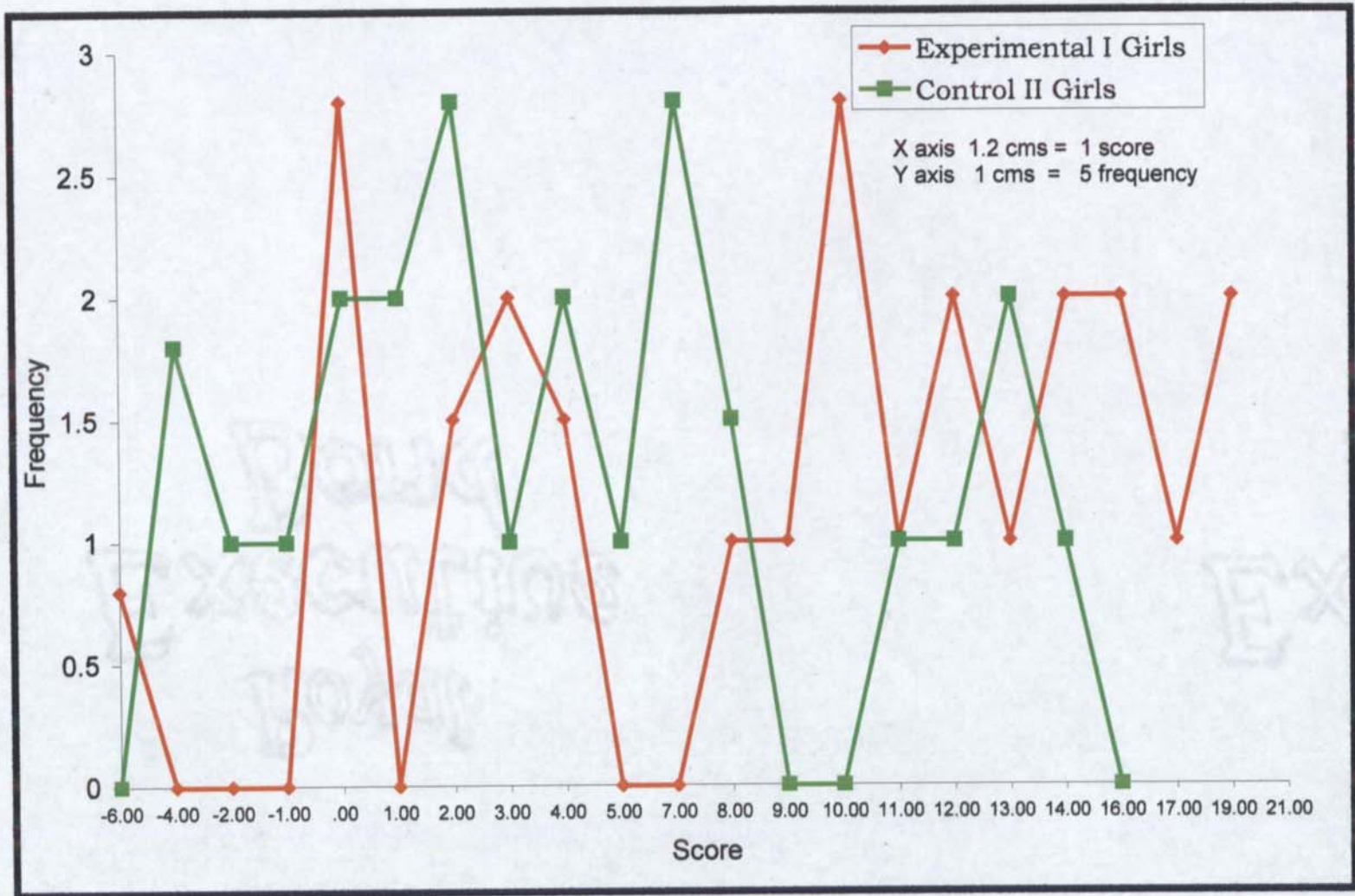


FIGURE 5-6 Comparison of the Individual Gain Scores of the Experimental Group I Girls and Control Group II Girls

A Visual examination of the graphical representation of individual Gain scores between the Girls of Experimental group I and Control group II points that the performance of these two groups are dissimilar. Mean Difference Analysis also indicated statistically significant difference. Performance of Experimental Girls is higher than that of Control Girls. Thus graphical observation confirms the result of Mean Difference Analysis.

Hypothesis Testing : Experimental group I and Control group II differ significantly in their mean Gains scores. Experimental group I which had high mean Gain scores was found to be superior to Control group II. Experimental group I Boys and Girls show advantage over Control group II Boys and Girls. So the third hypothesis is rejected.

5.2.1.4. COMPARISON OF RETENTION SCORES BEFORE CONTROL

Hypothesis : There will be no significant difference in the mean Retention scores (Objective - wise and Total) of the Experimental and Control groups, Boys and Girls.

To study the difference in Retention between the groups, the Retention scores (Objective-wise and Total) were compared in between the two Experimental and two Control groups. Comparison was made in between each Experimental and each Control group as well as in between the Total Experimental group and Total Control group. Sex-wise comparison was also made in between the groups.

5.2.1.4a. Comparison of Mean Retention Scores (Objective-wise and Total) Between the Experimental Group I and Control Group I

To study whether the Experimental group I and Control group I differ significantly in terms of mean Retention scores (Objective-wise and Total) test of significance of difference between means was used.

The means and standard deviations of the Retention scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.19.

TABLE 5.19

**Data and Results of the t-test
for the Retention (Objective-wise and Total)
Scores between the Experimental Group I and Control Group I**

Variable \ Group	Experimental Group I			Control Group I			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	6.521	3.458	48	7.674	2.109	46	1.96	0.05
Comprehension	7.417	3.086	48	8.609	3.015	46	1.89	NS
Application	2.333	1.576	48	1.891	1.120	46	1.57	NS
Analysis	1.792	1.202	48	2.196	1.204	46	1.63	NS
Synthesis	0.396	0.494	48	0.413	0.498	46	0.17	NS
Evaluation	0.917	0.895	48	0.913	0.915	46	0.02	NS
Retention Total	19.375	7.362	48	21.696	5.378	46	1.75	NS

Table 5.19 shows that the obtained t-values for the Objective-wise Retention in, Knowledge is only significant (at 0.05 level). Total as well as Objective-wise Retention in Comprehension, Application, Analysis, Synthesis and Evaluation are not significant.

Results indicate that the mean Retention scores of the Experimental group I and Control group I (Objective-wise and Total except Knowledge) does not differ significantly.

**5.2.1.4b. Comparison of Mean Retention Scores (Objective-wise and Total)
Between Experimental Group I and Control Group II**

To study whether the Experimental group I and Control group II differ significantly in terms of Retention in Biology (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Retention scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.20.

TABLE 5.20

**Data and Results of the t-test
for the Mean Retention (Objective-wise and Total)
Scores between the Experimental Group I and Control Group II**

Variable \ Group	Experimental Group I			Control Group II			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	6.521	3.458	48	8.167	3.048	48	2.47	0.05
Comprehension	7.417	3.086	48	7.979	3.884	48	0.79	NS
Application	2.333	1.576	48	2.188	1.454	48	0.47	NS
Analysis	1.792	1.202	48	1.958	0.988	48	0.74	NS
Synthesis	0.396	0.494	48	0.250	0.438	48	1.53	NS
Evaluation	0.917	0.895	48	0.917	0.821	48	0.00	NS
Retention Total	19.375	7.362	48	21.500	7.729	48	1.38	NS

Table 5.20 shows that the obtained t-value is significant only for Retention in Knowledge (at 0.05 level). Retention Total and Objective-wise Retention in Comprehension, Application, Analysis, Synthesis and Evaluation are not significant.

Results indicate that the mean Retention scores of the Experimental group I and Control group II (Objective-wise and Total except Knowledge) are not significantly different.

**5.2.1.4c. Comparison of Mean Retention Scores (Objective-wise and Total)
Between Experimental Group II and Control Group I**

To study whether the Experimental group II and Control group I differ significantly in terms of Retention Scores (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Retention scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.21.

TABLE 5.21

**Data and Results of the t-test
for the Mean Retention (Objective-wise and Total)
Scores between the Experimental Group II and Control Group I**

Variable \ Group	Experimental Group II			Control Group I			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	7.811	3.403	53	7.674	2.109	46	0.24	NS
Comprehension	7.227	2.853	53	8.609	3.015	46	2.33	0.05
Application	2.019	1.232	53	1.891	1.120	46	0.54	NS
Analysis	1.604	1.044	53	2.196	1.204	46	2.59	0.01
Synthesis	0.339	0.478	53	0.413	0.498	46	0.75	NS
Evaluation	0.755	0.939	53	0.913	0.915	46	0.85	NS
Retention Total	19.755	6.858	53	21.696	5.378	46	1.58	NS

Table 5.21 shows that the obtained t-values are significant at 0.01 level for the Objective-wise retention in Analysis and at 0.05 level for Comprehension. Retention Total and other Objective-wise scores in Knowledge, Application, Synthesis and Evaluation are found to be not significant.

Results indicate that the mean Retention scores of the Experimental group II and Control group I (Objective-wise and Total except Comprehension and Analysis) are not significantly different.

5.2.1.4d. Comparison of Mean Retention Scores (Objective-wise and Total) Between Experimental Group II and Control Group II

To study whether the Experimental group II and Control group II differ

significantly in terms of mean Retention scores (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Retention scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.22.

TABLE 5.22

**Data and Results of the t-test
for the Retention (Objective-wise and Total)
Scores between the Experimental Group II and Control Group II**

Variable \ Group	Experimental Group II			Control Group II			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	7.811	3.403	53	8.167	3.048	48	0.55	NS
Comprehension	7.226	2.583	53	7.979	3.884	48	1.10	NS
Application	2.019	1.232	53	2.188	1.454	48	0.63	NS
Analysis	1.604	1.044	53	1.958	0.988	48	1.75	NS
Synthesis	0.339	0.478	53	0.250	0.438	48	0.98	NS
Evaluation	0.755	0.939	53	0.917	0.821	48	0.92	NS
Retention Total	19.755	6.858	53	21.500	7.729	48	1.20	NS

Table 5.22 shows that the obtained t-values are not significant for the Total as well as Objective-wise Retention in Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation.

Results indicate that the mean Retention scores of the Experimental group II and Control group II (Objective-wise and Total) are not significantly different.

**5.2.1.4e. Comparison of Mean Retention Scores (Objective-wise and Total)
Between Experimental Group Boys and Control Group Boys**

To study whether the Experimental group Boys and Control group Boys differ

significantly in terms of mean Retention Scores (Objective-wise and Total), test of significance of difference between means was used.

The means and standard deviations of the Retention scores (Objective-wise and Total) were subjected to the Mean Difference Analysis. Data and results of the t-test are presented in Table 5.23.

TABLE 5.23

**Data and Results of the t-test for
the Mean Retention (Objective-wise and Total) Scores
between the Experimental Group Boys and Control Group Boys**

Variable \ Group	Experimental Group Boys			Control Group Boys			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	6.8727	3.491	55	7.5349	2.737	43	1.05	NS
Comprehension	6.8364	2.892	55	7.2326	3.138	43	0.64	NS
Application	1.8545	1.129	55	1.8372	1.214	43	0.07	NS
Analysis	1.4182	0.875	55	2.0698	1.183	43	3.02	0.01
Synthesis	0.3273	0.474	55	0.2093	0.412	43	1.32	NS
Evaluation	0.7091	0.936	55	0.8837	0.762	43	1.02	NS
Retention Total	18.0364	6.365	55	19.8140	5.783	43	1.44	NS

Table 5.23 shows that the obtained t-values for the Objective-wise Retention in Analysis is significant at 0.01 level. The Retention Total as well as Objective wise Retention in Comprehension, Application, Synthesis and Evaluation have non significant t-values.

Results indicate that the mean Retention scores of the Experimental group Boys and Control group Boys (Objective-wise and Total except Analysis) does not differ significantly.

The individual performance of the Boys in the Experimental and Control groups on Retention scores was graphically examined and presented in Figure 5-7.

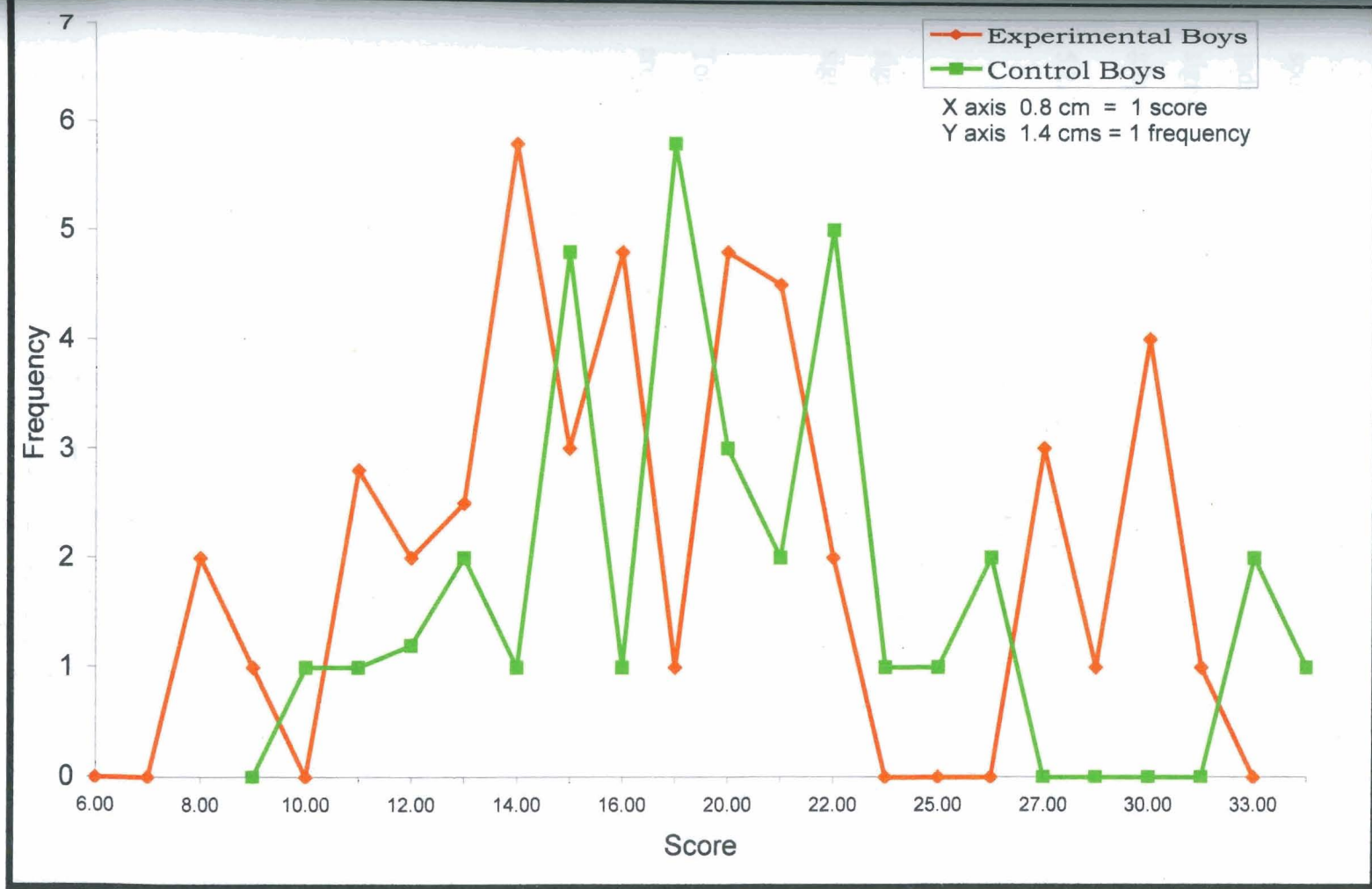


FIGURE 5-7 Comparison of the Individual Retention Scores of the Experimental Group Boys and Control Groups Boys

A visual examination of the graphical representation of individual Retention scores between the Boys of Experimental and Control groups indicate that the individual performance of the boys of these two groups are similar. Statistically significant difference was not observed through the Mean Difference Analysis. So, the graphical representation confirms the result of Mean Difference Analysis.

5.2.1.4.f Comparison of Mean Retention Scores (Objective-wise and Total) Between the Experimental Group Girls and Control Group Girls

To study whether the Experimental group Girls and Control group Girls differ significantly in terms of mean Retention Scores (Objective-wise and Total), test of significance of difference between means was used.

The mean and standard deviations of the Retention scores (Objective-wise and Total) were subjected to the mean Difference Analysis. Data and results of the t-test are given in Table 5.24.

TABLE 5.24

Data and Results of the t-test for the Mean Retention (Objective-wise and Total) Scores between the Experimental Group Girls and Control Group Girls

Variable \ Group	Experimental Group Girls			Control Group Girls			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	7.5870	3.449	46	8.2549	2.513	51	1.08	NS
Comprehension	7.8913	2.953	46	9.1765	3.537	51	1.95	NS
Application	2.5435	1.615	46	2.2157	1.361	51	1.07	NS
Analysis	2.0217	1.291	46	2.0784	1.036	51	0.24	NS
Synthesis	0.4130	0.498	46	0.4314	0.500	51	0.18	NS
Evaluation	0.9783	0.882	46	0.9412	0.947	51	0.20	NS
Retention Total	21.4130	7.488	46	23.0980	7.006	51	1.14	NS

Table 5.24 shows that the obtained t-values for Retention Total and Objective-wise Retention are not significant. Results indicate that the mean Retention scores of the Experimental group Girls and Control group Girls do not differ significantly.

The individual performance of the Girls in the Experimental and Control groups on Retention scores was graphically examined and presented in Figure 5-8.

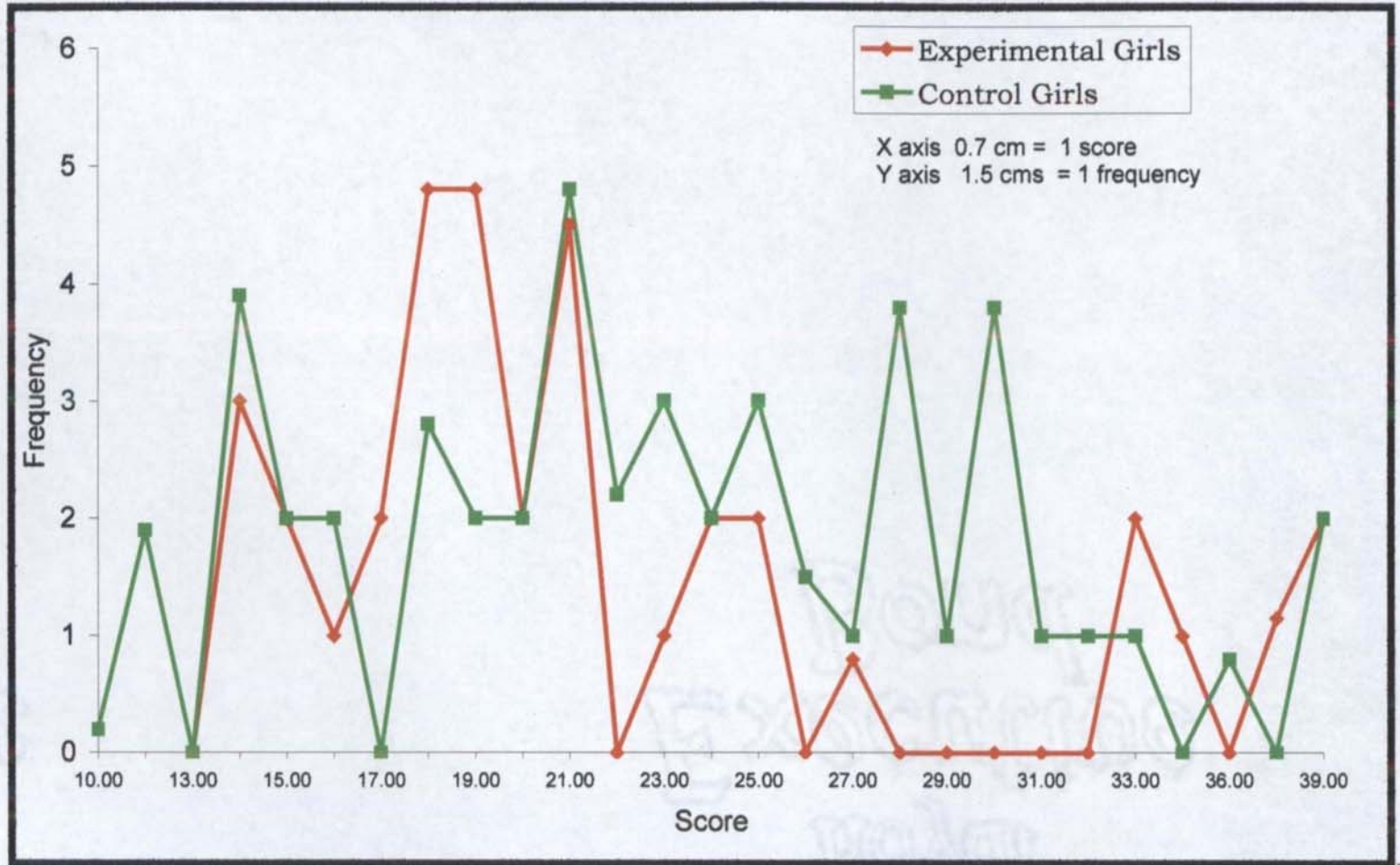


FIGURE 5-8 Comparison of the Individual Retention Scores of the Experimental Group Girls and Control Groups Girls

A visual examination of the graphical representation of individual Retention scores between the Girls of Experimental and Control groups points that the individual performance of the Girls of these two groups are similar. Mean Difference Analysis did not indicate statistically significant difference. So the graphical observation confirms the result of Mean Difference Analysis.

5.2.1.4g. Comparison of Mean Retention Scores (Objective-wise and Total) Between the Experimental Group Total and Control Group Total

To study whether the Experimental group Total and Control group Total differ significantly in terms of mean Retention scores (Objective-wise and Total), test of significance of difference between means was used.

The mean and standard deviations of the Retention scores (Objective-wise and Total) were subjected to the mean Difference Analysis. Data and results of the t-test are presented in Table 5.25.

TABLE 5.25

**Data and Results of the t-test for
the Mean Retention (Objective-wise and Total) Scores
between the Experimental Group Total and Control Group Total**

Variable \ Group	Experimental Group Total			Control Group Total			t-value	Level of Significance
	M ₁	SD ₁	N ₁	M ₂	SD ₂	N ₂		
Knowledge	7.1980	3.473	101	7.9255	2.628	94	1.66	NS
Comprehension	7.3168	2.953	101	8.2872	3.482	14	2.09	0.05
Application	2.1683	1.408	101	2.0462	1.303	94	0.65	NS
Analysis	1.6931	1.120	101	2.0745	1.100	94	2.40	0.05
Synthesis	0.3663	0.484	101	0.3298	0.473	94	0.53	NS
Evaluation	0.8317	0.917	101	0.9149	0.863	94	0.65	NS
Retention Total	19.5743	7.069	101	21.5957	6.648	94	2.06	0.05

As per Table 5.25 the obtained t-values are significant at 0.05 level for Retention Total and Objective-wise Retention in Comprehension and Analysis. But the t-values are not found significant for Retention in Knowledge, Application, Synthesis and Evaluation.

Results indicate that the mean Retention scores of the Experimental group Total and Control group Total (Objective-wise and Total except Knowledge, Application, Synthesis, and Evaluation) differ significantly.

Hypothesis Testing : It was found that significant difference does not exist in the mean Retention scores between the Experimental groups and Control groups. Experimental group Boys and Girls does not significantly differ from Control group Boys and Girls. Hence the fourth hypothesis is accepted.

5.2.1.5. SUMMARY AND DISCUSSION OF MEAN DIFFERENCE ANALYSIS

Results of the Mean Difference Analysis conducted for the comparison of the mean Pre-test scores, Achievement scores (Objective-wise and Total), Gain scores and Retention scores (Objective-wise and Total) between the two Experimental and two Control groups are summarised in Table 5.26, 5.27, 5.28 and 5.29.

TABLE 5.26

Summary of t-values for Pre-test Scores

Serial No.	Groups Compared	t-value	Level of Significance
1.	Experimental Group I and Control Group II	0.13	NS
2.	Experimental Group I Boys and Control Group II Boys	1.06	NS
3.	Experimental Group I Girls and Control Group II Girls	1.10	NS

From Table 5.26 it is clear that all of the three t-values obtained are found to be non-significant. So it can be concluded that Pre-test scores does not differentiate the Experimental and Control groups which received Pre-test. The pre-experimental status of the subjects in both the groups are same.

TABLE 5.27
Summary of t-values for Achievement (Total) Scores

Serial No.	Group Compared	t-value	Level of Significance
1.	Experimental Group I and Control Group I	5.55	0.01
2.	Experimental Group I and Control Group II	4.54	0.01
3.	Experimental Group II and Control Group I	3.17	0.01
4.	Experimental Group II and Control Group II	2.22	0.05
5.	Experimental Group Boys and Control Group Boys	5.89	0.01
6.	Experimental Group Girls and Control Group Girls	3.14	0.01
7.	Experimental Group Total and Control Group Total	5.35	0.01

As per Table 5.27 out of the seven t-values for Achievement Total, seven are significant (six at 0.01 level and one at 0.05 level). So it can be inferred that *Achievement in Biology differentiate* the Experimental and Control groups. These comparisons which show significant t-values reveal the *advantage of the Experimental groups* over the Control groups as the high mean scores are seen to associate with the Experimental groups due to the experimental treatment.

In sex-wise comparison, *Experimental group Boys and Girls* are superior to the Control group Boys and Girls.

TABLE 5.28

Summary of t-values for Gain Scores

Serial No.	Groups Compared	t-value	Level of Significance
1.	Experimental Group I and Control Group II	5.54	0.01
2.	Experimental Group I Boys and Control Group II Boys	4.81	0.01
3.	Experimental Group I Girls and Control Group II Girls	3.17	0.01

Table 5.28 makes it clear that all the three t-values obtained are significant at 0.01 level. Results indicate that Gain scores *differentiate the Experimental and Control groups* (Experimental group I and Control group II, which received Pre-test). Comparison indicates the superiority of *Experimental group* as high mean Gain scores are associated with Experimental group.

In sex-wise comparison, Experimental group I Boys and Girls were seen to have *advantage over* Control group II Boys and Girls.

TABLE 5.29

Summary of t-values for Retention (Total) Scores

Serial No.	Groups Compared	t-value	Level of Significance
1.	Experimental Group I and Control Group I	1.75	NS
2.	Experimental Group I and Control Group II	1.38	NS
3.	Experimental Group II and Control Group I	1.58	NS
4.	Experimental Group II and Control Group II	1.20	NS
5.	Experimental Group Boys and Control Group Boys	1.44	NS
6.	Experimental Group Girls and Control Group Girls	1.14	NS
7.	Experimental Group Total and Control Group Total	2.06	0.05

It is clear from Table 5.29 that out of the seven t-values, only one is significant. Thus it can be concluded that Retention in Biology *does not differentiate* the Experimental and Control groups.

Graphical comparisons of the individual scores of the subjects in the two Experimental and two Control groups on Pre-test scores, Achievement scores (Total), Gain scores and Retention scores (Total) were done for a visual examination of the performance. All the graphical representations *confirmed the results of Mean Difference Analysis*.

Results of the Mean Difference Analysis on Pre-test scores, Achievement scores (Objective-wise and Total), Gain scores and Retention scores (Objective-wise and Total) reveals the fact that the Experimental groups and Control groups differ significantly with regard to Achievement and Gain, even *without controlling the Covariates in the Experiment*. But the Experimental and Control groups does not differ significantly in their Retention.

5.2.2. ANALYSIS OF COVARIANCE FOR ACHIEVEMENT AND RETENTION

To study whether the Experimental groups and Control groups differ significantly or not with regard to the Achievement and Retention in Biology of standard VIII pupils after controlling the effects of five (four in the case of Pre-test non-received groups), Control variables, Covariance Analysis was utilised. ANCOVA was used, because the subjects in the study were not assigned randomly to Experimental and Control groups. ANCOVA permits the experimenter to statistically control for differences on the Pre-test (and the relevant Control variables) so that Post-test differences would not be due to initial differences prior to Experiment.

Single factor ANCOVA with five Covariates (separately and in combination of five at a time) was employed for Pre-test received groups (Experimental group I and Control group II). Single factor ANCOVA with four covariates (separately and in combination of four at a time) was employed for Pre-test non-received groups (Experimental group II and Control group I).

The results of Analysis of Covariance were further used to examine the *relative effectiveness* of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology after *controlling the single and combined effects of the covariates*. The variables controlled were *Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies* and *Socio-Economic Status*. Then the effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology was studied.

Separate Analysis of Covariance were utilised for Pre-test received groups and Pre-test non received groups. For Achievement and Retention separate ANCOVA were employed for both these groups. Thus Pre-test received group has 12 ANCOVA (six ANCOVA when Achievement treated as Dependent Variable and six ANCOVA when Retention treated as Dependent Variable), and Pre-test non received group has 10 ANCOVA (Five ANCOVA when Achievement treated as Dependent variable and five ANCOVA when Retention treated as Dependent Variable).

Before proceeding to ANCOVA the investigator scrutinised the data used for analysis, with a view to know whether the data are sufficient to satisfy the major assumptions suggested by Winer (1971), Wildt and Ahtola (1978) and Ferguson (1976) to carry out the ANCOVA procedure. The data were seen to satisfy the following assumptions.

- (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 σ_E^2 .
- (3) The (weighted) sum overall 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.

All computations were done using the software, Statistical Package for Social Sciences (SPSS - Hull & Nie, 2005).

Tests for Basic Assumptions

The basic assumptions of the ANCOVA, described earlier, were examined by analysing the data collected. The results of the analysis are presented as follows:

a. Linear Relationship between the Dependent Variable and the Covariates

The nature of the relationship between the Dependent variables (Achievement and Retention in Biology) and the Covariates (Pre-test, Verbal Intelligence, Non-Verbal Intelligence, Learning Strategies and Socio-Economic Status) was studied using *Scatter Plots*. A visual examination of the Scatter Plots revealed that the relationship between the Dependent variables and the Covariates did not depart greatly from the line of goodness of fit. Thus the assumptions of linear relationship between the Dependent variables and the Covariates were satisfied.

Scatter Plots of the five covariates (four covariates for Pre-test non received groups) against the Dependent variable (Achievement and Retention) are presented in Figure 5-9 and Figure 5-10.

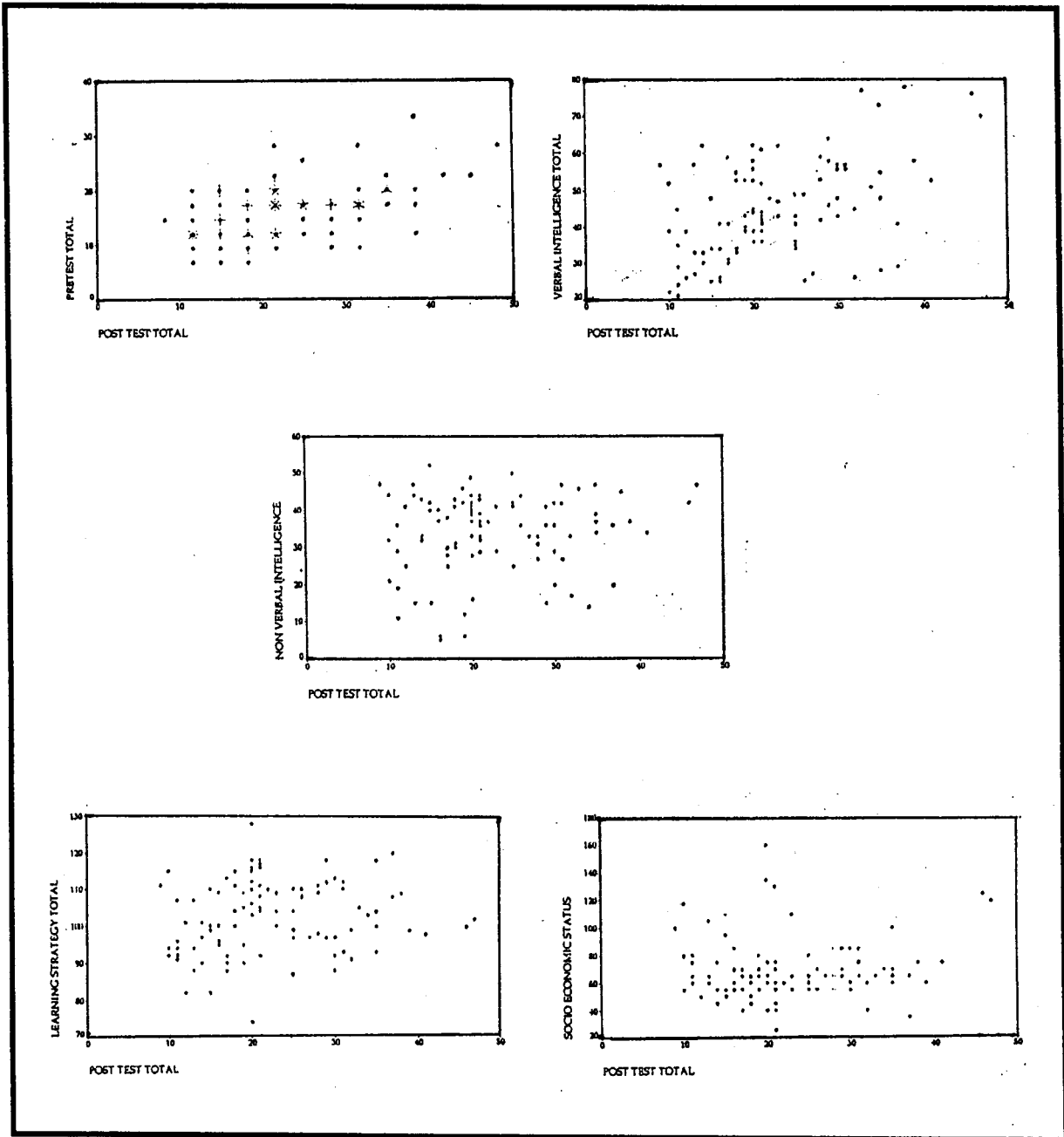


FIGURE 5-9 Scatter Plots of Achievement (Post-test) Scores (Total) with all Covariates

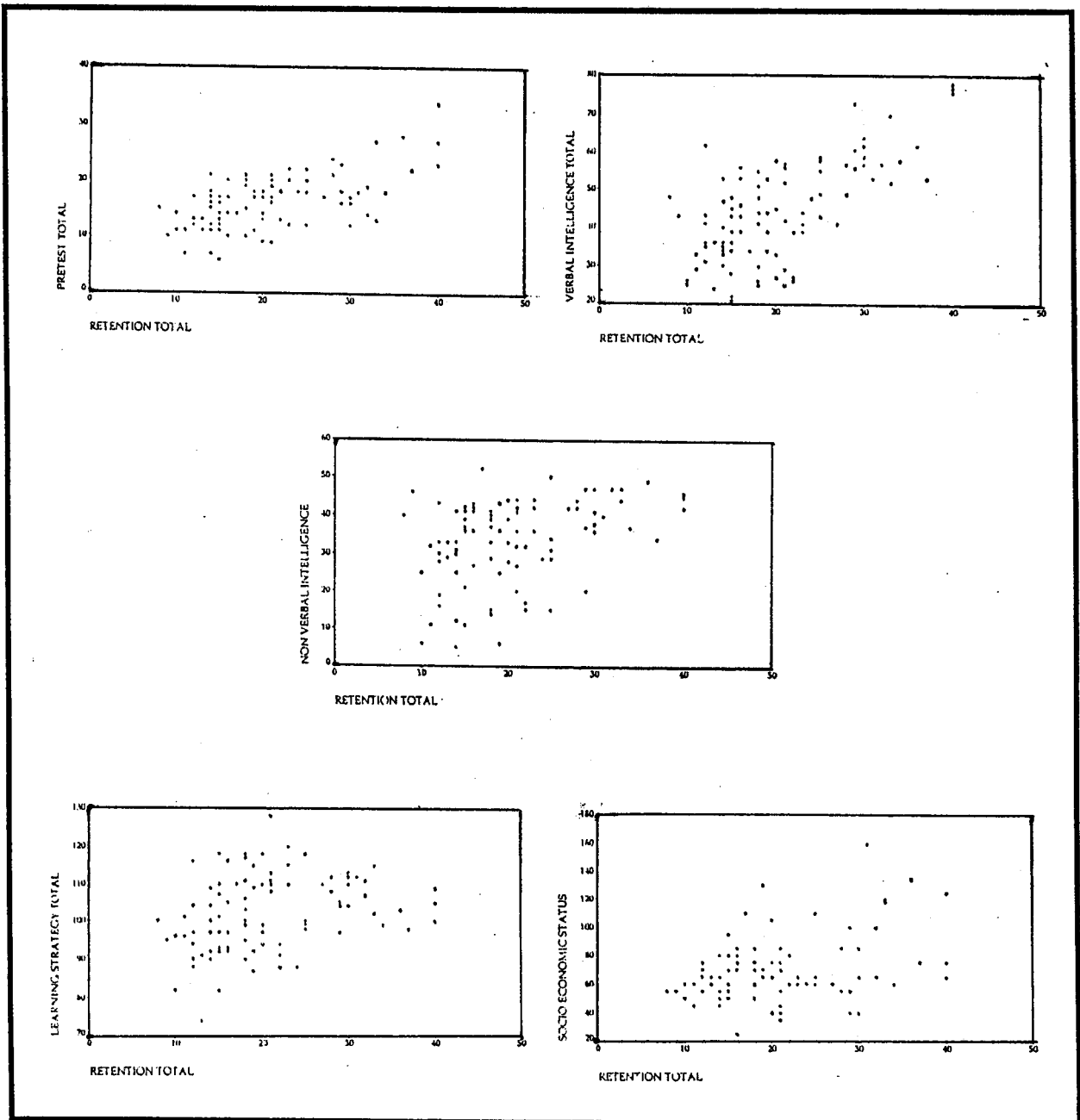


FIGURE 5-10 Scatter Plots of Retention Scores (Total) with all Covariates

b. Homogeneity of Variance

To satisfy the assumption of homogeneity of variance, separate analysis of variance was used. The ANOVA used for this purpose helped the investigator to test whether the slopes of the regression lines are the same (Homogeneity of within class regression) for the Independent variable.

Separate tests of Homogeneity of Variance were employed for each Analysis of Covariance for Achievement and Retention with the five Covariates (four in the case of Pre-test non received groups) separately and in combination. Out of the 22 F-ratios obtained, 15 were non significant, i.e., there is no considerable interaction effect of the treatment and the covariates. Seven F-ratios were significant indicating the interaction effect. This means, in most cases the within class regression coefficients were *homogeneous* or the same for the two levels of Independent variable. The outcome of these tests do not rule against pooling the within class regression (Winer, 1971). Thus it was found that the data were appropriate to fit the ANCOVA model.

c. Analysis of Variance for Achievement and Retention: Disregarding the covariates

The investigator used separate One-way Analysis of Variance with each ANCOVA for Pre-test received groups and Pre-test non received groups to study whether the two Experimental and two Control groups differ significantly or not in Achievement and Retention, *disregarding the Covariates*. For this purpose, the sum of squares, mean squares of variance along with the corresponding degrees of freedom and the F-values were calculated. A summary of the F-values obtained is presented in Table 5.30.

TABLE 5.30

**Summary of the F-values of ANOVA
for Achievement and Retention Total Scores for
Pre-test Received Groups and Pre-test Non Received Groups**

Groups Compared	Control Variables	Achievement		Retention	
		F-Value	Level of significance	F-Value	Level of significance
Experimental Group I & Control Group II (Pre-test received group)	Pre-Test Score	20.65	0.01	1.90	NS
	Verbal Intelligence	20.65	0.01	1.90	NS
	Non-verbal Intelligence	20.65	0.01	1.90	NS
	Learning Strategies	20.65	0.01	1.90	NS
	Socio-Economic Status	20.65	0.01	1.90	NS
	Total Effect of 5 Covariates	20.65	0.01	1.90	NS
Experimental Group II & Control Group I (Pre-test non received group)	Verbal Intelligence	9.47	0.01	2.40	NS
	Non-verbal Intelligence	9.47	0.01	2.40	N
	Learning Strategies	9.47	0.01	2.40	NS
	Socio-Economic Status	9.47	0.01	2.40	NS
	Total Effect of 4 Covariates	9.47	0.01	2.40	NS

All the 11 ANOVA (six ANOVA for Pre-test received group and five ANOVA for Pre-test non received group) employed, yielded significant F-values for Instructional Procedures on Achievement. This indicates that, statistically significant difference exists between the Experimental and Control groups with regard to Achievement *even before controlling of Covariates* is done. So it can be concluded that, the two types of Instructional Procedures, Peer Tutoring and Existing Method of Teaching do differentiate the treatment groups with regard to Achievement. But out of 11 ANOVA employed for Retention, none was found to yield significant F-values. It points that, *statistically significant difference does not exist* between the Experimental and Control groups with regard to Retention. So the inference is that the treatment

groups do not differ due to the different Instructional Procedures, Peer Tutoring and Existing Method of Teaching in the case of Retention.

5.2.2.1. ANALYSIS OF COVARIANCE FOR ACHIEVEMENT

Single factor ANCOVA was employed to study the difference between Experimental and Control groups in terms of Achievement in Biology. Single factor ANCOVA with five Covariates (Pre-test score, Verbal Intelligence, Non-Verbal Intelligence, Learning Strategies and Socio-Economic Status – singly and in combination of five at a time) was utilised for Pre-test received group and with four Covariates (Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status – singly and in combination of four at a time) was used for Pre-test non received group. ANCOVA was employed to examine whether significant difference exists even after controlling the effects of the covariates.

By employing single factor ANCOVA, the investigator could further study the relative effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement in Biology, after controlling the single and combined effects of the covariates. Two levels of Instructional Procedures – *Peer Tutoring* and *Existing Method of Teaching* – were incorporated in the ANCOVA as the two levels of Independent variable. The Covariates were Pre-test score (only for Pre-test received group), Verbal Intelligence, Non-verbal Intelligence, Learning strategies and Socio-Economic Status singly and in combination. *Achievement in Biology* was considered as the Dependent Variable.

With every ANCOVA which shows significant F-values, Scheffé test of Post-hoc comparison was done to find out the group (Experimental or Control) that caused the difference in the criterion means. The procedure of the ANCOVA for Achievement for Pre-test received group and Pre-test non received group is described with a view to test the relevant hypotheses and are given in the following sub-section.

5.2.2.1a. Analysis of Covariance for Achievement for Pre-test Received Group

Hypothesis : In pre-test received Experimental and Control groups, pupils taught through Peer Tutoring will not significantly differ in Achievement in Biology, than pupils taught through Existing Method of Teaching.

To test this hypothesis, the investigator studied whether or not significant difference exists between the Pre-test received Experimental and Control groups with regard to the *mean Achievement scores*, all together six ANCOVA was done. Each ANCOVA, controlling each covariate namely, Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and the combined effect of five covariates. Since the presentation and discussion of six ANCOVA will be too lengthy, the investigator compressed and compiled the whole discussion under a single Table and is presented in Table 5.31.

As per Table 5.31, the six F-values obtained for Instructional Procedure on Achievement are found beyond the tabled value (6.90, df: 1, 93) for 0.01 level of significance. This shows that, *statistically significant difference* exists between the criterion means of the groups even after the adjustment is made for the linear effects of each Covariate. Hence results of the ANCOVA suggests that, when a linear adjustment is made for the effect of variation due to the difference in the Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and the combined effect of the five covariates, of the subjects on Achievement in Biology, there exist *statistically significant difference* between the two Experimental and control groups.

Adjusted Means and Post-hoc Comparison

Since all the six values in ANCOVA were found significant, the investigator utilised Scheffe' test of post-hoc comparison with each ANCOVA, to determine which one of the two groups (Experimental or Control) caused the variation in the criterion means. By this technique, the investigator could compare the adjusted criterion means of relevant groups which show significant F-values.

The Scheffe' Procedure

The F-ratio between the pairs of means was calculated using the within group variance. Tables of F-values was consulted to obtain the values of F required for significance at 0.05 level and 0.01 level for $df_1 = k-1$ and $df_2 = N-K$ using the formula $F^1 = (K-1)F$, required for significance at 0.05 and 0.01 level. The F- values for the required df was also calculated. The values of F was compared with the value of F^1 to determine the significance of the difference between means.

For the six significant F-values of ANCOVA, six F-ratios were computed between the adjusted criterion means (Achievement in Biology) for the two groups based on Instructional Procedure. Since the description of six post-hoc comparisons will be lengthy, the investigator summarised all the six comparisons under Table 5.32.

TABLE 5.32

Summary of the Scheffe' Test of Post-hoc comparison between the Adjusted Means of Achievement in Biology

Groups Compared	Covariates	N		Adjusted Means		F Value	Values of F'		Significance of F
		n ₁	n ₂	M ₁	M ₂		0.05	0.01	
Experimental group I & Control group II	Pre-Test Score	48	48	26.244	18.902	30.66	3.94	6.90	0.01
	Verbal Intelligence	48	48	26.570	18.576	37.68	3.94	6.90	0.01
	Non-verbal Intelligence	48	48	26.871	18.275	32.04	3.94	6.90	0.01
	Learning Strategies	48	48	26.224	18.922	21.53	3.94	6.90	0.01
	Socio-Economic Status	48	48	26.218	18.928	21.02	3.94	6.90	0.01
	Total Effect of 5 Covariates	48	48	26.516	18.630	42.36	3.94	6.90	0.01

As per Table 5.32, the six F-values obtained, are significant at 0.01 level. Thus significant difference is noticed for the Experimental Group I and Control Group II as the F-values are greater than the values of F' (6.90) at 0.01 level of significance.

So it can be concluded from these results, that for the Pre-test received group, the two groups (Experimental group I and Control group II) based on Instructional Procedure *differ significantly* on their mean Achievement score. High mean scores were seen to associate with the Experimental group I, to which Peer Tutoring was administered. This indicates the effectiveness of Peer Tutoring over Existing Method of Teaching with regard to Achievement in Biology.

Hypothesis Testing : Significant difference was found between the mean Achievement scores of the Pre-test received Experimental group and Control group. In Scheffe' test it was found that the Experimental group to which Peer Tutoring was applied is advantageous due to high mean achievement scores. Therefore the hypothesis is rejected.

5.2.2.1.b. Analysis of Covariance for Achievement for Pre-test Non Received Group

Hypothesis : In Pre-test non received Experimental and Control groups, pupils taught through Peer Tutoring will not significantly differ in Achievement in Biology, than pupils taught through Existing Method of Teaching.

All together five ANCOVA were done to examine the significant difference between Pre-test non received Experimental and Control group with regard to mean Achievement scores. One by one, each covariate namely, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and the combined effect of four covariates were controlled in the five ANCOVA. To avoid the monotonous presentation, the description of five ANCOVA is reduced and presented in a single Table, given as Table 5.33.

TABLE 5.33

Summary of Single Factor ANCOVA for Achievement in Biology (Total Score) for Pre-test Non Received Groups

	Source of Variation	COVARIATES				
		Verbal Intelligence	Non-verbal Intelligence	Learning Strategies	Socio-Economic Status	Total Effect of 4 Covariates
SS	Group	811.86	531.42	379.27	358.07	751.17
	Within Cells	2811.77	3334.50	3217.81	3730.04	2540.96
df	Group	1	1	1	1	1
	Within Cells	96	96	96	96	93
MS	Group	811.86	531.42	379.27	358.07	751.17
	Within Cells	29.29	34.73	33.52	38.85	27.32
F		27.72	15.30	11.32	9.22	27.49
Significance of F		0.01	0.01	0.01	0.01	0.01

The five F-values obtained for Instructional Procedure on Achievement were found beyond the tabled value (6.90, df: 1, 93) for 0.01 level of significance. This indicated *statistically significant difference* between the criterion mean of the groups even after the adjustment is made for the linear effect of each covariate. Hence ANCOVA results suggest that, when a linear adjustment is made for the effect of variation due to the difference in the Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and the combined effect of four covariates, of the subjects on Achievement in Biology, the *two groups* Experimental and Control (Pre-test non received) *differ significantly*.

Adjusted Means and Post-hoc Comparison

Since all the five F-values obtained from five ANCOVA for Pre-test non received group were significant, Scheffe' Test of Post-hoc Comparison was conducted with each ANCOVA. Details of all the five comparisons are given in one table and is presented as Table 5.34.

TABLE 5.34

Summary of the Scheffe' Test of Post-hoc Comparison between the Adjusted Means of Achievement in Biology

Groups Compared	Covariates	N		Adjusted Means		F Value	Values of F'		Significance of F
		n ₁	n ₂	M ₁	M ₂		0.05	0.01	
Experimental Group II & Control Group I	Verbal Intelligence	53	46	23.179	17.074	31.32	3.94	6.90	0.01
	Non-verbal Intelligence	53	46	22.501	17.751	16.00	3.94	6.90	0.01
	Learning Strategies	53	46	22.089	18.164	11.32	3.94	6.90	0.01
	Socio-Economic Status	53	46	22.034	18.218	9.23	3.94	6.90	0.01
	Total Effect of 4 Covariates	53	46	23.084	17.169	31.58	3.94	6.90	0.01

All the five F-values obtained were significant at 0.01 level, as per Table 5.34. Thus significant difference is noticed for the Experimental and Control groups as the values are greater than the values of F' (6.90) at 0.01 level of significance.

So it is clear from the results that, for the Pre-test non received group, the two groups, Experimental and Control, differ significantly in their mean Achievement score. Experimental group, which utilised Peer Tutoring, has high mean score. This indicates the *effectiveness of Peer Tutoring over Existing Method of Teaching* with regard to Achievement in Biology.

Hypothesis Testing: Significant difference was found between the mean Achievement scores of the Pre-test non received Experimental group and Control group. Advantage was identified with Experimental group. So the hypothesis is rejected.

5.2.2.1.c. Summary and Discussion of Analysis of Covariance for Achievement

Results of 11 ANCOVA employed to study the effectiveness of Instructional Procedure (Peer Tutoring and Existing Method of Teaching) on Achievement (Total) in Biology for Pre-test Received Group and Pre-test Non-Received Group are summarised and discussed in this sub-section.

The F-values obtained for the 11 ANCOVA are consolidated and presented in Table 5.35.

TABLE 5.35

Summary of the F-values of ANCOVA for Achievement

Sl. No.	Source of Variation	Dependent Variable	Covariates	F-Value	Level of Significance	
1	Instructional Procedure (Peer Tutoring and Existing Method of Teaching)	Achievement in Biology	Pre-test Received Group	Pre-test	30.65	0.01
2				Verbal Intelligence	37.39	0.01
3				Non-verbal Intelligence	29.69	0.01
4				Learning Strategies	21.53	0.01
5				Socio-Economic Status	21.00	0.01
6				Total Effect of 5 Covariates	38.84	0.01
7			Pre-test Non Received Group	Verbal Intelligence	27.72	0.01
8				Non-verbal Intelligence	15.30	0.01
9				Learning Strategies	11.32	0.01
10				Socio-Economic Status	9.22	0.01
11				Total Effect of 4 Covariates	27.49	0.01

As Table 5.35 shows, altogether 11 ANCOVA were employed on Achievement for Pre-test received group and Pre-test non received group, using Pre-test scores (only for Pre-test received group) Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status as Covariates singly and in combination. This was done with a view to examine whether variation in the mean Achievement scores of the Experimental and Control groups occur or not after treatment.

When the effects of Covariates, Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and combined effect was controlled, F-values were found significant for the Pre-test received group. This

confirms that the Pre-test received Experimental and Control groups differ significantly in Achievement in Biology.

When the effect of Covariates, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and combined effect was controlled, F-values were found significant for the Pre-test non received group. This confirms that the Pre-test non received Experimental and Control groups differ significantly in Achievement in Biology.

Out of 11 ANCOVA employed to study the difference between Experimental groups and Control groups in Achievement, all the 11 ANCOVA yielded significant difference. From these results it can be concluded that treatment in the Experimental group (Peer Tutoring) was *more effective than the Control group* (Existing Method of Teaching). The Post-hoc comparison employed on the adjusted criterion means also revealed the advantage of the *Experimental Group*.

After Covariance Analysis, it was found that the Pre-test received groups and Pre-test non received groups significantly differed in their Achievement in Biology. In both cases, Pre-test received and non received, Experimental groups were seen to be superior to the Control groups. This revealed the *advantage of Peer Tutoring over Existing Method of Teaching* with regard to Achievement in Biology.

5.2.2.2. ANALYSIS OF COVARIANCE FOR RETENTION

To examine the difference between the Experimental and Control groups, if any, in terms of *Retention* in Biology, even after controlling the effects of the Covariates, single factor ANCOVA was utilised. Single factor ANCOVA with five covariates (Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status – singly and in combination of five at a time) was used for Pre-test received groups and with four Covariates (Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status – singly and in combination of four at a time) was used for Pre-test non received group.

By employing Single factor ANCOVA, the investigator could further study the relative effectiveness of Peer Tutoring and Existing Method of Teaching on *Retention* in Biology, after controlling the single and combined effects of the Covariates. The procedure of the ANCOVA on Retention for Pre-test received group and Pre-test non received group is described in the following sub-section.

5.2.2.2.a. Analysis of Covariance for Retention for Pre-test Received Group

Hypothesis : In Pre-test received Experimental and Control Groups, pupils taught through Peer Tutoring will not significantly differ in Retention in Biology, than pupils taught through Existing Method of Teaching.

In total, six ANCOVA were conducted to check whether significant difference exists between the Pre-test received Experimental and Control groups with regard to the mean Retention scores. Each Covariate namely, Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and combined effect of five covariates, were controlled in each of the six ANCOVA. Since the detailed description of six ANCOVA will be too long, those are summarised and presented in Table 5.36.

TABLE 5.36

Summary of Single Factor ANCOVA for Retention in Biology (Total Score) for Pre-test Received Groups

	Source of Variation	COVARIATES					
		Pre-Test Score	Verbal Intelligence	Non-verbal Intelligence	Learning Strategies	Socio-Economic Status	Total Effect of 5 Covariates
SS	Group	96.92	37.26	9.69	96.81	87.97	57.71
	Within Cells	3483.99	2838.44	4709.14	4898.76	4565.65	2144.88
df	Group	1	1	1	1	1	1
	Within Cells	93	93	93	93	93	89
MS	Group	96.92	37.26	9.69	96.81	87.97	57.71
	Within Cells	37.46	30.52	50.64	52.67	49.09	24.10
F		2.59	1.22	0.19	1.84	1.79	2.39
Significance of F		NS	NS	NS	NS	NS	NS

As per Table 5.36, the six F-values obtained for Instructional Procedure on Retention were found below the tabled value (3.94, df 1,98) for 0.05 level of significance. This shows that statistically significant difference does not exist between the criterion means of the groups after adjustment is made for the linear effect of each covariate. Hence it can be concluded that there exists *no statistically significant difference* between the Experimental and Control groups with regard to Retention.

Since none of the six F-values obtained from ANCOVA were found significant for treatment groups on Retention, Post-hoc comparison was not conducted.

Hypothesis Testing: Significant difference was not found between the mean Retention scores of Pre-test received Experimental group and Control group. Hence the hypothesis is accepted.

5.2.2.2b. Analysis of Covariance for Retention for Pre-test Non Received Group

Hypothesis: In Pre-test non received Experimental and Control groups, pupils taught through Peer Tutoring will not significantly differ in Retention in Biology, than pupils taught through Existing Method of Teaching.

To identify the significant difference, if any, between the Pre-test non received Experimental and Control groups with regard to Retention, all together five ANCOVA were conducted. In the five ANCOVA, each Covariate namely, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and the combined effect of four Covariates were controlled. The investigator has reduced the five detailed discussion of ANCOVA into one, and is presented under Table 5.37.

TABLE 5.37

Summary of Single Factor ANCOVA for Retention in Biology (Total Score) for Pre-test Non Received Groups

	Source of Variation	COVARIATES				
		Verbal Intelligence	Non-verbal Intelligence	Learning Strategies	Socio-Economic Status	Total Effect of 4 Covariates
SS	Group	0.53	43.21	87.83	99.59	3.70
	Within Cells	3146.62	3561.44	3382.55	3665.87	2949.22
df	Group	1	1	1	1	1
	Within Cells	96	96	96	96	93
MS	Group	0.53	43.21	87.83	99.59	3.70
	Within Cells	32.78	37.10	35.23	38.19	31.71
F		0.02	1.16	2.49	2.61	0.12
Significance of F		NS	NS	NS	NS	NS

From the Table 5.37, it is clear that the five F-values obtained for Instructional Procedure on Retention is below the tabled value (3.94, df 1,98) for 0.05 level of significance. It means that statistically significant difference does not exist between the criterion means of the groups after adjustment is made for the linear effects of each Covariate. So it can be concluded that there *does not exist statistically significant difference* between the Experimental and Control groups with respect to Retention.

Since none of the five F-values obtained from ANCOVA were found significant for treatment groups on Retention, Post-hoc comparison was not conducted.

Hypothesis Testing: Significant difference was not found between the mean Retention scores of the Pre-test non received Experimental group and Control group. Therefore the hypothesis is accepted.

5.2.2.2.c. Summary and Discussion of Analysis of Covariance for Retention

Results of 11 ANCOVA employed to study the effectiveness of Instructional Procedure (Peer Tutoring and Existing Method of Teaching) on Retention (Total) in Biology for Pre-test received group and Pre-test non received group are summarised and discussed in this sub-section.

The F-values obtained for the 11 ANCOVA are consolidated and presented in Table 5.38.

TABLE 5.38

Summary of the F-values of ANCOVA for Retention

Sl. No.	Source of Variation	Dependent Variable	Covariates	F-Value	Level of Significance	
1	Instructional Procedure (Peer Tutoring and Existing Method of Teaching)	Retention in Biology	Pre-test Received Group	Pre-test	2.59	NS
2				Verbal Intelligence	1.22	NS
3				Non-verbal Intelligence	0.19	NS
4				Learning Strategies	1.84	NS
5				Socio-Economic Status	1.79	NS
6				Total Effect of 5 Covariates	2.39	NS
7			Pre-test Non Received Group	Verbal Intelligence	0.02	NS
8				Non-verbal Intelligence	1.16	NS
9				Learning Strategies	2.49	NS
10				Socio-Economic Status	2.61	NS
11				Total Effect of 4 Covariates	0.12	NS

As Table 5.38 shows, altogether 11 ANCOVA were employed for Retention in Biology for Pre-test received group and Pre-test non received group, using Pre-test scores (only for Pre-test received group) Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status as Covariates singly and in combination. This was done to know whether variation in the mean Retention scores of the Experimental and Control groups occur or not after treatment.

In the Pre-test received group and Pre-test non received group, the F-values were found to be non significant when the effects of the Covariates were removed out singly and in combination. Hence it can be concluded that the Pre-test

received and Pre-test non received Experimental and Control group *does not differ significantly in Retention in Biology*.

Out of the 11 ANCOVA employed to study the difference between the Experimental and Control groups in Retention, none yielded significant F-values. This shows that the treatment in the Experimental group (Peer Tutoring) and the Control group (Existing Method of Teaching) is *equally effective*, with regard to Retention. Experimental group does not have any advantage over the Control group.

After Covariance Analysis was conducted it was seen that the Pre-test received and Pre-test non received Experimental and Control groups does not show difference in their Retention in Biology. So it can be concluded that, the two types of Instructional Procedure, Peer Tutoring and Existing Method of Teaching does not differentiate the Pre-test received as well as Pre-test non received treatment groups with respect to Retention in Biology.

**EFFECTIVENESS OF PEER TUTORING AND EXISTING METHOD
OF TEACHING ON ACHIEVEMENT AND RETENTION
IN BIOLOGY OF STANDARD VIII PUPILS**

RESHMA P.T.

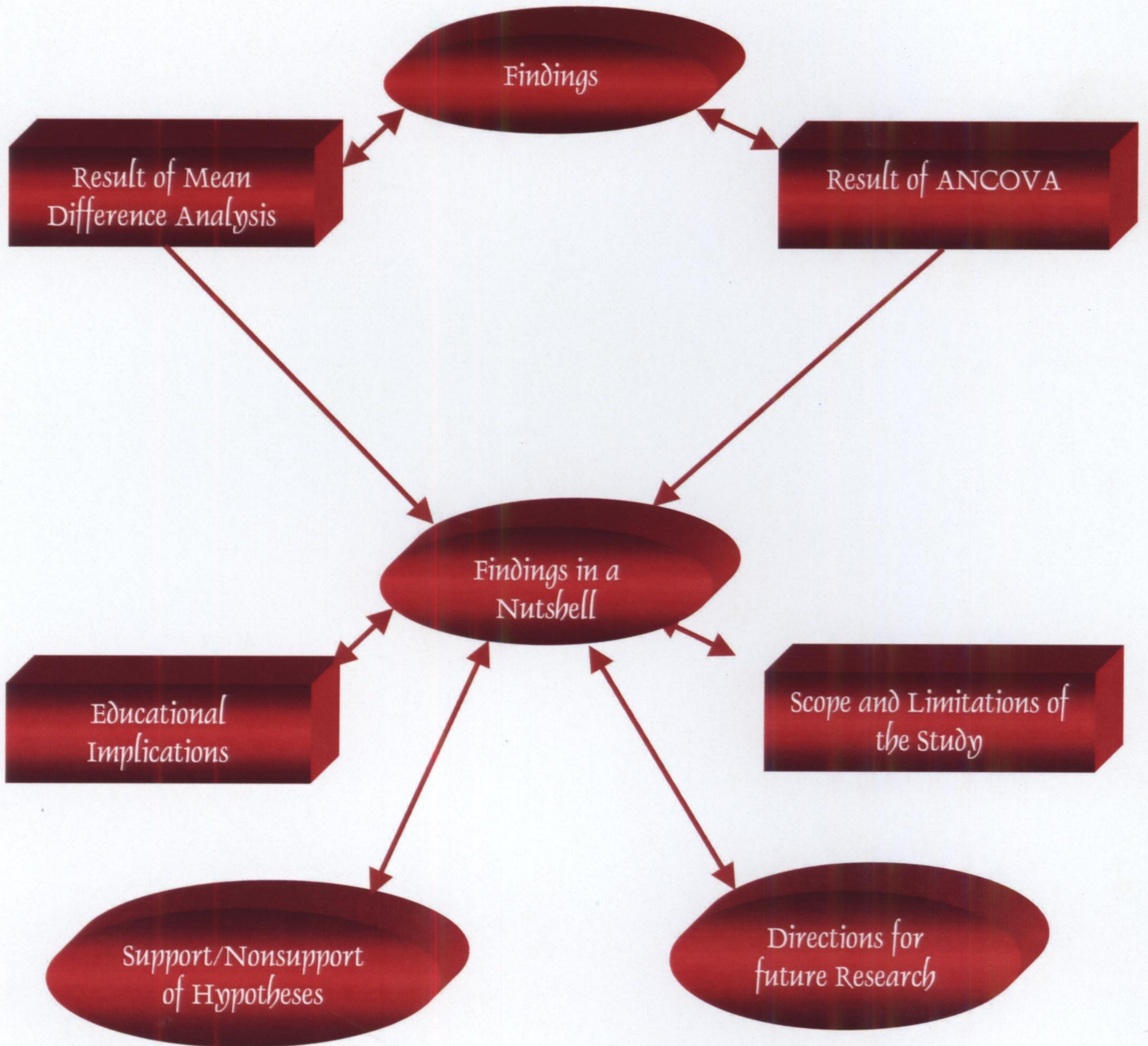
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Findings and Implications

CHAPTER Six



CHAPTER



Findings and Implications

The present chapter contains the major findings evolved as a result of the experimental investigation, the educational implications of the findings and the directions for future research and are classified under the following major heads.

6.1. MAJOR FINDINGS

6.1.1 RESULTS OF MEAN DIFFERENCE ANALYSIS

6.1.2. CONCLUSION OF THE RESULTS OF MEAN DIFFERENCE ANALYSIS

6.1.3. RESULTS OF THE COVARIANCE ANALYSIS FOR ACHIEVEMENT

6.1.4 RESULTS OF THE COVARIANCE ANALYSIS FOR RETENTION

6.1.5. CONCLUSION OF THE RESULTS OF COVARIANCE ANALYSIS

6.1.6. FINDINGS IN A NUTSHELL

6.2. SUPPORT/NONSUPPORT OF HYPOTHESES

6.3. EDUCATIONAL IMPLICATIONS OF THE STUDY

6.4. SCOPE AND LIMITATIONS OF THE STUDY

6.5. DIRECTIONS FOR FUTURE RESEARCH

6.1. MAJOR FINDINGS

The major findings of the study are presented briefly as follows.

6.1.1. RESULTS OF MEAN DIFFERENCE ANALYSIS

Mean Difference Analysis was done as an initial step to study whether there exists or not any difference between the two Experimental and two Control groups with regard to Pre-test, Achievement, Gain and Retention scores in Biology without controlling the relevant variables. Results of the Mean Difference Analysis are presented in the following sub-sections.

6.1.1.1. Comparison of Pre-test Scores Between the Pre-test Received Groups – Experimental Group I and Control Group II

There was no significant difference in the comparison of the *mean Pre-test scores* for the Experimental group I and Control group II.

Boys and Girls of the Experimental group I and Control group II also did not significantly differ in their mean Pre-test scores. So it can be concluded that the Experimental and Control group subjects are *similar* in their previous knowledge of subject matter.

The graphical representation of individual Pre-test scores between the Experimental group I Boys and Control group II boys and Experimental group I Girls and Control group II girls also points that the individual performance of the Boys and Girls of these two groups are *similar*.

6.1.1.2. Comparison of Achievement Scores Between the Experimental and Control Groups

Significant difference was noted in the comparison of *mean Achievement score* between all the Experimental groups and Control groups. (Experimental group I and

Control group I, Experimental group I and Control group II, Experimental group II and Control group I and Experimental group II and Control group II). In all the comparisons, high Achievement scores were associated with Experimental groups. Comparison of Achievement scores between Experimental group total and Control group total also yielded significant t-value. High Achievement score was associated with Experimental group.

So it can be inferred that, the Experimental group subjects taught through *Peer Tutoring outperformed* the Control group subjects taught through Existing Method of Teaching.

In sex wise comparison, significant difference was noted in the mean Achievement scores between the Boys of Experimental and Control groups as well as between the Girls of Experimental and Control groups. High Achievement scores were seen to associate with the Experimental group Boys and Girls, in both the comparisons.

The performance of Boys as well as Girls of Experimental and Control groups were dissimilar as obtained from the graphical representation of their individual Achievement scores. In both cases performance of Experimental Boys and Girls were better than that of Control Boys and Girls.

Hence the Experimental group Boys and Girls who learned through *Peer Tutoring performed better* than the Control group Boys and Girls who learned through Existing Method of Teaching. The significant t-values along with the corresponding mean scores are given in the following break-up for clarity.

Groups compared	Mean scores		t-value	Level of significance
	M ₁	M ₂		
Experimental Group I and Control Group I	26.188	18.196	5.55	0.01
Experimental Group I and Control Group II	26.188	18.958	4.54	0.01
Experimental Group II and Control Group I	22.057	18.196	3.17	0.01
Experimental Group II and Control Group II	22.057	18.958	2.22	0.05
Experimental Group Boys and Control Group Boys	22.2727	15.3023	5.89	0.01
Experimental Group Girls and Control Group Girls	26.1087	21.3529	3.14	0.01
Experimental Group Total and Control Group Total	24.0198	18.5851	5.35	0.01

6.1.1.3. Comparison of Gain Scores Between the Pre-test Received Groups – Experimental Group I and Control Group II

Significant difference was noted in the comparison of the *mean Gain scores* for the Experimental group I and Control group II for which pre-testing was done. High Gain scores were seen to associate with the Experimental group I.

The comparison of mean Gain scores between the Boys as well as between the Girls of Experimental group I and Control group II yielded significant t-values. High Gain scores were seen to associate with Experimental group in both the comparison.

The graphical representation of individual Gain scores between the Boys as well as between the Girls of Experimental group I and Control group II also indicated dissimilarity in the individual performance of Boys and Girls of these groups. Performance of Experimental group Boys and Girls were higher than that of Control

group Boys and Girls. It makes clear that, pupils *gain more when Peer Tutoring is the Instructional procedure* even before controlling the relevant extraneous variables.

For clarity, the significant t-values and mean scores are given as follows:

Groups compared	Mean scores		t-value	Level of significance
	M ₁	M ₂		
Experimental Group I and Control Group II	10.125	2.792	5.54	0.01
Experimental Group I Boys and Control Group II Boys	9.7143	0.6957	4.81	0.01
Experimental Group I Girls and Control Group II Girls	10.4444	4.7200	3.17	0.01

6.1.1.4. Comparison of Retention Scores Between the Experimental and Control Groups

It was found that, the comparison of mean Retention scores between *none of the Experimental groups and Control groups yielded significant t-values*. (Experimental group I and Control group I, Experimental group I and Control group II, Experimental group II and Control group I, Experimental group II and Control group II). But significant difference was noted in the comparison of mean Retention score between Experimental group total and Control group total. High Retention scores was associated with Control group. This difference may be due to the effect of Covariates which were not controlled in the mean difference analysis.

Significant difference was not found in the comparison of mean Retention scores between the Boys of Experimental group and Control group and between the Girls of Experimental group and Control group.

The performance of Boys as well as of Girls of Experimental and Control groups were similar as obtained from the graphical representation of their individual Retention scores.

So it is indicated that, *both the Instructional Procedures*, Peer Tutoring and Existing Method of Teaching are *equally effective for retaining* the knowledge acquired. Significant t-value with associated mean score is presented.

Group compared	Mean scores		t-value	Level of significance
	M ₁	M ₂		
Experimental Group Total and Control Group Total	19.5743	21.5957	2.06	0.05

6.1.2. CONCLUSION OF THE RESULTS OF MEAN DIFFERENCE ANALYSIS

The Pre-test received groups were found to have *significant difference* in their mean Achievement and Gain scores. But their mean Pre-test and Retention scores were found to be *non significant*. High Achievement and Gain scores were found to associate with the *Experimental group I*. This means that, the *Experimental group I which utilised Peer Tutoring show advantage over the Control group II to which Existing Method of Teaching was applied*.

Significant difference was noted in the comparison of mean Achievement scores for the Pre-test non received groups. But they did not *differ significantly* in their mean Retention scores. Experimental group II had high scores in Achievement. So it can be concluded that in Pre-test non received group also Experimental group II, which utilised Peer Tutoring as Instructional Procedure, *is superior to Control group I*, which utilised Existing Method of Teaching.

A summary of the t-values of mean difference analysis is given in the following break-up.

Sl. No.	Variable	Groups compared	t-Value	Level of significance
1	Pre-test Score	Experimental Group I and Control Group II	0.13	NS
2	Achievement (Total) Scores	Experimental Group I and Control Group I	5.55	0.01
3		Experimental Group I and Control Group II	4.54	0.01
4		Experimental Group II and Control Group I	3.17	0.01
5		Experimental Group II and Control Group II	2.22	0.05
6		Experimental Group Total and Control Group Total	5.35	0.01
7	Gain Score	Experimental Group I and Control Group II	5.54	0.01
8	Retention (Total) Scores	Experimental Group I and Control Group I	1.75	NS
9		Experimental Group I and Control Group II	1.38	NS
10		Experimental Group II and Control Group I	1.58	NS
11		Experimental Group II and Control Group II	1.20	NS
12		Experimental Group Total and Control Group Total	2.06	0.05

The comparison made between mean Gain scores and five out of five comparison made between mean Achievement scores yielded significant t-values. So, as a whole, the Experimental groups and Control groups *significantly differ* in their mean *Gain scores* and *Achievement scores*. High Gain and Achievement scores associated with the Experimental group indicated the *effectiveness of Peer Tutoring* as compared to Existing Method of Teaching, before the effects of Covariates were controlled.

It is clear that, the comparison made between Pre-test scores and four out of five comparisons made between Retention scores yielded non significant t-values. That is, in total the Experimental groups and Control groups does *not significantly differ in their mean Pre-test and Retention scores*. Both Instructional Procedures, Peer

Tutoring and Existing Method of Teaching are *equally advantageous with respect to Retention*, before controlling the effects of covariates. But Experimental group total and Control group total was found to differ significantly in their mean Retention score comparison. Control group total show advantage over Experimental group total.

A summary of the t-values in the comparison of mean Pre-test, Achievement, Gain and Retention score between Experimental and Control groups on the basis of sex is presented in the following break-up.

Sl. No.	Variable	Groups compared	t-Value	Level of significance
1	Pre-test Score	Experimental Group I Boys and Control Group II Boys	1.06	NS
2		Experimental Group I Girls and Control Group II Girls	1.10	NS
3	Achievement (Total) Scores	Experimental Group Boys and Control Group Boys	5.89	0.01
4		Experimental Group Girls and Control Group Girls	3.14	0.01
5	Gain Scores	Experimental Group I Boys and Control Group II Boys	4.81	0.01
6		Experimental Group I Girls and Control Group II Girls	3.17	0.01
7	Retention (Total) Scores	Experimental Group Boys and Control Group Boys	1.44	NS
8		Experimental Group Girls and Control Group Girls	1.14	NS

From the break-up it is clear that, out of the obtained t-values for mean comparisons, on the basis of sex, all the t-values for the comparison of mean Gain score and Achievement score *were significant*. But none of the t-values for the comparison of mean Pre-test score and Retention score were found significant. Experimental group Boys and Girls had *high mean scores* on Gain and Achievement. Hence it can be

concluded that Boys and Girls of Experimental groups, who were taught through *Peer Tutoring outperformed* the Control group Boys and Girls taught through *Existing Method of Teaching*, with respect to Achievement and Gain. But they do not differ in their Pre-test scores as well as Retention.

6.1.3. RESULTS OF THE COVARIANCE ANALYSIS FOR ACHIEVEMENT

Analysis of Covariance was used to know whether the Experimental and Control groups, which has received Pre-test and which has not received Pre-test, differ significantly or not, in terms of Achievement in Biology when the relevant variables were controlled. Scheffe' test of Post-hoc Comparison was employed after ANCOVA which showed significant F-values in the comparison. By Scheffe' test the investigator could identify the group (whether Experimental or Control group) which caused the difference in Achievement. Results of Covariance Analysis are briefly presented in the following sub-sections.

6.1.3.1. Effectiveness of Instructional Procedures on Achievement for Pre-test Received Group

Result of the six Covariance Analysis with Pre-test Score, Verbal Intelligence, Non-Verbal Intelligence, Learning Strategies, Socio-Economic Status and combined effect of five Covariates revealed that the F-values for Instructional Procedures on Achievement are *significant*.

Scheffe' Test of Post-hoc Comparison

The adjusted criterion means of Achievement were compared using Scheffe' test of post-hoc comparison. Significant F-values were found in the comparison. It indicated that the Experimental and Control groups differ in terms of Achievement.

In all the six post-hoc comparisons, high mean Achievement scores were seen to associate with the *Experimental group* to which Peer Tutoring was administered. This

indicated the *effectiveness of Peer Tutoring* over Existing Method of Teaching with regard to Achievement in Biology.

A summary of the obtained F-values in ANCOVA and Scheffe' Test are presented in the following break-up.

Covariates	ANCOVA		SCHEFFE' TEST	
	F-Value	Level of significance	F-Value	Level of significance
Pre-test Score	30.65	0.01	30.66	0.01
Verbal Intelligence	37.39	0.01	37.68	0.01
Non-Verbal Intelligence	29.69	0.01	32.04	0.01
Learning Strategies	21.53	0.01	21.53	0.01
Socio-Economic Status	21.00	0.01	21.02	0.01
Combined effect of five Covariates	38.84	0.01	42.36	0.01

6.1.3.2. Effectiveness of Instructional Procedures on Achievement for Pre-test Non Received Group

The five F-values obtained as a result of the ANCOVA with Verbal Intelligence, Non-Verbal Intelligence, Learning Strategies, Socio-Economic Status and combined effect of four Covariates were found *significant*.

Scheffe' Test of Post-hoc Comparison

Scheffe' test of Post-hoc comparison was used to compare the adjusted criterion means of Achievement of Pre-test non received group. All the five F-values obtained were *found significant*. That means the Pre-test non received Experimental and Control groups differ with regard to Achievement. Summary of F-values obtained from ANCOVA and Scheffe' Test are presented in the break-up follows.

Covariates	ANCOVA		Scheffe' Test	
	F-Value	Level of significance	F-Value	Level of significance
Verbal Intelligence	27.72	0.01	31.32	0.01
Non-Verbal Intelligence	15.30	0.01	16.00	0.01
Learning Strategies	11.32	0.01	11.32	0.01
Socio-Economic Status	9.22	0.01	9.23	0.01
Combined Effect of Four Covariates	27.49	0.01	31.58	0.01

Experimental group had high mean scores on Achievement, in all the five comparisons. Experimental group was taught through Peer Tutoring. This *ensures the effectiveness of Peer Tutoring* in relation with Existing Method of Teaching.

6.1.4. RESULTS OF THE COVARIANCE ANALYSIS FOR RETENTION

To know whether the Pre-test received and Pre-test non received Experimental and Control groups differ significantly or not in terms of Retention, when relevant variables were controlled, altogether eleven ANCOVA were done. Results of the Analysis of Covariance are briefly presented in the following sub-sections.

6.1.4.1. Effectiveness of Instructional Procedures on Retention for Pre-test Received Group

Results of the six ANCOVA done by controlling five Covariates namely Pre-test score, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies, Socio-Economic Status and their combined effect revealed that the F-values for Instructional Procedures on Retention are *non significant*. So, the two groups which received Pre-test (Experimental group I and Control group II) does not differ in terms of Retention.

6.1.4.2. Effectiveness of Instructional Procedures on Retention for Pre-test Non Received Group

It was clear from the result of five ANCOVA done by controlling four Covariates and their combined effect, that the F-values for Instructional Procedures on Retention for Pre-test non received groups were non-significant. Hence it can be concluded that, in terms of Retention in Biology, the Pre-test non received Experimental and Control groups do not differ. That is, both Instructional Procedures are *equally effective* in Retention of knowledge acquired.

6.1.5. CONCLUSION OF THE RESULTS OF COVARIANCE ANALYSIS

Single factor ANCOVA employing five Covariates (four covariates for Pre-test non received group) separately and in combination, was used to control the effects of the Covariates namely, Pre-test scores, Verbal Intelligence, Non-verbal Intelligence, Learning Strategies and Socio-Economic Status.

For Achievement in Pre-test received groups, six out of six ANCOVA showed *significant F-values*, in Pre-test non received groups, five out of five ANCOVA yielded *significant F-values*. Whereas for Retention, for Pre-test received groups and Pre-test non received groups, *none* of the ANCOVA showed significant F-values.

The result of the ANCOVA for Achievement and the result of Scheffe' test done thereafter approved the fact that even after removing the effects of Covariates, the *Experimental groups and Control groups showed significant difference in the mean Achievement scores*. This difference was due to Peer Tutoring, because high Achievement scores were associated with *Experimental group to which Peer Tutoring was administered*.

6.1.6. FINDINGS IN A NUTSHELL

Findings of the study are given briefly in the following,

- 6.1.6.1. The Pre-test received groups (Experimental group I and Control group II) does not show *any difference* in their previous knowledge of the subject matter. Before the experiment both the groups had equal status with regard to achievement in Biology as measured by the Pre-test.
- 6.1.6.2. The two Experimental groups which were taught through Peer Tutoring, *achieved more* on the Post-test as compared with the two Control groups when the relevant extraneous variables were not considered.
- 6.1.6.3. Out of the two Pre-test received groups, Experimental group I and Control group II, the *Experimental group gained more* from what is taught through Peer Tutoring.
- 6.1.6.4. There was *no difference* between the two Experimental and two Control groups on retention of the materials acquired, Peer Tutoring and Existing Method of Teaching were equally beneficial for Retention.
- 6.1.6.5. Among the pre-test received groups, the Experimental group I which was taught through Peer Tutoring *achieved more* than the Control group II which was taught through Existing Method of Teaching, showing the *advantage of Peer Tutoring* procedures when the relevant variables were controlled.
- 6.1.6.6. In the Pre-test non received groups, Experimental group II to which Peer Tutoring was applied show *more Achievement* in Biology as compared to the Control group I to which Existing Method of Teaching was applied, showing the *effectiveness of Peer Tutoring* when the relevant variables were controlled.
- 6.1.6.7. Peer Tutoring as well as Existing Method of Teaching were found *equally effective* in retaining the acquired knowledge, in the case of Pre-test received groups, when the extraneous variables were controlled statistically.

6.1.6.8. In the Pre-test non received group, there was *no difference* among the students who received the two levels of Instructional Procedures – Peer Tutoring and Existing Method of Teaching – in retaining the materials studied, when the relevant variables were controlled.

6.2. SUPPORT / NON SUPPORT OF HYPOTHESES

In this part of the chapter, the investigator consolidated and presented the arguments to support or non support the hypotheses. This is done with a view to facilitate a global view about the outcomes of the present experimental investigation.

6.2.1. The first hypothesis states that, *There will be no significant difference in the mean Pre-test scores of the Experimental group I and Control group II, Boys and Girls.*

It was found that, significant difference does not exist in the mean Pre-test scores between the Experimental group I and Control group II. Experimental group I Boys and Girls does not significantly differ from Control group II Boys and Girls. Therefore the first hypothesis is *accepted*.

6.2.2. The second hypothesis states that, *There will be no significant difference in the mean Post-test scores (Objective-wise and Total) of the Experimental and Control groups, Boys and Girls.*

Significant difference was noted in the mean Achievement (Post-test) scores between the Experimental groups and Control groups. Advantage was noted for Experimental group to which high mean Achievement score was associated. Experimental group Boys and Girls were found to be superior over Control group Boys and Girls. Thus the second hypothesis is *rejected*.

6.2.3. The third hypothesis states that, *There will be no significant difference in the mean Gain scores of the Experimental group I and Control group II, Boys and Girls.*

Experimental group I and Control group II differ significantly in their mean Gain scores. Experimental group I which had high mean Gain scores was found to be superior to Control group II. Experimental group I Boys and Girls show advantage over Control group II Boys and Girls. So the third hypothesis is *rejected*.

6.2.4. The fourth hypothesis states that, *There will be no significant difference in the mean Retention scores (Objective-wise and Total) of the Experimental and Control groups, Boys and Girls.*

It was found that, significant difference does not exist in the mean Retention scores between the Experimental groups and Control groups. Experimental group Boys and Girls does not significantly differ from Control group Boys and Girls. Hence the fourth hypothesis is *accepted*.

6.2.5. The fifth hypothesis states that, *In Pre-test received Experimental and Control groups, pupils taught through Peer Tutoring will not significantly differ in Achievement in Biology than pupils taught through Existing Method of Teaching.*

Six ANCOVA followed by Scheffe' Test were done for testing this hypothesis. Significant difference was found in ANCOVA for Achievement. Six out of six ANCOVA employed, yielded significant F-values. In all the six comparisons, higher mean Achievement scores associated with the *Experimental Group* to which Peer Tutoring was implemented. Thus Peer Tutoring proved its advantage over the Existing Method of Teaching with regard to Achievement. Therefore the fifth hypothesis is *rejected*.

6.2.6. The sixth hypothesis states that, *In Pre-test non received Experimental and Control groups, pupils taught through Peer Tutoring will not significantly differ in Achievement in Biology than pupils taught through Existing Method of Teaching.*

Five ANCOVA followed by Scheffe' Test were done for testing this hypothesis. Significant difference was found in ANCOVA for Achievement. Five out of five ANCOVA employed, yielded significant F-values. In all the five comparisons, higher mean Achievement scores associated with the *Experimental Group* to which Peer Tutoring was implemented. Thus Peer Tutoring proved its advantage over the Existing Method of Teaching with regard to Achievement. Therefore the sixth hypothesis is *rejected*.

6.2.7. The seventh hypothesis states that, *In Pre-test received Experimental and Control groups, pupils taught through Peer Tutoring will not significantly differ in Retention in Biology than pupils taught through Existing Method of Teaching.*

Six ANCOVA were done for testing this hypothesis. Significant difference was not found in ANCOVA for Retention. Six out of six ANCOVA employed, yielded non significant F-values. So Peer Tutoring as well as Existing Method of Teaching were proved to be equally effective with regard to Retention. Hence the seventh hypothesis is *accepted*.

6.2.8. The eighth hypothesis states that, *In Pre-test non received Experimental and Control groups, pupils taught through Peer Tutoring will not significantly differ in Retention in Biology than pupils taught through Existing Method of Teaching.*

Five ANCOVA were done for testing this hypothesis. Significant difference was not found in ANCOVA for Retention. Five out of five ANCOVA employed, yielded non significant F-values. So Peer Tutoring as well as Existing Method of Teaching were proved to be equally effective with regard to Retention. Hence the eighth hypothesis is *accepted*.

6.3. EDUCATIONAL IMPLICATIONS OF THE STUDY

The present study was aimed to identify the effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology of standard VIII pupils. The major findings and the conclusions drawn from it enabled the investigator to make some suggestions which will contribute to improve the existing system of teaching Biology in secondary classes.

Peer Tutoring: Need of the Classroom

The major finding revealed the effectiveness of Peer Tutoring. Pupils taught through Peer Tutoring were seen to have *more advantage* than pupils taught through Existing Method of Teaching, in terms of Achievement in Biology. From studies conducted earlier, this may be due to the lack of a democratic atmosphere in the present classrooms. Children are excessively dependent on the external control of the teacher. But in Peer Tutoring, children learn from their classmates in a *joyful atmosphere*. Thus learning becomes more interesting. The student acting as teacher will be more able to understand the pupils and clear their doubts. This will make learning more effective and easier.

In Peer Tutoring, students relate with each other and share their works. Peer Tutoring offers a *non-threatening* atmosphere. There is no fear for teacher, as teacher is in the role of a guide. Students can freely express their opinions and ask questions, which they will hesitate to do in the presence of a teacher. Student teachers have a sharper feel for the group as they are more aware of the likes and dislikes of students. Learning therefore becomes more joyful.

Peer Tutoring produce benefits to both students giving and receiving instruction, including learning gains, development of *positive social interaction skills* with another student and heightened self-esteem. It builds up the self-confidence of tutors and they gain a new appreciation for the role of a teacher.

Teachers also benefit from Peer Tutoring. It frees teacher's time and reduce teacher's stress level. Teachers are enabled to focus on new materials.

Make Teachers Aware

Implementing Peer Tutoring in present classrooms is relatively easier because, the Existing Method of Teaching give importance to ***activity oriented classrooms***. Teachers can use Peer Tutoring also as a ***supplement*** towards their classroom teaching. The only thing to be strictly followed is the importance of tutor training. Whether administered as an individual programme or supplementary programme, without proper tutor training, Peer Tutoring programme will not be successful.

First of all teachers should be made aware of the positive effects– academic, social and personal – of Peer Tutoring. They should be encouraged in the use of Peer Tutoring as a teaching modality. Teachers can made aware of the importance of tutor training by the use of video recordings of previous Peer Tutoring programmes. With the help of workshops, demonstration classes and video recordings, different types of tutor training techniques can be introduced.

Topic and Training

Peer Tutoring can fit the existing syllabus. The topics selected by the teacher for Peer Tutoring may be ***suitable for the student tutors*** to deal with. Teachers can prepare the tutor training modules upon the selected topic, and render training for the selected tutors. The tutor training classes can be conducted during extra class hours or interval times. Teacher will have to take extra strain, but will be free from the duty of taking class. So teacher can give more concentration on tutor training and module preparation procedures.

A Change in Old Classrooms

Though tutor training sessions are of longer time, Peer Tutoring can be carried out in 45 minute class periods. The seating arrangement of the class can be changed to

that of a horse-shoe shape and teacher should previously plan how to group students and the number of students in each group. Teacher must be present at the time of Peer Tutoring. This will give a *confidence* on the part of tutors and also teacher can render help whenever needed.

Peer Tutoring programmes can be conducted in schools by a single teacher or as a joint venture of two or more teachers, of same discipline or interdiscipline. Teachers can co-operate with each other in tutor training, training module preparation, ability grouping, etc.

Peer Tutoring practices can be even, experimented in other extra-curricular activities with the proper guidance and plan of teachers. In spirit, Peer Tutoring sessions will add a feel of pleasure in students when compared with the boring affairs of a traditional classroom.

Molding Teachers

Implementation of Peer Tutoring in regular classrooms require *careful* and *systematic measures on the part of teachers*. *Training should be provided* to teachers in the preparation of tutor training modules and Peer Tutoring modules. Teachers should be aware of different types of tutoring and training methods and techniques. Hence training for Peer Tutoring should be definitely included as a part of the course in teacher training institutions. So that all teachers will be aware and accomplished of the necessary measures to be adopted while implementing Peer Tutoring in classrooms.

6.4. SCOPE AND LIMITATIONS OF THE STUDY

The present study was aimed to investigate the relative effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology of standard VIII pupils. Appropriate standardised tools with proven Psychometric properties were used to collect the data. The sample was four intact class divisions of

standard VIII pupils. The investigator hopes that the result yielded by the study may help the teachers and other educationalists to modify the teaching learning processes.

The present study was to examine the relative effectiveness of Peer Tutoring and Existing Method of Teaching on Achievement and Retention in Biology of secondary school pupils (Standard VIII) of Kerala State only and hence the conclusion may not be extended beyond the population sampled. This is the major delimitation of the present study.

Some other limitations anticipated by the investigator are given as follows :

- 6.4.1. The study is confined to a small sample of four intact class divisions of standard VIII students, as this is considered as the representative of secondary school pupils.
- 6.4.2 Among several instructional procedures, only two (Peer Tutoring and Existing Method of Teaching) are experimented in the present study.
- 6.4.3 Among the large number of variables that influence pupil's achievement, like, Achievement Motivation, Emotional Instability, Maturity Level, Anxiety, Classroom climate etc., only Pre-test scores, Intelligence (Verbal and Non-verbal), Learning Strategies and Socio-Economic status were treated as the Control variables for the present study.
- 6.4.4 The study was limited to Malayalam Language only.
- 6.4.5 Although there are several sophisticated Experimental Designs like the Time Series Design, the Equivalent Time Samples Design, 2 x 2 Factorial Design, M x N Factorial Design, Multivariate Design etc., the investigator selected the Solomon Four – Group Design for the present study.
- 6.4.6. The effectiveness of Peer Tutoring and Existing Method of Teaching is measured in terms of Academic Achievement and Retention only. Other aspects

of learning (Such as Psychological development, Social development etc.) were not considered.

6.5. DIRECTIONS FOR FUTURE RESEARCH

Conducting such an experimental investigation, enabled the investigator to suggest some allied areas in the concerned field of the study, where further research works are needed.

6.5.1 Small supplementary Programmes

From the study conducted it was found that Peer Tutoring can suit the classroom teaching as an individual independent instructional procedure and in conjunction with other instructional procedures. *So the effectiveness of Peer Tutoring can be evaluated by conducting small supplementary Peer Tutoring programmes as a part of Existing Method of Teaching.*

6.5.2 Comparative Studies

Different types of Peer Tutoring were proved to be effective in producing learning outcomes. They include cross-age tutoring, True-age tutoring and Reciprocal Peer Tutoring. *Comparative studies can be made to check the advantage between these different Peer Tutoring programmes.*

6.5.3. Peer Tutoring in Other Disciplines

The review conducted on Peer Tutoring has shown that it is a better instructional procedure in almost all fields like language, mathematics, reading, writing, science, computer and medical fields. *Studies can be conducted to measure the effect of Peer Tutoring in many of these fields.*

6.5.4. Every student As Tutor

Peer Tutoring offers immense benefits - social, personal and academical - on the part of tutors. So if every student is given a chance to be the tutor, everyone can be benefited. *Achievement of tutors can be tested through Peer Tutoring Programmes.*

6.5.5. Peer Tutoring for Special Need Students

Peer Tutoring was found to be an effective tool to remediate learning failure among mentally and physically challenged students, children from poverty and abuse, and learning disabled students. *So small Peer Tutoring programmes measuring the effectiveness of disabled students as tutors and tutees can be conducted.*

6.5.6. Personal and Social Growth of Students

Literature review has revealed that personal and social development of students involved in Peer Tutoring situations are much more as compared to other instructional procedures. Students improved their social interactions and tutors became more confident, employable and responsible. *Peer Tutoring can be evaluated by giving emphasis on the social and personal growth and development of students.*

6.5.7. Tutor Training

The importance of tutor training was explicit from the review of literature, conducted. Careful consideration needs to be given to ways in which student tutors are supported before, during and after the projects. *Research works are needed in order to specify procedures that improve tutor's ability to perform independently.*

6.5.8 . Implementation of Peer Tutoring Programme

Though Peer Tutoring is approved as a promising tool for ensuring classroom teaching, teachers as well as school authorities hesitate in using this instructional procedure in regular classroom teaching. There exists many barriers against implementing a Peer Tutoring programme in regular classrooms. *Analysis and validation is required to determine the conditions under which Peer Tutoring procedure can be effectively applied across the schools days.*

6.5.9. In Non Academic and Specialized Areas

Peer Tutoring offers success to the participants involved in all aspects. So this multifold benefits can also be applied in other non academic and specialized areas also. *Application of peer tutoring in areas like Music, Horticulture, Sports etc., can be documented.*

**EFFECTIVENESS OF PEER TUTORING AND EXISTING METHOD
OF TEACHING ON ACHIEVEMENT AND RETENTION
IN BIOLOGY OF STANDARD VIII PUPILS**

RESHMA P.T.

Thesis
submitted to the University of Calicut
for the Degree of
DOCTOR OF PHILOSOPHY IN EDUCATION

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UNIVERSITY OF CALICUT**

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**EFFECTIVENESS OF PEER TUTORING AND EXISTING METHOD
OF TEACHING ON ACHIEVEMENT AND RETENTION
IN BIOLOGY OF STANDARD VIII PUPILS**

RESHMA P.T.

Thesis
submitted to the University of Calicut
for the Degree of
DOCTOR OF PHILOSOPHY IN EDUCATION

**DEPARTMENT OF EDUCATION
UNIVERSITY OF CALICUT**

2006

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Appendices

Appendix I B

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

TRAINING MODULE FOR TUTOR TRAINING

Dr. P.K. Sudheesh Kumar

Reshma P.T.

Subject : Biology
Class : 8
Unit : Interdependence in the Living World
Lesson : Food relationship in the ecosystem

Content Analysis

Major concept : Minor concepts
Biosphere : Ecosystem
Food chain

PHASE 1-INTRODUCTORY PHASE

(Teacher enters into the class where students selected for tutor training are seated)

Pupils : Good morning teacher.
Teacher : Good morning. Let us introduce ourselves, first. We will do that in a new way. You write down your name, house name, place and favourite game in a piece of paper. Fold and keep it on this table. Each one of you take any of the slip and read it aloud. The student whose name is read must stand up.

(Teacher and students follows that pattern of introduction).

Teacher : Likewise, today we will experiment a new method of teaching in our class in, which you will learn lessons through cooperation. It is known as 'Peer Tutoring'. It is a method in which students are taught by classmates who are advanced in knowledge. The whole class is divided into small groups. A tutor is allotted for teaching and clearing doubts of each group. And you are selected for becoming such tutors. Those who are ready for this please put up your hands.

(All the tutors put up their hands).

Teacher : Very good. All of you can do that. That is why you are selected.

Pupil : But teacher, how will we teach?

- Teacher : I'll explain everything. Before that are you aware of the importance of the role of tutor and responsibilities to be done.
- Pupils : No.
- Teacher : Tutoring is a heavy responsibility. Mutual respect and trust is the basis of tutoring. You must try to gain their trust in yourself.
- Pupil : How is it possible?
- Teacher : You must try to understand their feelings and communicate patiently. Always be open minded and natural. Never punish them or criticize them. Don't hesitate to admit that you do not know a thing if you are not aware. Be punctual in tutoring processes.
You will have to take care of many things other than this. A pamphlet containing all those details will be given to you at the end of this period.

Guidelines to Tutors

1. Inculcate trust among pupils.
2. Tutors must make things easier.
3. Never hesitate to admit your ignorance.
4. Ask questions.
5. Your students must be able to explain what they have learned.
6. Be a good listener.
7. Have fun during tutoring.
8. Start from what they know.
9. Though they look like children, mentally they may not be so.
10. Majority of the pupils will be careless.
11. If they tell it is boring, take an interval.

Do's and Don't's for tutors

Do's

1. Inculcate responsibility among students.
2. Give ear to what your pupils have to say.
3. Encourage them to express their thoughts and feelings.
4. Always be friendly.
5. Give verbal and tangible rewards.
6. Keep separate record for each pupil (About the tutoring session, the learning materials used etc.)
7. Keep a record of your pupil's progress.
8. Meet your teacher regularly.
9. Be punctual during tutoring sessions.

Don't's

1. Do not punish the pupils.
2. Never insult or use harsh words.
3. Never do their homework.

Pupils : Will we able to do this?

Teacher : Why not? My whole hearted cooperation is always with you.

PHASE II-TEACHING PHASE

Teacher : The fourth unit in your biology text book, Interdependence in the living world, is selected for teaching. Let us start.

Pupils : (With enthusiasm) Yes teacher.

Teacher : What is biosphere?

Pupils : The place were living things are found.

Teacher : It is the space above and below the surface of earth, where living things are found. Look out of your classroom. What can you see?

Pupils : Tree, bird, soil, man, plant, flower, sky, light.

Teacher : (Rephrasing student answers) Yes, tree, plant, bird, man, sunlight, air, etc. isn't it? Can you classify them into two?

Pupils : (After thinking) Living things and non living things.

Teacher : Which are living things?

Pupils : Tree, plant, man, bird.

Teacher : Which are non living things?

Pupils : Sunlight, air.

Teacher : So, how many types of factors are present in biosphere? what are they?

Pupils : Two types. Living and non living things.

Teacher : Is there any relation between them?

Pupils : Yes, O₂ in the air is used by the living things for respiration. Sunlight is used by plants for preparation of food.

Teacher : Yes, a living thing is depending on its surrounding in many ways. What are they?

Pupils : Plants use sunlight for photosynthesis. O₂ is used for breathing by the living things. CO₂ is used by plants for photosynthesis. Water is the medium of living for aquatic plants and animals, and is also used for photosynthesis. Nutrients in the soil are used for the growth of living things.

Teacher : Okay. What are the characteristics of a biosphere?

Pupils : In a biosphere, living and non living things are present. They are interdependent.

Teacher : There is a specific name for this system. Do you know that?

Pupils : (After thinking) No.

- Teacher : Ecosystem. Forest is an ecosystem. Can you differentiate the different living and non living things in it?
- Pupils : Living things-Lion, Tiger, Deer, Bear, Monkey, Rabbit, Peacock, Tree, Plant, Flower.
Non living things-Soil, light, air, water.
- Teacher : Okay. Habitat is the natural environment of an organism. Can you give an example?
- Pupils : Tree is the habitat of monkey, earthworm's habitat is soil.
- Teacher : Very good. Such different habitats will be present in one ecosystem itself. Can you name the different habitats in forest?
- Pupils : Tree, Soil, Grassland.
- Teacher : Yes. What is an ecosystem?
- Pupils : A system comprising living and non living things and their interdependence.
- Teacher : How many factors will be there in an ecosystem?
- Pupils : Living and non living things.
- Teacher : Yes. How are they related?
(Pupils explain the relation between living and non living things one by one).
- Teacher : We have learned about the relation between living and non living things in ecosystem. Now is there any relation between living things in the ecosystem?
- Pupils : (After thinking for some time) One organism is feeding on another.
- Teacher : That means they are having a food relation among them. Can you give examples?
- Pupils : Cat eat rat.
Another pupil: Lion eat deer.
Another pupil: Cow eat grass.
- Teacher : Who eat cow?
- Pupils : Lion, Tiger.
- Teacher : One eat other and is eaten by another. Can you find out such a relation between the living things which I say.
- Pupils : (With enthusiasm) Yes teacher.
- Teacher : Snake, rat, hawk, paddy.
You must write from the living thing coming first to the last. I'll give you 2 minutes.
(After a short discussion, pupils find out the relation).
- Pupils : Rat eat paddy, snake eat rat, snake is eaten by hawk.
- Teacher : Correct.
Look at this food relation, each organism is coming one after the other as a part of chain. So we can call it 'food chain'. Can you define it?

(Pupils define food chain. Teacher helps and corrects mistakes).

Teacher : This food chain is written in a particular form. Put an arrow mark from the first component to the next. Then from the second component to the third and so on, till the last component.

(Teacher shows the pupils how to write food chain)

Teacher : Now you try.

(Pupils write, teacher give advices and corrects mistakes).

Teacher : Correct. Now I will show you a picture. Looking at this you should write at least four food chains each. I will give you ten minutes.

(Teacher show the picture containing different plants and different animals like caterpillar, grass hopper, rabbit, cow, goat, fox, hen, snake, frog, deer, tiger, lion, man, vulture and eagle. Students asks questions. Teacher answers them).

Teacher : (After some time) Have you finished?

Pupils : Yes

Teacher : Each one read out what you have written.

Pupils : (One by one)

1. Grass → Grass hopper → frog → Snake
2. Plant → Caterpillar → Hen → Fox
3. Grass → Deer → Lion → Vulture
4. Plant → Goat → Man.

Teacher : Very good.

Now check what you have written. From whom does all of them start?

Pupils : Plant.

Teacher : Why all food chains are starting from plants.

Pupils : In nature only green plants has the ability to prepare food.

Teacher : Very good. It is correct. In nature only green plants can prepare their own food through photosynthesis. If so what can we call them?

(Pupils look each other in doubt).

Teacher : 'Producers'. Because they are producing the food. Understand?

Pupils : Yes

Teacher : What will happen to an ecosystem if green plants are not present?

Pupils : The next trophic level will not get food. They will perish.

Teacher : What about the next level?

Pupils : They will also die without food.

Teacher : That means the ecosystem altogether will be destroyed. Isn't it?

- Pupils : Yes.
 Teacher : What can we infer from this?
 Pupils : Green plants are necessary for the existence of an ecosystem.
 Teacher : Very good.

PHASE III-TUTORING PHASE

- Teacher : You have learned this much. Now you have to teach all these to your classmates.
- Pupils : Yes
- Teacher : We will see how it is.
 You must show this picture to the students in your group.
 (Teacher shows the picture of a pond ecosystem).
 Then ask them what all can they see. What can you see?
- Pupils : Sun, plant, water, fish, frog, flower.....
- Teacher : Now ask them to classify these into living and non-living things. How will they classify?
- Pupils : Living things include plants, fish, frog, flower etc, and non-living things include sun, water, soil, etc.
- Teacher : Ask them how they are related:
 What answer must they give?
 (Pupils gives some relations between living and non living things).
- Teacher : That is not enough. Make them understand that each non living thing is related with living things.
 Sunlight- Plants use for photosynthesis.
 O₂- Living things use for respiration.
 CO₂- Plants use for photosynthesis.
 Water- Medium for the living of aquatic plants and animals, also used by plants for photosynthesis.
 Temperature- Arrange favourable temperature for the life of each organism.
 Nutrients- Used for the growth of plants and animals.
- Teacher : Repeat it till all of them are thorough. After that make each of them say aloud each relation.
 Now what must we teach next?
- Pupils : About ecosystem.
- Teacher : Explain to them that such a system in which living and non living things are related with each other is called an ecosystem. Also give examples, what are the examples?
- Pupils : Forest, pond, field, grassland.
- Teacher : Correct. What is habitat?
- Pupils : The natural environment surrounding an organism.
- Teacher : Explain to them that habitat is the natural surrounding in which an organism lives and that there are a number of habitats in a single ecosystem.

Pupils : Can't we give the examples of monkey living on tree and lion living in cave in forest?

Teacher : Sure. You yourselves can find out many examples. Now you must teach the food relation among the living things in the ecosystem. For that give them this chart containing the picture of different living things.

(Teacher shows them the chart)

Ask them what relation exists between these.

Pupils : They will say there is food relation.

Teacher : Explain to them that there is a food relation between living things and that one organism is eaten by another.

Pupils : Can't we ask them to find out such a relation in which an animal which is eating another animal and is eaten by another from the chart.

Teacher : Sure. Ask each one of them to find out each relation. After that ask them to find out a food relation from the first to last. From whom will it start?

Pupils : From plants.

Teacher : Correct them if they have mistakes. Ask them to read it aloud. After that explain to them that in a food relation living things are placed one after another as it is in a chain and so it is called as a food chain.

Ask them what it is. What is a food chain?

Pupils : A relation in which one organism eat other and is eaten by another organism is called a food chain.

Teacher : After that show how to write a food chain. How will you write it?

Pupils : Put an arrow mark from the starting level to the next, and continue this till the last level.

Teacher : Correct. Ask them to write out maximum number of food chains by looking at the picture. Check whether it is correct. Then make them read it aloud. Now ask them to check what they have written. Ask from whom does each food chain starts. What must they answer?

Pupils : From plants.

Teacher : Ask the reason for this. What is the reason?

Pupils : In nature only green plants has the ability to prepare food.

Teacher : Explain to them that in nature green plants only can prepare their own food and therefore they are called as producers. Discuss with them the after effects of the absence of green plants from an ecosystem. After that teach them each point. Now you can ask questions from the starting of the lesson. If they have doubts. You must teach again.
Now, what do you feel? Are you sure that you can teach this much.

Pupils : (With smile) We will try our level best.

Teacher : Good. But trying is not enough. Before taking class, you should study again and again what you have learned now. This is a plan which will help you to conduct a class. I will give this plan and the pamphlets and pictures to you (Teacher gives the lesson formats, pamphlets and pictures to the pupils).

If you have doubts you can contact me. Best wishes to all of you. Thank you.

Pupils : Thank you teacher.

(Teacher leaves the classroom).

Appendix II A
UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION
PEER TUTORING MODULE

Dr. P.K. Sudheesh Kumar

Reshma. P.T

വിഷയം : ജീവശാസ്ത്രം
ക്ലാസ്സ് : 8
പാഠം : ജീവലോകത്തെ പരസ്പരാശ്രയത്വം
പാഠ്യഭാഗം : ആവാസവ്യവസ്ഥയിലെ ആഹാരബന്ധങ്ങൾ
സമയം : 45 മിനുട്ട്

Objectives

1. ജീവമണ്ഡലം, ആവാസം, ആവാസവ്യവസ്ഥ, ആഹാരശൃംഖല എന്നിവയെക്കുറിച്ച് കൂട്ടി അറിവ് നേടുന്നു.
2. ജീവമണ്ഡലത്തിലെ വിവിധ ജീവീയ അജീവീയ ഘടകങ്ങളെയും അവ തമ്മിലുള്ള പരസ്പര ബന്ധവും, ആഹാരശൃംഖലയിലെ വിവിധ കണ്ണികളും അവ തമ്മിലുള്ള ബന്ധവും ഗ്രഹിക്കുന്നു.
3. പഠിച്ചറിഞ്ഞ കാര്യങ്ങളിൽ നിന്ന് പുതിയ ആഹാരശൃംഖലകളെ കണ്ടെത്താൻ പ്രാപ്തി നേടുന്നു.
4. ഉല്പാദകരായ ഹരിതസസ്യങ്ങളുടെ അഭാവത്തിൽ ആവാസവ്യവസ്ഥയുടെ നിലനില്പ് എന്താവുമെന്ന് പ്രവചിക്കുന്നു.
5. സഹകരണത്തിലൂന്നിയ പഠനപ്രവർത്തനങ്ങളിൽ അനുകൂലമായ മനോഭാവം വളർത്തുന്നു.
6. സംഘബോധം വളർത്തുന്നു.
7. സംശയങ്ങൾ, ചോദ്യങ്ങൾ എന്നിവ ഉന്നയിക്കാനും കൂട്ടായി ചർച്ച ചെയ്ത് ഉത്തരങ്ങൾ കണ്ടെത്തുവാനുമുള്ള കഴിവ് വികസിപ്പിക്കുന്നു.
8. പഠനപ്രവർത്തനങ്ങളിൽ ഉള്ള ആത്മവിശ്വാസം വർദ്ധിക്കുന്നു.

PHASE I - INTRODUCTORY PHASE

(അദ്ധ്യാപകൻ ക്ലാസ്സിൽ പ്രവേശിക്കുന്നു. കുട്ടികളെ അഭിവാദ്യം ചെയ്യുന്നു. കുട്ടികൾ എല്ലാവരും എഴുന്നേറ്റ് നിന്ന് അദ്ധ്യാപകനെ പ്രത്യഭിവാദ്യം ചെയ്യുന്നു).

ടീച്ചർ : ആദ്യമായി നമുക്ക് പരിചയപ്പെടാം.

(ടീച്ചർ സ്വയം പരിചയപ്പെടുത്തുന്നു. കുട്ടികൾ ഓരോരുത്തരും എഴുന്നേറ്റു നിന്ന് പരിചയപ്പെടുത്തുന്നു).

ടീച്ചർ : നിങ്ങളെല്ലാവരും ബയോളജി പഠിക്കാൻ തയ്യാറായിരിക്കുകയാണോ?

കുട്ടികൾ : അതെ.

ടീച്ചർ : എങ്കിൽ നമ്മളിന്ന് ഒരു പുതിയ രീതിയിലൂടെയാണ് ബയോളജി പഠിക്കുന്നത്. 'പിയർ ട്യൂട്ടറിംഗ്' എന്നാണ് അതിന്റെ പേര്. അതെന്താണെന്നറിയാമോ.

കുട്ടികൾ : ഇല്ല.

ടീച്ചർ : നിങ്ങളുടെ സഹപാഠികൾ തന്നെ നിങ്ങളെ പഠിപ്പിക്കുന്ന രീതി. നിങ്ങൾക്കതിന് താല്പര്യമുണ്ടോ?

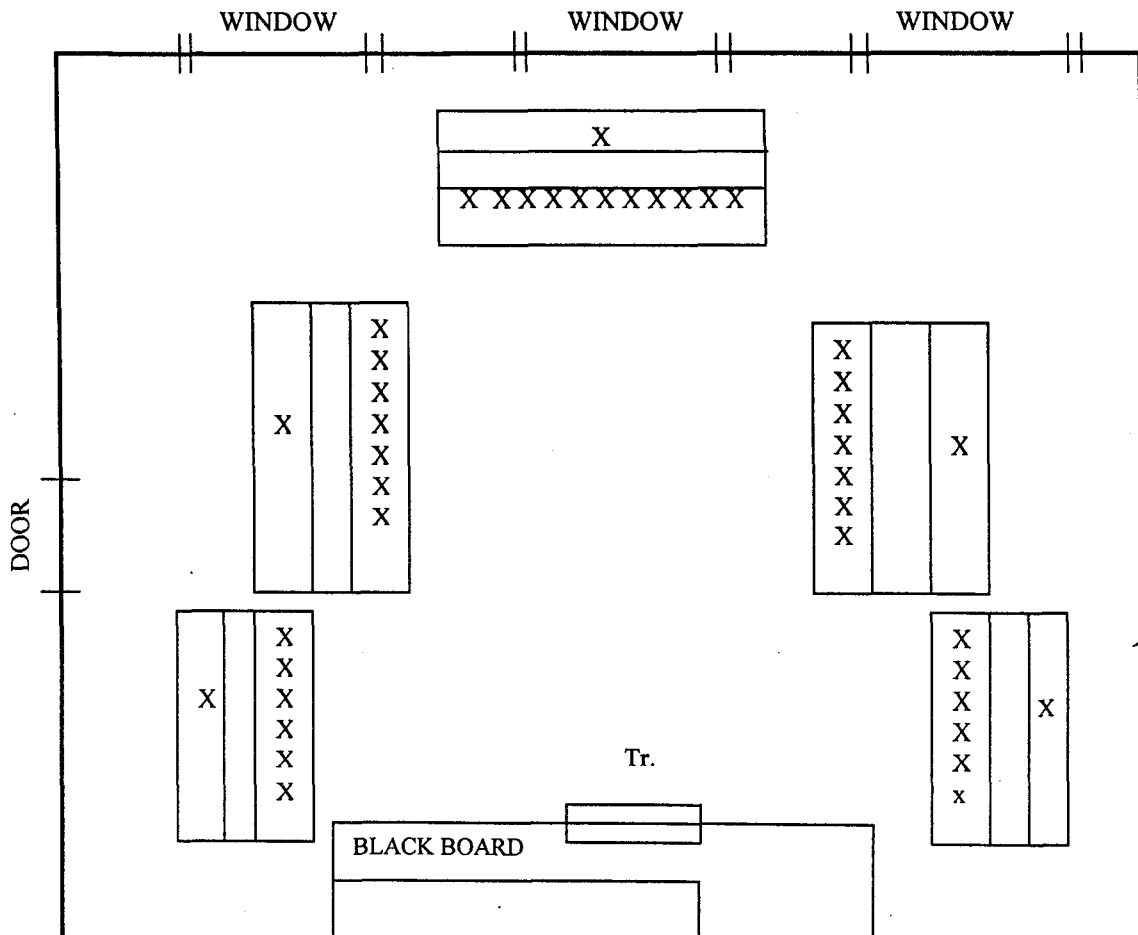
കുട്ടികൾ : (ആവേശത്തോടെ) ഉണ്ട്.

ടീച്ചർ : (ട്യൂട്ടർമാരെ അടുത്തേക്ക് വിളിക്കുന്നു). ഇവരാണ് ഇന്ന് നിങ്ങളെ പഠിപ്പിക്കാൻ പോവുന്നത്. അതിനുമുമ്പ് നിങ്ങൾ അഞ്ചു ഗ്രൂപ്പായി തിരിയണം. ടീച്ചർ പേരു വിളിക്കുന്ന അഞ്ചുപേർ വീതം ഒരു ഗ്രൂപ്പാവുക.

(ടീച്ചർ മുൻ നിശ്ചയിച്ചപ്രകാരം ഓരോ ഗ്രൂപ്പിലേക്കും തിരഞ്ഞെടുത്തിട്ടുള്ള കുട്ടികളുടെ പേരുകൾ വിളിക്കുന്നു. ഓരോ ഗ്രൂപ്പിനും ഓരോ ട്യൂട്ടറെ വീതം നിയോഗിക്കുന്നു).

ടീച്ചർ : ഈ പഠനരീതിയിൽ ഇപ്പോഴുണ്ടാക്കിയതുപോലെ കൊച്ചു ഗ്രൂപ്പുകളായാണ് നിങ്ങളിരിക്കേണ്ടത്. അതിനായി നിങ്ങളുടെ ഇരിപ്പിടം പുതിയൊരു രീതിയിൽ ക്രമീകരിക്കേണ്ടതുണ്ട്.

(ഇരിപ്പിടം ക്രമീകരിക്കേണ്ടതിന്റെ മാതൃക ടീച്ചർ ബോർഡിൽ വരയ്ക്കുന്നു).



ടീച്ചർ : ബോർഡിൽ കാണിച്ചിരിക്കുന്ന രീതിയിലാണ് നിങ്ങൾ ഇരിക്കേണ്ടത്. (ബോർഡിൽ കാണിച്ച കുതിരലാടത്തിന്റെ മാതൃകയിൽ കുട്ടികൾ ഗ്രൂപ്പ് തിരിഞ്ഞ് ഇരിക്കുന്നു).

ടീച്ചർ : എല്ലാവർക്കും സൗകര്യപ്രദമായി ഇരിക്കാൻ സാധിക്കുന്നുണ്ടോ?

(ചില കുട്ടികൾ ചെറിയ പരാതികൾ പറയുന്നു. ടീച്ചർ അവ ശ്രദ്ധിച്ച് പരിഹാരമുണ്ടാക്കുന്നു).

ടീച്ചർ : ഇനി നിങ്ങളുടെ ഗ്രൂപ്പിന്റെ ട്യൂട്ടർമാർ നിങ്ങളെ പഠിപ്പിക്കും. നിങ്ങൾ ഓരോരുത്തരും അത് ശ്രദ്ധിച്ചുകേട്ട് മനസ്സിലാക്കണം.

PHASE II - TUTORING PHASE

(ട്യൂട്ടർ തന്റെ ഗ്രൂപ്പിലെ കുട്ടികളെ അഭിവാദ്യം ചെയ്യുന്നു. കുട്ടികൾ പ്രത്യഭിവാദ്യം ചെയ്യുന്നു).

ട്യൂട്ടർ : നമുക്കു പഠിച്ചുതുടങ്ങാം. നിങ്ങൾ തയ്യാറായോ.

കുട്ടികൾ : തുടങ്ങാം. ഞങ്ങൾ തയ്യാറാണ്.

ട്യൂട്ടർ : ആദ്യം ഞാൻ നിങ്ങൾക്കൊരു ചിത്രം കാണിച്ചുതരാം. ആ ചിത്രം ശ്രദ്ധിച്ചു നോക്കണം. എന്നിട്ട് എന്തെല്ലാം കാണുന്നുണ്ട് എന്നു പറയണം.

(ട്യൂട്ടർ ഒരു കുളത്തിന്റെ ആവാസവ്യവസ്ഥ അടങ്ങിയ ചിത്രം കാണിക്കുന്നു. കുട്ടികൾ ഔത്സുക്യത്തോടെ നോക്കുന്നു).

ട്യൂട്ടർ : എന്തെല്ലാം കാണുന്നുണ്ട് ? ഓരോരുത്തരായി പറയൂ.

കുട്ടികൾ : സൂര്യൻ, വെള്ളം, ചെടി, മത്സ്യം, തവള, കൊക്ക്, താമര.....

(കുട്ടികൾ ഓരോരുത്തരായി ചിത്രത്തിലെ ഓരോ വസ്തുവും പറയുന്നു).

ട്യൂട്ടർ : ഇനി ഈ വസ്തുക്കളെ ജീവനുള്ളവയായും ജീവനില്ലാത്തവയായും തരംതിരിച്ച് പറയാമോ.

കുട്ടികൾ : (അല്പസമയത്തെ ചർച്ചയ്ക്കുശേഷം) ചെടി, മത്സ്യം, തവള, കൊക്ക് തുടങ്ങിയവ ജീവനുള്ളവ. സൂര്യൻ, വെള്ളം, മണ്ണ് തുടങ്ങിയവ ജീവനില്ലാത്തവ.

ട്യൂട്ടർ : ജീവനുള്ളവയും ജീവനില്ലാത്തവയും തമ്മിൽ എന്തെങ്കിലും ബന്ധമുണ്ടോ?

(നിശ്ശബ്ദത. കുട്ടികൾ ചോദ്യം മനസ്സിലാവാത്ത രീതിയിൽ നോക്കുന്നു).

ട്യൂട്ടർ : ജീവനില്ലാത്തവ ജീവനുള്ളവയ്ക്ക് എന്തെങ്കിലും തരത്തിൽ ഉപകരിക്കുന്നുണ്ടോ?

കുട്ടികൾ : ഉണ്ട്. സൂര്യപ്രകാശം ചെടികൾ ഭക്ഷണം പാകം ചെയ്യാൻ ഉപയോഗിക്കുന്നു. ജലം ചെടിയുടെ വളർച്ചയ്ക്ക് ആവശ്യമാണ്.

ട്യൂട്ടർ : അതു മാത്രമാണോ അവ തമ്മിലുള്ള ബന്ധം. ഞാൻ ഓരോന്നായി പറഞ്ഞുതരാം. നിങ്ങൾ ശ്രദ്ധിച്ചു കേൾക്കണം. (1) സൂര്യപ്രകാശം ഹരിതസസ്യങ്ങൾപ്രകാശസംശ്ലേഷണത്തിന് ഉപയോഗിക്കുന്നു. പ്രകാശസംശ്ലേഷണം എന്നാലെന്താണെന്നറിയില്ലേ?

കുട്ടികൾ : സൂര്യപ്രകാശത്തിന്റെ സാന്നിധ്യത്തിൽ ചെടികൾ CO₂ഉം, ജലവും ഉപയോഗിച്ച് ഭക്ഷണം പാകം ചെയ്യുന്ന രീതി.

ഡ്യൂട്ടർ : വെരി ഗുഡ്. 2) മറ്റൊരു അജീവീയ ഘടകമായ O₂എല്ലാ ജീവികളും ശ്വസിക്കാൻ ഉപയോഗിക്കുന്നു.

കുട്ടികൾ : O₂ വായുവിലല്ലേ ഉള്ളത്? അപ്പോൾ ജലത്തിലെ ജീവികൾ എങ്ങിനെ ശ്വസിയ്ക്കും?

ഡ്യൂട്ടർ : O₂ വായുവിലും, ജലത്തിൽ ലയിച്ചുചേർന്ന രീതിയിലും ഉണ്ട്.

(കരയിലെ ജീവികൾ വായുവിലെ ഓക്സിജനും, ജലജീവികൾ ജലത്തിൽ ലയിച്ചുചേർന്ന ഓക്സിജനും ശ്വസിക്കുന്നു എന്ന് ഡ്യൂട്ടർ കുട്ടികളെ പറഞ്ഞു മനസ്സിലാക്കുന്നു).

കുട്ടികൾ : അജീവീയ ഘടകം എന്നാൽ ജീവനില്ലാത്തതുതന്നെയല്ലേ.

ഡ്യൂട്ടർ : അതെ, ജീവനുള്ള ഘടകങ്ങളെ ജീവീയഘടകങ്ങളെന്നും ജീവനില്ലാത്ത ഘടകങ്ങളെ അജീവീയ ഘടകങ്ങളെന്നും പറയുന്നു.

3) വായുവിലെ CO₂നെ സസ്യങ്ങൾ പ്രകാശസംശ്ലേഷണത്തിന് ഉപയോഗിക്കുന്നു.

4) ജലം സസ്യങ്ങൾ പ്രകാശസംശ്ലേഷണത്തിന് ഉപയോഗിക്കുന്നു. ജലജീവികൾക്ക് ജീവിക്കാനുള്ള ചുറ്റുപാടൊരുക്കുന്നു.

5) മണ്ണിലെയും, ജലത്തിലെയും വിവിധതരം പോഷകങ്ങൾ സസ്യങ്ങളുടെയും ജന്തുക്കളുടേയും വളർച്ചയ്ക്കാവശ്യമാണ്.

6) താപനില ഓരോ ജീവിയ്ക്കും ജീവിക്കാനുതകുന്ന രീതിയിൽ അനുയോജ്യമാവുന്നു.

(കരയിലെ ഉയർന്ന താപനിലയും, ജലത്തിലെ കുറഞ്ഞ താപനിലയും അതത് സ്ഥലത്തെ ജീവികൾക്ക് അനുയോജ്യമാണെന്ന് പറഞ്ഞു മനസ്സിലാക്കുന്നു).

ഡ്യൂട്ടർ : എല്ലാ പോയന്റും എല്ലാവർക്കും മനസ്സിലായോ?

(കുട്ടികൾ വീണ്ടും സംശയങ്ങൾ ചോദിക്കുന്നു. ഡ്യൂട്ടർ ക്ഷമയോടെ അവയോരോന്നും നിവൃത്തികരിക്കുന്നു).

ഡ്യൂട്ടർ : ഇനി ഓരോരുത്തരായി ജീവീയ ഘടകങ്ങളും അജീവീയ ഘടകങ്ങളും തമ്മിലുള്ള ബന്ധങ്ങൾ പറയൂ.

(കുട്ടികൾ ഓരോരുത്തരായി ഓരോ പോയന്റും പറയുന്നു. ഡ്യൂട്ടർ മുഖഭാവത്തിലൂടെയും വാക്കിലൂടെയും ചെറിയ പ്രശംസകൾ നൽകുന്നു).

ഡ്യൂട്ടർ : നല്ലത്. നിങ്ങളെല്ലാവരും നന്നായി ശ്രദ്ധിക്കുന്നുണ്ട്. ഇനി നമുക്ക് അടുത്ത ഭാഗത്തിലേക്ക് കടക്കാം.

കുട്ടികൾ : ശരി.

ഡ്യൂട്ടർ : പ്രകൃതിയിൽ ജീവനുള്ളതും ജീവനില്ലാത്തതുമായ പല ഘടകങ്ങളും ഉണ്ടെന്നും, അവ പരസ്പരം ബന്ധപ്പെട്ട് കിടക്കുകയാണെന്നും പഠിച്ചല്ലോ. ഇത്തരത്തിലുള്ള വ്യവസ്ഥയെയാണ് ആവാസവ്യവസ്ഥ എന്നു പറയുന്നത്. നിങ്ങളിപ്പോൾ കണ്ട ചിത്രത്തിലെ 'കുളം' ആവാസവ്യവസ്ഥക്ക് ഉദാഹരണമാണ്.

വേറെ ഉദാഹരണങ്ങൾ നിങ്ങൾക്ക് കണ്ടെത്താമോ?

കുട്ടികൾ : (അല്പനേരത്തെ ആലോചനയ്ക്കുശേഷം) പുഴ, കടൽ.

സ്റ്റുടർ : അവയെ ആവാസവ്യവസ്ഥ എന്നുപറയാൻ കാരണമെന്ത്?

പുഴയിലും കടലിലും വിവിധതരം ജീവനുള്ളതും ജീവനില്ലാത്തതുമായ ഘടകങ്ങളുണ്ട്. അവയെല്ലാം പരസ്പരം ബന്ധപ്പെട്ടിരിക്കുന്നു.

സ്റ്റുടർ : ഗുഡ്. മറ്റുദാഹരണങ്ങളാണ് വനം, വയൽ, പുൽപ്രദേശം, തുടങ്ങിയവ. ഇവയിലെല്ലാം വിവിധതരം ജീവിയ-അജീവിയ ഘടകങ്ങളും അവയുടെ പരസ്പര ബന്ധവും നിലനിൽക്കുന്നുണ്ട്. 'വനം' എന്ന ആവാസവ്യവസ്ഥയിലെ ഘടകങ്ങളും അവയുടെ പരസ്പരബന്ധവും ഒരാൾ വിവരിക്കൂ.

(ഒരു കുട്ടി വനത്തിലെ വിവിധ ജീവിയ അജീവിയ ഘടകങ്ങളും അവയുടെ പരസ്പര ബന്ധവും വിവരിക്കുന്നു. വിട്ടുപോയ ഭാഗങ്ങൾ സ്റ്റുടർ കുട്ടിച്ചേർക്കുന്നു. ഇതുപോലെ വയൽ, പുൽപ്രദേശം, നദി, സമുദ്രം തുടങ്ങിയ ആവാസവ്യവസ്ഥകളെക്കുറിച്ചും ഓരോരുത്തരെക്കൊണ്ടും പറയിപ്പിക്കുന്നു).

സ്റ്റുടർ : വെരി ഗുഡ്. അപ്പോൾ ആവാസവ്യവസ്ഥ എന്താണെന്ന് നിങ്ങൾക്ക് മനസ്സിലായി അല്ലെ. ഇനി അതൊന്ന് നിർവ്വചിക്കൂ.

(കുട്ടികൾ ആവാസ വ്യവസ്ഥ നിർവ്വചിക്കുന്നു. സ്റ്റുടർ സഹായിക്കുന്നു).

സ്റ്റുടർ : ഒരു ആവാസവ്യവസ്ഥയിൽത്തന്നെ ഒരുപാട് ജീവികളുണ്ട് അല്ലെ. ഓരോ ജീവികളും ജീവിക്കാൻ ഒരു ചുറ്റുപാട് ആവശ്യമല്ലെ.

കുട്ടികൾ : അതെ.

സ്റ്റുടർ : ഇങ്ങനെ ഓരോ ജീവിയും വസിക്കുന്ന പ്രകൃത്യായുള്ള ചുറ്റുപാടിനെയാണ് ആവാസം എന്നു പറയുന്നത്. ഉദാഹരണത്തിന്, കൂരങ്ങൾ മരത്തിലും, സിംഹം ഗുഹയിലും, പാമ്പ് മാളത്തിലും ജീവിക്കുന്നു. വേറെ ഉദാഹരണങ്ങൾ പറയാമോ?

(കുട്ടികൾ മറ്റു ചില ഉദാഹരണങ്ങൾ കണ്ടെത്തി പറയുന്നു).

സ്റ്റുടർ : ശരി, അപ്പോൾ ആവാസം എന്നാലെന്താണ്?

കുട്ടികൾ : ഒരു ജീവി ജീവിക്കുന്ന പ്രകൃത്യായുള്ള ചുറ്റുപാട്.

സ്റ്റുടർ : ഒരു ആവാസവ്യവസ്ഥയിൽ എത്ര ആവാസങ്ങളുണ്ടാവും?

കുട്ടികൾ : നിരവധി ആവാസങ്ങൾ.

സ്റ്റുടർ : കുളം, വയൽ, സമുദ്രം എന്നീ ആവാസവ്യവസ്ഥകളിലെ വിവിധ ആവാസങ്ങൾ ഓരോരുത്തരായി പറയൂ.

(കുട്ടികൾ ഓരോരുത്തരായി ഓരോ ആവാസവ്യവസ്ഥയിലേയും ആവാസങ്ങൾ പറയുന്നു. സ്റ്റുടർ പ്രോത്സാഹിപ്പിക്കുന്നതോടൊപ്പം തെറ്റുകളും തിരുത്തുന്നു).

സ്റ്റുടർ : ആവാസവ്യവസ്ഥയിലെ ജീവനുള്ളവയും ജീവനില്ലാത്തവയും തമ്മിലുള്ള ബന്ധം നാം പഠിച്ചുകഴിഞ്ഞു. ഇനി ഈ ചാർട്ട് നോക്കി ജീവനുള്ളവ തമ്മിൽ എന്തു ബന്ധമാണുള്ളതെന്ന് പറയണം.

(സ്വട്ടർ വിവിധ ജീവികളുടെ ചിത്രങ്ങൾ ഒട്ടിച്ച ചാർട്ട് എല്ലാവരെയും കാണിക്കുന്നു. കുട്ടികൾ അല്പസമയത്തെ ചർച്ചയ്ക്കുശേഷം ജീവികൾ തമ്മിൽ ആഹാരബന്ധമുണ്ടെന്ന് കണ്ടെത്തുന്നു.)

സ്വട്ടർ : ശരി. എന്നുവെച്ചാൽ ഒരു ജീവി മറ്റൊരു ജീവിയെയാണ് ആഹാരമാക്കുന്നത് അല്ലെ.

കുട്ടികൾ : അതെ.

സ്വട്ടർ : അങ്ങിനെയെങ്കിൽ ആഹാരമാക്കുന്ന ജീവിയേയും ആഹാരമാക്കപ്പെടുന്ന ജീവിയേയും ഓരോരുത്തരും കാണിച്ചു തരുമോ?

(കുട്ടികൾ ഓരോരുത്തരായി ഓരോ ആഹാരബന്ധം കണ്ടെത്തുന്നു).

സ്വട്ടർ : ശരി. ആദ്യം വരുന്ന ജീവിമുതൽ അവസാനം വരുന്ന ജീവി വരെ ഒരു ആഹാരബന്ധം മുഴുവനായി കണ്ടെത്താമോ?

(കുട്ടികൾ പരസ്പരം ചർച്ചചെയ്യുന്നു. ഇടക്കിടെ സംശയങ്ങൾ ചോദിക്കുന്നു. സ്വട്ടർ അവ പരിഹരിക്കുന്നു).

കുട്ടികൾ : പുഴു ഇല തിന്നുന്നു, പുഴുവിനെ കോഴി തിന്നുന്നു, കോഴിയെ കുറുക്കൻ തിന്നുന്നു, കുറുക്കനെ സിംഹം തിന്നുന്നു.

സ്വട്ടർ : ശരി. സിംഹം മരിക്കുമ്പോൾ എന്തു സംഭവിക്കുന്നു?

കുട്ടികൾ : ശരീരം അഴുകി മണ്ണിനോട് ചേരും.

സ്വട്ടർ : ശരീരം അഴുകാൻ സഹായിക്കുന്നത് ആരാണെന്നറിയാമോ?

കുട്ടികൾ : ബാക്ടീരിയ.

സ്വട്ടർ : വെരി ഗുഡ്. ബാക്ടീരിയയെക്കുറിച്ച് നിങ്ങൾ പഠിച്ചിട്ടുണ്ടോ? അവയുടെ ധർമ്മമെന്താണ്?

കുട്ടികൾ : അഴുകിയ ജൈവവസ്തുക്കളെ ആഹാരമാക്കി വിഘടിപ്പിച്ച് പ്രകൃതിയിലേക്ക് തിരിച്ചെത്തിക്കുന്നു.

സ്വട്ടർ : ശരി. ഇനി നിങ്ങൾ കണ്ടെത്തിയ ആഹാരബന്ധം ഒന്ന് ശ്രദ്ധിക്കൂ. ഒരു ജീവി മറ്റൊരു ജീവിയെ തിന്നുകയും മറ്റൊന്നിനാൽ തിന്നപ്പെടുകയും ചെയ്യുന്നു. ഓരോ ജീവിയും ഒന്നിനുപിറകെ ഒന്നായി ഒരു ചങ്ങലയിലെ കണ്ണികൾ പോലെ സ്ഥിതിചെയ്യുന്നു, അല്ലെ. അതിനാൽ ഇത്തരം ആഹാരബന്ധങ്ങളെ 'ആഹാരശൃംഖല' എന്നു പറയുന്നു.

ആഹാരശൃംഖല എന്താണെന്ന് വിവരിക്കാമോ?

(കുട്ടികൾ ആഹാരശൃംഖല വിവരിക്കുന്നു, സ്വട്ടർ തെറ്റു തിരുത്തുന്നു).

സ്വട്ടർ : ആഹാരശൃംഖല ഒരു പ്രത്യേക രീതിയിലാണ് എഴുതുന്നത്. തുടങ്ങുന്ന കണ്ണിയിൽനിന്നും തൊട്ടടുത്ത കണ്ണിയിലേക്ക് സൂചനാ ചിഹ്നം വരയ്ക്കുക. ആ കണ്ണിയിൽനിന്നും വീണ്ടും അടുത്ത കണ്ണിയിലേക്ക്. ഇങ്ങിനെ അവസാനത്തെ കണ്ണിവരെ തുടരുക.

(സ്വട്ടർ ആഹാരശൃംഖല എഴുതുന്ന രീതി കാണിച്ചുകൊടുക്കുന്നു. കുട്ടികൾ എഴുതി നോക്കുന്നു. സ്വട്ടർ വേണ്ട നിർദ്ദേശങ്ങൾ നൽകുന്നു).

സ്വട്ടർ : ഇനി ചാർട്ടിൽ നോക്കി ആകാവുന്നത്രയും ആഹാരശൃംഖലകൾ എഴുതിനോക്കൂ.

(കുട്ടികൾ സജീവമായ ചർച്ചയിൽ ഏർപ്പെടുന്നു. പരസ്പരം സംശയങ്ങൾ ചോദിക്കുകയും പരിഹാരം കണ്ടെത്തുകയും ചെയ്യുന്നു).

ഡ്യൂട്ടർ : (അല്പസമയത്തിനുശേഷം) എഴുതിക്കഴിഞ്ഞോ?

കുട്ടികൾ : കഴിഞ്ഞു.

(ഡ്യൂട്ടർ കുട്ടികൾ എഴുതിയ ആഹാരശൃംഖലകൾ ശരിയാണോ എന്ന് പരിശോധിക്കുന്നു).

ഡ്യൂട്ടർ : ശരി. ഇനി ഓരോരുത്തരായി എഴുതിയത് വായിക്കൂ.

(കുട്ടികൾ ഓരോരുത്തരായി ഓരോ ആഹാരശൃംഖലയും ഉറക്കെ വായിക്കുന്നു).

ഡ്യൂട്ടർ : ഇനി എഴുതിയ ആഹാരശൃംഖലകൾ ഒന്നു പരിശോധിക്കൂ. എല്ലാം ആരംഭിക്കുന്നത് ആരിൽ നിന്നുമാണ്?

കുട്ടികൾ : സസ്യത്തിൽ നിന്നും.

ഡ്യൂട്ടർ : അതെന്തുകൊണ്ടാണെന്നറിയാമോ?

കുട്ടികൾ : പ്രകൃതിയിൽ സസ്യത്തിനു മാത്രമേ ആഹാരം പാകം ചെയ്യാനുള്ള കഴിവുള്ളൂ.

ഡ്യൂട്ടർ : അതെ. പ്രകൃതിയിൽ ഹരിത സസ്യങ്ങൾക്കു മാത്രമേ പ്രകാശ സംശ്ലേഷണം വഴി ആഹാരമുണ്ടാക്കുവാനുള്ള കഴിവുള്ളൂ. അതുകൊണ്ട് സസ്യങ്ങളെ 'ഉൽപാദകർ' എന്നു വിളിക്കുന്നു.

സസ്യങ്ങൾ എന്താണ് ഉൽപാദിപ്പിക്കുന്നത്?

കുട്ടികൾ : ആഹാരം.

ഡ്യൂട്ടർ : ഈ ആഹാരം പിന്നീട് എവിടെയെത്തുന്നു?

കുട്ടികൾ : ചെടികളെ ഭക്ഷണമാക്കുന്ന ജീവികളിലേക്ക്.

ഡ്യൂട്ടർ : ആ ജീവികളിൽനിന്നും പിന്നീടങ്ങോട്ട്?

കുട്ടികൾ : അടുത്ത കണ്ണിയിലെ ജീവികളിലേക്ക്.

ഡ്യൂട്ടർ : അങ്ങിനെയെങ്കിൽ ആവാസവ്യവസ്ഥയിൽ ഹരിതസസ്യങ്ങൾ ഇല്ലാതായാൽ എന്തെല്ലാം സംഭവിക്കുമെന്ന് നമുക്ക് നോക്കാം.

(ഹരിത സസ്യങ്ങൾ ഇല്ലാതായാലുള്ള വിപത്തുകളെക്കുറിച്ചു ഡ്യൂട്ടറും കുട്ടികളും ചർച്ച ചെയ്യുന്നു. ചർച്ചയ്ക്കൊടുവിൽ ഹരിതസസ്യങ്ങളുടെ അഭാവം ആവാസവ്യവസ്ഥയിലെ ഓരോ കണ്ണിയേയും സാരമായി ബാധിക്കുമെന്നും ആവാസവ്യവസ്ഥയുടെ നിലനില്പുതന്നെ ഇല്ലാതാവുമെന്നും എന്നുമുള്ള ധാരണയിൽ ഡ്യൂട്ടർ കുട്ടികളെ എത്തിക്കുന്നു).

ഡ്യൂട്ടർ : ഹരിത സസ്യങ്ങളുടെ പ്രാധാന്യം മനസ്സിലായല്ലോ? ഇത്രയും അമൂല്യമായ സസ്യങ്ങളെ നാം നശിപ്പിക്കരുത്, മാത്രമല്ല കൂടുതൽ ചെടികളും മരങ്ങളും നട്ടുപിടിപ്പിക്കാൻ നമ്മൾ കുട്ടികൾ താല്പര്യം കാണിക്കണം.

(ഡ്യൂട്ടർ, മരങ്ങൾ നട്ടുപിടിപ്പിക്കുന്നതിന്റെ ആവശ്യകതയെക്കുറിച്ച് കുട്ടികളെ ബോധവാന്മാരാക്കുന്നു. കുട്ടികൾ താല്പര്യത്തോടെ ശ്രദ്ധിക്കുന്നു).

PHASE III-CONCLUDING PHASE

ഡ്യൂട്ടർ : ഇന്ന് പഠിപ്പിച്ചത്രയും പാഠഭാഗം നിങ്ങൾക്ക് മനസ്സിലായോ?

കുട്ടികൾ : (ഉത്സാഹത്തോടെ) മനസ്സിലായി.

ഡ്യൂട്ടർ : എങ്കിൽ ഞാൻ ചില ചോദ്യങ്ങൾ ചോദിക്കാം.

(ഡ്യൂട്ടർ പാഠഭാഗത്തിന്റെ ആരംഭം മുതലുള്ള ചോദ്യങ്ങൾ ചോദിക്കുന്നു. കുട്ടികൾ എല്ലാവരും ഉത്തരങ്ങൾ പറയുന്നു. ഡ്യൂട്ടർ ഉത്തരങ്ങൾ ആവർത്തിക്കുകയും പുനഃക്രമീകരിക്കുകയും ചെയ്യുന്നു).

ഡ്യൂട്ടർ : ശരി. ഇനി കുറച്ച് ചോദ്യങ്ങൾ എഴുതിയെടുത്തോളൂ. അടുത്ത ക്ലാസ്സിൽ വരുമ്പോഴേക്ക് ഉത്തരങ്ങൾ എഴുതിക്കൊണ്ടുവരണം.

(ഡ്യൂട്ടർ ചോദ്യങ്ങൾ നൽകുന്നു).

ഡ്യൂട്ടർ : ഇന്നത്തെ പാഠഭാഗം ഇവിടെത്തീരുന്നു. നമുക്കു പിരിയാം. നന്ദി.

കുട്ടികൾ : നന്ദി.

(ടീച്ചർ അഞ്ചു ഗ്രൂപ്പുകളേയും തിരിച്ചു വിളിക്കുന്നു).

ടീച്ചർ : പഠിപ്പിച്ചതെല്ലാം നിങ്ങൾക്കെല്ലാവർക്കും മനസ്സിലായോ?

കുട്ടികൾ : മനസ്സിലായി.

ടീച്ചർ : ഈ രീതിയിലുള്ള പഠനം നിങ്ങൾക്കിഷ്ടമായോ?

കുട്ടികൾ : ഇഷ്ടമായി.

ടീച്ചർ : ശരി. എന്നാൽ നമുക്ക് തുടർന്നുവരുന്ന ബയോളജി ക്ലാസ്സുകളിലും ഈ രീതി അവലംബിക്കാം. നന്ദി.

കുട്ടികൾ : (സന്തോഷത്തോടെ) നന്ദി ടീച്ചർ.

(ടീച്ചർ ക്ലാസ്സ്മുറിവിട്ട് പുറത്തേക്ക് പോവുന്നു).



Appendix II B
UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION
PEER TUTORING MODULE

Dr. P.K. Sudheesh Kumar

Reshma P.T.

Subject : Biology
Class : 8
Unit : Interdependence in the Living World
Lesson : Food relationship in Ecosystem
Time : 45 minutes

Objectives

1. The pupil gains knowledge about Biosphere, Habitat, Ecosystem, Foodchain, etc.
2. The pupil develops understanding about living things, non living things and their interdependence and the different components of food chain and the relation between them.
3. Acquires ability to locate new food chains from what is known.
4. Predicts what will happen to the ecosystem in the absence of green plants.
5. Develops positive attitude towards cooperative learning activities.
6. Develops cooperative spirit
7. Develops ability to ask questions, doubts, etc. and find solution to them through group discussions.
8. Increases the confidence in learning activities.

PHASE I : INTRODUCTORY PHASE

(Teacher enters in to the class and wish students. All students stand up and respond to her)

Teacher : First of all, we will introduce ourselves to each other.

(Teacher introduces herself and after that each pupil introduce themselves).

Teacher : Are you prepared to learn Biology?

Pupils : Yes.

Teacher : Today we can learn Biology through a new method known as 'Peer Tutoring'. Do you know what it is?

Pupils : No.

Teacher : It is a way in which your classmates act as teachers and teach you the lessons. Are you interested?

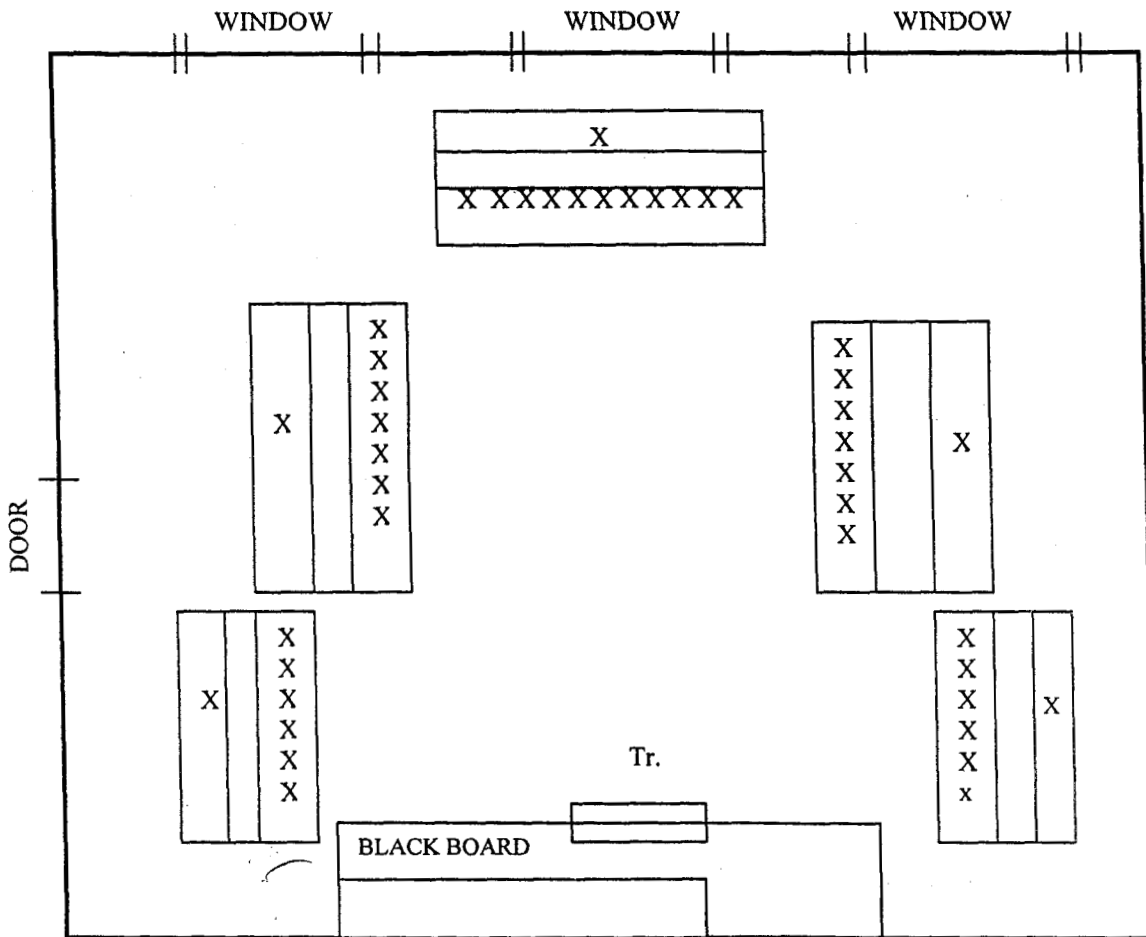
Pupils : (With enthusiasm) Yes.

Teacher : (Asks the tutors to come forward). These students will teach you today. Before that the whole class must divide into five groups. I will call out the name of pupils in each group.

(Teacher calls out the name of pupils belonging to each group as decided earlier. Assigns a tutor to each group).

Teacher : In this method of teaching, you have to sit as five separate groups. For this, we will rearrange our classroom.

(Teacher draw the model of seating arrangement on the board).



Teacher : You must sit as it is shown on the board.

(Pupils rearrange the classroom according to the horse shoe shaped model on the board).

Teacher : Are everybody comfortable?

(Some students complaints and teacher listens to them carefully and solves the problems).

Teacher : Now, each tutor will teach each group. All of you must listen to it carefully.

PHASE II : TUTORING PHASE

(Tutor wishes the tutees in her group. Tutees wish her back).

Tutor : Let us start learning. Are you ready?

Pupils : Yes, We are ready.

Tutor : First of all I will show you a picture. Look at it carefully and tell what you can see in it.

(Tutor shows the picture of a pond eco-system).

Tutor : Each one of you tell me what you can see in the picture.

Pupils : Sun, water, plant, fish, frog, crane, lotus

(Pupils, one by one tell each and every object in the picture).

Tutor : Can you classify them into living things and non-living things.

Pupils : (After a few minutes of discussion) Plant, fish, frog, and crane are living things. Sun, water, mud, etc. are non-living things.

Tutor : Is there any relation between living things and non-living things?

(Silence. Pupils are not able to interpret the question).

Tutor : Are non-living things beneficial to living things in any way?

Pupils : Yes. Plants use sunlight for preparation of foods and they need water for their growth.

Tutor : Is that the only relation between them. I will tell it one by one, listen carefully.

(1) Plants use sunlight for photosynthesis. Do you know what is photosynthesis?

Pupils : It is the process in which plants prepare food in the presence of sunlight using CO₂ and water.

Tutor : Very good. (2) All living things take in O_2 during respiration.

Pupils : O_2 is present in air. Then how will aquatic animals respire?

Tutor : O_2 is present in air in the form of gas and in water in a dissolved state.

(Tutor makes the pupils understand that terrestrial animals respire O_2 in the air and aquatic animals respire the dissolved O_2 in the water).

Tutor : (3) Plants use CO_2 in the air for photosynthesis.

(4) water is the medium of living for aquatic animals and it is also used by plants for photosynthesis.

(5) Various nutrients present in soil and water are necessary for the growth of plants and animals.

(6) Temperature is suitable for the living of each animal.

(Tutor explains that the high temperature in the land is suitable for terrestrial animals and the low temperature in water is suitable for aquatic animals).

Tutor : Are all the points clear to everybody?

(Pupils again ask doubts. Tutor solves all of them with patience).

Tutor : Now each one of you tell the relationship between living things and non living things.

(Each pupils tells each point. Tutor encourages them verbally and through facial expressions).

Tutor : Good. All of you are listening very well. Now we will move on to next content.

Pupils : Okay.

Tutor : You have learned that, in nature there are living as well as non-living things and they are related to each other. Such a system is known as ecosystem. The pond which you have seen in the picture is an example for ecosystem. Can you give other examples?

Pupils : (After thinking for few minutes) River, sea.

Tutor : Why they are called as ecosystem?

Pupils : There are different living as well as non-living things in river and sea and all of them are interrelated.

Tutor : Good. Forest, field, grassland, etc. are other examples. In all these areas, living and non living things and their interrelation exists. One of you explain the different living and non-living things in forest.

(One pupil explains the living and non-living things in forest and their relation. Tutor adds the missing points. Likewise tutor make the pupils explains the examples like field, grassland, river, sea, etc.)

Tutor : Very good. So you know what is ecosystem. Can you define it?

(Pupils define ecosystem. Tutor render help).

Tutor : There are so many living things in the ecosystem. So doesn't each one of them need a particular surrounding for their living?

Pupils : Yes.

Tutor : Such a natural surrounding in which each animal lives is known as habitat. For example monkey lives on trees, lion in the den, snake in burrows, etc. Can you find out other examples?

(Pupils give certain examples).

Tutor : What is habitat?

Pupils : Natural surrounding in which a living thing lives.

Tutor : How many habitats will be there in an ecosystem?

Pupils : So many.

Tutor : Tell the different habitats in the ecosystems, pond, field, sea, etc.

(One by one each pupil gives the habitat in each ecosystem. Tutor encourages as well as corrects mistakes).

Tutor : You have studied the relation between living and non living things in an ecosystem. Now, look at the chart, and tell me what is the relation between living things?

(Tutor shows them a chart containing the picture of different living things. After some time of discussion, the pupils find out that a food relation exists between the living things).

Tutor : Okay. That means one living thing preys on another living thing.

Pupils : Yes.

Tutor : If so, can you show me the living thing which becomes the prey and that which is the predator?

(Each pupil finds out each food relation).

Tutor : Okay. Can you find out a food relation from the first living thing to the last one?

(Pupils discuss with each other. Asks doubts. Tutor clarifies them).

Pupils : Caterpillar feed on leaves. Caterpillar is eaten by hen. Hen is eaten by fox. Lion feeds on fox.

Tutor : What will happen when lion dies?

Pupils : Body will decay and decompose to soil

Tutor : Who helps in the decomposition of body?

Pupils : Bacteria.

Tutor : Very good. Have you learned about bacteria? What is their function?

Pupils : Feed on decayed matter and degrade them and bring back them to nature.

Tutor : Look at the food relation you have framed. One organism eat other and is eaten by another organism. Each living thing come one after another as in chain. So we can call such relations as 'food chain'. Can you describe food chain?

(Pupils explain food chain. Tutor corrects them).

Tutor : Food chain is written in a particular way. Draw an arrow from the first member to the next. Then from that member to the third. Likewise continue till the last member.

(Tutor show the pupils how to write a food chain. Pupils try writing, tutor gives necessary advices).

Tutor : Now try to write down maximum number of food chains by looking at the chart.

(Pupils engage in discussion. Asks doubts to each other and solves them).

Tutor : (After some time) Have you finished writing?

Pupils : Yes

(Tutor checks whether the food chains they have written is correct)

Tutor : Now each one read out what they have written.

(Pupils one by one read out each food chain).

- Tutor : Now check the food chain you have framed. From whom does all start?
- Pupils : From plants.
- Tutor : You know why?
- Pupils : In nature, only plants have the ability to prepare food.
- Tutor : Yes. In nature green plants only have the ability to prepare food with the help of photosynthesis. So green plants are called 'producers'. What does they produce?
- Pupils : Food.
- Tutor : Where does this food goes to?
- Pupils : To the animals eating plants.
- Tutor : Where does it go from those animals?
- Pupils : To the next animal.
- Tutor : If so, let us see what will happen to the ecosystem in the absence of green plants.

(Tutor and pupils discuss about the aftereffects of the absence of green plants. At the end the tutor makes the pupils understand that the absence of green plants affects each component of the ecosystem and it will lead to the destruction of the ecosystem).

- Tutor : Have you understood the importance of plants? So we should not destroy these valuable plants and should take interest to plant more trees.

(Tutor makes them understand the need for planting more trees. Pupils listen with interest).

PHASE III - CONCLUDING PHASE

- Tutor : Did you understand what was taught today?
- Pupils : (With enthusiasm) Yes.
- Tutor : Then I will ask some questions.

(Tutor asks questions from the starting of the lesson. All pupils give answers. Tutor repeats and rephrases the answers).

- Tutor : Now write down some questions. You should answer them by next class.

(Tutor gives questions).

- Tutor : Today's portion is over. Thank you.
- Pupils : Thank you.

(Teacher calls back the five groups).

Teacher : Did you all understand what was taught today?

Pupils : Yes.

Teacher : Did you like this method?

Pupils : Yes

Teacher : So we will adopt this method in the next biology classes also.
Thank you.

Pupils : (Happily) Thank you teacher.

(Teacher leaves the classroom)

Appendix III A

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION LESSON FORMAT FOR EXISTING METHOD OF TEACHING

Dr. P.K. Sudheesh Kumar

Reshma. P.T

അദ്ധ്യാപികയുടെ പേര് :	രേഷ്മ. പി.ടി.
ക്ലാസ്സ് :	8
വിഷയം :	ജീവശാസ്ത്രം
പാഠം :	ജീവലോകത്തെ പരസ്പരാശ്രയത്വം
പാഠ്യഭാഗം :	ആവാസവ്യവസ്ഥയിലെ ആഹാരബന്ധങ്ങൾ
സമയം :	45 മിനുട്ട്

Curricular Objectives

1. പ്രകൃതിയിലെ വിവിധ ആവാസങ്ങളെയും ആവാസവ്യവസ്ഥയേയും മനസ്സിലാക്കുന്നു.
2. ആവാസവ്യവസ്ഥയിലെ വിവിധ ജീവീയ-അജീവീയ ഘടകങ്ങളെയും അവ തമ്മിലുള്ള ബന്ധങ്ങളെയും കുറിച്ച് കൂടുതൽ വിവരങ്ങൾ കണ്ടെത്തുന്നു.
3. ആഹാരശൃംഖലയെക്കുറിച്ചുള്ള അറിവ് നേടുന്നു.
4. പ്രകൃതിയിലെ ഏക ഉൽപാദകർ സസ്യങ്ങളാണെന്ന് മനസ്സിലാക്കുന്നു.

Learning Materials/Aids

1. പ്രകൃതിയിലെ വിവിധ ജീവീയ ഘടകങ്ങളെയും അജീവീയഘടകങ്ങളെയും കാണിയ്ക്കുന്ന ഒരു ചിത്രം.
2. വിവിധ ജീവികളുടെ ചിത്രങ്ങളടങ്ങിയ ചാർട്ട്.
3. ആറു വ്യത്യസ്ത ആഹാരശൃംഖലകൾ ഉണ്ടാക്കാൻ ആവശ്യമായ ജീവികളുടെ ചിത്രങ്ങൾ.
4. Flannel board.

Curricular Statements	Behavioural Specifications	Activities	Evaluation
<p>പ്രകൃതിയിൽ ജീവീയ-അജീവീയ ഘടകങ്ങൾ ഉണ്ട്. ഇവ പരസ്പരം ബന്ധപ്പെട്ടിരിക്കുന്നു. ഇത്തരമൊരു വ്യവസ്ഥ-ആവാസവ്യവസ്ഥ. ജീവിയുടെ പ്രകൃത്യായുള്ള ചുറ്റുപാട് ആവാസം. ഒരു ആവാസവ്യവസ്ഥയിൽത്തന്നെ നിരവധി ആവാസങ്ങൾ. ഉദാഹരണങ്ങൾ</p> <p>അജീവീയ ഘടകങ്ങൾ ജീവീയ ഘടകങ്ങൾക്ക് വിവിധ തരത്തിൽ പ്രയോജനപ്പെടുന്നു.</p> <p>പ്രകൃതിയിൽ ജീവനുള്ള ഘടകങ്ങൾ തമ്മിൽ ആഹാരബന്ധത്തിൽ ഏർപ്പെട്ടിരിക്കുന്നു.</p> <p>ആവാസവ്യവസ്ഥയിൽ ഒരു ജീവി മറ്റൊരു ജീവിയെ തിന്നുകയും മറ്റൊന്നിനാൽ തിന്നപ്പെടുകയും ചെയ്യുന്നു.- ആഹാര-ശൃംഖല-നിർവ്വചനം.</p>	<p>Observing Classifying Inferring Identifying</p> <p>Formulating hypotheses Interpreting Inferring Reporting Identifying variables</p> <p>Observing Interpreting Making operational definitions</p>	<p>ക്ലാസ്സിലെ എല്ലാ കുട്ടികളെയും ടീച്ചർ ആറു ഗ്രൂപ്പായി തിരിക്കുന്നു. ഓരോ ഗ്രൂപ്പിനും ഓരോ പേരുകൾ നൽകുന്നു.</p> <p>പ്രകൃതിയിലെ വിവിധ ജീവീയ-അജീവീയ ഘടകങ്ങളെ കാണിയ്ക്കുന്ന ചിത്രം ടീച്ചർ ക്ലാസ്സിൽ നിരീക്ഷിപ്പിക്കുന്നു.</p> <p>ഓരോ ജീവിയുടേയും ചുറ്റുപാടിനെക്കുറിച്ച് ആരായുന്നു. ആവാസം എന്ന് നൽകുന്നു.</p> <p>ജീവീയ-അജീവീയ ഘടകങ്ങളെ തിരിച്ചറിയാൻ ആവശ്യപ്പെടുന്നു.</p> <p>അവ തമ്മിലുള്ള ബന്ധം ആരായുന്നു.</p> <p>ആവാസവ്യവസ്ഥയെക്കുറിച്ച് പറയുന്നു.</p> <p>ഓരോ ഗ്രൂപ്പിനും രണ്ടു ചോദ്യങ്ങളടങ്ങിയ പേപ്പർ സ്ലിപ്പുകൾ നൽകുന്നു, പത്തു മിനിറ്റിനുള്ളിൽ ഉത്തരം കണ്ടെത്താൻ ആവശ്യപ്പെടുന്നു.</p> <p>1) പ്രകൃതിയിൽ, അജീവീയ ഘടകങ്ങൾ ജീവീയ ഘടകങ്ങൾക്ക് എങ്ങിനെയാണെല്ലാം പ്രയോജനപ്പെടുന്നു?</p> <p>2) ജീവീയ ഘടകങ്ങൾ പരസ്പരം ഏതെങ്കിലും തരത്തിൽ ബന്ധപ്പെട്ടിട്ടുണ്ടോ? ഏതു തരത്തിൽ.</p> <p>ഓരോ ഗ്രൂപ്പിനും വ്യത്യസ്തമായ ആഹാരശൃംഖലകൾ ഉണ്ടാക്കാൻ ആവശ്യമായ ജീവികളുടെ ചിത്രങ്ങൾ നൽകുന്നു, അവ തമ്മിലുള്ള ആഹാരബന്ധം കണ്ടെത്താൻ ആവശ്യപ്പെടുന്നു.</p>	<p>വിവിധ ആവാസവ്യവസ്ഥകൾക്ക് ഉദാഹരണങ്ങൾ നൽകുക.</p> <p>ഒരു ആവാസവ്യവസ്ഥയിൽ എത്ര ആവാസങ്ങളുണ്ടാവും? ഇതിനു കാരണമെന്ത്?</p> <p>ജീവീയ ഘടകമോ അജീവീയ ഘടകമോ. ഇതിലേതാണ് ആവാസവ്യവസ്ഥയിൽ കൂടുതൽ പ്രാധാന്യം അർഹിക്കുന്നത്? അജീവീയ ഘടകങ്ങളുടെ അഭാവം ആവാസവ്യവസ്ഥയെ എങ്ങിനെയാണെല്ലാം ബാധിക്കും?</p> <p>ആഹാരശൃംഖല എന്നാൽ എന്ത്? ഒരു ആവാസവ്യവസ്ഥയിൽ എത്ര ആഹാരശൃംഖലകളുണ്ടാവും?</p>

<p>ഒരു ആവാസവ്യവസ്ഥയിൽ നിരവധി ആഹാരശൃംഖലകളുണ്ട്.</p> <p>എല്ലാ ആഹാരശൃംഖലകളും ആരംഭിക്കുന്നത് ഹരിതസസ്യങ്ങളിൽ നിന്നുമാണ്. പ്രകൃതിയിലെ ഏക ഉൽപാദകർ-ഹരിതസസ്യങ്ങൾ.</p> <p>ഹരിതസസ്യങ്ങളുടെ അഭാവം ആവാസവ്യവസ്ഥയെ ഇല്ലാതാക്കും.</p>	<p>definitions Predicting</p> <p>Observing Classifying</p> <p>Infering Formulating hypotheses Predicting</p>	<p>ആഹാരശൃംഖല എന്താണെന്ന് പറയുന്നു. നിർവ്വചിക്കാൻ ആവശ്യപ്പെടുന്നു.</p> <p>ടീച്ചർ ആഹാരശൃംഖല എഴുതുന്ന മാതൃക കാണിക്കുന്നു.</p> <p>ഓരോ ഗ്രൂപ്പും കണ്ടെത്തിയ ആഹാരശൃംഖലകൾ ആ മാതൃകയിൽ എഴുതാൻ ആവശ്യപ്പെടുന്നു.</p> <p>വിവിധ ജീവികളുടെ ചിത്രങ്ങളടങ്ങിയ ചാർട്ട് നിരീക്ഷിച്ച് പരമാവധി ആഹാരശൃംഖലകൾ കണ്ടെത്തി എഴുതാൻ പറയുന്നു.</p> <p>എഴുതിയ ആഹാരശൃംഖലകൾ പരിശോധിച്ച്, അതെല്ലാം ആരംഭിക്കുന്നത് ആരിൽ നിന്നുമാണെന്നും, അതെന്തുകൊണ്ടാണെന്നും കണ്ടെത്താൻ ആവശ്യപ്പെടുന്നു.</p>	<p>ഒരു ജീവി ഒന്നിലേറെ ആഹാരശൃംഖലകളിൽ ഉൾപ്പെട്ടിരിക്കുന്നു. അതെന്തുകൊണ്ട്?</p> <p>ഹരിതസസ്യങ്ങളുടെ അഭാവം ആവാസവ്യവസ്ഥയെ എത്രത്തോളം തരത്തിൽ ബാധിക്കും?</p>
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Follow-up Activities

1. പഠിച്ച കാര്യങ്ങൾ ശാസ്ത്രപുസ്തകത്തിൽ കുറിച്ചുവെയ്ക്കുക.
2. ഒരു ആഹാരശൃംഖലയുടെ ചിത്രം ചാർട്ട് പേപ്പറിൽ വരയ്ക്കുക.
3. നിങ്ങളുടെ സ്കൂൾ വളപ്പിലും, വീട്ടു വളപ്പിലും ചെടികളും മരങ്ങളും വെച്ചുപിടിപ്പിക്കുക.
4. ആവാസവ്യവസ്ഥ, വനനശീകരണം എന്നിവയെക്കുറിച്ച് ലഘു കുറിപ്പുകൾ എഴുതുക.

Appendix III B

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

LESSON FORMAT FOR EXISTING METHOD OF TEACHING

Dr. P.K. Sudheesh Kumar

Reshma. P.T

Teacher's name : Reshma P.T
Class : 8
Subject : Biology
Unit : Interdependence in the living world
Lesson : Food relationship in the ecosystem
Time : 45 minutes.

Curricular Objectives

1. Understand the different habitats and ecosystem in nature
2. Collects more details about different living and non-living things in ecosystem and their relation
3. Gain knowledge about food chain
4. Understands that plants are the only producers in nature.

Learning Materials/Aids

1. A picture showing different living and non living things of nature
2. A chart containing picture of different living things
3. Picture of different animals and plants for preparing six different food chains
4. Flannel board

Curricular Statements	Behavioural Specifications	Activities	Evaluation
<p>There are living and non-living things in nature. They are inter related. Such a system ecosystem. The natural surrounding of an organism - habitat. There are so many habitats in an ecosystem. Examples</p>	<p>Observing Classifying Inferring Identifying</p>	<p>Teacher divides the whole class into six group, and name each group</p> <p>Teacher show a picture in the class containing different living and non-living things in nature. Ask them about the living surrounding of each organism. Present the concept of habitat. Ask them to identify living and non living things. Ask about the relation between them. Present the concept of ecosystem.</p>	<p>Give examples for different ecosystems How many habitats will be there in an ecosystem? Why?</p>
<p>Non living things are useful to living things in many ways. Living things are involved in food relationship</p>	<p>Formulating hypotheses Interpreting Inferring Reporting Identifying variables</p>	<p>Give a paper slip containing two questions to each group . Ask them to find answer within 10 minutes</p> <ol style="list-style-type: none"> 1. How are non living things useful to living things. 2. Are living things related with each other in any way? 	<p>Living thing or non living thing. Which is more important in an ecosystem? How will the absence of non living things affect ecosystem?</p>
<p>In an ecosystem one organism eat other and is eaten by another organism.</p>	<p>Observing Interpreting Making operational definitions</p>	<p>Give the picture of different living things to each group to construct different food chains. Ask to find</p>	<p>What is food chain? How many food chains will be present in an ecosystem?</p>

<p>Food chain – definition</p>	<p>Predicting</p>	<p>out the food relation between them. Describes food chain. Ask pupils to define it. Shows them the way of writing a food chain. Asks them to write the food chains they have framed in the same manner</p>	
<p>There are many food chains in one ecosystem</p>	<p>Observing Classifying</p>	<p>Show, them the chart containing pictures of different organisms, and ask them to write maximum food chains.</p>	<p>Why an organism is involved in more than one food chain?</p>
<p>All food chains start with green plants. Green plants are the only producers of nature . Absence of green plants will destroy the ecosystem.</p>	<p>Inferring Formulating hypotheses Predicting</p>	<p>Ask pupils to check the food chains they have framed and to find from whom does all food chains start and why.</p>	<p>In what all way does the absence of green plants affects ecosystem?</p>

Follow up Activities.

1. Note down the points studied, in a science book.
2. Draw the diagram of a food chain in a chart paper.
3. Plant trees in your school and house premises.
4. Write short notes on ecosystem and deforestation.

Appendix IV A

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

ACHIEVEMENT TEST IN BIOLOGY (FINAL)

Dr. P.K. Sudheesh Kumar

Reshma. P.T.

നിർദ്ദേശങ്ങൾ:

1. ഇത് ഒരു ബയോളജി ടെസ്റ്റാണ്. ഉത്തരങ്ങൾ അടയാളപ്പെടുത്തുന്നതിന് വേറെ കടലാസ് തന്നിട്ടുണ്ട്. ചോദ്യക്കടലാസിൽ ഒന്നും എഴുതുകയോ വരയ്ക്കുകയോ ചെയ്യരുത്.
2. എല്ലാ ചോദ്യങ്ങൾക്കും A, B, C, D എന്നിങ്ങനെ നാല് ഉത്തരങ്ങൾ വീതം കൊടുത്തിരിക്കുന്നു. അവയിൽ ഒന്നുമാത്രമാണ് ശരി/ ഏറ്റവും അനുയോജ്യമായ ഉത്തരം. ഉത്തരക്കടലാസിൽ ഓരോ ചോദ്യ നമ്പറിനുമെതിരെ നാലു കള്ളികൾ തന്നിരിക്കുന്നു. ഓരോ ചോദ്യത്തിനും ശരിയായ ഉത്തരം കണ്ടുപിടിച്ചതിനുശേഷം ഉത്തരക്കടലാസിൽ ചോദ്യ നമ്പറിനുനേരെ ശരിയുത്തരത്തെ കുറിക്കുന്ന അക്ഷരം എഴുതുക.
3. നിങ്ങൾ ആദ്യം എഴുതിയ അക്ഷരം തെറ്റിയെങ്കിൽ സ്ഥാനം മാറ്റുന്നതിനു മുൻപ് അതിനു ചുറ്റും ഒരു ചെറിയ സമചതുരം () വരച്ചതിനുശേഷം ശരിയായ സ്ഥാനത്ത് അക്ഷരം എഴുതുക.
4. എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം എഴുതാൻ ശ്രദ്ധിക്കുക.
5. പരിശോധകൻ 'start' എന്നു പറയുമ്പോൾ ഉത്തരം അടയാളപ്പെടുത്താൻ ആരംഭിക്കുക.

1. അതിഥിയായ ജീവി ആതിഥേയരായ ജീവികളിൽ നിന്നും ആഹാരം തേടുന്ന ബന്ധത്തെ എന്തു വിളിക്കുന്നു?

A. ഇരപിടിക്കൽ ബന്ധം

B. സഹോപകാരിത

C. പരാദ ജീവിതം

D. സഹഭോജിത ബന്ധം

2. ആഹാരശൃംഖലയുടെ പ്രധാനപ്പെട്ട സവിശേഷത എന്താണ്?

A. എല്ലാം ഹരിതസസ്യങ്ങളിൽ നിന്നുമാണ് ആരംഭിക്കുന്നത്

B. നിരവധി ജീവജാലങ്ങൾ അടങ്ങിയതാണ്

C. എല്ലാ ആഹാരശൃംഖലകളും പരസ്പരം ബന്ധപ്പെട്ടതാണ്

D. വിവിധ ട്രോഫിക് തലങ്ങൾ ഉൾപ്പെട്ടതാണ്

3. താഴെ കൊടുത്തവയിൽ ആവാസവ്യവസ്ഥയ്ക്ക് ഉദാഹരണം ഏത്?

A. വനം

B. മരത്തടി

C. ജലം

D. കുറ്റിച്ചെടി

4. ജീവമണ്ഡലത്തിന്റെ സന്തുലിതാവസ്ഥ തെറ്റാനുള്ള മുഖ്യ കാരണം ഏതാണ്?
 - A. സസ്യജാലങ്ങളുടെ നാശം
 - B. ശുദ്ധജലത്തിന്റെ ദൗർലഭ്യം
 - C. ജീവികളുടെ വംശനാശം
 - D. മനുഷ്യന്റെ വിവേകരഹിതമായ കൈകടത്തൽ

5. താഴെ തന്നിട്ടുള്ളവയിൽ ഏതാണ് ശരിയായ ക്രമം?
 - A. ഉൽപാദകർ, ദിതീയ ഉപഭോക്താക്കൾ, പ്രാഥമിക ഉപഭോക്താക്കൾ, വിഘാടകർ
 - B. പ്രാഥമിക ഉപഭോക്താക്കൾ, ഉൽപാദകർ, ദിതീയ ഉപഭോക്താക്കൾ, വിഘാടകർ
 - C. ഉൽപാദകർ, പ്രാഥമിക ഉപഭോക്താക്കൾ, ദിതീയ ഉപഭോക്താക്കൾ, വിഘാടകർ
 - D. പ്രാഥമിക ഉപഭോക്താക്കൾ, ദിതീയ ഉപഭോക്താക്കൾ, ഉൽപാദകർ, വിഘാടകർ

6. ജീവിവർഗ്ഗത്തിന്റെ അടിസ്ഥാന നിർമ്മാണ ഘടകമായ കോശത്തെ കണ്ടെത്തിയ ശാസ്ത്രജ്ഞൻ ആരാണ്?
 - A. റൂഡോൾഫ് വിർഷോ
 - B. റോബർട്ട് ഹുക്ക്
 - C. എം. ജെ. ഷ്ലീഡൻ
 - D. തിയോഡോർ ഷ്വാൻ

7. താഴെ കൊടുത്തവയിൽ ജീവദ്രവ്യം എന്നർത്ഥം വരുന്ന വാക്ക് ഏതാണ്?
 - A. ലൈസോസോം
 - B. സെൻട്രോസോം
 - C. ഫ്ളോയം
 - D. പ്രോട്ടോപ്ലാസം

8. കോശത്തെ കണ്ടെത്തിയത് ഏതു വർഷത്തിലാണ്?
 - A. 1565 - ൽ
 - B. 1655 - ൽ
 - C. 1665 - ൽ
 - D. 1555 - ൽ

9. താഴെ കൊടുത്തിട്ടുള്ളവയിൽ ബാഹ്യകോശ ജീവിക്ക് ഉദാഹരണം ഏതാണ്?
 - A. പാരമീസിയം
 - B. യൂഗ്ലീന
 - C. അമീബ
 - D. ഹൈഡ്ര

10. ഹരിതകണത്തിൽ എവിടെയാണ് ഹരിതകം കാണപ്പെടുന്നത്?
 - A. സ്ട്രോമയിൽ
 - B. ലാമല്ലെയിൽ
 - C. ഗ്രാനയിൽ
 - D. ഹരിതകണത്തിന്റെ ആന്തരഭാഗത്ത് ഒട്ടിപ്പിടിച്ച്

11. നെഫ്രീഡിയ ഏതു ജീവിയിലാണ് കാണുന്നത്?
 - A. ഹൈഡ്ര
 - B. പാറ്റ
 - C. അമീബ
 - D. മണ്ണിര

20. ശ്വസനത്തിലൂടെ കാർബൺ ഡൈ ഓക്സൈഡ് പുറത്തുവിട്ടിട്ടും അന്തരീക്ഷത്തിലെ കാർബൺ ഡൈ ഓക്സൈഡിന്റെ അളവ് ഉയരാത്തതെന്താണ്?

- A. കാർബൺ ഡൈ ഓക്സൈഡ് പ്രകാശസംശ്ലേഷണത്തിലൂടെ ധാന്യകമായി മാറുന്നു.
- B. കാർബൺ ഡൈ ഓക്സൈഡ് ചത്ത ജീവികളുടെ ശരീരത്തിൽ കൂടുങ്ങിക്കിടക്കുന്നു.
- C. കാർബൺ ഡൈ ഓക്സൈഡ് കാർബണേറ്റുകളായി മാറുന്നു.
- D. കാർബൺ ഡൈ ഓക്സൈഡ് ചിന്നിച്ചിതറിപ്പോവുന്നു.

21. കോശസിദ്ധാന്തം എന്താണ് സമർത്ഥിക്കുന്നത്?

- A. എല്ലാ കോശങ്ങൾക്കും മർമ്മം ഉണ്ട്
- B. ഊർജ്ജ ആവശ്യത്തിനായി കോശം ഉപയോഗിക്കുന്നത് എ.ടി.പി ആണ്.
- C. കോശം വിഭജനം നടത്തുന്നത് ഊനഭംഗത്തിലൂടെയാണ്
- D. ശരീരത്തിന്റെ അടിസ്ഥാന നിർമ്മാണ ഘടകങ്ങളാണ് കോശങ്ങൾ

22. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പിന്റെ കണ്ടുപിടുത്തം കോശത്തിന്റെ സൂക്ഷ്മഘടനയെക്കുറിച്ചുള്ള പഠനം എളുപ്പമാക്കി. എന്തുകൊണ്ട്?

- A. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പിലൂടെ ജീവനുള്ള കോശങ്ങളെ കാണാൻ കഴിയും
- B. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പ് കോശത്തിന്റെ പഠനത്തിനായി തയ്യാറാക്കപ്പെട്ടിട്ടുള്ളതാണ്.
- C. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പിലൂടെ ആറുലക്ഷം മടങ്ങ് വലിപ്പത്തിൽ വസ്തുക്കളെ കാണാൻ കഴിയും.
- D. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പിലൂടെ നോക്കിയാൽ പ്രതിബിംബം സ്ക്രീനിൽ ദർശിക്കാൻ കഴിയും.

23. കോശത്തെ ഒരു ഫാക്ടറിയുമായി ഉപമിച്ചാൽ ഫാക്ടറി നിയന്ത്രണകേന്ദ്രത്തിന്റെ ധർമ്മം വഹിക്കുന്നത് ഏത് കോശാംഗമായിരിക്കും?

- A. മൈറ്റോകോൺട്രിയ B. റൈബോസോം
- C. ഹരിത കണം D. മർമ്മം

24. ഒരു പയറുവിത്തിന്റെ മുള ഹരിതകം ഉൽപാദിപ്പിക്കാൻ തുടങ്ങി. ഇതു കാണിക്കുന്നത് ആ ഭാഗം താഴെ പറയുന്ന ഏതിനാൽ പ്രചോദിപ്പിക്കപ്പെട്ടു എന്നാണ്?

- A. പ്രകാശം B. ജലം
- C. ഓക്സിജൻ D. കാർബൺ ഡൈ ഓക്സൈഡ്

25. താഴെ കൊടുത്തിട്ടുള്ളവയിൽ ഏതാണ് ടിഷ്യൂതല ഘടനയിലുള്ള ജീവിക്ക് ഉദാഹരണം?

- A. യുഗ്മീന B. പാരാമീസിയം
- C. അമീബ D. ഹൈഡ്ര

26. ഒരു കോശത്തിന്റെയും, ജീവിയുടെയും, സമൂഹത്തിന്റെയും വളർച്ചയിൽ പൊതുവായിട്ടുള്ളത് എന്താണ്?
- A. അവയുടെ വളർച്ച പരിസ്ഥിതിയുടെ സ്വാധീനത്തിലാണ്.
 - B. അവയുടെ വളർച്ചയ്ക്ക് ഊർജ്ജം ആവശ്യമാണ്.
 - C. അവയുടെ വളർച്ചയിൽ രാസപ്രവർത്തനങ്ങൾ ഉൾപ്പെട്ടിട്ടുണ്ട്.
 - D. മേൽ പറഞ്ഞ മൂന്ന് ഉത്തരങ്ങളും.
27. 19-ാം നൂറ്റാണ്ട് കോശശാസ്ത്രത്തിലെ സുപ്രധാന കാലഘട്ടമായാണ് കണക്കാക്കപ്പെടുന്നത്. എന്തുകൊണ്ട്?
- A. കോശം കണ്ടെത്തിയത് ഈ വർഷങ്ങളിലാണ്
 - B. കോശത്തെ സംബന്ധിക്കുന്ന അനേകം കണ്ടുപിടുത്തങ്ങൾ ഈ വർഷങ്ങളിലാണ് ഉണ്ടായിട്ടുള്ളത്
 - C. കോശത്തെക്കുറിച്ച് പഠിച്ച ശാസ്ത്രജ്ഞന്മാരിൽ ഏറിയ പങ്കും ജനിച്ചത് ഈ വർഷങ്ങളിലാണ്.
 - D. കോശത്തെ കണ്ടെത്താൻ സഹായിച്ച സാങ്കേതിക ഉപകരണങ്ങൾ നിർമ്മിക്കപ്പെട്ടത് ഈ വർഷങ്ങളിലാണ്.
28. ശ്വേതരക്താണുക്കളിൽ കൂടുതലായി കാണപ്പെടുന്ന കോശാംഗം ലൈസോസോമുകളാണ്. ഇതിൽ നിന്നും ശ്വേത രക്താണുക്കളുടെ ധർമ്മത്തെക്കുറിച്ച് എന്തു മനസ്സിലാക്കാം?
- A. ആഹാരം വിവിധ ഭാഗങ്ങളിൽ എത്തിക്കുന്നു.
 - B. ഉദ്ദീപനങ്ങൾ സ്വീകരിക്കുകയും കൈമാറുകയും ചെയ്യുന്നു.
 - C. രോഗാണുക്കളിൽ നിന്ന് ശരീരത്തെ സംരക്ഷിക്കുന്നു
 - D. ഊർജ്ജം ഉൽപാദിപ്പിക്കുന്നു.
29. മൈറ്റോകോൺട്രിയ പേശീകലകളിലാണ് ഏറ്റവും കൂടുതലായി അടങ്ങിയിട്ടുള്ളത്. ഇതിനു കാരണമെന്താണ്?
- A. പേശീകലകൾ മറ്റു കലകളെ അപേക്ഷിച്ച് വലുതാണ്.
 - B. പേശീചലനങ്ങൾക്കാണ് ഏറ്റവും കൂടുതൽ ഊർജ്ജം ആവശ്യമുള്ളത്.
 - C. അനൈശ്ചരിക പേശികളുടെ ചലനത്തെ നിയന്ത്രിക്കുന്നത് മൈറ്റോകോൺ-ട്രിയാണ്.
 - D. മറ്റു കലകളുടെ പ്രവർത്തനത്തിന് ഊർജ്ജം ആവശ്യമില്ല.
30. തണുപ്പുകാലത്ത് ഒരാളുടെ ശരീരത്തിൽനിന്നും പോവുന്ന മുത്രത്തിന്റെ അളവ് കൂടും. എന്തുകൊണ്ട്?
- A. കൂടുതൽ മാലിന്യങ്ങൾ ശരീരത്തിൽ അടിയുന്നതുകൊണ്ട്
 - B. കൂടുതൽ വെള്ളം കുടിക്കുന്നതുകൊണ്ട്
 - C. വിയർപ്പിന്റെ അളവ് കുറയുന്നതുകൊണ്ട്
 - D. കൂടുതൽ ക്ഷീണിക്കുന്നതുകൊണ്ട്
31. താഴെ പറയുന്നതിൽ ഏതു ഘടകമാണ് ഗ്ലോമുലാർ ഫിൽട്രേറ്റിൽ നിന്നും പുനരാഗിരണം ചെയ്യപ്പെടാൻ സാധ്യത കുറവുള്ളത്?
- A. അമിനോ ആസിഡ്
 - B. യൂറിക് ആസിഡ്
 - C. സോഡിയം
 - D. ഗ്ലൂക്കോസ്

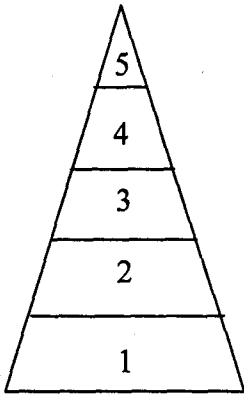
32. ഒരു പ്രദേശത്തെ കാലാവസ്ഥയെ നിയന്ത്രിക്കുന്നതിൽ സസ്യജാലങ്ങൾക്ക് മുഖ്യ പങ്കുണ്ട് എന്നതിനർത്ഥം എന്താണ്?

- A. അതതു പ്രദേശത്തെ കാലാവസ്ഥയെ നിയന്ത്രിക്കുന്നത് സസ്യജാലങ്ങൾ മാത്രമാണ്.
- B. കാലാവസ്ഥാ മാറ്റങ്ങൾ ഇല്ലാതാക്കാൻ കൂടുതൽ സസ്യങ്ങൾ വെച്ചുപിടിപ്പിക്കണം.
- C. ഓരോ കാലാവസ്ഥയിലും അതതു കാലാവസ്ഥയ്ക്കിണങ്ങിയ സസ്യങ്ങളെ വളർത്തണം
- D. ഒരു പ്രദേശത്തെ കാലാവസ്ഥ പ്രധാനമായും അവിടുത്തെ സസ്യജാലങ്ങളുടെ അളവിനെ ആശ്രയിച്ചിരിക്കുന്നു.

33. കഠിനമായ ശാരീരികാധാനത്തിൽ ഏർപ്പെട്ടിരിക്കുന്ന വ്യക്തി കൂടുതൽ വിയർക്കുന്നതെന്തുകൊണ്ട്?

- A. കൂടുതൽ ക്ഷീണിക്കുന്നതുകൊണ്ട്.
- B. മാലിന്യങ്ങൾ കൂടുതലായി ശരീരത്തിൽ അടിയുന്നതുകൊണ്ട്.
- C. ത്വക്കിനുതാഴെ രക്തസഞ്ചാരം കൂടുന്നതുകൊണ്ട്.
- D. കൂടുതൽ വെള്ളം കുടിക്കുന്നതുകൊണ്ട്.

34. സന്തുലിതാവസ്ഥയിൽ നിലനിൽക്കുന്ന ഒരു ആവാസവ്യവസ്ഥയിൽ പുല്ലു, പ്രാഥമിക ഉപഭോക്താവ്, ദ്വിതീയ ഉപഭോക്താവ്, തൃതീയ ഉപഭോക്താവ്, വിഘടകർ എന്നിങ്ങനെ അഞ്ചു ഘടകങ്ങളുണ്ട്. ഈ അഞ്ചു ഘടകങ്ങളേയും അവയുടെ ആഹാരബന്ധത്തിന്റെ അടിസ്ഥാനത്തിൽ താഴെ കാണുന്ന രീതിയിൽ ചിത്രീകരിക്കാം.



മാംസഭുക്കുകളുടെ അഭാവം മൂലം സസ്യഭുക്കുകൾ പെറ്റുപെരുകിയാൽ ഏത് ട്രോഫിക് തലത്തെയാവും അത് ദോഷകരമായി ബാധിക്കുക?

- A. 4
- B. 3
- C. 2
- D. 1

35. $A \rightarrow B \leftrightarrow C$

A, B, C എന്നിവ മൂന്ന് ജീവികളും അവ തമ്മിലുള്ള ആഹാരബന്ധവും ആണ് സൂചിപ്പിക്കുന്നതെങ്കിൽ, താഴെ കൊടിത്തിട്ടുള്ളവയിൽ ശരിയായ ഉത്തരം ഏതാണ്?

- A. A യും C യും തമ്മിൽ ഇരപിടിക്കൽ ബന്ധമാണുള്ളത്.
- B. A യും B യും തമ്മിൽ സഹോപകാരിത ബന്ധം നിലനിൽക്കുന്നു.

- C. B യും C യും തമ്മിൽ സഹോപകാരിത ബന്ധം നിലനിൽക്കുന്നു.
 D. B യും C യും തമ്മിൽ ഇരപിടിക്കൽ ബന്ധമാണുള്ളത്.
36. ഒരു പച്ചക്കറിത്തോട്ടത്തിൽ സൂര്യപ്രകാശത്തിന്റെ നേരിട്ടുള്ള പ്രചോദനത്താൽ സംഭവിക്കാത്തത് ഏതു പ്രവർത്തിയാണ്.
- A. വിത്തുമുളയ്ക്കുന്നത്
 B. പുഷ്പിക്കൽ
 C. സ്വേദനം
 D. മണ്ണ് ഫലപുഷ്ടമാക്കുന്നത്.

37. $I \rightarrow A \rightarrow II$

A സൂചിപ്പിക്കുന്നത് ജലവും (H_2O) കാർബൺ ഡൈ ഓക്സൈഡും (CO_2) ആണെങ്കിൽ, താഴെ കൊടുത്തവയിൽ ഏതാണ് ശരിയുത്തരം?

- A. I പ്രകാശസംശ്ലേഷണവും, II ശ്വസനവും
 B. I പ്രകാശസംശ്ലേഷണവും, II വിഘടനവും
 C. I ശ്വസനവും, II പ്രകാശസംശ്ലേഷണവും,
 D. I വിഘടനവും II ശ്വസനവും
38. ഗോൾഗി വസ്തുക്കളുടെ ധർമ്മം സ്രവങ്ങൾ ഉൽപാദിപ്പിക്കലാണെങ്കിൽ, അവ ഏറ്റവും കൂടുതലായി കാണപ്പെടുന്നത് ഏതിലായിരിക്കും?

- A. പേശീ കോശങ്ങൾ B. അസ്ഥി കോശങ്ങൾ
 C. ഗ്രന്ഥീ കോശങ്ങൾ D. രക്ത കോശങ്ങൾ

39. വലതുകയ്യിൽ ആറുവിരലുകൾ ഉള്ള ഒരു പുരുഷനും സാധാരണ അവസ്ഥയിലുള്ള ഒരു സ്ത്രീക്കും പിറന്ന കുഞ്ഞിന് രണ്ടു കൈകളിലും ആറുവിരലുകൾ വീതം ഉള്ളതായി കണ്ടു. മാതാപിതാക്കളുടെ ശരീരത്തിലെ ഏതു കോശഘടകമാണ് ഇതിന് കാരണമായത്?

- A. ആർ. എൻ. എ B. ഡി. എൻ. എ
 C. റൈബോസോം D. ജൈവകണങ്ങൾ

40. പൂർണ്ണ ആരോഗ്യവാനായ ഒരു വ്യക്തി ആഴ്ചയിൽ ഓരോ ദിവസവും വിസർജ്ജിച്ച മൂത്രത്തിന്റെ അളവ് പട്ടികയിൽ നൽകിയിരിക്കുന്നു. അയാൾ എല്ലാ ദിവസവും കുടിച്ച വെള്ളത്തിന്റെ അളവ് തുല്യമായിരുന്നു.

ദിവസം	മൂത്രത്തിന്റെ അളവ് (CC യിൽ)
ഞായർ	1520
തിങ്കൾ	1540
ചൊവ്വ	1470
ബുധൻ	1510
വ്യാഴം	1240
വെള്ളി	1450
ശനി	1770

അന്തരീക്ഷത്തിലെ താപനില ഏറ്റവും കുറഞ്ഞ ദിവസം ഏതായിരുന്നു?

- A. ശനി
- B. ഞായർ
- C. തിങ്കൾ
- D. ചൊവ്വ

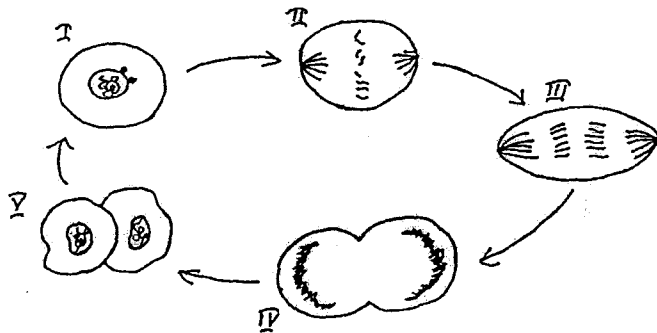
41. ഒരു ചീങ്കണ്ണി ആട്ടിൻകുട്ടിയെ ഭക്ഷിക്കുന്നു. അതു കഴിഞ്ഞ ഉടനെ പ്ലോവർ പക്ഷി ചീങ്കണ്ണിയുടെ വായ്ക്കുള്ളിൽ കടന്ന് ആഹാരശകലങ്ങൾ കൊത്തിത്തിന്നുന്നു. ആഹാരശൃംഖലയുടെ അടിസ്ഥാനത്തിൽ വിലയിരുത്തുകയാണെങ്കിൽ പ്ലോവർ പക്ഷിയുടെ സ്ഥാനം താഴെ പറഞ്ഞവയിൽ ഏതാണ്?

- A. ഉൽപാദകർ
- B. പ്രാഥമിക ഉപഭോക്താവ്
- C. ദ്വിതീയ ഉപഭോക്താവ്
- D. തൃതീയ ഉപഭോക്താവ്

42. ഹിമാലയൻ നിരകളിൽ കാണുന്ന എട്ടുകാലികളാണ് ഭൂമിയിലെ ഏറ്റവും ഉയരം കൂടിയ പ്രദേശത്തു ജീവിക്കുന്ന ജീവികൾ. അവ മാംസഭുക്കുകളാണ്. അങ്ങനെയെങ്കിൽ അവർ ഭക്ഷണം സമ്പാദിക്കുന്നത് ഏതു രീതിയിലാവും ?

- A. ദിവസേന ഭക്ഷണത്തിനായി താഴ്വരകളിലേക്കിറങ്ങി വരും
- B. കാറ്റിന്റെ ഗതിയിൽ മലമുകളിലേക്ക് പറന്നെത്തുന്ന പ്രാണികളെ ഭക്ഷണമാക്കും
- C. പരസ്പരം ഭക്ഷണമാക്കും
- D. അവർ സസ്യഭുക്കുകളായിത്തീരും

43. ചിത്രത്തിലെ കോശവിഭജനം ഒരു സസ്യകോശത്തെയോണോ ജന്തുക്കോശത്തെയോണോ പ്രതിനിധീകരിക്കുന്നത്?

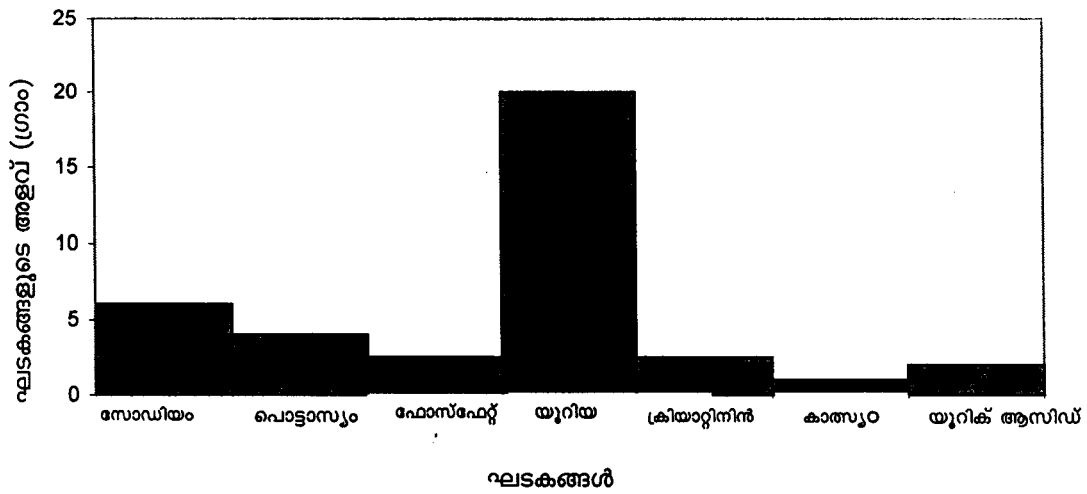


- A. ജന്തുക്കോശം. കീലങ്ങളും ന്യൂക്ലിയോലസും അടങ്ങിയിട്ടുണ്ട്.
- B. ജന്തുക്കോശം. സെൻട്രിയോളുകൾ കാണിച്ചിട്ടുണ്ട്. കൂടാതെ കോശം ഇടുങ്ങിക്കഴിയുന്നു.
- C. സസ്യകോശം. സെൻട്രിയോളുകളും കോശഭിത്തിയും കാണിച്ചിരിക്കുന്നു.
- D. സസ്യകോശം. കീലതന്തുക്കളും മർമ്മകവും കാണിച്ചിരിക്കുന്നു.

44. ചില വൈറസുകളിൽ ആർ.എൻ.എ. ഉണ്ട് പക്ഷെ ഡി.എൻ. എ ഇല്ല. ഇതെന്താണ് സൂചിപ്പിക്കുന്നത്?

- A. ഈ വൈറസുകൾക്ക് വിഭജിക്കാൻ സാധിക്കയില്ല.
- B. ഇവയിൽ പാരമ്പര്യസ്വഭാവ വാഹകരായി ആർ. എൻ. എ വർത്തിക്കുന്നു.
- C. അവയ്ക്ക് മാംസ്യങ്ങൾ നിർമ്മിക്കാനാവും പക്ഷെ ന്യൂക്ലിക് ആസിഡുകൾ നിർമ്മിക്കാനാവില്ല.
- D. പ്രജനനത്തിനായി അവയുടെ ന്യൂക്ലിക് ആസിഡുകൾ ആതിഥേയരുടെ ഡി. എൽ. എ യുമായി ചേരണം.

45. ഒരു സസ്തനിയുടെ തൈമസ് ഗ്രന്ഥി രോഗപ്രതിരോധം വർദ്ധിപ്പിക്കുന്നതുമായി ബന്ധപ്പെട്ടിട്ടുണ്ടെന്ന് താഴെ പറയുന്നതിൽ ഏതാണ് സമർത്ഥിക്കുന്നത്?
- A. ഹൃദയത്തിന്റെ ഏറ്റവും അടുത്ത് സ്ഥിതി ചെയ്യുന്നു.
 - B. ശ്വേതരക്താണുക്കളുടെ എണ്ണത്തിലെ ആധിക്യം.
 - C. രോഗാണുക്കളുടെ കവാടമായ ശ്വസനിയുടെ അടുത്ത് സ്ഥിതി ചെയ്യുന്നു.
 - D. കൂടുതൽ രക്തക്കുഴലുകളുടെ സാന്നിദ്ധ്യം.
46. താഴെ കൊടുത്തിരിക്കുന്ന ഗ്രാഫിൽ ഒരു വ്യക്തിയുടെ മൂത്രത്തിന്റെ അളവും അതിലെ ഘടകങ്ങളും കാണിച്ചിരിക്കുന്നു.



മൂത്രത്തിന്റെ അളവിനെ ഗണ്യമായി സ്വാധീനിക്കുന്നത് ഏതു രാസഘടകമാണ്?

- A. യൂറിക് ആസിഡ്
 - B. യൂറിയ
 - C. സോഡിയം
 - D. പൊട്ടാസ്യം
47. ഒരു ജീവശാസ്ത്രജ്ഞൻ രാസപദാർത്ഥങ്ങളെ അവ ഒരു കോശത്തിന്റെ നിലനില്പിന് നൽകിയ സംഭാവനകളുടെ അടിസ്ഥാനത്തിൽ വർഗ്ഗീകരിക്കുന്നു. താഴെ കൊടുത്തവയിൽ ഏതിലാണ് ഫേനം ഏറ്റവും അനുയോജ്യമാവുക.
- A. സംരക്ഷണം
 - B. സംഭരണം
 - C. നിയന്ത്രണം
 - D. സംവഹനം
48. ഈ ഭൂമുഖത്തെ ജനജീവിതം ഇല്ലാതാക്കാൻ താഴെ പറഞ്ഞതിൽ ഏതു വ്യത്യാസമായിരിക്കും കൂടുതൽ കാരണമാവുന്നത്?
- A. ശരാശരി താപനിലയിൽ 10°C കുറവ് വരുന്നത്
 - B. സൂര്യന്റെ എല്ലാ വികിരണരശ്മികളേയും ഭൂമിയിലേക്ക് കടത്തിവിടുന്നത്.
 - C. ചന്ദ്രൻ അപ്രത്യക്ഷമാവുന്നത്.
 - D. ഭൂമിയുടെ ഭ്രമണപഥം വൃത്തത്തിലാവുന്നത്.

49. സന്തുലിതാവസ്ഥയിൽ നിലനിന്നിരുന്ന ഒരു കുളത്തിലെ കീടങ്ങളുടെ എണ്ണം ക്രമാതീതമായി പെരുകുന്നത് ശ്രദ്ധയിൽപ്പെട്ടു. താഴെ പറഞ്ഞവയിൽ ഏതായിരിക്കും അതിന് ഏറ്റവും അനുയോജ്യമായ കാരണം?
- A. സസ്യജാലങ്ങളുടെ ആധിക്യം
 - B. കീടങ്ങളുടെ വളർച്ചയെ പരിപോഷിപ്പിക്കുന്ന കാലാവസ്ഥ
 - C. തവളകളുടെ എണ്ണം കുറയുന്നത്.
 - D. കുളത്തിലെ മറ്റു ജീവിവർഗ്ഗത്തിന്റെ എണ്ണം പെരുകുന്നത്.
50. സസ്യങ്ങളിൽ വിസർജ്ജനത്തിന് പ്രത്യേക അവയവങ്ങൾ രൂപപ്പെട്ടിട്ടില്ല. താഴെ കൊടുത്തവയിൽ ഏതായിരിക്കും അതിന് ഏറ്റവും അനുയോജ്യമായ കാരണം?
- A. സസ്യങ്ങളിൽ ഉപാപചയം നടക്കാറില്ല.
 - B. സസ്യങ്ങളിൽ വിസർജ്ജ്യവസ്തുക്കൾ ഉണ്ടാവാറില്ല.
 - C. മണ്ണിൽ സ്ഥിതി ചെയ്യുന്നതിനാൽ മണ്ണിലൂടെയാണ് മാലിന്യങ്ങൾ പുറന്തള്ളുന്നത്.
 - D. ജീവൽപ്രവർത്തനങ്ങളുടെ നിരക്ക് കുറവായതിനാൽ മാലിന്യങ്ങളും കുറവാണ്.

Appendix IV B
UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

ACHIEVEMENT TEST IN BIOLOGY

RESPONSE SHEET
(FINAL)

വിദ്യാർത്ഥിയുടെ പേര് ക്ലാസ്സ്

സ്കൂൾ

ആൺകുട്ടി/പെൺകുട്ടി

ക്രമ നമ്പർ	A	B	C	D	ക്രമ നമ്പർ	A	B	C	D
1					26				
2					27				
3					28				
4					29				
5					30				
6					31				
7					32				
8					33				
9					34				
10					35				
11					36				
12					37				
13					38				
14					39				
15					40				
16					41				
17					42				
18					43				
19					44				
20					45				
21					46				
22					47				
23					48				
24					49				
25					50				

Appendix IV C

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

ACHIEVEMENT TEST IN BIOLOGY (FINAL)

Dr. P.K. Sudheesh Kumar

Reshma P.T.

Directions:

1. This is a Biology test. Separate sheet is given for marking answers. Do not write or draw anything in the question paper.
 2. For each question four alternatives (A, B, C, D) are given. Out of them only one is correct / most suitable answer. In the answer sheet, four squares are given against each question number. After selecting the correct answer, write the alphabet denoting the answer against the question number.
 3. If the alphabet you have written first is wrong, before changing it draw a small square (□) around it and then write the correct alphabet.
 4. You should attempt all questions.
 5. Start marking the answers only after the invigilator says 'Start'.
-

1. What is the relationship called in which an organism absorbs food from the host organism?
A. Predation
B. Mutualism
C. Parasitism
D. Commensalism
2. What is the main characteristic of food chain?
A. All food chains start with green plants.
B. Food chains include numerous living beings.
C. All food chains are interrelated.
D. Food chains include different trophic levels.
3. Which among the following is an example for ecosystem?
A. Forest
B. Tree trunk
C. Water
D. Shrub
4. What is the main reason for the imbalance of biosphere?
A. Destruction of plants
B. Scarcity of pure water

If herbivores increase in number due to the absence of carnivores, which trophic level will be affected?

- A. 4 B. 3 C. 2 D. 1

35. $A \rightarrow B \leftrightarrow C$

If A, B, and C are three organisms and the arrows denote the food relation between them, which among the following will be correct?

- A. Predation exists between A and C
 B. Mutualism exists between A and B
 C. Mutualism exists between B and C
 D. Predation exists between B and C

36. In a vegetable crop, which among the following is not directly influenced by sunlight?

- A. Germination of seed B. Flowering
 C. Transpiration D. Fertilization of soil

37. $I \rightarrow A \rightarrow II$

If A denotes water (H_2O) and carbondioxide (CO_2), which among the following is correct?

- A. I photosynthesis, II respiration
 B. I photosynthesis, II decomposition
 C. I respiration, II photosynthesis
 D. I decomposition, II respiration

38. If the function of golgi apparatus is producing secretions, where will be they mostly found?

- A. Muscle cells B. Bone cells
 C. Gland cells D. Blood cells

39. For a male, having six fingers in the right hand and a female who is normal, a baby was born with six fingers in both hands. Which cellular component of the parents caused this?

- A. RNA B. DNA
 C. Ribosome D. Plastids

40. The amount of urine excreted by a healthy man in a week is given in the table. The amount of water he had taken was same for all days.

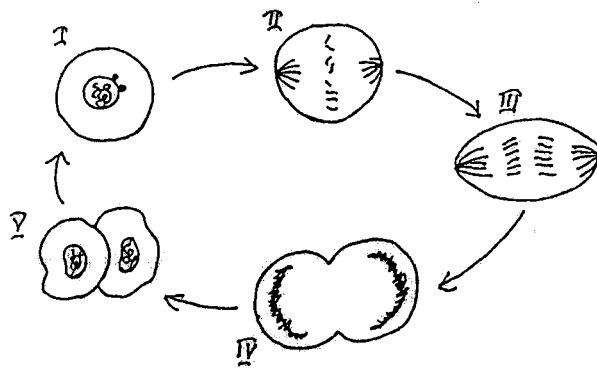
Day	Amount of urine (in cc)
Sunday	1520
Monday	1540
Tuesday	1470
Wednesday	1510

Thursday	1240
Friday	1450
Saturday	1770

Atmospheric temperature was least on which day?

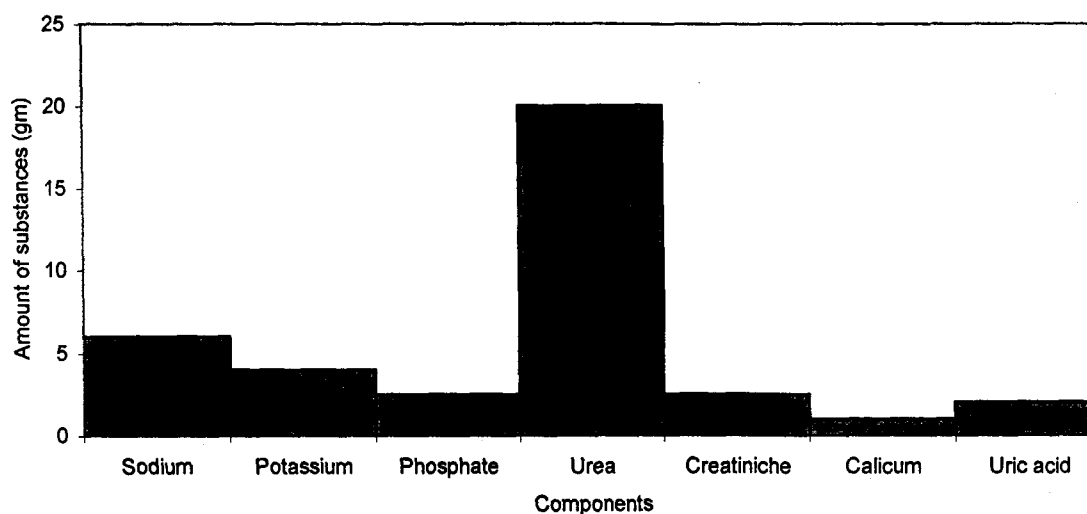
A. Saturday B. Sunday C. Monday D. Tuesday

41. A crocodile eats a lamb. Soon after that a plover bird enters the mouth of crocodile and picks up the food particles. On the basis of food chain, to which among the following does plover bird belongs go?
- A. Producer B. Primary consumer
C. Secondary consumer C. Tertiary consumer
42. The spiders living in the Himalayan territory are the organisms living on the most highest territory on the earth. They are carnivores. If so, how will they get food?
- A. Daily they come down to valleys for food.
B. They feed on the insects carried away with the wind to the territory.
C. They feed on each other.
D. They become herbivores.
43. The cell division in the diagram given below denotes plant cell or animal cell?



- A. Animal cell. Because spindles and nucleolus are seen.
B. Animal cell. Centrioles are seen and cytoplasm deepens from both sides.
C. Plant cell. Centriole and cell wall are seen.
D. Plant cell. Spindle fibres and nucleolus are seen.
44. Certain viruses have RNA but not DNA. What does this denotes?
- A. These virus cannot divide.
B. In them RNA acts as carriers of hereditary characteristics.
C. They can synthesise proteins but not nucleic acids.
D. For reproduction, their nucleic acids must join with the DNA of hosts.

45. Which among the following establishes that the thymus gland in a mammal is associated with increasing immunisation?
- It is very close to heart.
 - Large number of white blood corpuscles.
 - Placed near the bronchi, which is the entrance for all pathogens.
 - Presence of immense blood vessels.
46. In the graph shown below, the factors in urine of a person for one day and its measures are given.



Which factor greatly influence the quantity of urine?

- Uric acid
 - Urea
 - Sodium
 - Potassium
47. A biological scientist classifies chemical substances according to their contributions towards the existence of a cell.
- To which among the following does vacuole best suit?
- Protection
 - Storage
 - Control
 - Transport
48. Which difference among the following will be more reasonable for the extinction of life on earth?
- 10°C decrease in the average temperature.
 - All ultraviolet rays of sun entering the earth.
 - Disappearance of moon.
 - Change in the revolutionary path of earth to a circle.

49. The increase in the number of pests in a pond in equilibrium was noted. Which among these is the best reason for that?
- A. Abundance of plants.
 - B. Climate favourable to the growth of pest.
 - C. Decrease in the number of frogs.
 - D. Increase in the number of other living things in pond.
50. There are no specialised structure for excretion in plants. Which among these is the satisfactory explanation for that?
- A. In plants metabolic activities does not take place.
 - B. There are no waste materials in plants.
 - C. They excrete their waste materials through roots as they are fixed in soil.
 - D. Waste materials are minimum as life processes are also minimum.

Appendix IV D
UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

ACHIEVEMENT TEST IN BIOLOGY

RESPONSE SHEET
(FINAL)

Name of Pupil: Class:

School:

Boy/Girl:

No.	A	B	C	D	No.	A	B	C	D
1					26				
2					27				
3					28				
4					29				
5					30				
6					31				
7					32				
8					33				
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22					47				
23					48				
24					49				
25					50				

Appendix IV E

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

ACHIEVEMENT TEST IN BIOLOGY

SCORING KEY

(FINAL)

Sl. No.	Answer	Sl. No.	Answer
1.	C	26.	D
2.	A	27.	B
3.	A	28.	C
4.	D	29.	B
5.	C	30.	C
6.	B	31.	B
7.	D	32.	D
8.	C	33.	C
9.	D	34.	D
10.	B	35.	C
11.	D	36.	C
12.	C	37.	C
13.	C	38.	C
14.	D	39.	B
15.	C	40.	A
16.	C	41.	C
17.	B	42.	B
18.	A	43.	B
19.	B	44.	B
20.	A	45.	B
21.	D	46.	B
22.	C	47.	B
23.	D	48.	B
24.	A	49.	C
25.	D	50.	D

Appendix VA
UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION
VERBAL GROUP TEST OF INTELLIGENCE

Dr. P.K. Sudheesh Kumar
Hameed. A & Prasanna.A

വിദ്യാർത്ഥികളുടെ മാനസികമായ കഴിവുകൾ പരിശോധിക്കുന്നതിനുവേണ്ടി തയ്യാറാക്കിയിട്ടുള്ളതാണ് ഈ ടെസ്റ്റ്. വിവിധ തരത്തിലുള്ള 5 ടെസ്റ്റുകൾ ഇതിൽ ഉൾക്കൊള്ളിച്ചിരിക്കുന്നു. ഓരോ ടെസ്റ്റിന്റെയും ആരംഭത്തിൽ കൊടുത്തിട്ടുള്ള നിർദ്ദേശങ്ങൾ എഴുതിത്തുടങ്ങുന്നതിനുമുമ്പ് ശ്രദ്ധിച്ചു വായിക്കുക. ഉത്തരം എഴുതേണ്ട രീതി ഉദാഹരണ സഹിതം വ്യക്തമാക്കിയിട്ടുണ്ട്. നിർദ്ദിഷ്ട സമയത്തിനുള്ളിൽ ഉത്തരം എഴുതിത്തീർക്കാൻ ശ്രദ്ധിക്കുകയും, പറഞ്ഞതിനുശേഷം മാത്രം എഴുതിത്തുടങ്ങുകയും, ഏറ്റവും വേഗത്തിൽ എഴുതിത്തീർക്കാൻ ശ്രമിക്കുകയും ചെയ്യേണ്ടതാണ്. തന്നിരിക്കുന്ന ഈ ചോദ്യക്കടലാസ്സിൽ എന്തെങ്കിലും എഴുതുകയോ, അടയാളപ്പെടുത്തുകയോ ചെയ്യരുത്. പ്രത്യേകം തന്നിട്ടുള്ള ഉത്തരക്കടലാസ്സിൽ മാത്രമേ ഉത്തരം എഴുതാവൂ.

TEST - I VERBAL ANALOGY

ഈ വിഭാഗത്തിൽ കൊടുത്തിട്ടുള്ള ചോദ്യങ്ങളിൽ മൂന്നു വാക്കുകൾ വീതം തന്നിട്ടുണ്ട്. നാലാമത്തെ വാക്ക് നിങ്ങൾ എഴുതേണ്ടതാണ്. തന്നിരിക്കുന്ന മൂന്നു വാക്കുകളിൽ ആദ്യത്തെ രണ്ടു വാക്കുകൾ തമ്മിലുള്ള ബന്ധം മനസ്സിലാക്കി മൂന്നാമത്തെ വാക്കിനോട് യോജിക്കുന്ന വാക്ക് A, B, C, D എന്നീ ക്രമത്തിൽ കൊടുത്തിരിക്കുന്ന നാലുവാക്കുകളിൽ നിന്നും തെരഞ്ഞെടുത്ത് ഉത്തരക്കടലാസ്സിൽ അടയാളപ്പെടുത്തുക.

ഉദാഹരണം:

ദാഹം:	വെള്ളം::	വിശപ്പ്:	... ..
A. മാംസം	B. വിശ്രമം	C. ആഹാരം	D. ക്ഷീണം

ദാഹം വരുമ്പോൾ വെള്ളം കുടിയ്ക്കുന്നു. അതുപോലെ വിശപ്പുവരുമ്പോൾ ആഹാരം കഴിക്കുന്നു. അതുകൊണ്ട് 'C' യാണ് ശരിയായ ഉത്തരം

A.	B.	C. ✓	D.
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- | | | | | |
|----|---------------|-----------------|-------------------|----------------|
| 1. | കൗശലം: | കുറുക്കൻ:: | വിഡ്ഢിത്തം: | |
| | A. കുരങ്ങൻ | B. കരടി | C. മാൻ | D. കഴുത |
| 2. | ദയ: | ക്രൂരത:: | നിശബ്ദത: | |
| | A. നിശ്ചലം | B. ശബ്ദം | C. ശാന്തത | D. ധ്യാനം |
| 3. | നാടകം: | സംവിധായകൻ:: | ന്യൂസ്പേപ്പർ: | ... .. |
| | A. മാനേജർ | B. പത്രാധിപർ | C. ഉടമസ്ഥൻ | D. പ്രസ്സ് |
| 4. | കപ്പൽ: | ക്യാപ്റ്റൻ:: | വിമാനം: | ... .. |
| | A. കടൽ | B. എയർപോർട്ട് | C. ഡ്രൈവർ | D. പൈലറ്റ് |
| 5. | കരച്ചിൽ: | ചിരി:: | വിഷമം: | ... .. |
| | A. സന്തോഷം | B. ഉന്മേഷം | C. ശാന്തി | D. സമാധാനം |
| 6. | ഷർട്ട്: | തൂണി:: | ചെരുപ്പ്: | ... .. |
| | A. ഉളി | B. തുകൽ | C. ചെരുപ്പുകുത്തി | D. തയ്യൽക്കാരൻ |
| 7. | കാക്ക: | കറുപ്പ്:: | ഹംസം: | ... .. |
| | A. പക്ഷി | B. വെള്ളം | C. വെളുപ്പ് | D. തവിട്ട് |
| 8. | മാസിക: | വായനക്കാരൻ:: | റേഡിയോ: | ... .. |
| | A. പരസ്യക്കാർ | B. അറിയിപ്പുകാർ | C. കാഴ്ചക്കാർ | D. കേൾവിക്കാർ |

- | | | | | |
|-----|---------------|----------------|-----------------|-------------------|
| 9. | വിറക്: | കോടാലി: | തുണി: | ... .. |
| | A. മെഷീൻ | B. സൂചി | C. കത്രിക | D. നൂല് |
| 10. | വിദ്യാർത്ഥി: | ക്ലാസ്സറൂം: | കളിക്കാരൻ: | ... .. |
| | A. സ്റ്റേഡിയം | B. മത്സരം | C. കോച്ച് | D. കളി |
| 11. | വീട്: | മേൽക്കൂര: | ഭൂമി: | ... .. |
| | A. വായു | B. ആകാശം | C. അന്തരീക്ഷം | D. ധ്രുവങ്ങൾ |
| 12. | കുട്ടി: | മാതാപിതാക്കൾ: | ബുക്ക്: | ... .. |
| | A. അധ്യാപകൻ | B. പ്രസാധകൻ | C. പ്രസ്സ് | D. ഗ്രന്ഥകർത്താവ് |
| 13. | വർഷം: | മാസം: | ആഴ്ച: | ... .. |
| | A. മണിക്കൂർ | B. മിനിറ്റ് | C. രണ്ടാഴ്ച | D. ദിവസം |
| 14. | രാത്രി: | പകൽ: | ദേഷ്യം: | ... .. |
| | A. സഹായം | B. ദയ | C. ഇഷ്ടം | D. സന്തോഷം |
| 15. | കവി: | കവിത: | സംഗീതം: | ... .. |
| | A. രചയിതാവ് | B. എഴുത്തുകാരൻ | C. നിർമ്മാതാവ് | ...കണ്ടക്ടർ |
| 16. | മഞ്ഞ്: | വെള്ളപ്പ്: | കൽക്കരി: | ... .. |
| | A. പുക | B. ചുവപ്പ് | C. കറുപ്പ് | D. മഞ്ഞ |
| 17. | പശു: | മൃഗം: | കോഴി: | ... .. |
| | A. വീട് | B. പക്ഷി | C. മുട്ട | D. കൂട് |
| 18. | നീന്തൽ: | വെള്ളം: | സ്കേറ്റിംഗ്: | ... .. |
| | A. മഞ്ഞ് | B. ആകാശം | C. പർവ്വതം | D. ശൂന്യാകാശം |
| 19. | മനുഷ്യൻ: | ആത്മകഥ: | രാഷ്ട്രം: | ... .. |
| | A. ജനങ്ങൾ | B. ജനസംഖ്യ | C. ഭൂമിശാസ്ത്രം | D. ചരിത്രം |
| 20. | മരുന്ന്: | രോഗം: | പുസ്തകം: | ... .. |
| | A. അറിവ് | B. അധ്യാപകൻ | C. ഗ്രന്ഥകാരൻ | D. രചയിതാവ് |

TEST - II VERBAL CLASSIFICATION

ഈ വിഭാഗത്തിലുള്ള ചോദ്യങ്ങളിൽ ഓരോന്നിലും A, B, C, D എന്നിങ്ങനെ നാലുവാക്കുകൾ വീതം തന്നിട്ടുണ്ട്. അതിൽ ഒരെണ്ണം മറ്റു മൂന്നു വാക്കുകളോടും യോജിക്കാതെ നിൽക്കുന്നു. അത് ഏതെന്ന് കണ്ടുപിടിച്ച് ഉത്തരക്കടലാസിൽ അടയാളപ്പെടുത്തുക.

ഉദാഹരണം:

1. A. മധുരം B. മുളക് C. എരിവ് D. കയ്പ്

ഇതിൽ A, C, D എന്നിവ വിവിധ രുചികളെ കാണിക്കുന്നു. B (മുളക്) രുചികളിൽ ഉൾപ്പെടുന്നതല്ല. അതുകൊണ്ട് ശരി ഉത്തരം 'B' ആണ്.

A.	B. ✓	C.	D.
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|---------------------|-----------------|----------------|------------------|
| 1. A. അധ്യാപകൻ | B. പ്രിൻസിപ്പാൾ | C. വിദ്യാർത്ഥി | D. പ്രൊഫസർ |
| 2. A. ബസ്സ് | B. വിമാനം | C. സൈക്കിൾ | D. ലോറി |
| 3. A. നടക്കുക | B. ചിന്തിക്കുക | C. നീന്തുക | D. ചാടുക |
| 4. A. വൃത്തം | B. ചതുരം | C. ത്രികോണം | D. ഷഡ്ഭുജം |
| 5. A. സൗന്ദര്യം | B. വാർദ്ധക്യം | C. മിടുക്കൻ | D. യൗവനം |
| 6. A. ഗ്രാമം | B. കിലോഗ്രാമം | C. മീറ്റർ | D. കിന്റൽ |
| 7. A. സമാധാനം | B. ശബ്ദം | C. ധ്യാനം | D. നിശ്ചലം |
| 8. A. സംവിധായകൻ | B. നടൻ | C. പാട്ടുകാരൻ | D. പ്രാസംഗികൻ |
| 9. A. ദിവസം | B. കലണ്ടർ | C. മാസം | D. ആഴ്ച |
| 10. A. കിന്റൽ | B. ഇഞ്ച് | C. മൈൽ | D. വാരം |
| 11. A. നാവ് | B. കണ്ണ് | C. പല്ല് | D. മുക്ക് |
| 12. A. ഗോതമ്പ് | B. റാഗി | C. നെല്ല് | D. പയറ്റ് |
| 13. A. പാമ്പ് | B. തിമിംഗലം | C. അരണ | D. ആമ |
| 14. A. പെൻസിൽ | B. കട | C. പെയിന്റിംഗ് | D. ക്യാൻവാസ് |
| 15. A. മാവ് | B. പ്ലാവ് | C. തെങ്ങ് | D. തേക്ക് |
| 16. A. മാങ്ങ | B. ആപ്പിൾ | C. തക്കാളി | D. ഉരുളക്കിഴങ്ങ് |
| 17. A. ചെവി | B. വിരൽ | C. കൈ | D. കാൽ |
| 18. A. കോഴി | B. ആട് | C. പശു | D. കാക്ക |
| 19. A. ഓഫീസ് | B. വീട് | C. ബംഗ്ലാവ് | D. കുടിൽ |
| 20. A. അറിയിപ്പുകാർ | B. കാഴ്ചക്കാർ | C. രചയിതാവ് | D. കേൾവിക്കാർ |

TEST - III NUMERICAL REASONING

താഴെ കൊടുത്തിരിക്കുന്ന 6 ചോദ്യങ്ങളിൽ കുറെ സംഖ്യകൾ ഓരോ ക്രമത്തിൽ കൊടുത്തിരിക്കുന്നു. ഒന്ന് എഴുതാതെയും വിട്ടിരിക്കുന്നു. താഴെ A, B, C, D എന്നീ ക്രമത്തിൽ നാല് ഉത്തരങ്ങൾ കൊടുത്തിരിക്കുന്നു. ഇവയിൽ ശരിയുത്തരം കണ്ടെത്തി അടയാളപ്പെടുത്തുക.

ഉദാഹരണം:

1. 2, 4, 6, --, 10
 A. 5 B. 8 C. 7 D. 11

A.	B. ✓	C.	D.
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1. 4, 9, 16, 25, 36 - - - -
 A. 39 B. 47 C. 49 D. 59
2. 25, 24, 22, 19, - -, 10
 A. 15 B. 16 C. 17 D. 14
3. 6, 8, - -, 20, 36, - -
 A. 15 B. 14 C. 16 D. 12
4. 2, 6, 12, 20, 30, - -
 A. 42 B. 46 C. 40 D. 36
5. 3, 3, 6, 18, - -
 A. 68 B. 33 C. 72 D. 29
6. 0, 2, 4, 6, - -, 10
 A. 7 B. 5 C. 8 D. 9

7 മുതൽ 10 വരെയുള്ള ചോദ്യങ്ങളിൽ ഓരോന്നിലും A, B, C, D എന്നിങ്ങനെ നാലു സംഖ്യകൾ തന്നിട്ടുണ്ട്. അതിൽ ഒരു സംഖ്യ മറ്റു മൂന്നു സംഖ്യകളോടും യോജിക്കാതെ നിൽക്കുന്നു. അത് ഏതെന്ന് കണ്ടുപിടിച്ച് ഉത്തരക്കടലാസിൽ അടയാളപ്പെടുത്തുക.

ഉദാഹരണം:

- A. 1 B. 3 C. 6 D. 7

ഇതിൽ A, B, D എന്നിവ ഒരു സംഖ്യകളെ സൂചിപ്പിക്കുന്നു. എന്നാൽ 'C' ഒരു സംഖ്യയല്ല അതുകൊണ്ട് ഉത്തരം 'C' യാകുന്നു.

7. A. 1 B. 5 C. 25 D. 75
 8. A. 3 B. 4 C. 7 D. 9

9. A. 12 B. 24 C. 35 D. 48

10. A. 150 B. 36 C. 12 D. 4

11 മുതൽ 20 വരെയുള്ള ചോദ്യങ്ങളിൽ മൂന്നു സംഖ്യകൾ വീതം തന്നിട്ടുണ്ട്. നാലാമത്തെ സംഖ്യ നിങ്ങൾ എഴുതേണ്ടതാണ്. തന്നിരിക്കുന്ന മൂന്നു സംഖ്യകളിൽ ആദ്യത്തെ രണ്ടു സംഖ്യകൾ തമ്മിലുള്ള ബന്ധം മനസ്സിലാക്കി മൂന്നാമത്തെ സംഖ്യയോട് യോജിക്കുന്ന സംഖ്യ A, B, C, D എന്നീ ക്രമത്തിൽ കൊടുത്തിരിക്കുന്ന സംഖ്യകളിൽ നിന്നും തെരഞ്ഞെടുത്ത് ഉത്തരക്കടലാസിൽ അടയാളപ്പെടുത്തുക.

ഉദാഹരണം:

1. 1:2 :: 2: - - -

A. 1 B. 3 C. 6 D. 7

ഒന്നിന്റെ ഇരട്ടിയാണ് രണ്ട്. അതുപോലെ രണ്ടിന്റെ ഇരട്ടിയാണ് നാല് അതുകൊണ്ട് ഉത്തരം 'B' ആണ്.

11. 3:5 :: 11: - - -

A. 12 B. 13 C. 14 D. 15

12. 5:25 :: 3: - - -

A. 6 B. 12 C. 15 D. 9

13. 1:6 :: 7: - - -

A. 12 B. 13 C. 11 D. 14

14. 10:20 :: 18: - - -

A. 26 B. 36 C. 46 D. 52

15. 4:5 :: 8: - - -

A. 6 B. 7 C. 5 D. 9

16. 12:72 :: 6: - - -

A. 58 B. 38 C. 46 D. 52

17. 12:4 :: 24: - - -

A. 6 B. 10 C. 8 D. 12

18. 28:22 :: 46: - - -

A. 40 B. 38 C. 42 D. 29

19. 49:7 :: 4: - - -

A. 16 B. 8 C. 2 D. 12

20. 48:8 :: 18: - - -

A. 8 B. 4 C. 2 D. 3

TEST - IV VERBAL REASONING

ഈ വിഭാഗത്തിലുള്ള ഓരോ ചോദ്യങ്ങൾക്കും A, B, C, D എന്ന ക്രമത്തിൽ നാലു വീതം ഉത്തരങ്ങൾ കൊടുത്തിട്ടുണ്ട്. ചോദ്യം ശരിയായി വായിച്ച് മനസ്സിലാക്കി ശരിയായ ഉത്തരം ഉത്തരക്കടലാസിൽ അടയാളപ്പെടുത്തുക.

ഉദാഹരണം:

- ബിന്ദുവിന് സിന്ധുവിനേക്കാൾ വണ്ണം കൂടുതലാണ്. മഞ്ചുവിനു ബിന്ദുവിനേക്കാൾ വണ്ണം കുറവാണ്. മഞ്ചുവിനും സന്ധ്യയ്ക്കും തുല്യ വണ്ണമാണുള്ളത്. എന്നാൽ ഇവരിലാർക്കാണ് ഏറ്റവും വണ്ണം കൂടുതൽ?
 A. മഞ്ചു B. ബിന്ദു C. സിന്ധു D. സന്ധ്യ

ബിന്ദുവിനാണല്ലോ മറ്റൊരാളെക്കാളും വണ്ണം കൂടുതൽ അതുകൊണ്ട് ഉത്തരം 'B' എന്ന് അടയാളപ്പെടുത്തുക.

A.	B. ✓	C.	D.
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- അപ്പു ചിപ്പുവിനേക്കാൾ നന്നായി പാടും. ദേവന് കണ്ണനേക്കാളും പാടാൻ കഴിയില്ല. കണ്ണന് അപ്പുവിനേക്കാൾ പാടാൻ കഴിയും. എന്നാൽ ഇവരിൽ ആരാണ് നന്നായി പാടുന്നത്?
 A. അപ്പു B. കണ്ണൻ C. ചിപ്പു D. ദേവൻ
- രാമൻ രമയേക്കാൾ പിന്നിലാണ് നടക്കുന്നത്. രമണി രമയേക്കാൾ പിന്നിലും രാമനേക്കാൾ മുന്നിലുമാണ് നടക്കുന്നത്. രാജു രമണിയേക്കാൾ മുൻപിലാണ് നടക്കുന്നത് എങ്കിൽ ഏറ്റവും പുറകിൽ നടക്കുന്നതാര്?
 A. രാമൻ B. രമണി C. രമ D. രാജു
- അജയ് വിജയനേക്കാൾ ജോലി ചെയ്യും. അശോകും അജിത്തും ജോലി ചെയ്യുന്നതിൽ തുല്യരാണ്. വിജയ് അശോകിനേക്കാൾ നന്നായി ജോലി ചെയ്യും. ഇവരിൽ ഏറ്റവും കൂടുതൽ ജോലി ചെയ്യുന്നതാര്?
 A. അശോക് B. അജിത്ത് C. വിജയ് D. അജയ്
- രമ്യ ഭവ്യയോളം നൃത്തം ചെയ്തില്ല. ദിവ്യ ഭവ്യയേക്കാൾ നന്നായി നൃത്തം ചെയ്യും. വിദ്യ ദിവ്യയേക്കാൾ നൃത്തത്തിൽ മിടുക്കിയാണ് എങ്കിൽ ഇവരിലാരാണ് നൃത്തത്തിൽ മിടുമിടുക്കി?
 A. ദിവ്യ B. ഭവ്യ C. രമ്യ D. വിദ്യ
- ദീപകിന്റെ അച്ഛനാണ് മോഹനന്റെ മകൻ എങ്കിൽ ദീപകും മോഹനനും തമ്മിലുള്ള ബന്ധമെന്ത്?
 A. മകൻ B. സഹോദരൻ C. അനന്തരവൻ D. കൊച്ചുമകൻ
- റഫീക്കിന് മുനീറിനേക്കാൾ കാഴ്ചയുണ്ട്. ഷമീറിന് സുധീറിനേക്കാൾ കാഴ്ചകുറവാണ്. സുധീറിന് റഫീക്കിനോളം കാഴ്ചശക്തിയില്ല. ഇവരിൽ ആർക്കാണ് കാഴ്ച ഏറ്റവും കൂടുതൽ?
 A. സുധീറിന് B. ഷമീറിന് C. റഫീക്കിന് D. മുനീറിന്

7. രണ്ടുപേർ ചേർന്ന് പത്ത് ദിവസം കൊണ്ട് ഒരു ജോലി ചെയ്തുതീർത്തു. എങ്കിൽ ഒരാൾക്ക് ഒരു ദിവസം കൊണ്ട് എത്ര ജോലി ചെയ്യാൻ കഴിയും?
A. 1/2 B. 1/5 C. 1/10 D. 1/20
8. ഒരു വെടിയൊച്ച A എന്ന സ്ഥലത്തു നിന്നും B എന്ന സ്ഥലത്തെത്താൻ എടുക്കുന്ന സമയം 2 മിനിറ്റ്. എന്നാൽ 5 വെടിയൊച്ചകൾ A എന്ന സ്ഥലത്തു നിന്നും B എന്ന സ്ഥലത്തെത്താൻ എത്ര സമയമെടുക്കും?
A. 10 മി. B. 2 മി. C. 4 മി. D. 5 മി.
9. ഷർമിളയ്ക്ക് മാലയേക്കാൾ പ്രായം കുറവാണ്. കുഞ്ചനും നന്ദയ്ക്കും തുല്യ പ്രായമാണുള്ളത്. സുധീഷിന് നന്ദയേക്കാൾ പ്രായം കുറവാണ്. സുധീഷിന് ഷർമിളയേക്കാൾ പ്രായം കൂടുതലാണ്. മാലയ്ക്ക് സുധീഷിനോളം പ്രായം ഇല്ല. എന്നാൽ ഏറ്റവും കൂടുതൽ പ്രായമാർക്ക്?
A. സുധീഷ് B. മാല C. ഷർമിള D. കുഞ്ചൻ
10. ഒരു കോളേജിലെ ഫീസടയ്ക്കാൻ 'ക്യൂ'വിലെ കുട്ടികളുടെ എണ്ണം 70 ആകുന്നു. അതിൽ മോഹനന്റെ സ്ഥലം ജനലിന്റെ അടുത്തുനിന്നും 54-മത്തൊന്നെങ്കിൽ അവന്റെ പുറകിൽ എത്ര പേരുകാണും?
A. 15 B. 16 C. 17 D. 18
11. തെക്കുപടിഞ്ഞാറ് വടക്കൊന്നെങ്കിൽ വടക്കുകിഴക്ക് എന്തായിരിക്കും?
A. പടിഞ്ഞാറ് B. തെക്കുപടിഞ്ഞാറ് C. കിഴക്കുപടിഞ്ഞാറ് D. തെക്ക്
12. A, B യുടെ മകനാണ് B യും C യും സഹോദരികളാണ് D, C യുടെ അമ്മയും E, D യുടെ മകനുമാണ് എന്നാൽ താഴെ പറയുന്നവയിൽ ഏതാണ് ശരി?
A. A യുടെ അമ്മയുടെ സഹോദരിയാണ് E
B. C യും E യും സഹോദരിസഹോദരന്മാരാണ്.
C. C, A യുടെ അമ്മമ്മയാണ്.
D. A യും E യും സഹോദരന്മാരാണ്.
13. ഒരു കമ്പനിയിലെ തൊഴിലാളികളുടെ എണ്ണം 60 ആകുന്നു. അതിൽ 1/4 പേർക്ക് കാറും 1/2 പേർക്ക് സ്കൂട്ടറും 1/10 പേർക്ക് കാറും സ്കൂട്ടറുമുണ്ട്. എന്നാൽ എത്ര പേർക്കാണ് കാറോ, സ്കൂട്ടറോ ഇല്ലാത്തത്?
A. 12 B. 32 C. 30 D. 28
14. 51 പേരുള്ള ഒരു ക്ലാസ്സിൽ അഖിലിന് 21-മത്തെ റാങ്കാണ്. ഏറ്റവും ഒടുവിലത്തെ റാങ്കുള്ള കുട്ടിയിൽ നിന്നും കണക്കാക്കുമ്പോൾ അഖിലിന് എത്രാമത്തെ റാങ്കായിരിക്കും ഉണ്ടാവുക?
A. 12 B. 37 C. 31 D. 35
15. ഒരാൾ 'X' എന്ന സ്ഥലത്തു നിന്നും 4 മൈൽ കിഴക്കോട്ടു നടന്ന് ഇടത്തോട്ട് തിരിഞ്ഞ് വീണ്ടും 5 മൈൽ നടന്ന് വീണ്ടും ഇടത്തോട്ട് തിരിഞ്ഞ് 2 മൈൽ നടന്നു. എങ്കിൽ അയാൾ ഇപ്പോൾ നടക്കുന്ന ദിശയേത്?
A. വടക്ക് B. പടിഞ്ഞാറ് C. കിഴക്ക് D. തെക്ക്
16. F, A യുടെ സഹോദരനാണ് C, A -യുടെ മകളാണ് K, F ന്റെ സഹോദരിയാണ് G, C യുടെ സഹോദരനാണ്. ഇതിൽ ആരാണ് G യുടെ അമ്മാവൻ?
A. F B. C C. K D. A

- 17. വിനുവിനേക്കാൾ രണ്ടുവയസ്സുള്ള ജിനുവിന് മിനുവിനേക്കാൾ മൂന്നുമടങ്ങ് പ്രായമുണ്ട്. മൂന്നുപേരുടേയും വയസ്സുകൂട്ടിയാൽ 19 കിട്ടും എങ്കിൽ ജിനുവിന്റെ വയസ്സ് എത്ര?
A. 5 B. 3 C. 9 D. 10
- 18. ഒരു മാവേലിസ്റ്റോറിന്റെ മൂന്നിലുള്ള ക്യൂവിൽ നിൽക്കുന്ന X എന്നയാളിന്റെ സ്ഥാനം മൂന്നിൽ നിന്നും 22-മത്തെയും പിന്നിൽ നിന്നും 28-മത്തേതുമാണെങ്കിൽ ആകെ ക്യൂവിലുള്ള ആളുകളുടെ എണ്ണമെത്ര?
A. 49 B. 52 C. 50 D. 54
- 19. A യ്ക്ക് Y യേക്കാൾ നീളം കൂടുതലാണ് B യ്ക്ക് X നേക്കാൾ നീളം കുറവാണ് X നും Y യ്ക്കും തുല്യ നീളമാണുള്ളത് Z ന് A യേക്കാൾ നീളം കൂടുതലുണ്ട് എങ്കിൽ ഏറ്റവും നീളം കുറവാർക്ക്?
A. X B. Y C. A D. B
- 20. ശ്യാമിന്റെ അച്ഛനാണ് സഞ്ജയിന്റെ മകനെങ്കിൽ ശ്യാമും സഞ്ജയും തമ്മിലുള്ള ബന്ധം എന്ത്?
A. മകൻ B. കൊച്ചുമകൻ C. സഹോദരൻ D. അനന്തരവൻ

TEST - V COMPREHENSION

ഈ വിഭാഗത്തിലുള്ള ചോദ്യങ്ങളിൽ ഓരോന്നിലും ഏതാനും ചില പ്രസ്താവനകൾ കൊടുത്തിട്ടുണ്ട്. ഇവ ശ്രദ്ധാപൂർവ്വം വായിച്ച് അതിനുതാഴെ കൊടുത്തിരിക്കുന്ന ചോദ്യങ്ങൾക്ക് ഉത്തരം കണ്ടെത്തുക. A, B, C, D എന്നീ ക്രമത്തിൽ നാലു ഉത്തരങ്ങൾ കൊടുത്തിരിക്കുന്നു. ശരി ഉത്തരം കണ്ടെത്തി ഉത്തരക്കടലാസിൽ അടയാളപ്പെടുത്തുക.

ഉദാഹരണം:

സതീഷിന്റെ പുത്രന്മാരാണ് A യും B യും, പുത്രിമാരാണ് C യും, D യും ശ്യാമയുടെ മക്കളാണ് X ഉം Y യും മനോജിന്റെ മക്കളായ E യും F ഉം ഒരു കമ്പനിയിൽ ജോലിയുള്ളവരാണ്. A യും D യും വിവാഹിതരാണ്. X വിവാഹം ചെയ്തിരിക്കുന്നത് C യെയും F വിവാഹം ചെയ്തിരിക്കുന്നത് A യെയും ആണ്. മനോജിനും ശ്യാമയ്ക്കും തമ്മിൽ സഹോദരിസഹോദര ബന്ധമാണ്.

ചോദ്യങ്ങൾ:

- 1. X-ഉം E -യും തമ്മിലുള്ള ബന്ധമെന്ത്?
 - A. മകനും അച്ഛനും,
 - B. സഹോദരിസഹോദരന്മാർ
 - C. സഹോദരിസഹോദരന്മാരുടെ മക്കൾ
 - D. മകളും അച്ഛനും

A.	B.	C. ✓	D.
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(1) ഒരു വീട്ടിലെ നാല് അംഗങ്ങളാണ് W, X, Y, S ഇവരിൽ W, X, Y വിദ്യാഭ്യാസമുള്ളവരാണ് W, Y, Z സത്യസന്ധരും Y, Z എന്നിവർ ജോലിയുള്ളവരുമാകുന്നു. W, X, Z എന്നിവർക്ക് വിനയവുമുണ്ട്.

- 1. ആർക്കാണ് വിദ്യാഭ്യാസം, സത്യസന്ധത എന്നീ ഗുണങ്ങളുള്ളതും എന്നാൽ ജോലിയില്ലാത്തതും?
 - A. W
 - B. X
 - C. Y
 - D. Z
- 2. ജോലിയും, വിദ്യാഭ്യാസവും, സത്യസന്ധതയും ഉള്ളതാർക്കാണ്?
 - A. W
 - B. X
 - C. Y
 - D. Z
- 3. ആർക്കാണ് ജോലിയും സത്യസന്ധതയുമുള്ളതും എന്നാൽ വിദ്യാഭ്യാസമില്ലാത്തതും?
 - A. W
 - B. X
 - C. Y
 - D. Z
- 4. വിദ്യാഭ്യാസവും വിനയവും ഉണ്ടെങ്കിലും സത്യസന്ധതയും ജോലിയും ഇല്ലാത്തതാർക്ക്?
 - A. W
 - B. X
 - C. Y
 - D. Z
- 5. സത്യസന്ധതയും, ജോലിയും, വിനയവും ഉണ്ടായിട്ടും വിദ്യാഭ്യാസമില്ലാത്തതാർക്കാണ്?
 - A. W
 - B. X
 - C. Y
 - D. Z

(2) ദിനേശിന് A എന്ന പുത്രിയും B, C എന്ന പുത്രന്മാരുമുണ്ട്. ശ്യാമിന് P, Q എന്ന പുത്രന്മാരും R എന്ന പുത്രിയുമുണ്ട്. P യും C യും വിവാഹിതരാണ്. M-ഉം N ഉം അവരുടെ പുത്രന്മാരും. രോഹിതിന്റെ പുത്രൻ S, പുത്രി T യുമാണ്. T വിവാഹം കഴിച്ചിരിക്കുന്നത് B യെ, അവരുടെ പുത്രിമാരാണ് D യും E യും പുത്രൻ G.

6. Q വിന് N മായുള്ള ബന്ധമെന്ത്?
A. അച്ഛൻ B. മുത്തച്ഛൻ C. അമ്മാവൻ D. പുത്രൻ
7. ദിനേശിന് E യുമായുള്ള ബന്ധമെന്ത്?
A. മുത്തച്ഛൻ B. അമ്മാവൻ C. അച്ഛൻ D. പുത്രൻ
8. M ന് R നോടുള്ള ബന്ധമെന്ത്?
A. അമ്മ B. മകൾ C. അനന്തിരവൾ D. അമ്മായി
9. B യ്ക്ക് G യോടുള്ള ബന്ധമെന്ത്?
A. മകൻ B. അമ്മ C. അമ്മായി D. അനന്തിരവൾ
10. E. യ്ക്ക് S നോടുള്ള ബന്ധമെന്ത്?
A. പേരക്കിടാവ് B. അമ്മാവൻ C. സഹോദരിപുത്രി D. അച്ഛൻ

(4) $5PQ8 = 5^2 + 8 = 25 + 8 = 33$ ആയാൽ

11. $4PQ4 = ?$
A. 16 B. 20 C. 24 D. 12
12. $4PQ1 = ?$
A. 17 B. 12 C. 8 D. 9
13. $5PQ5 = ?$
A. 20 B. 30 C. 15 D. 25
14. $6PQ? = 108$
A. 72 B. 82 C. 52 D. 42
15. $?PQ9 = 109$
A. 50 B. 25 C. 20 D. 10

(5) ഒരു വീട്ടിലെ ആറ് അംഗങ്ങളാണ് U, V, W, X, Y, Z ഇവരിൽ ഒരാൾ ഫുഡ്ബോൾ കളിക്കാരനും മറ്റൊരാൾ ചെസ്സ് കളിക്കാരനും, ഇനിയുമൊരാൾ ക്രിക്കറ്റുകളിക്കാരനുമാണ്. അവിവാഹിതകളായ U ഉം X ഉം ഒരു കളിയിലും പങ്കെടുക്കുന്നില്ല. ഒറ്റ സ്ത്രീകളും ഫുഡ്ബോൾ കളിയിലോ ക്രിക്കറ്റ് കളിയിലോ ഏർപ്പെടുന്നില്ല. ഇവരിൽ ഒരു വിവാഹ ജോടിയിലെ ഭർത്താവാണ് Z. W ന്റെ സഹോദരനായ V ഒരു ചെസ്സ് കളിക്കാരനോ ക്രിക്കറ്റുകളിക്കാരനോ അല്ല. Y, V യുടെ കുട്ടുകാരനും ക്രിക്കറ്റുകളിക്കാരനുമാണ്.

16. ആരാണ് ഫുഡ്ബോൾ കളിക്കാരൻ?
A. X B. U C. Y D. Z
17. ആരാണ് ചെസ്സ് കളിക്കാരി?
A. U B. V C. W D. X
18. ആരാണ് 'Z' ന്റെ ഭാര്യ?
A. W B. V C. U D. Y

19. ആരെല്ലാമാണ് സ്ത്രീകൾ
A. UXV B. VYX C. XZY D. UXW
20. ആരെല്ലാമാണ് പുരുഷന്മാർ?
A. XUY B. UXV C. VYZ D. WXZ

Appendix V B

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

VERBAL GROUP OF INTELLIGENCE

RESPONSE SHEET

വിദ്യാർത്ഥിയുടെ പേര് ക്ലാസ്സ്

സ്കൂൾ

ആൺകുട്ടി/പെൺകുട്ടി

ക്രമ നമ്പർ	ഉത്തരങ്ങൾ				ക്രമ നമ്പർ	ഉത്തരങ്ങൾ				ക്രമ നമ്പർ	ഉത്തരങ്ങൾ				ക്രമ നമ്പർ	ഉത്തരങ്ങൾ			
	A	B	C	D		A	B	C	D		A	B	C	D		A	B	C	D
1	A	B	C	D	1	A	B	C	D	1	A	B	C	D	1	A	B	C	D
2	A	B	C	D	2	A	B	C	D	2	A	B	C	D	2	A	B	C	D
3	A	B	C	D	3	A	B	C	D	3	A	B	C	D	3	A	B	C	D
4	A	B	C	D	4	A	B	C	D	4	A	B	C	D	4	A	B	C	D
5	A	B	C	D	5	A	B	C	D	5	A	B	C	D	5	A	B	C	D
6	A	B	C	D	6	A	B	C	D	6	A	B	C	D	6	A	B	C	D
7	A	B	C	D	7	A	B	C	D	7	A	B	C	D	7	A	B	C	D
8	A	B	C	D	8	A	B	C	D	8	A	B	C	D	8	A	B	C	D
9	A	B	C	D	9	A	B	C	D	9	A	B	C	D	9	A	B	C	D
10	A	B	C	D	10	A	B	C	D	10	A	B	C	D	10	A	B	C	D
11	A	B	C	D	11	A	B	C	D	11	A	B	C	D	11	A	B	C	D
12	A	B	C	D	12	A	B	C	D	12	A	B	C	D	12	A	B	C	D
13	A	B	C	D	13	A	B	C	D	13	A	B	C	D	13	A	B	C	D
14	A	B	C	D	14	A	B	C	D	14	A	B	C	D	14	A	B	C	D
15	A	B	C	D	15	A	B	C	D	15	A	B	C	D	15	A	B	C	D
16	A	B	C	D	16	A	B	C	D	16	A	B	C	D	16	A	B	C	D
17	A	B	C	D	17	A	B	C	D	17	A	B	C	D	17	A	B	C	D
18	A	B	C	D	18	A	B	C	D	18	A	B	C	D	18	A	B	C	D
19	A	B	C	D	19	A	B	C	D	19	A	B	C	D	19	A	B	C	D
20	A	B	C	D	20	A	B	C	D	20	A	B	C	D	20	A	B	C	D

Appendix V C

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

VERBAL GROUP TEST OF INTELLIGENCE

**Dr. P.K. Sudheesh Kumar
Hameed, A. & Prasanna, A.**

This test is prepared to test the mental abilities of children. This test includes 5 sub tests. Before writing the answer, read the instructions carefully given in the beginning of each sub test. The mode of answering is explained with example. You should start answering only after the instruction is given, and try to complete within the stipulated time. Don't write or mark anything on this question booklet. Mark your response only in the Response sheet provided.

TEST-1 VERBAL ANALOGY

In this section, for each question, three words are given. You have to write the fourth word. By understanding the relationship between the first word and second word from the given three words; select the fourth word from the alternatives A, B, C and D and mark it on the response sheet provided.

Example:

Thirst : Water :: Hunger:

A. Meat B. Lesiure C. Food D. Weariness

We drink water when we have thirst. Like wise we take food when we are hungry. Hence the correct answer is "C".

A	B	C✓	D
---	---	----	---

1. Clever : Fox :: Foolishness:
A. Monkey B. Bear C. Deer D. Ass
2. Mercy : Cruelty :: Silence:
A. Serene B. Noise C. Calmness D. Meditation
3. Drama : Director :: Newspaper
A. Manager B. Editor C. Owner D. Press
4. Ship : Captain :: Aeroplane:
A. Sea B. Airport C. Driver D. Pilot
5. Cry : Laugh :: Sadness:
A. Happiness B. Energetic C. Harmony D. Peace
6. Shirt : Cloth :: Chappals:
A. Chissel B. Leather C. Cobbler D. Tailor
7. Crow : Black :: Swan:
A. Bird B. Water C. White D. Grey
8. Magazine : Reader :: Radio:.....
A. Advertisers B. Announcers C. Spectators D. Listners

9. Firewood : Axe :: Cloth:
A. Machine B. Needle C. Scissors D. Thread
10. Student : Classroom :: Player:
A. Stadium B. Competition C. Coach D. Game
11. House : Roof :: Earth:
A. Air B. Sky C. Atmosphere D. Poles
12. Child : Parents :: Book:
A. Teacher B. Publisher C. Press D. Author
13. Year : Month :: Week:
A. Hour B. Minute C. Two weeks D. Day
14. Night : Day :: Hatred:.....
A. Help B. Mercy C. Love D. Failure
15. Poet : Poem :: Music:.....
A. Composer B. Writer C. Producer D. Conductor
16. Snow : White :: Coal:.....
A. Smoke B. Red C. Black D. Yellow
17. Cow : Animal :: Hen:.....
A. House B. Bird C. Egg D. Nest
18. Swimming : Water :: Skating:.....
A. Ice B. Sky C. Mountain D. Space
19. Man : Autobiography :: Nation:.....
A. People B. Population C. Geography D. History
20. Medicine : Disease :: Book:.....
A. Knowledge B. Teacher C. Author D. Publisher

TEST - II VERBAL CLASSIFICATION

In this section, for each question, four words are given, of which, three can be grouped together find out the fourth word, and mark it on the response sheet.

Example

1. A. Sweetness B. Chilly C. Hotness D. Bitterness

Among these words, A, C and D denote different tastes. B (chilly) is not included in this category. So the right answer is 'B'.

A	B ✓	C	D
---	-----	---	---

- | | | | | |
|-----|---------------|--------------------|-----------------|--------------|
| 1. | A. Teacher | B. Principal | C. Student | D. Professor |
| 2. | A. Bus | B. Aeroplane | C. Bicycle | D. Lorry |
| 3. | A. Walking | B. Thinking | C. Swimming | D. Jumping |
| 4. | A. Circle | B. Square | C. Triangle | D. Hexagon |
| 5. | A. Beauty | B. Senility | C. Chap | D. Youth |
| 6. | A. Gram | B. Kilogram | C. Metre | D. Quintal |
| 7. | A. Peace | B. Sound | C. Meditation | D. Stillness |
| 8. | A. Director | B. Actor | C. Singer | D. Orator |
| 9. | A. Day | B. Calender | C. Month | D. Week |
| 10. | A. Quintal | B. Inch | C. Mile | D. Feet |
| 11. | A. Tongue | B. Eye | C. Teeth | D. Nose |
| 12. | A. Wheat | B. Raggy | C. Paddy | D. Pie |
| 13. | A. Snake | B. Whale | C. Chameleon | D. Tortoise |
| 14. | A. Pencil | B. Umbrella | C. Paint | D. Canvas |
| 15. | A. Mango tree | B. Jack fruit tree | C. Coconut tree | D. Teak |
| 16. | A. Mango | B. Apple | C. Tomato | D. Potato |
| 17. | A. Ear | B. Finger | C. Hand | D. Leg |
| 18. | A. Hen | B. Goat | C. Cow | D. Crow |
| 19. | A. Office | B. House | C. Bungalow | D. Hut |
| 20. | A. Announcers | B. Spectators | C. Lyricist | D. Listeners |

TEST- III NUMERICAL REASONING

For the 6 items given below, certain numbers are given in particular orders. For each item four alternatives are given as A, B, C and D. Find out the right answer and mark it on the answer sheet.

Example:

1. 2, 4, 6, --, --, 10
 A. 5 B. 8 C. 7 D. 11

A	B ✓	C	D
---	-----	---	---

1. 4, 9, 16, 25, 36 ----
 A. 39 B. 47 C. 49 D. 59
2. 25, 24, 22, 19, --, 10
 A. 15 B. 16 C. 17 D. 14
3. 6, 8, --, 20, 36
 A. 15 B. 14 C. 16 D. 12
4. 2, 6, 12, 20, 32, --
 A. 42 B. 46 C. 40 D. 36
5. 3, 3, 6, 18, --
 A. 68 B. 33 C. 72 D. 29
6. 0, 2, 4, 6, --, 10
 A. 7 B. 5 C. 8 D. 9

For the questions 7 to 10, four numerals are given. Find out the numeral that is not related to the other three and mark it on the response sheet provided.

Example:

- A:1 B:3 C:6 D:7

A, B and D are the odd numbers whereas C is not an odd number. Therefore the answer is 'C'.

A	B	C ✓	D
---	---	-----	---

7. A. 1 B. 6 C. 25 D. 75
 8. A. 3 B. 4 C. 7 D. 9
 9. A. 12 B. 24 C. 35 D. 48
 10. A. 150 B. 36 C. 12 D. 4

For the questions 11 to 20 three numbers are given. You have to find out the fourth number from the given three numerals. There is a relationship between the first two. Select the most appropriate numeral to the third one from the numerals A, B, C and D.

Example:

1. 1: 2 :: 2:.....
 A. 6 B. 4 C. 1 D. 5

One is multiple of two. Similarly two is the multiple of four. Therefore the answer is 'B'.

A	B ✓	C	D
---	-----	---	---

11. 3: 5 :: 11:.....
 A. 12 B. 13 C. 14 D. 15
12. 6: 25 :: 3:.....
 A. 6 B. 12 C. 15 D. 9
13. 1: 6 :: 7:.....
 A. 12 B. 13 C. 11 D. 14
14. 10: 20 :: 18:.....
 A. 26 B. 36 C. 46 D. 32
15. 4: 5 :: 8:.....
 A. 6 B. 7 C. 5 D. 9
16. 12: 72 :: 6:.....
 A. 58 B. 36 C. 46 D. 52
17. 12:4 :: 24:.....
 A. 6 B. 10 C. 8 D. 12
18. 28:22 :: 46:.....
 A. 40 B. 38 C. 42 D. 29
19. 49: 7 :: 4:.....
 A. 16 B. 8 C. 2 D. 12
20. 48:8 :: 18:.....
 A. 8 B. 4 C. 2 D. 3

TEST-IV VERBAL REASONING

For each question in this section four alternatives are given as A, B, C, and D. Read the questions carefully and mark the answers on the response sheet provided.

Example:

1. Bindu is fatter than Sindhu. Manju is not so fatter than Bindu. Manju and Sandhya are equally fat. Then who among them is the fattest?

A. Manju B. Bindu C. Sindhu D. Sandhya

A	B ✓	C	D
---	-----	---	---

1. Appu sings better than Chippu. Devan can't sing as good as Kannan. Kannan can sing better than Appu. Who is the singer among them?

A. Appu B. Kannan C. Chippu D. Devan

2. Raman is walking behind Rama. Ramani is walking behind Rama but in front of Raman. Raju is walking in front of Ramani. Then who is walking behind everybody?

A. Raman B. Ramani C. Rama D. Raju

3. 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

4. Ramya cannot dance as Bhavya. Divya can dance, better than Bhavya. Vidhya's performance in dance is better than Divya. Then who is the top dancer?

A. Divya B. Bhavya C. Ramya D. Vidya

5. If son of Mohanan is the father of Deepak. What is the relationship between Deepak and Mohanan?

A. Son B. Brother C. Nephew D. Grandson

6. Rafeeq has better sight power than Muneer. Shameer have less sight to that of Sudheer. Sudheer doesn't have sight as that of Rafeeq. Who among these have more power of sight?
- A. Sudheer B. Shameer C. Rafeeq D. Muneer
7. If two persons have completed a job within 10 days, what amount of job one can do in one day?
- A. $\frac{1}{2}$ B. $\frac{1}{5}$ C. $\frac{1}{10}$ D. $\frac{1}{20}$
8. If the sound of a gunfire takes 2 minutes to reach from place A to place B, how much time the sounds of five gunfire will take to reach from place A to B?
- A. 10 minutes B. 2 minutes C. 4 minutes D. 5 minutes
9. Sharmila is younger than Mala. Kunjan and Nanda are of the same age. Sudheesh is younger than Nanda and elder than Sharmila. Mala is not as old as Sudheesh. Then who is the eldest one?
- A. Sudheesh B. Mala C. Sharmila D. Kunjan
10. There are 70 students in a queue for remitting the fees. If the place of Mohan is 54th from the window how many students are there behind Mohanan?
- A. 15 B. 16 C. 17 D. 18
11. If South-West is North, What will be the North-East?
- A. West B. South west C. East west D. South
12. A is the son of B. B and C are sisters. D is the mother of C and E is the son of D. Then, which is right among the following?
- A. E is the uncle of A
B. C and E are brother and sister
C. C is the grandmother of A
D. A and E are brothers.
13. There are 80 employees in a company in which $\frac{1}{4}$ of them have a car $\frac{1}{2}$ of them have scooter and $\frac{1}{10}$ of them have both car and scooter. Then how many of them are there without a car or scooter?
- A. 12 B. 32 C. 30 D. 28

14. In a class having a strength of 51 students, the rank of Akhil is 21st. When count from the least ranked student, which will be the rank of Akhil?
- A. 12 B. 30 C. 31 D. 35
15. A person started his journey from the place, X. After walking 4 miles towards east he turned left and again walked 5 miles. Then he turned left and walked two miles. Then, to which direction now he is walking?
- A. North B. West C. East D. South
16. F is the brother of A and C is the daughter of A. K is the sister of F and G is the brother of C. Among them who is uncle of 'G'.
- A. F B. C C. K D. A
17. Jinu is two years elder than Vinu and have three times the age of Minu? If, the ; sum of the age of 3 persons is 27, what is the age of Jinu?
- A. 5 B. 3 C. 9 D. 10
18. If the place of X, who is standing in a queue in front of a Maveli store, from the front is 22 and from the back is 28. How many persons are there in the queue?
- A. 49 B. 52 C. 50 D. 54
19. A is longer than B and B is shorter than X. X and Y are of the same length. If Z is longer than A, who is the shortest one?
- A. X B. Y C. A D. B
20. If father of Syam is the son of Sajjay, what is the relationship; between Syam and Sajjay.
- A. Son B. Grandson C. Brother D. Nephew

TEST- V COMPREHENSION

In this section, for every question, some statements are given. Four alternatives are given for every question as A, B, C and D. Read the statements carefully and find out the answers and mark it on the answer sheet provided.

Example:

Satheesh have two sons. A and B and two daughters C and D. Shyama have two children X and Y. Manoj have two children namely E and F and they are employed in a company. A and D are married. X married C and F married A. Manoj is the brother of Shyama.

Question:

1. What is the relationship between X and E?
- A. Father and Son B. Brother and Sister
C. Cousins D. Father and daughter

A	B	C ✓	D
---	---	-----	---

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.
1. Who have education and honesty, but is not employed?
A. W B. X C. Y D. Z
2. Who is honest, educated and employed?
A. W B. X C. Y D. Z
3. Who is honest and employed but does not have education?
A. W B. X C. Y D. Z
4. Who have education and humility, yet not with honesty and employment.
A. W B. X C. Y D. Z
5. Who doesn't have education, even if he is humble, honest and employed.
A. W B. X C. Y D. Z

- 2) Dinesh have a daughter namely A and two sons namely B and C. Shyam have two sons namely P and Q and a daughter R. P and C are married and they have two sons, M and N. Rohit is the father of both S and T. T and B are married and they have two daughters D and E and a son G.
6. What is the relationship between Q and N.
A. Father B. Grand father C. Uncle D. Son
 7. What is the relationship between Dinesh and E?
A. Grand father B. Uncle C. Father D. Son
 8. What is the relationship between M and R?
A. Mother B. Daughter C. Niece D. Aunt
 9. What is the relationship between B and G?
A. Daughter B. Mother C. Aunt D. Niece
 10. What is the relationship between E and S?
A. Grand son B. Uncle C. Niece D. Father
3. If $5^2 + 8 = 25 + 8 = 33$
11. $4^2 + 8 = ?$
A. 16 B. 20 C. 24 D. 12
 12. $4^2 + 1 = ?$
A. 17 B. 12 C. 8 D. 9
 13. $5^2 + 5 = ?$
A. 20 B. 30 C. 24 D. 12
 14. $6^2 + ? = 108$
A. 72 B. 30 C. 15 D. 25
 15. $?^2 + 9 = 109$
A. 50 B. 25 C. 20 D. 10
- 4) U, V, W, X, Y and Z are the members of a home. One among them is a foot ball player and another one, a chess player. The third person is a cricket player. U and X are unmarried women and they do not participate in any game. No women are engaged in playing football or in cricket. Z is the husband of a married couple. V, the brother of W is not a chess player or a cricket player. Y, is the friend of 'V' and a cricket player.

16. Who is the football player?
A. X B. U C. Y D. Z
17. Who is the chess player?
A. U B. V C. W D. X
18. Who is the wife of 'Z'?
A. W B. V C. U D. Y
19. Who are the ladies?
A. UXV B. VYX C. XZY D. UVW
20. Who are the gents?
A. XUY B. UXV C. XYZ D. WXZ

Appendix V D

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

VERBAL GROUP OF INTELLIGENCE

RESPONSE SHEET

Name:

Class:

Age:

School:

Boy/Girl

Sl. No.	ANSWERS				Sl. No.	ANSWERS				Sl. No.	ANSWERS				Sl. No.	ANSWERS				Sl. No.	ANSWERS			
1	A	B	C	D	1	A	B	C	D	1	A	B	C	D	1	A	B	C	D	1	A	B	C	D
2	A	B	C	D	2	A	B	C	D	2	A	B	C	D	2	A	B	C	D	2	A	B	C	D
3	A	B	C	D	3	A	B	C	D	3	A	B	C	D	3	A	B	C	D	3	A	B	C	D
4	A	B	C	D	4	A	B	C	D	4	A	B	C	D	4	A	B	C	D	4	A	B	C	D
5	A	B	C	D	5	A	B	C	D	5	A	B	C	D	5	A	B	C	D	5	A	B	C	D
6	A	B	C	D	6	A	B	C	D	6	A	B	C	D	6	A	B	C	D	6	A	B	C	D
7	A	B	C	D	7	A	B	C	D	7	A	B	C	D	7	A	B	C	D	7	A	B	C	D
8	A	B	C	D	8	A	B	C	D	8	A	B	C	D	8	A	B	C	D	8	A	B	C	D
9	A	B	C	D	9	A	B	C	D	9	A	B	C	D	9	A	B	C	D	9	A	B	C	D
10	A	B	C	D	10	A	B	C	D	10	A	B	C	D	10	A	B	C	D	10	A	B	C	D
11	A	B	C	D	11	A	B	C	D	11	A	B	C	D	11	A	B	C	D	11	A	B	C	D
12	A	B	C	D	12	A	B	C	D	12	A	B	C	D	12	A	B	C	D	12	A	B	C	D
13	A	B	C	D	13	A	B	C	D	13	A	B	C	D	13	A	B	C	D	13	A	B	C	D
14	A	B	C	D	14	A	B	C	D	14	A	B	C	D	14	A	B	C	D	14	A	B	C	D
15	A	B	C	D	15	A	B	C	D	15	A	B	C	D	15	A	B	C	D	15	A	B	C	D
16	A	B	C	D	16	A	B	C	D	16	A	B	C	D	16	A	B	C	D	16	A	B	C	D
17	A	B	C	D	17	A	B	C	D	17	A	B	C	D	17	A	B	C	D	17	A	B	C	D
18	A	B	C	D	18	A	B	C	D	18	A	B	C	D	18	A	B	C	D	18	A	B	C	D
19	A	B	C	D	19	A	B	C	D	19	A	B	C	D	19	A	B	C	D	19	A	B	C	D
20	A	B	C	D	20	A	B	C	D	20	A	B	C	D	20	A	B	C	D	20	A	B	C	D

Appendix V E

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION
VERBAL GROUP TEST OF INTELLIGENCE

SCORING KEY

TEST 1		TEST 2		TEST 3		TEST 4		TEST 5	
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	D	7	A
8	D	8	A	8	B	8	B	8	D
9	C	9	B	9	C	9	D	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	C	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 VI A

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

LEARNING STRATEGY SCALE

(FINAL)

Dr. P.K. Sudheesh Kumar

Reshma. P.T.

നിർദ്ദേശങ്ങൾ: താഴെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനൾ ശ്രദ്ധാപൂർവ്വം വായിക്കുക. അവ നിങ്ങളുടെ പഠനസ്വഭാവവുമായി ബന്ധമുള്ളതാണ്. ഓരോ പ്രസ്താവനയും നിങ്ങളെ സംബന്ധിച്ചിടത്തോളം എത്രമാത്രം ശരിയാണെന്ന് തീരുമാനിക്കുക. നിങ്ങളുടെ തീരുമാനം അഞ്ചു തരത്തിലാകാം. (1) എല്ലായ്പ്പോഴും ശരിയാണ് (2) ശരിയാണ് (3) തീരുമാനമില്ല (4) തെറ്റാണ് (5) എല്ലായ്പ്പോഴും തെറ്റാണ്. പ്രതികരണം രേഖപ്പെടുത്താൻ പ്രത്യേകം തന്നിട്ടുള്ള കടലാസ്സിൽ നിങ്ങളുടെ തീരുമാനം ഏതാണോ അതിനു താഴെയുള്ള വൃത്തത്തിൽ 'x' അടയാളമിടുക. എല്ലാ പ്രസ്താവനയ്ക്കും പ്രതികരണം രേഖപ്പെടുത്താൻ പ്രത്യേകം ശ്രദ്ധിക്കുക.

1. ഒരു പ്രത്യേക കാര്യം പഠിക്കുന്നതിനു പിന്നിലെ ഉദ്ദേശത്തെക്കുറിച്ച് ഞാൻ ചിന്തിക്കാറില്ല.
2. പഠനപ്രക്രിയയെക്കുറിച്ച് മുൻകൂട്ടി ഒരു രൂപരേഖ ഞാൻ തയ്യാറാക്കാറുണ്ട്.
3. പഠിക്കേണ്ടതെന്താണെന്ന് തിരിച്ചറിഞ്ഞുകഴിഞ്ഞാൽ അവ മുമ്പ് പഠിച്ച സമാന ആശയങ്ങളുമായി ഞാൻ ബന്ധപ്പെടുത്താറുണ്ട്
4. പഠനവസ്തു എനിയ്ക്കറിയാവുന്ന പഠനാനുഭവങ്ങളുമായി എങ്ങനെ ബന്ധപ്പെട്ടിരിക്കുന്നു എന്നതിനെക്കുറിച്ച് എനിയ്ക്ക് യാതൊരു ധാരണയുമില്ല.
5. പഠനവസ്തുവിലെ ഏതെങ്കിലും കാര്യങ്ങൾക്കാണ് കൂടുതൽ ശ്രദ്ധ കൊടുക്കേണ്ടതെന്ന് മുൻകൂട്ടി തീരുമാനിയ്ക്കാറുണ്ട്.
6. പാഠഭാഗത്തിലെ ഏതെല്ലാം ആശയങ്ങൾക്ക് ഊന്നൽ നൽകി പഠിക്കണമെന്ന് മുൻകൂട്ടി തീരുമാനിക്കാറില്ല.
7. അദ്ധ്യാപകർ പറഞ്ഞുതരുന്ന പാഠഭാഗങ്ങൾ എല്ലാം എനിയ്ക്ക് മനസ്സിലാകാറുണ്ടോ എന്ന് ഞാൻ സ്വയം വിലയിരുത്താറില്ല.
8. ദുരുഹമായ പാഠഭാഗങ്ങളുടെ അവ്യക്തതയുടെ കാരണങ്ങളെക്കുറിച്ച് എനിയ്ക്ക് നല്ല ധാരണയുണ്ട്.
9. പാഠഭാഗങ്ങൾ പഠിച്ചതിനുശേഷം ഹൃദിസ്ഥമായോ എന്നറിയാൻ എഴുതിനോക്കാറുണ്ട്
10. വായിക്കുമ്പോൾ പ്രധാന ആശയങ്ങൾ തമ്മിൽ ബന്ധപ്പെടുത്തി ഞാൻ സ്വയം വിലയിരുത്താറില്ല.
11. പഠനത്തിന്റെ പൂർണ്ണതയ്ക്കായി ഞാൻ നിഘണ്ടു ഉപയോഗിക്കാറില്ല.

12. ടെലിവിഷനിലൂടെയും റേഡിയോവിലൂടെയും ഉള്ള വിദ്യാഭ്യാസപരിപാടികൾ ഞാൻ ശ്രദ്ധിക്കാറില്ല.
13. പഠിക്കാനും ഓർക്കാനും ബുദ്ധിമുട്ടനുഭവപ്പെടാറുള്ള വസ്തുതകളെ ഞാൻ എന്റേതായ ചില മാനദണ്ഡങ്ങളിലൂടെ തരംതിരിച്ച് പഠിക്കാറുണ്ട്.
14. സമാനമായ ആശയങ്ങളും തത്വങ്ങളും അവയുടെ പ്രാധാന്യമനുസരിച്ച് തരംതിരിക്കാൻ എനിക്ക് സാധിക്കാറില്ല.
15. വസ്തുതകളുടെ സാമ്യവും വ്യത്യാസവും അടിസ്ഥാനമാക്കി അർത്ഥവത്തായ അനുമാനങ്ങളിലെത്താൻ എനിക്ക് കഴിയാറില്ല.
16. പാഠഭാഗവുമായി ബന്ധപ്പെട്ട വസ്തുതകൾ മനസ്സിലാക്കുമ്പോൾ അവയിലൂടെ എത്തിച്ചേരുന്ന ആശയങ്ങളെ എനിക്ക് അനുമാനിയ്ക്കാനാകും
17. മുൻപരിചയമുള്ള വസ്തുക്കളുമായി ബന്ധപ്പെട്ടവ പഠിയ്ക്കുമ്പോൾ കൂടുതൽ മനസ്സിലാക്കാൻ കഴിയാറുണ്ട്.
18. അറിയാത്ത കാര്യങ്ങൾ പഠിയ്ക്കുമ്പോൾ അറിയുന്നവയുമായി എങ്ങനെ ബന്ധപ്പെടുത്താമെന്ന് ഞാൻ ചിന്തിക്കാറില്ല.
19. പുതിയ കാര്യം പഠിക്കുമ്പോൾ അറിയാവുന്ന ചില വിവരണവുമായി അവ ബന്ധപ്പെടുത്തി പഠനവസ്തുവിലെ അർത്ഥം ഗ്രഹിയ്ക്കാനും മനസ്സിലുറപ്പിക്കാനും ശ്രമിക്കാറുണ്ട്.
20. പാഠഭാഗങ്ങൾ തമ്മിലുള്ള പരസ്പരബന്ധം മനസ്സിലാക്കി ആശയങ്ങൾ കൂടുതൽ വികസിപ്പിയ്ക്കുവാൻ എനിക്ക് കഴിയാറില്ല.
21. പാഠഭാഗത്തിൽ നിന്നുരുത്തിരിഞ്ഞ മർമ്മപ്രധാനമായ ആശയങ്ങളും പദങ്ങളും പഠനസമയത്ത് കുറിച്ചുവെയ്ക്കാറുണ്ട്.
22. അദ്ധ്യാപകർ ക്ലാസ്സിൽ പറയുന്ന കാര്യങ്ങൾ ചുരുക്കി എഴുതിയെടുക്കുന്ന സ്വഭാവം എനിക്കില്ല.
23. ക്ലാസ്സിൽ പഠിപ്പിക്കുന്ന ചില കാര്യങ്ങൾ രേഖാചിത്രങ്ങളിലൂടെ പഠിയ്ക്കുമ്പോൾ എളുപ്പത്തിൽ മനസ്സിലാവാറുണ്ട്.
24. പഠനസമയത്ത് കേന്ദ്ര ആശയത്തെ ഞാൻ മനസ്സിൽ കാണാറില്ല.
25. തുടർച്ചയായ പഠനം എന്നെ മാനസികമായി തളർത്തുമ്പോൾ പഠിച്ച കാര്യങ്ങൾ എന്നോടു തന്നെ പറഞ്ഞ് പഠനപുരോഗതി ഉറപ്പിയ്ക്കാറുണ്ട്.
26. പഠനം ദുഃഖമുണ്ടാക്കുമ്പോൾ ഹാസ്യകഥകൾ ഞാൻ വായിയ്ക്കാറില്ല.
27. ക്ലാസ്സിൽ വ്യക്തമാവാത്ത കാര്യങ്ങൾ കൂട്ടുകാരോടോ രക്ഷിതാക്കളോടോ ചോദിച്ച് ഞാൻ മനസ്സിലാക്കാറുണ്ട്.
28. പഠിയ്ക്കുമ്പോൾ അവ്യക്തമായി തോന്നുന്ന കാര്യങ്ങൾ കൂട്ടുകാരുമായി ചർച്ച ചെയ്യാറില്ല.
29. ഒരു പഠനപ്രശ്നം പരിഹരിക്കേണ്ടിവരുമ്പോൾ സുഹൃത്തുക്കളുമൊത്തുള്ള ഒരു പ്രവർത്തനരീതിയാണ് എന്റേത്.
30. പഠനത്തെ ബാധിക്കുന്ന പ്രശ്നങ്ങൾ പരിഹരിയ്ക്കുന്നതിന് ഞാൻ കൂട്ടുകാരുമായി സഹകരിയ്ക്കാറില്ല.

Appendix VI B

**UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION**

**LEARNING STRATEGY SCALE
RESPONSE SHEET**

(FINAL)

വിദ്യാർത്ഥിയുടെ പേര്:.....

ക്ലാസ്സ്:.....

സ്കൂൾ:.....

ആൺകുട്ടിയോ/പെൺകുട്ടിയോ.....

ക്രമനംപർ	എല്ലാ യപ്പോഴും ശരിയാണ്	ശരിയാണ്	തീരുമാന മിട്ടിട്ടു ണ്ടെന്ന്	എല്ലാ യപ്പോഴും തെറ്റാണ്	ക്രമനംപർ	എല്ലാ യപ്പോഴും ശരിയാണ്	ശരിയാണ്	തീരുമാന മിട്ടിട്ടു ണ്ടെന്ന്	എല്ലാ യപ്പോഴും തെറ്റാണ്
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	16	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	17	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	18	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	19	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	20	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	21	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	22	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	23	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	24	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	25	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	26	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	27	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	28	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	29	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	30	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix VI C

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION LEARNING STRATEGY SCALE

(FINAL)

Dr. P.K. Sudheesh Kumar

Reshma. P.T

DIRECTIONS: Read the statements given below carefully. They are related with your learning behaviours. Decide to what extent each statement is correct according to you. Your decision can be of five types (1) Always Correct (2) Correct (3) Undecided (4) Incorrect (5) Always Incorrect. Mark 'X' in the circle below your decision in the sheet given for marking response. Try to mark response for all statements.

1. I don't think about the aim behind studying a particular thing.
2. I prepare a plan of learning activities in advance.
3. Once I identified what are to be studied, I relate them with similar ideas which I have studied before.
4. I don't have any idea of how my learning experiences are related to things to be studied.
5. I decide in advance which part of the study material is to be given more focus.
6. It is not decided in advance which ideas of the lesson should be given emphasis.
7. I don't assess whether I understand every portions explained by the teachers.
8. I do have a thorough understanding about the reasons for the vagueness of obscure portions.
9. After studying the portions, I write them down to check if I have byhearted them.
10. While reading, I don't self-evaluate, correlating the main ideas together.
11. I don't use dictionary for the completion of my study.
12. I attend to the educational programmes on radio and T.V.
13. Using my own standardisations, I classify and study the facts which are difficult to learn and memorise.
14. I can't classify similar ideas and principles in accordance to their importance.

15. I can't get at a hypothesis on the basis of the similarity and difference of the facts.
16. While understanding the facts related to portions, I can guess the ideas which is attained through such facts.
17. When I study certain facts related to materials which I already know, it is easier for me.
18. When I study new things I don't think how to relate it with known things.
19. When I study a new thing, I try to realise the meaning by relating them with some known descriptions.
20. I am not able to expand the idea by interrelating different study parts.
21. I note down the important ideas and words in lessons while studying.
22. I am not in a habit of taking down lecture notes.
23. It is easier for me when teachers teach using diagrams.
24. While studying I don't think about the main idea.
25. While continuous hours of study make me mentally weak, I assure progress in study by recollection.
26. I don't read humorous stories while I am unhappy due to learning.
27. I try to understand the study portions with the help of friends and parents.
28. I don't discuss with my friends, the portions which are not clear to me.
29. It is my habit to work with my friends to solve a learning problem.
30. I don't cooperate with my friends to solve learning problems.

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Appendix VI D

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

LEARNING STRATEGY SCALE RESPONSE SHEET

(FINAL)

Name of the pupil: Class:

School: Boy/Girl:.....

Serial No.	Always Correct	Correct	Undecided	Incorrect	Always incorrect	Serial No.	Always Correct	Correct	Undecided	Incorrect	Always incorrect
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	16	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	17	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	18	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	19	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	20	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	21	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	22	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	23	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	24	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	25	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	26	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	27	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	28	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	29	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	30	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix VII B

UNIVERSITY OF CALICUT DEPARTMENT OF EDUCATION

SOCIO-ECONOMIC STATUS SCALE

Instructions:

Read the questions carefully given below and write down the answers wherever necessary. Put a tick mark (✓) against the correct answers, where the answers are given.

1. Name:
2. Boy/Girl:
3. School/Institution:
4. Date:
5. The informations about the family members can be indicated in the column given below from 1 to 9. Put a tick mark (✓) in the necessary columns.

Members	Illiterate	Std. I to IV	Std. V to VII	Std. VIII to X	Pre University, Pre Degree, TTC, Intermediate	BA., BSc., B.Com, Engg. Diploma etc.	MA, MSc, M.Ed, BL, B.Sc (Engg), MBBS., BSc., (Tech) Ph.D, etc.	If any occupation the name of the occupation	Monthly Income
	1	2	3	4	5	6	7	8	9
Father (Guardian)									
Mother									

NB 5316

