CHAPTER IV

METHODOLOGY

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4.1 INTRODUCTION

Methodology includes the description of the techniques or methods and the tools the researcher has used for collecting, organizing, analyzing and interpreting data. It gives a detailed description of the research variables and procedures. Also the accuracy and adequacy of the research findings depend upon the appropriateness of the method followed. Development of new research methodologies especially research synthesis, may enable researchers to identify those educational theoretical frameworks which have sustained empirical evidence. Thus, a study should be formulated to best suit the nature of the problem under investigation, objectives of the study, resources available, characteristics of the population and expected precision and quality.

Methodology is a highway of vibrant and throbbing processes whereby hazy sets of assumptions get transformed into a clear cut blue print where-in the phenomenon under investigation is approached systematically through a series of calculated measures and procedures.

The objective of the present study is to develop a Peer Tutoring Model and testing its effectiveness in Mathematics at secondary level. Accordingly, the 8th standard students from various schools of Kerala who followed state syllabus are the target population of the study. Here the details of methodology adopted for the study are described under the following major heads.

4.2 Method adopted

4.3 Research design

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4.5 Sample selected for the study
4.6 Tools and materials used for the collection of data
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4.8 Statistical techniques used for analysis

4.2 METHODOLOGIES ADOPTED

Method in research is sequential steps adopted in studying a problem with certain objectives. The success of any research depends upon the suitability of method adopted. A qualitative and quantitative procedure is necessary to collect the needed data. In research different methods are used. The suitability of a particular method of study depends on the purpose and scope of the study. The decision about the method or methods to be employed always depends upon the nature of the selected problem and kind of data needed for its solution.

There are many methods which are commonly used for educational research. They are the Historical method, Normative Survey method, Experimental method, Scientific method etc. Above all 'Experimental method' is systematic and logical method of hypothesis testing under carefully controlled conditions, and 'Survey method in Education' describes procedures for the collection of information associated with education (Kothari, 2005). This information is used to extend understanding of educational issues and to assist in the development of educational policy. In the present study, the investigator adopted Experimental-cum-Survey method to compare the effectiveness of peer tutoring strategy with the prevailing approach.
4.3 RESEARCH DESIGN

In the experimental method, the investigator has to follow an experimental design. This is the blue print of the procedures that enable the researcher to test hypothesis. In the present study the pre-test–post-test nonequivalent group design is used. This design is often used in classroom experiments when experimental and control groups are such naturally assembled groups as inact classes, which may be similar (Best & Khan, 1999). Hence, without disturbing the natural settings of the classrooms, intact class groups; which are normally non-equated are selected for the study. These non-equivalent class groups are later statistically equated by applying appropriate statistical techniques.

![Fig: 4.1 Diagrammatic Representation of Modus Operandi](image)
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The present study has been designed with the objective to test the Peer tutoring model in Mathematics at secondary level. One major chapter of Std.VIII Mathematics was arranged as learning units. The investigator herself taught the control group and the selected tutees taught the experimental group.

4.4 VARIABLES OF THE STUDY

The independent, dependent and controlled variables involved in the study are given in Table 4.1.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>Controlled Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Peer tutoring</td>
<td>1. Achievement</td>
<td>1. Subject taught</td>
</tr>
<tr>
<td>Strategy</td>
<td>2. Mathematics</td>
<td>2. SES</td>
</tr>
<tr>
<td></td>
<td>5. Multiple Intelligence</td>
<td></td>
</tr>
</tbody>
</table>

4.5 SAMPLE SELECTED FOR THE STUDY

In any research the study of total population is not possible due to practical limitations of time, cost and other factors. Sample is a small portion of population for observation and analysis. The purpose of sampling is to gain information about a population, rarely is a study conducted that includes the total population of interest as subjects (Gay, 1996).
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The sample selected for the study comprised of 400 numbers of students of standard VIII selected from seven schools coming under three districts of Kerala-Thiruvananthapuram, Kollam and Pathanamthitta. While selecting the sample, due representation was given to variables like sex, locality, SES and other variables.

As it was difficult to get two equivalent groups, one of the groups was randomly taken as experimental group and the other as control group.

Distribution of the Sample

The distribution of the sample selected for the study is given in Table 4.2.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of Institution</th>
<th>Type</th>
<th>Treatment</th>
<th>No.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Govt.H.S.S, Thattathumala, Tvm (Dist)</td>
<td>Rural</td>
<td>Experimental</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Government</td>
<td>Control</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>R.R.V.H.S, School, Kilimanoor, Tvm (Dist)</td>
<td>Rural</td>
<td>Experimental</td>
<td>26</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Management</td>
<td>Control</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Govt.H.S.S, Pettah, Tvm (Dist)</td>
<td>Urban</td>
<td>Experimental</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Government</td>
<td>Control</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Govt.H.S.S, Murinjakal, Pathanamthitta (Dist)</td>
<td>Urban</td>
<td>Experimental</td>
<td>26</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Government</td>
<td>Control</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Govt.H.S.S, Kadakkal, Kollam (Dist)</td>
<td>Rural</td>
<td>Experimental</td>
<td>30</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Government</td>
<td>Control</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>C.P.H.S.S, Kadakkal, Kollam (Dist)</td>
<td>Rural</td>
<td>Experimental</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Management</td>
<td>Control</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MarBasellious, H.S.S, Kottarakkara, Kollam (D)</td>
<td>Urban</td>
<td>Experimental</td>
<td>30</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Management</td>
<td>Control</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

As part of the qualitative study, a sample of 50 teachers including educational experts was considered.
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4.6 TOOLS AND TECHNIQUES FOR COLLECTION OF DATA

For all types of research the investigator needs certain instruments to gather new and unknown data for the study. These instruments thus employed as means for data collection are called tools. The success of a research study depends mostly on the nature of the techniques and tools used. A large number of tools and techniques are available for data collection in research. In the present study the investigator prepared a model for testing peer tutoring in Mathematics at secondary level in consultation with the previous investigators, experts in the field of education and the supervising teachers.

The tools and techniques used in the present study are:

1. Kerala Self Concept Scale
2. Kerala Scale of Achievement Motivation
3. Mathematics Interest Inventory
4. Multiple Intelligence Inventory
5. Strategy Evaluation Proforma (Peer Tutoring)
6. Format for Tutors’/Tutees’ Diary.
7. Participant Observation Schedule for Researchers/Teachers
9. Lesson Designs Based on Prevailing Teaching Method.
10. Achievement Test in Mathematics
4.6.1 First Term Markas Pre-Scores

The marks scored by pupils in terminal examination in all the selected schools are taken as pre-scores for grading the pupils in terms of their achievement. A simple prescriptive pre-test at the beginning of the school year, or the screening tests conducted periodically throughout the year, is the option to establish a student skill base line. From a pre-test, a plan can be written containing the learning objectives that the student need to master.

Since the school terminal examinations are conducted by covering the quite similar content areas and also it maintains equal administration standards, the marks scored by the pupils in terminal examinations can be taken as pre-scores.

4.6.2 The Kerala Socio-Economic Scale

The Socio-Economic Scale (SES) developed by the University of Kerala (Nair, 1973) is a popular research tool, which measures socio-economic status. It measures the individual’s Father’s education level, Father’s occupation level and Father’s income level. An equal weightage is given for Mother’s education level, Mother’s occupation level and Mother’s income level.

The income levels were slightly modified, with respect to the response collected, according to the latest income ratings.

The tool is in the form of a questionnaire, which in addition to obtaining data for quantifying socio-economic status, is also of help in personal information relating to each subject. Parent’s education level, parent’s occupation level, parent’s income level, and hence socio-
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economic status has been determined by quantifying the data, giving weightages as described in the Table 4.3.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent’s Education Level</td>
<td>(1) M.A/M.SW/M.Com/M.B.B.S/M.Ed/</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>B.Tech/L.L.B etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) B.A/B.Sc/B.Com/Diploma in Engg. etc.</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>(3) Pre-university/Pre-degree/T.T.C/I.T.I etc.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(4) Standard VIII to X</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(5) Standard I to VII</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(6) Illiterates</td>
<td>0</td>
</tr>
<tr>
<td>Parent’s Occupation Level</td>
<td>(1) High professional</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(2) Semi professional</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>(3) Skilled</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>(4) Semi skilled</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(5) Unskilled</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(6) Unemployed</td>
<td>0</td>
</tr>
<tr>
<td>Parent’s Income Level</td>
<td>(1) Above Rs.15000 /month</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(2) Rs.9001 to Rs.15000/month</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(3) Rs.4501 to Rs.9000/month</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(4) Rs.1501 to Rs.4500/month</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(5) Upto Rs1.500/month</td>
<td>1</td>
</tr>
</tbody>
</table>
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The procedure of quantifying 'Father’s Occupation Level' is given below.

**High Professionals:**-

Ministers, Judges, Bank Executives and Officials, Doctors, Engineers, Lawyers, University Teachers, Heads of Research Organizations, Heads of Government Departments, Secretaries of Government, Big Landlords, Business Executives etc., belong to this category and a '10 point' score was allotted to this category.

**Semi-Professionals:**-

Chemists, Druggists, Qualified Nurses, Managers, Superintendent of Offices, Small scale Business Man, Contractors, Small Landlords, Sub Inspectors of Police, Sub-Registrars, Assistant Education Officers, Block Development Officers, Officers of Sub District Level, Public Health Workers, High School and Higher Secondary School Teachers etc. come under this category and they were assigned a '9 point' score.

**Skilled:**-

Mechanics, Fitters, Electricians, Drivers, Photographers, Laboratory assistants, Carpenters, Document Workers, Clerks, Head Constables, Primary School Teachers, Factory Machine Operators, Village Officers etc. fall under this category and they were assigned a '8 point' score.
Semi-Skilled:-

Farmers, Small-scale merchants, Library attenders, Police constables etc. belong to this category and they were assigned a '5 point' score.

Unskilled:-

Coolies, Ordinary Labourers, Watchmen, Peons etc. are from unskilled groups. A '3 point' score was assigned to this group.

Unemployed:-

Those who have no work at all. No weightage was assigned to this category (zero score). Summated score for parent’s education level, parent’s occupation level and parent’s income level (with equal weightage given for both) is taken as the score for 'socio-economic status' of an individual.

4.6.3 Self-Concept Scale

The variable was measured using the Kerala self-concept scale, standardized by Nair(1976). This scale, a self-report inventory, standardized for cultural samples from South India. The test contains sixty items grouped in pairs and divided into two sections A and B. For each item in section A, there is an equivalent item in section B. The subjects are asked to enter their responses by marking against any one of its five entries marked 'A', 'B', 'C', 'D' or 'E' in the response sheet. Here 'A' stands for 'Strongly agree', 'B' stands for 'Agree', 'C' stands for 'Neutral', 'D' stands for 'Disagree' and 'E' for 'Strongly disagree'. The score for each item in Section A is compared with score in section B. The difference is computed using appropriate procedures.
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Each item in section A represents an individual’s perception of ideal self. Two examples are given below from section A.

(i) I wish, if my parents had been the most influential people in our locality.

(ii) I wish, if I could be the most popular student in my class.

The matching items in section B for these two items are the following:

(i) My parents are the most influential people in our locality.

(ii) I am the most popular student in my class.

Item '1' in section A represents the ideal concept of the individual with respect to the influence that his parents can wield in the locality. Item '1' in section B represents the actual concept of the individual about actual influence that his parents wield in the locality. The individual by ticking in one of the categories (A, B, C, D, E) is getting a score for his perception of the ideal self and real self. The responses for each item can be scored according to the scheme given below.

<table>
<thead>
<tr>
<th>Rating</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Theoretically the score for the 'ideal self' cannot exceed the score for the 'real self'. When the difference is small, it represents a higher self-concept as compared with larger difference. The maximum possible difference is '4'. This represents the lowest score of an item with respect to self-concept. Each difference is subtracted from '4' (the
maximum possible difference) to obtain a positive self-concept score for each item. This procedure helps to express a higher self-concept in terms of higher scores and vice versa.

All the item scores are summated to obtain the total score of the whole test.

4.6.3 (a) Reliability and Validity

The test manual provides evidence of the test’s reliability and validity. The reliability of the scale has been found in two methods the split-half reliability coefficient for the scale, as reported in the test manual, is 0.74 (N=100). The test-retest reliability coefficient for the scale is 0.83 (N=56). The coefficient quoted above indicates that the scale is a reasonably valid and reliable instrument for measuring the self-concept.

The validity of the scale has been estimated against a 'semantic differential scale' of self-concept (translated version of the Osgood model developed for another research study) as external criterion. The resulting correlation was 0.48 (N=56), showing that the scale is a reasonably valid measure of self-concept. Sample test is given in Appendix 1.

4.6.4 Achievement Motivation Scale.

The Kerala scale of achievement motivation developed by Nair (1976) has 60 items in the form of statements and is standardized to measure the level of achievement motivation among Secondary School pupils of Kerala.
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The subjects are to respond to the items by marking either 'Y' (yes), 'U' (undecided) or 'N' (no) on the response sheet supplied. Each 'Y' response carries one credit. There is no time limit for the test. Two illustrative items are:

(i) What others think of me won’t be an obstacle to my success in life.
(ii) I feel tired when I have to perform very important things.

4.6.4 (a) Reliability and Validity

The test-retest reliability of the scale is 0.73 (N=56) and the split-half reliability coefficient for the scale is 0.82. The test has been validated against the total achievement of students of Secondary School classes as external criterion. Details of validity are:

With school marks of standard VIII as external criterion, validity is 0.33 (N = 47).

With school marks of standard IX as external criterion, validity is 0.44 (N = 38).

With school marks of standard X as external criterion, validity is 0.39 (N = 42).

A copy of the test is given as Appendix 2

4.6.5 Mathematics Interest Inventory

An Inventory is usually a sort of standardized questionnaire. They are valuable for measuring such traits as sociability, emotionality, resourcefulness, suggestibility, interest and honesty.
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Interest inventories are devices generally in the form of questionnaires or sentence completion designed to measure the interests of individuals in specific fields. Since the present study is concerned with Mathematics interest of disadvantaged group of students, the investigator found that an interest inventory in this particular area should be an inevitable and the most suggestive tool for this research. While going through the literature related to the topic the investigator came to know about the Mathematics Interest Inventory constructed by Prasanna Kumar (1992) for secondary school pupils, and found that the tool is quite suitable for present study. So the investigator decided to use this interest inventory for collecting the data required for the study.

"Interest Inventories attempt to yield a measure of the types of activities that an individual has a tendency to like and to choose. One kind of instrument has compared the subject’s pattern of interest to the interest patterns of successful practitioners in a number of vocational fields. A distinctive pattern has been discovered to be characteristic of each field. The assumption is that an individual is happiest and most successful working in a field most like his or her own measured profile of interest" (Best & Khan, 1999).

Mathematics Interest Inventory stands for a battery of items useful for eliciting responses indicative of interest in the field of Mathematics. The investigator tries to assess the Mathematical interest of pupil in studying mathematical theories and activities in which Mathematics involves. The investigator while passing through review of related literature came to know about Mathematics Interest Inventory
constructed by Prasanna Kumar for secondary pupils and found that the tool is quite suitable for the present study and a copy is attached in Appendix 3.

4.6.5 (a) Validity of the Mathematics Interest Inventory

Validity of a test is the degree to which a test measures what it proposes to measure, when compared with accepted criteria. Wright stone, Justman and Robbins consider that "validity (of measuring instrument) is that characteristic which indicated the degree to which the instrument measures or provides a diagnosis of the psychological characteristics that it purports to measure".

Content validity, construct validity, curricular validity, concurrent validity, face validity, empirical validity, predictive validity and factorial validity are the various types of validity. In the present study, the investigator used 'Empirical Validity' for determining the validity of the Mathematics Interest Inventory.

For empirical validity, an external criterion was required. The teachers were requested to rate the pupils according to the Mathematics interest on a five-point scale. Then using teacher’s ratings and interest scores a correlation table was prepared.

The correlation between the interest scores and teacher’s ratings was found out by the product moment method using the formula.

\[
X = \frac{\sum x'y' - C_x . C_y}{N \sigma_x . \sigma_y}
\]
The obtained value of x is 0.49, which shows that the prepared inventory has sufficient validity.

4.6.5 (b) Reliability of the Mathematics Interest Inventory

Anastasi (1998) considers the reliability of a test as the consistency of the scores obtained by the same individuals on different occasions or with different sets of equal forms. According to Noll, "Reliability of a test is the consistency with which the test measures whatever it does measure".

There are different methods for determining reliability. The test-retest methods, the parallel form method, the split-half method and the method of rational equivalence are some of them.

The reliability of Mathematics Interest Inventory was found out by the split-half method.

The scores obtained by a group of fifty pupils of standard IX was selected at random and were divided into two equal halves by pooling scores on the odd number of items and the even number of items. A correlation table was prepared.

The Pearson’s Product Moment Coefficient of Correlation was found out from the distribution and the coefficient obtained was 0.69. This is for half the test; and for the whole test Spearman Brown Prophecy formula is used.

\[ R = \frac{2r}{1+r} \]

Where R – reliability of the whole test
r– reliability of half test
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The reliability of the whole test is 0.816. Hence the inventory has very high reliability.

Since the Mathematics Interest Inventory has sufficient validity and reliability the investigator decided to use this interest inventory for collecting the data required for the study. The Mathematics Interest Inventory used in the present study consists of 40 questions. Each question is an appeal to the subjects to choose one alternative from the three alternatives given, supposing that equal facilities are provided to the three alternatives in each question. Naturally one of the three choices is related to and the particular choice scores a point in each of the 40 questions. The rest of the two alternatives gain no points in each case. Thus maximum score possible is 40 points.

4.6.5 (c) Administration of Interest Inventory

The Mathematics Interest Inventory was administered in the experimental group before and after experimentation. The interest inventory consists of two-paged question booklet having 40 multiple-choice items (Given in Appendix IV). The students were provided with answer sheet (Model of answer sheet in Appendix IV) and were asked to put a circle on their choice (A, B or C) as answers. The time allotted was 30 minutes. The answer sheets were collected back and each item is scored by giving one point credit to response related to Mathematics and zero to others. All the points obtained were summed up to get the total score and subjected to statistical analysis.
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4.6.6 Multiple Intelligence Inventory

A survey has been conducted for identifying the multiple intelligence of students through multi-applicability of mathematical skills. The investigator had referred Mc Kenzie’s (1999) Multiple Intelligence Survey for the preparation of the inventory. The term inventory is generally applied as devices which aid a person in studying the interest, attitudes and personality of an individual. Multiple Intelligence Inventory includes 9 sections and copies are attached in Appendix 4.

Section 1 of Multiple Intelligence Inventory deals with Naturalist Strength which includes statements from "Categorizing things by common traits" to "Pick up on subtle differences in meaning".

Section 2 of Multiple Intelligence Inventory deals with Musical Strength which includes statement from "Easily pick up on patterns" to "Remembering song lyrics is easy".

Section 3 of Multiple Intelligence Inventory deals with Logical Strength which includes statement from "Known for being neat and orderly" to "Things have to make sense".

Section 4 of Multiple Intelligence Inventory deals with Existential Strength which includes statement from "It is important to see the role in the 'big picture' of things" to "It is important to feel connected to people, ideas and beliefs".
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Section 5 of Multiple Intelligence Inventory deals with **Interpersonal Strength** which includes statement from "Learn best interacting with others" to "Dislike working alone".

Section 6 of Multiple Intelligence Inventory deals with **Kinesthetic Strength** which includes statement from "Learn by doing" to "Live an active Lifestyle".

Section 7 of Multiple Intelligence Inventory deals with **Verbal Strength** which includes statement from "Foreign languages creates interest" to "Enjoy public speaking and participating in debates".

Section 8 of Multiple Intelligence Inventory deals with **Intrapersonal Strength** which includes statement from "Attitude effects how I learn" to "Willingness to protest or sign a petition to right a wrong".

Section 9 of Multiple Intelligence Inventory deals with **Visual Strength** which includes statement from "Re-arranging a room and re-decorating are fun" to "One can visualize in their mind".

This inventory is based on the concept of Multiple Intelligence which was developed in 1983 by Howard Gardner, a Pennsylvanian Professor of Education at Harvard University. He questioned the idea that intelligence is a single entity, that it results from a single factor, and that can be measured via intelligence question tests. He postulates types of intelligence that permits individuals to solve problems, create products and discover new knowledge in a diverse array of culturally valued activities. The Nine sections in the survey reflect the nine distinct sets of processing operation performed by individuals.
(1) In the present study, the Multiple Intelligence Inventory is used to evaluate the multiple intelligence of students who participated in the peer tutoring program.

(2) Every peer tutoring programme needs competent and resourceful tutors. Even though the achievement test performance of students, previous records in the school, Teacher’s observation etc. give us a picture about the students’ performance, the multiple intelligence survey will be beneficial to have an understanding about the multiple intelligence of the participating students.

(3) The success of tutoring depends largely on the intellectual ability of the tutors. An effective peer tutoring program demands intelligent tutors. The multiple intelligence survey presents a procedure for gathering data pertaining to the intellectual ability of students and this helps to select the tutors.

(4) Since this peer tutoring program is based on developing mathematical competency, the students who score high in sections 3 and 9 are expected to have high mathematical ability. Along with this, as the peer tutoring program is centered around interactions in the social set up, the interpersonal intelligence of the students are also taken into account. Section 5 checks interpersonal intelligence. Those pupils who have high scores in all these three sections were selected as the tutors. The scores of each student were considered while grouping tutees also, i.e., it is made sure that each group of tutees contains certain students having high mathematical ability.
4.6.6.1 Reliability

Reliability of Multiple Intelligence Survey was found by the present investigator on the basis of test-re-test method. The tool was administered twice on a sample of 80 students studying in standard VIII with an interval of one month. The correlation between the two sets of scores was found using Pearson’s Product Moment Correlation Method. The correlation coefficient thus obtained was 0.86. This indicates that the tool is highly reliable.

4.6.6.2 Validity

The validity of Multiple Intelligence Survey was assessed on theoretical basis (Anastasi & Urbina, 1997). Face validity and content validity were specifically considered for this purpose. The tool claims face validity because the component / sections of Multiple Intelligence appear to measure what each was expected to measure. The tool also claims content validity in the sense that each subsection covers the content area. The opinions of five experts were obtained for establishing face validity and content validity.

4.6.6.3 Scoring Method

The score for each subsection of Multiple Intelligence Survey was obtained by counting the number of statements chosen by the respondent. The maximum score of each subsection was 10.
4.6.7 Strategy Evaluation Proforma

An evaluation proforma is a tool with a set of statements that requires the respondent to state their opinions regarding a phenomenon in an authentic manner (Selinger & Shohamy, 1989).

One of the major objectives of the present study is to find out the opinion of the teachers about the peer tutoring. So, the investigator developed a 'Strategy Evaluation Proforma' which was prepared and distributed among the educational experts and secondary school teachers. It was prepared with the intention to collect the opinion of the educational experts and teachers based on all the aspects related to peer tutoring. Optimum care was taken to make it as brief and pin pointed and copies are attached (Appendix 5).

4.6.7.1 Steps in the Construction of the Tool

The major steps followed in the construction of this tool are described under different heads.

1. Planning of the Test
2. Item writing
3. Item Editing
4. Arrangement of items
5. Preliminary try out
6. Pilot study
7. Item analysis
8. Establishing reliability and validity
9. Item selection
10. Final format of test
4.6.7.1.1 Planning of the Test

The areas selected for the study is very important. It makes the study worthwhile and useful. Initially, 60 items were prepared by giving weightage according to the priority of the areas by the investigator. The scale was prepared based on the following areas after a thorough study of available data about different aspects of peer tutoring such as organization, cognitive development, social interaction, meta cognitive development and affective development.

4.6.7.1.2 Item Writing

Writing of suitable items is an important step in the process of constructing any research tool. The investigator prepared initially 60 items. Items were arranged according to the areas concerned. Each item was prepared with a view to measure the opinion of the teachers about peer tutoring in secondary school.

4.6.7.1.3 Item Editing

Checking and scrutinizing items in the process for constructing a research tool is item editing. Utmost care was taken while editing the items. The initial draft of the tool was submitted to the expert for verification. The experts verified and modified the feasibility of the items. After careful examination, repeated items were expelled and ambiguous items were re-written in simple and meaningful language.

4.6.7.1.4 Arrangement of Items

All the items were arranged in a random manner giving almost equal weightage to different aspects of peer tutoring.
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4.6.7.1.5 Preliminary Tryout

A preliminary try out was made to find out the weakness and workability of the items. For this purpose the tool was administrated to the teachers of selected secondary schools in Thiruvananthapuram, Pathanamthitta and Kollam Districts. The difficulties in responding to the items were noted. This step helped the investigator to modify certain items, which were vague and interrogative.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Aspects</th>
<th>No of items</th>
<th>Percentage</th>
</tr>
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<tr>
<td>2.</td>
<td>Cognitive development</td>
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</tr>
<tr>
<td>3.</td>
<td>Social interaction</td>
<td>12</td>
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<tr>
<td>4.</td>
<td>Meta cognitive developments</td>
<td>10</td>
<td>16.67</td>
</tr>
<tr>
<td>5.</td>
<td>Affective development</td>
<td>12</td>
<td>20.00</td>
</tr>
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<td>Total</td>
<td>60</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 4.4 Weightage of Items in the Initial Format of Strategy Evaluation Proforma

4.6.7.1.6 Pilot Study

The investigator selected a sample of 30 teachers from different schools and administered the rating scale for pilot study. The objective of pilot study was to find out whether the tool served its purpose and to find out the difficulties and misunderstanding shown by the respondents. Sufficient instructions were given to the people and assured them that the data collected from them will be kept confidential and will be used for the object of the research purpose only. The full co-operation of the Heads of the institutions was obtained and test was administrated without much difficulty.
4.6.7.1.7 Item Analysis

Items are analyzed both qualitatively and quantitatively in terms of their statistical properties. Qualitative analysis includes the consideration of content validity and the evaluation of items in terms of effective item writing procedure.

Quantitative analysis on the other hand includes item difficulty and items discrimination. The item analysis is a technique for determining the quality of each individual item in a test. The quality of a test is determined by the quality of item used and hence each item is analyzed. The important characteristics of item analysis are

(a) Discriminating power
(b) Difficulty index

The items are then analyzed by finding the discriminating power and difficulty index.

4.6.7.1.7 (a) Discriminating Power

The discriminating power of an item is evident by its power to discriminate between the upper and the lower groups. The difference between the correct responses of the two groups will be an indication how far it can discriminate the two groups. Items with discriminating power 0.40 and above are selected for the final draft.

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

$$U = \text{Number of right responses in the upper group.}$$

$$L = \text{Number of right responses in the lower group}$$

$$N = \text{Number of pupils either in upper group or in lower group.}$$
4.6.7.1.7 (b) Difficulty Index

The purpose of difficulty index is to find out how difficult or easy an item is. Difficulty index refers to the percentage of total pupils who answers a particular item correctly. An item with high difficulty index is considered to be an easy item. Item having difficulty index between 0.40 and 0.60 are considered as ideal ones.

Difficulty index = \( \frac{U+L}{2N} \), Where

- \( U \) = Number of correct responses in the upper group.
- \( L \) = Number of correct responses in the lower group
- \( N \) = Number of pupils either in upper group or in the lower group.

Discriminating power and difficulty index are computed for each item in order to select worthy items in the final test. Further the highest 27 per cent are chosen as upper group and lowest 27 per cent as lower group. The middle is rejected and the number of right answers of each item in upper group and lower group are found out and designated them as 'U' and 'L' respectively.

In the present test, discriminating power and difficulty index are computed by using the respective formulae mentioned earlier. For the final test, item having discriminating power between 0.35 and 0.75, difficulty index between 0.40 and 0.78 are selected. Selection is done in such a way so as to comply with the weightage assigned to the content and objectives.

Discriminating power and difficulty index calculated for each item is given below.
### Table 4.5 Selection and Rejection of Items in the Strategy Evaluation Proforma on the Basis of Discriminating Power and Difficulty Index

<table>
<thead>
<tr>
<th>Item Number</th>
<th>U</th>
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<th>D.P</th>
<th>D.I</th>
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<td>0.10</td>
<td>0.05</td>
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</tr>
</tbody>
</table>

Here S indicates selected items and R indicates rejected items.
4.6.7.1.8 Establishing the Reliability and Validity of Strategy Evaluation Proforma for peer tutoring

4.6.7.1.8 (a) Determination of the Reliability

In the present study, the investigator used split-half method to test the reliability of the tool. For this purpose, the items are divided into two equivalent comparable halves and each half is considered as a separate list. The odd number of items and even number of items are considered separately to develop the half tests. Then the reliability coefficient of the half test is calculated by using the following formula.

\[
r_{\frac{1}{2} \frac{1}{2}} = \frac{\sqrt{\sum X^2 - \frac{(\sum X)^2}{N}} \sum Y - \sum X \times \sum Y}{N}\]

Where \(r_{\frac{1}{2} \frac{1}{2}}\) = reliability coefficient of half tests

\(\sum X\) – Total score of the even numbered items

\(\sum Y\) – Total score of odd numbered items

\(N\) – Total number of teachers in the group.

Then the split half reliability of the tool was calculated by using Spearman Brown Prophecy Formula,

\[
r_{xy} = \frac{2r_{\frac{1}{2} \frac{1}{2}}}{1 + r_{\frac{1}{2} \frac{1}{2}}} = \frac{2 \times 0.52}{1 + 0.52} = 0.68,
\]

Where \(r_{xy}\) = Estimated reliability of the whole scale

\(r_{\frac{1}{2} \frac{1}{2}}\) = Reliability of the half test

Thus the reliability of the Strategy Evaluation Proforma is found to be 0.68.
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4.6.7.1.8 (b) Determination of the Validity

Three different procedures have been used for estimating the validity. They are explained below:

The draft test consisted of 58 items, under five components. The item validity of the scale is ensured by the item analysis. Harper’s chart is used to find out, the item difficulty, and 'the discrimination index'. Based on these two indices the best discriminating items were selected. Thus, altogether 35 items are included in the final test.

The components selected for collecting the opinion on peer tutoring among students are organization, cognitive development, social interaction, metacognitive development, and affective development. All the items in the tool reveal many of the aspects of peer tutoring. These specialities show that the opinion scale for peer tutoring has content validity.

The items in the test are taken from the standard books, and the experts also helped the construction of the test items. The generalised nature of the items enabled the teachers to answer them correctly. Simple instructions and illustrations are given in the test. The construct validity of the test is achieved in these ways.

4.6.7.1.9 Item Selection

Selection of items for the final test are done on the basis of finding the difficulty index and discriminating power. Garret (1961) suggested that items with validity indices of 0.20 or more and difficulty indices of 0.40 to 0.60 are regarded as satisfactory.
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Validity refers to the extent to which a measure actually measures the intended value. Moreover, validity is the efficiency with which a test measures what it attempts to measure. To construct the tool, the investigator had taken special attention on the validity of the scale. Content validity, concurrent validity and construct validity were determined based on expert’s consultation. The tool thus prepared was scrutinized by experts to ensure construct or face validity.

4.6.7.1.10 Final Format of the Tool

It is a self-administering tool and may be administrated individually as well as in group. The instructions are printed in simple English language. It has no time limit to complete this self-administered scale. The final form of tool contained 40 statements and it can be scored accurately by hand. This scale consists of five alternatives like 'strongly agree', 'agree', 'undecided', 'disagree' and 'strongly disagree'.

The answers ticked by the respondent are to be taken into consideration and the scores are to be assigned regarding the responses obtained for each situation. The sum of all the scores assigned would be the total study habits score of the individual.
4.6.8 Format for Tutors’/Tutees’ Diary

Tutors’/Tutees’ Diary is used to evaluate one’s own performance while the peer tutoring program is going on. Tutors are trained to teach students; and the basic teaching principles that they follow are to motivate them and to assess results. Tutors learn to recognize the learning styles of a tutee and their own tutoring styles. They learn the rudiments of what they are going to teach (content) and the best ways of how to teach it (methods).

The secret to peer tutoring success is its self-actualizing power for the ordinary child or adolescent. It is also a part of the constructivist approach to learning. For the first time, most of these experiences being needed, valued and respected by another person in their new roles as a tutor. This helps activate the tutor’s/tutee’s 'emotional intelligence', producing a new view of self as a worthwhile human being. In peer tutoring many students can begin seeing themselves as

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Aspects</th>
<th>No of items</th>
<th>Percentage</th>
</tr>
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</tr>
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</tr>
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<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.6 Weightage of Items in the Final Format of Strategy Evaluation Proforma
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givers and helpers rather than passive 'victims' in the 'learning prison' of school.

An effective peer tutoring program features a precise format of activities that control the entire process from the beginning to the end of each session. Training must allow the tutor time to practice the desired behavior and procedures and not just talk about it. For reviewing the different tutoring activities and to design an effective peer tutoring programme we can use tutors’/tutees’ diary. It consists of the opinion about tutoring activity, punctuality and skills mastered during the peer tutoring programme to which tutors/ tutees are asked to respond. This will act as both a record of results and an important quality control management tool for teacher.

The most valuable component of evaluation for peer tutoring program can often come from students themselves. Their feedback can come in many forms. An 'outline of a plan for the evaluation of peer tutoring programme' presents a variety of methods and procedures for gathering data from students which is shown in 'Format for Tutors’/Tutees’ Diary' given in Appendix 6.

4.6.9 Participant Observation Schedule for Researchers/Teachers.

Participant observational research is an observational research in which the observer participates in a group in order to record behaviour of the members of the group. It is most useful in studying a small group that is separated from the population as a whole, when little is known about the group or when the group’s activities are generally available to public view [Jorgenson, as cited in Mc Burney, 1989].
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The participant observations used were systematic and selective in nature. Systematic in the sense that the observations were noted down immediately and interpretations were simultaneously made. Each group was observed at regular intervals, and was thus selective in nature.

Every peer tutoring programme needed a measurement system to evaluate how well the tutees (and in most cases, the tutors) were learning. The primary task of evaluation was to better guide instruction in order to find what a student knows, defines strengths and weaknesses, and plans how to better individualize future learning. Evaluation needed to be an on-going part of the programme to assess both day-to-day pupils’ progress and long-term achievement at the end of a semester or grading point. This type of assessment is an organized, systematic and gradual gathering of relevant information of the tutor/tutees work.

Participant observation can become a daily corrective function built into every phase of peer tutoring programme. Immediate remediation becomes the goal rather than a reward or punishment system. Children are evaluated in terms of reaching specific learning objectives, rather than compared against hypothetical test norm.

The interaction among members was observed through participant observation after which they were given a student evaluation proforma (Tutors’/Tutees’ Diary) on their performance in group. The combined tutor teacher, and tutee reporting forms function as a written record that filters useful and contradictory information as a part of the overall evaluation process.
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The details regarding the participant observation schedule by teacher/researcher of each item and its response sheet are given in Appendix 7.

4.6.10 Check-list for Evaluation of Peer Tutoring Model by Teachers/Experts

Tutoring can be an important means of introducing or expanding active learning in the classroom for teachers and experts. Peer tutoring can help teachers/experts change the 'learning culture' of a classroom and the day-to-day nature of the educational endeavor. Peer tutoring programmes help teachers to establish their own support groups. Teachers can meet to break down peer isolation, coach others, and develop innovative partnerships among individuals and schools. "Learning how to learn" is at the heart of peer tutoring and good schooling and is an important life skill. With proper supervision and training, potential high school dropouts can improve their own academic skills and be rescued from a potentially bleak future.

If the teachers/experts learn to use proven peer tutoring management best practices, the investment of their professional time will be kept to a minimum. The evaluation of the Peer Tutoring Model will allow the teacher to make accurate decisions on modifying both the tutoring and his or her own teaching content on a regular basis. Through the evaluation of Peer Tutoring Model, teachers / experts can test the effectiveness and offer suggestions for further improvement.

In addition to tutors/tutees, research scholars’ reports and evaluation check-list can provide for valuable short-term and long-term information on the effectiveness of peer tutoring programme. This tool
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will provide a far broader perspective on the overall effects of the Peer Tutoring Model. The evaluation will give teachers/experts an opportunity to think clearly about the short-term and long-term consequences of peer tutoring for a specific student in the classroom. All completed check-lists will provide the details of effectiveness of peer-tutoring model, invaluable qualitative data on student achievement and also provide ideas for planning as peer-tutoring programme evolves.

The teachers/experts need both qualitative and quantitative data to measure the peer tutoring programme results. The information will help the teachers/experts to make future tutoring instruction improvements, as well as strengthen long-term support for peer tutoring among fellow teachers/experts, the school administrators and student’s parents. The details regarding the checklist for evaluation of Peer Tutoring Model by teachers/experts of each item are given in Appendix 8.

4.6.11 5F Model for Peer Tutoring

The crucial step in the present investigation was the preparation and evaluation of a model for peer tutoring with emphasis on Mathematics at secondary school level. The relevant literature on Peer Tutoring highlighted the existence of several models which may serve the purpose to some extent. The details are presented in the 3rd chapter of this report. Apart from these a general model in peer tutoring was also presented in Chapter II.
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It was on the basis of a thorough study of these models that the present model was prepared. The present model, it was hoped, would serve the purpose of experimenting on peer tutoring with the frame developed for the purpose. This means that the present model for peer tutoring, though comprehensive and final for all practical purposes can be experimented with, at any point of time for concerned.

The model has been identified as 5F Model for Peer Tutoring. The details of this model are presented below.

There are five stages in the 5F Model for Peer tutoring proposed in the present investigation. They are as follows.

(i) Framing stage [Planning or Designing]

(ii) Forming stage [Preparation or Development]

(iii) Flocking stage [Grouping or Gathering]

(iv) Flaming stage [Execution or Implementation]

(v) Feedback stage [Evaluation or Assessment]

Each stage consists of four different steps so as to carry out an effective implementation. The description of the stages is given below.
Fig: 4.2 A Flow Chart of the 5F Model for Peer Tutoring

- **FRAMING STAGE**
  1. Selection of a topic.
  2. Define the objectives.
  3. Define the tutorial context.
  4. Preparation of materials.

- **FORMING STAGE**
  1. Identifying tutors.
  2. Designing tutoring techniques.
  3. Training the tutors.
  4. Practising tutoring skills.

- **FLOCKING STAGE**
  1. Categorizing students into small groups.
  2. Allotting each peer tutor a group for tutoring.
  3. Establishing rapport with each group by the tutor.
  4. Reviewing classroom rules and teaching new rules whenever appropriate.

- **FLAMING STAGE**
  1. Content presentation by tutor.
  2. Discussion on the content.
  3. Analyzing different views.
  4. Tutor and tutee collaboratively improve the quality of teaching and learning process.

- **FEEDBACK STAGE**
  1. Evaluation of peer tutoring.
  3. Collect responses of tutors and tutees.
  4. Provide feedback and make necessary modifications.
4.6.11.1 Framing Stage

Framing or planning is very essential for the successful completion of any activity. It holds good for instruction too, as instruction is a systematic activity to be carried out by a teacher successfully.

Also, framing stage is the initial step in which the adequate materials to conduct peer tutoring is prepared in accordance with definite plan. Peer tutoring requires a basic programme curriculum that pre-establishes the sequence of learning objectives as well as a system to be followed.

Putting peer tutoring into practice requires planning or framing as the primary step. Some factors that need consideration include what, how, when, where, the length and frequency of each session. Other factors include time span and physical size of each session.

Framing involves the selection of the most appropriate and feasible set of activities to be executed. This will guide the entire process from beginning to the end of tutoring session.

Proper framing will save you from wastage of time and from later frustration. It will also be easier to spot problems earlier and make adjustments more quickly to different elements of the peer tutoring programme.

The four steps under this stage are

(i) Selection of a topic
(ii) Define the objectives
(iii) Define the tutorial context
(iv) Preparation of materials
The following section gives a description of each step.

4.6.11.1(1) Selection of a Topic

The major decision for anyone running a tutoring scheme is the degree of control to be exercised over the content of teaching. The topic selected should be of the nature that the tutors can cope most readily and the tutees can learn best. The topic must be readily intelligible to the tutees; give something for tutors to do; ensure appropriate reinforcement of tutee’s learning, offer some choice to participants. The length and frequency of tutoring session depends
mainly on the topic to be covered and the time in which it should be covered (Goodlad & Hirst, 1989).

From the topics in the mathematical syllabus of standard VIII under the state syllabus, the Mathematics teacher can select suitable topic for conducting peer tutoring programme, e.g., Volume of sphere, Area of triangle, Surface area of cube etc. may be useful for peer tutoring as per the assessment of a teacher. Of this one topic namely 'Area of a triangle' can be considered for peer tutoring.

Here, for conducting peer tutoring programme, the teacher selected the topic 'Area of triangle', because this topic will be of interest to students in terms of

(i) Practical utility
(ii) Importance in daily life
(iii) Development of different skills
(iv) Awareness about qualitative and quantitative measurement etc.
(v) Stimulate the reflective and creative thinking of students.
(vi) It increases student's motivation by enlisting their personal interest with success in mastering something and thereby gaining the 'rank' of tutors.

4.6.11.1(2) Define the Objectives

Once the topic for peer tutoring is selected, the next step naturally is to define its objectives. Without clear objectives, the teacher will find it impossible to measure reliability what the tutor-tutee were able to accomplish. The teacher here is expected to formulate the objectives of selecting this topic for tutoring. The objectives may be defined in terms of tutor-tutee relationship, and also
in terms of the outcome of the objectives in the cognitive, affective, and psychomotor domains.

Clearly defined objectives are the most important piece of planning a Peer Tutoring Model. So teachers need to give the tutors clear, measurable learning objectives at the beginning of each tutoring session. This gives the tutor a clear description of what the learner will be able to do after the instruction. Without clear objectives, the teacher will find it impossible to measure reliably what the tutors/tutee were able to accomplish.

For example, in the case of Area of a triangle the following objectives can be formulated.

(i) To attain the knowledge about various types of triangle
(ii) To make the tutees understand the concept of area
(iii) To enable the tutees to develop the skills for solving problems related to area of triangles.
(iv) To enable the students to apply the formula in real life situations.

These objectives provide the framework for all the remaining decisions that will be made. Student’s gains can be evaluated in social/behavioral situations or in meta-cognitive areas. The type of gains can be answered by, and are related to, what you want the students to better be able to do. Decide what you want students to achieve in terms of goals and if you want these goals met by tutors, tutees or both.

In this step, the nature of the objectives are clearly determined as well as the limit and scope of the objectives also defined - peer tutoring requires a basic program that pre-establishes a sequence of learning
objectives and a system for tutors to measure the tutee’s mastery of each objective.

4.6.11.1(3) Define the Tutorial Context

When deciding to implement peer tutoring, consider whether your classroom arrangement is suitable for group/pair work. Classroom supports such as rules and procedures, system of reinforcement, and clear expectations need to be in place before peer tutoring is implemented. Supports from administration, parents, and other staff members should also be considered.

The tutoring context also includes the presence of the concerned Mathematics teacher who is ready to help the tutor in an emergency situation. Though the teacher is available throughout the tutoring situation minimum help alone will be provided by him or her. The situation further permits the tutees to clarify any doubt by the tutor. The tutor, as a matter of fact, is given confidence to handle the situation effectively. He or she will be given adequate training by the concerned teacher. Adequate materials will be made available to the tutor in terms of reference book and teaching aids.

4.6.11.1(4) Preparation of Materials

The tutor is well equipped with all the relevant materials before entering into the tutoring session. As far as possible, the tutor himself or herself prepares all the necessary materials required for tutoring. The teacher helps the tutor whenever the help is required by the tutor. All the preparations will be made by the tutor well in advance with the help of teacher. This is self-motivating as for the tutor is concerned. The
amount of preparation time varies from one activity to another. During this time tutor and tutee should bother about the availability of material resources. Tutors must be provided with materials for teaching the identified skills and reaching the learning objectives.

Preparation should not only set the atmosphere for learning, but it should also arrest attention of the student and focus it on the new topic (Colinetal., 1980). It pertains preparing the material and motivating tutors/tutees to learn the new topic. The mind of child should be prepared to receive new knowledge with the integration of previous knowledge.

The materials selected can gradually build the new concepts based on responses elicited from the tutees. Preparation of materials must be intelligible, involve tutors actively, reinforces the learning of tutees and include choices for participants.
Most teachers use the materials provided by the school for content area of peer tutoring. For non-content area skills (such as social skills of behavioural monitoring) you may need to create your own forms. Make sure that all students involved in tutoring have the necessary materials if they have to use reinforcement for appropriate behaviour or correct responses. Teacher should ensure that the materials for teaching should be easily available and economical in cost, i.e., peer tutoring programme should be in its minimal cost to implement. If possible create a ‘hand book’ for preparation of materials and encourage tutors to take notes properly.

4.6.11.2 Forming Stage

Forming means a thing done to make ready for something. A tutor is not a professional teacher, but is used more as a learning technician. In the forming stage, the tutors are selected and given proper training before starting the peer-tutoring programme. Training tutor is perhaps, one of the most important and rewarding task of the professional teacher in a peer tutoring scheme. It can help the tutor to organize their thoughts and needed tutoring activities.

An important underlying principle to make any peer tutoring programme effective is "Keep it simple for students". At the forming stage the teacher should remember that she will be training students, not teachers. An effective peer tutoring programme teaches a precise format of activities that control the entire process from the beginning to the end of the programme. At this stage the teacher should try to prepare a portfolio containing the daily tutors’ diary lesson outcomes,
daily progress report, check list for learning, check list for skill acquisition and so on.

At the forming stage the teacher needs to give tutors clear and measurable learning objectives. For that first we analyse the subject that specifies what is to be taught for a good peer tutoring programme. Then use diagnostic prescriptive approach that uses feedback from the tutee’s response to the tutoring lesson. An additional loops or bypass program of the skills that have been mastered following in the procedures for teaching whatever is specified by the lessons and tutoring procedures must be carefully taught and role-played.

Fig 4.4 ASchematic Representation of Forming Stage
Various steps included in forming stage are

(i) Identifying tutors
(ii) Designing tutoring techniques
(iii) Training the tutors
(iv) Practising tutoring skills.

The following section gives a description of each step.

4.6.11.2(1) Identifying Tutors.

Potential tutors may be recommended by teachers or counselors, and potential tutees may be encouraged by counselors, teachers or parents. Ultimately, however, self-selection is the major avenue by which students become involved (Melissa & Miller, 2005). Programme teachers have found that dedication and perseverance are the most important qualities in both tutors and tutees, and these attitudes are not likely to be present if a student is in the class against his or her will.

An important step to ensure the success of peer tutoring is to know how to choose the tutor. The following are some points the teacher must take into consideration when choosing a tutor. The teacher must

(a) Choose a tutor who wants to be a tutor
(b) Choose a tutor who shows compassion and willingness to help others.
(c) Choose a tutor who is willing to devote time for meeting with the teacher.
(d) Choose a patient tutor who gives encouragement and praise (Madewell, 2004)
Person (1999) stated that "it would be quite difficult for a teacher in a class room to craft such an elaborate dialogue that would meet the needs of a particular student".

In the present study for this purpose the teacher administered the Multiple Intelligence Test in the class and on the basis of the component scores, selected students getting high scores in logical and mathematical intelligence. In a class of 30 students five top scores were selected and each was put as a member of six member tutoring group. In other words, the class of 30 students was categorized into five groups, in each of which one student whogot high scores in mathematical and logical intelligence was selected as the tutor, and the remaining five students were the tutees in each group.
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4.6.11.2(2) Designing Tutoring Techniques

If the students are tutoring, modeling, monitoring or assessing each other, different procedures for tutor/tutees training will be necessary. Most tutoring sessions take place in the classroom during the scheduled period of the content area covered. Frequency and duration are usually defined according to the need.

Teaching students using peertutoring methods is essential for the programme’s success. Whatever forms the tutoring may take, tutors need to be shown how to start tutoring, how the syllabus is organized; how to reinforce tutees learning; what to do if things go badly; how to end a session etc. The techniques which are useful for training tutors include interviewing, role playing and brain-storming.

The method adopted by the tutor in handling the classes should be simple so that the tutees can thoroughly understand the topic. For this, adequate preparation must be made in advance. The tutor goes through the entire topic and gets clarified all doubts with the help of the Mathematics teacher. The method of teaching or discussion should be decided well in advance. The tutor will be given sufficient information with regard to the number of tutees, the time available for tutoring, in addition to the subject matter to be handled. The technique adopted should be flexible to blend elements from each in preparing the training programme that will be most effective for the specific student population.

Common techniques used in peer tutoring process are interviewing the tutees, interactive role playing according to a structured informative scenario and assessment discussion, short
sessions of brain storming which are aimed at the generation of ideas, written structuring on a blackboard, involvement of all participants, reviewing and assessment, concluding sessions positively, and keeping relevant process records etc.

Tutors and tutees of whatever age taking part in a tutoring scheme may feel awkward and embarrassed in the unfamiliar situation. Some semi-structured devices to put them into interaction have been found useful for ice-breaking. A common procedure is to have the tutors interview the tutees.

Role-playing can be used not only to stimulate tutoring encounters, but also to stimulate discussion among tutors in training session. One of the principal problems experienced by untrained tutors is identified with lack of knowledge and consequently frustrations, of their tutees. Role-playing can not only equip tutors with the skills necessary to handle the tutoring but also can give them experience of being in the tutees shoes.

Qualitative change in learning can be demonstrated effectively using portfolio assessment techniques. This form of evaluation is a way of bringing together systematically gathered information and then using it to guide future instruction.

Brain storming is a technique for the rapid generation of ideas and for putting tutors into discussion with each other. Rules commonly applied to brain-storming are 'No criticism and No discussion'. The particular value of tutors is that, like role playing, it provides the opportunity for tutors to think their way into a peer tutoring situation, and to discover the resources which they can bring to it.
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Lippit et al. (1968) argue that brainstorming makes everyone’s ideas available as resources for a group; it maximizes individual participation, pools the thinking of a group to develop a list of the most creative solutions to problems, uses one person’s thinking to spark off another person’s thinking, warms up a group to focus on a subject or on a specific task, and helps the group to focus on a subject or on a specific task; and helps the group to look at a situation or a problem from as many viewpoints as possible.

4.6.11.2(3) Training the Tutors

At the beginning of each peer tutoring programme, tutors / tutees receive training in study skills, learning strategies, organizational skills, mnemonic devices, time management and other methods for learning how to learn effectively. Students also learn communication skills and ways to give each other encouragement and positive feedback (Foster, 1972).

For peer tutoring programme the teacher needs to ensure that tutors are adequately prepared for each tutoring session. Tutors are not mini-professors, so they are not expected to know everything or to give lectures on topics that haven’t been taught or covered in the course before. In this way, tutors usually focus on material that their tutees are already familiar with. A tutor’s task can be categorized. Tutors often add, refine or change their tutees’ content knowledge. Thus, tutors are trained to understand their tutees’ learning needs and hence address these needs.
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Tutors are trained to exhibit certain behaviours and responses for certain unique situations. Tutees sometimes may have problems that the tutor may not be able to deal with. Because of this, tutors are trained to be selective in making suggestions and addressing certain issues. Tutors are sometimes viewed as teachers to their tutees. This creates a professional relationship. Therefore, tutors are trained to maintain a certain level of professionalism.

In peer tutoring, tutors and tutees are usually of the same age-group. Because of this, conflicts may develop. Tutors are thus encouraged to be collaborators and to be very encouraging and constructive. We all learn differently and as a result, tutors are advised to be patient and supportive to their tutees.
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The following training skills require special attention:

- How to start a tutoring session by establishing a friendly atmosphere
- Familiarity with the content of the syllabus
- What to do when tutee gives a correct answer
- What to do when the answer is wrong
- What to do if a tutoring session goes badly
- How to vary the content of peer tutoring sessions
- How to end peer tutoring session
- Record keeping

The way of training in these skills, and the amount of time to be given to each of them will vary depending upon the background and qualifications of those engaged in the peer tutoring scheme. What should be apparent is that most of the skills are ones which must be acquired by practice rather than private study. If no slot is available in the curriculum of the tutors, some sort of training workshop will need to be arranged. Such a workshop can, not only provide the occasion for training tutors in the necessary skills, but also provide an overall orientation towards the whole programme.

Most commentators suggest that the role of the teacher in this step is very crucial. The teacher gives adequate training to the tutor so that there is no doubt about what to teach and how to explain the various points so that the tutee is satisfied with the performance of the tutor. The teacher, after explaining the various methods of teaching the particular topic, decides which method suits best the tutor so that she/he can effectively and efficiently handle the topic.
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The supervising teacher should carry out training for the tutors to handle the tutorial context effectively.

4.6.11.2(4) Practising Tutoring Skills

The various aspects in tutoring will be considered separately. Especially the various skills like the skill in presenting the topic, skill in explaining various concepts and terms, and the skill in applying the contents of the topics in various situations in daily life and the skill in problem solving will be given importance. Adequate
practice will be made by the tutor in the presence of the teacher so that
the tutor is well prepared for tutoring.

As a teacher you need to decide how many students you want to
involve initially and eventually in peer tutoring. Tutors should be
trained to conduct a number of tutoring skills (Goodlad & Hirst, 1989).

- Start the tutoring
- Create a positive and friendly relationship between participants
- Understand the organization of syllabus
- Reinforce tutee’s learning
- Solve practical problems that may arise and correct tutee’s
  'Mistakes in a positive and fanciful way'.

The way of training tutors in these skills, and the amount of time
to be given to each of them, will of course, vary depending upon the
background and qualification of those engaged in the peer tutoring
scheme. What should be apparent is that most of the skills are ones
which must be acquired by practice rather than by private study. If no
chance is available, for practice in the curriculum of the tutors, some
sort of training workshop will need to be arranged. Most commentators
suggest that, in addition to any such workshop, regular debriefing
sessions will be needed in which the co-ordinator can sort out with
tutor’s problems which have arisen.
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4.6.11.3 Flocking Stage

Flocking means gather or go in a group. Once a teacher has given proper training to the tutors, he or she will need balanced groups to carry out the peer tutoring programme. On the basis of the direction from the concerned teacher, the students flock together for the implementation of the program. In this stage, the tutor gains a more in-depth understanding of how to apply the skills and capacities he or she knows and improving their initial-thinking abilities.

Man is essentially a social being. Right from birth, he lives and moves in society and is vitally influenced by it. His attitudes are modified and behaviour is adjusted and controlled by the social environment. Group life offers the individual the opportunity to express his feeling of self-assertion, communication, and combat and grows up emotionally, socially and physically. It is the social group that provides opportunities for imitation, modeling, and reinforcements for development of social behaviour. School, being a well-organized group, provides innumerable social situations that enable the child to acquire socially acceptable behaviour patterns.

The behaviour of a person in a group is different from his individual behaviour. In the individual behaviour, a person is free to think, feel and act. Within the group every individual learns, group values such as co-operation, tolerance, accommodation, team spirit and competition, to lead and follow, to think for a common cause etc.
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Grouping of learners is essential for getting the result of peer tutoring. Learners can be grouped either heterogeneously or homogeneously. For this, various grouping techniques like random, mixed ability etc. can be used in the classroom. Within a group, different members should be given different duties. Duties like that of group leader, recorder, presenter etc. can be allotted to the learners and shuffled frequently.

There are several factors to be considered while grouping the students for peer tutoring. Some of these factors are gender, ethnicity, class level, similarity in academic achievement level and social characteristics. There is a common saying in chemistry that 'like dissolve like'. This means that chemicals of similar chemical nature are more likely to react and dissolve intimately with each other. Similarly in grouping 'likeness' of tutors and tutees is also important. These similarities help tutors and tutees to collaborate because they may see each other as equals and thus communicate with each other easily.

The four steps under this stage are

(i) Categorizing students into small groups
(ii) Allotting each peer tutor a group for tutoring
(iii) Establishing rapport with each group by the tutor
(iv) Review classroom rules and teach new rules whenever appropriate
The following section gives a description of each step in this stage.

4.6.11.3(1) Categorizing Students into Small Groups

It is an important task of the Mathematics teacher to categorize students in small groups. The preferable strength of a group would be a maximum of six students and a minimum of three. It may be mentioned here that the minimum number is two when one-to-one tutoring is focused.
Various methods can be adopted by the teacher to form various groups. One method is to categorize them as 'very high', 'high', 'average', 'low' and 'very low' achievers on the basis of previous marks obtained by them in their Mathematics achievement test by the teacher. Another method is to categorize them as 'pragmatists', 'activists', 'reflectors' and 'theorists' based on learning styles of the students (Kolb, 1984). Yet another method is to group them into various categories based on sociometric technique called sociogram.

Here the present investigator used Multiple Intelligence Survey for the purpose as noted earlier. More details about Multiple Intelligences Survey are attached in Appendix V.

On the basis of scores obtained for logical, spacial and interpersonal strength, five groups of students were formed.
4.6.11.3(2) Allotting Each Peer Tutor a Group for Tutoring

Tutoring is a process in which the cognition of the tutor is more important. A successful tutor should be knowledgeable, self-determined, strategic and an empathetic thinker. The thoughts of the tutor should be guided and directed in a particular way so as to help them to channelize their divergent thinking.

Effective tutoring requires that the tutor can reason about the tutee’s performance in relation to an instruction in the light of this. In order to provide an effective next instruction, the tutor also needs to anticipate the learner’s future performance in relation to this instruction.

The peer tutor should be a collaborator, not a monitor. Another vital trait for the peer tutor is knowledge of the tutoring situation. First of all the tutors may comprehend the desired goal and they should
clearly understand how to achieve this goal during the course of tutoring.

There is a basic code of ethics that all peer tutors are responsible to uphold. It includes

- Possessing subject proficiency and knowledge
- Respecting the student as an individual
- Building the student’s confidence through honest encouragement
- Giving total attention to the student during tutoring sessions
- Serving as a guide rather than authority figure
- Showing patience and understanding of the student’s abilities

The top scorers will be allotted to each group and will be called the tutor for each group or at the end of each academic year. All the faculty members are asked to nominate the students whom they feel have the academic skills, interpersonal strength and enthusiasm for learning; which are the required qualities for a successful peer tutor.

4.6.11.3(3) Establishing Rapport with Each Group by the Tutor

It is important for the tutor to develop or establish an amicable relationship with the tutees. This will help the tutor and tutees to relax and feel more comfortable. This, in turn, stimulates interest and fosters concentration.

The tutor will be provided with sufficient information as to how rapport can be established with the members of the peer group in which he is also a member. One of the main points to be remembered by the tutor is that he is actually a member of the group, even though he has to play the role of the tutor. He/she must also convince his peer members
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that he is ready to involve in the tutoring session with maximum sincerity and dedication so that the members will be benefited during the tutoring session. He or she should also clarify the points any number of times with patience. The tutors should try to create a positive and friendly relationship between participants.

For establishing rapport with tutees the tutor should

- Engage pupils in non-instructional, friendly conversation
- Practice in establishing a relaxed atmosphere by smiling, calling the tutees by their first names, acting in friendly manner, sitting next to the tutees rather than opposite to them etc.
- Introduce themselves and exchange information
- Avoid attempting to elicit correct response by prompting
- Tell or show the pupil correct response when the pupil is incorrect.
4.6.11.3(4) Review Classroom Rules and Teach New Rules Whenever Appropriate

There are formal rules and regulations prevalent in every school, which is followed by the concerned teacher. These rules may be reviewed in such a way that the tutor can exercise his or her duties without any hindrance. The Mathematics teacher can formulate appropriate rules and regulations while the class is engaged by the tutor.

The tutor is empowered to handle the teaching-learning situation in his or her own way, without disturbing or violating the rules and regulations followed in the school.

The student who is a tutor should not ridicule other students or punish them. The manner in which the tutor must behave may not be similar to the one followed by the Mathematics teacher. However, the tutor must be well informed of the various behavioral techniques he or she is entitled to follow while tutoring. Make aware both what good tutor and tutee behaviours are, before starting peer tutoring.

One person should be responsible for the overall co-ordination of a tutoring scheme to ensure proper consultation and co-ordination of the activities of the participants (Goodlad & Hirst, 1989).

Tutoring schemes should be kept as simple as possible. Particular attention needs to be given to: suitable time and place for tutoring to take place, and for introducing and de-briefing meetings; selection of tutors and tutees; documentation (so that tutors, tutees, and organizers know how everyone is getting on), finance etc.
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The Mathematics teacher is in charge of the class, legally as well as morally. The tutor should consult the teacher before going off on a new track or departing in any significant way from the syllabus.

The organization of the content should in the increasing order of difficulty. The difficulty level of the topic is to be judged from the tutor’s point of view, based on the mental development and capabilities of the pupil.

4.6.11.4 Flaming Stage

The word 'flaming' figuratively means the implementation or execution of the peer tutoring program. This is the most important step in which the teachers need to give the tutors clear, measurable learning objectives at the beginning of each tutoring session. This gives the tutor a clear description of what the learner will be able to do after the instruction.

A good peer tutoring plan and preparation may not lead to success unless it is skillfully executed. An expert execution demands utilizing the training received in terms of expertness, proper arrangements of special conditions, focusing attention on the specific well defined activities etc.

In this stage the teacher helps the students in assigning work to different students in accordance with their interest, aptitude and capabilities. Each member of the group should be actively involved in the execution of Peer Tutoring Model. The teacher should carefully supervise and guide the students in the execution of the peer tutoring programme as per the proposed action plan. Overall at this stage the
actual tutoring takes place. Here the tutees acquire new knowledge and ideas. For effective learning outcome, the tutor should ensure active tutees participation by providing a number of learning activities. Tutor can also make use of audio visual aids and illustrative materials to make the learning interesting, effective and meaningful. Here tutors should stimulate the mental faculties of the tutees by asking thought provoking questions. This is very important for teaching Mathematics. The tutor can gradually build the new concepts based on the response elicited from the tutees.

Fig 4.7 A Schematic Representation of Flaming Stage
The four steps under this stage are

1) Content presentation by tutor

2) Discussion on the content

3) Analysing different views

4) Tutor and tutee collaboratively improve the quality of teaching and learning process.

The following section gives a description of each step.

4.6.11.4(1) Content Presentation by Tutor

During this step, the content area of the lesson is presented. The tutor can present the same with an introduction, since previous planning has already been made for the same. The content is presented with clarity. All the relevant information can be presented. Examples can be given so that the tutees get a clear idea about the content.
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Tutees learn best, and tutors can cope most readily, when the contents are structured. The content must be readily intelligible to the tutees; give something for tutors to do, ensure appropriate reinforcement of tutees’ learning etc. The content presented should be accurate and up-to-date. It should include the recent developments in the Mathematics relating practical and social utility value. The content should be organized in the increasing order of difficulty. Principle of vertical correlation should be followed to relate the present knowledge with the past and future.

The presentation of the content should be carefully organized with reference to the logical as well as psychological considerations which makes peer tutoring program effective. Also the subject matter must be attractive and interesting with appropriate illustrations in terms of pictures, diagrams and figures.

4.6.11.4(2) Discussion on the Content

After presenting the content, sufficient time was given to the tutees for a discussion about the content. Each tutee may be encouraged to ask questions, make comments and clarify doubts. The tutor is expected to respond to the opinions of the tutee and a lively discussion can be had.

The tutor should ensure that content is not side tracked during the discussion. Besides, the tutor should also make sure that sufficient time is given to each tutee so that everything is done as per the time schedule.
While discussing the content, the tutor keeps in mind that
(a) Discussion should include recalling new terms, facts, concepts and principles in an appropriate way
(b) Understanding various relationship and facts in selected topics and objectives
(c) Application of knowledge and understanding in different situations

Thus the discussions have the capacity of acquiring knowledge, broadening of understanding provision for improving skills, developing of attitudes, deepening of appreciation, provision for rectifying mistakes and planning for remedial measures.
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4.6.11.4(3) Analyzing Different Views

The different views highlighted during the discussion are recalled by the tutor so as to analyze their merits and demerits. This gives an opportunity to the tutee to get a better understanding of the matter already discussed.

The most important element to be noted in this step is that there will be feedback as far as the tutee is concerned. He or she will be delighted to see that his/her suggestion or doubt is appreciated.

Analyzing different views means breakdown of a communication into its constituent elements or parts so that the relative hierarchy of ideas are made clear and/or the relations between the ideas expressed are made explicit. This section includes an analysis of elements, relationships and organizational principles.
4.6.11.4(4) Tutor and Tutee Collaboratively Improve the Quality of Teaching and Learning Process

The quality of teaching-learning process can be said to improve due to the active involvement of the tutee in the tutoring process. The role of the tutor and his or her relation with the tutees is a deciding factor in evaluating the quality of the tutoring process.

Usually in the classroom situation the Mathematics teacher becomes the deciding factor as to whether the learner is interested in Mathematics or not. The personal interest, aptitude, intelligence and motivation of the learner coupled with the interest and teacher effectiveness of the Mathematics teacher acts as the stimulator for creating an interest in the learner to learn Mathematics. These characteristics develop considerably in the tutoring process, just because of the fact that the learner (the tutee) learns better in the tutoring process than in the prevailing teaching - learning process.
4.6.11.5 Feedback Stage

The final step in the evaluation process of Peer Tutoring Model is the use of results as feedback. If the teacher/researcher, after testing his pupils, finds that the objectives have not been realized to a great extent, he will use the result in reconsidering the objectives and in reorganizing the learning activities. He will retrace his steps to find out the drawbacks in the objectives or in learning activities or entire progress of the learner. This is known as feedback. Whatever results the teacher gets after evaluating his pupils they should be utilized for the betterment of students (Mujis et al., 2001).

Feedback is necessary for the teacher/researcher to determine the pupils’ status at the beginning of the course at periodic intervals and then at the end of the peer tutoring programme. Then only one can judge the pupils’ progress through this programme.

Measurement of results and providing meaningful feedback are significant part of the implementation of tutoring process. The most valuable points about the tutoring programme can be feedback expected from both teachers and students at the end of the session. Effective monitoring will require careful personal observation of the students engaged in each session. Feedback helps to determine the progress of the tutoring session.

In the peer tutoring programme, immediate feedback is provided to the tutee for improving learning, to tutors for improving teaching. The tutor receives feedback to know what to do next (short-term
diagnosis and for long-term diagnosis). The effectiveness of this feedback is clearly a function of the care with which the procedures are developed for a specific peer tutoring programme.

Important feedback procedures include small, simple and carefully sequenced steps in context, use of positive reinforcement, explicitly defined behavioural objectives, careful planning and use of continuous and explicit responding activity, tutor’s self-sufficiency in providing desired behavioural outcome, active learning, discovery learning and individualized instruction (Dendapani, 2008).

As our review of learning assessment and programme feedback has shown, it appears that there are multiple pathways for gathering such information. The teacher needs both quantitative and qualitative data to measure peer tutoring programme results. This information will help the teacher/researcher to improve future tutoring as well as strengthen long-term support for peer tutoring among fellow teachers, school administrators, and the students’ parents. This stage is used for ascertaining how well the students have understood the concepts and to assess how effective the method of teaching had been.

The four steps under this stage are

(i) Evaluation of peer tutoring
(ii) Assess students learning
(iii) Collect responses of tutors and tutees
(iv) Provide feedback and make necessary modification
The following section gives a description of each step.

4.6.11.5(1) Evaluation of Peer Tutoring

Evaluation means grading what the teacher/researcher and the students (tutors/tutees) did in the tutoring session. Evaluation helps to determine the progress of tutoring session. Evaluation can also be done through testing or self-questioning. Testing is carried throughout the entire programme. Examples of question asked in self-questioning
may; "How did the student do overall?", "Did I forget anything important?", "How can I improve the pace of the session?" etc.

The evaluation of peer tutoring can be done on the basis of different criteria such as:

(a) Achievement test (Pre-test and Post-test) in Mathematics constructed based on the lesson

(b) Self reports and observational data to determine if targeted improvements were made using Tutors’/Tutees’ Diary

(c) Check-list for the evaluation of tutor’s skill by researcher

(d) Check-list for the evaluation of Peer Tutoring Model by Teachers/Experts

Such evaluation tools either readily available or developed for the purpose may be used for evaluating peer tutoring. The tutoring process may be evaluated as 'Poor', 'Fair', 'Good', 'VeryGood', or
"Excellent" on the basis of certain criteria formulated based on the statistical principles.

For example, if the scores are obtained above mean + SD, the programme may be evaluated as 'Excellent'; and if it is lower than mean – SD it can be considered as 'Poor'.

Schematically the concept of educational evaluation may be presented by showing the relationship among objectives, content, learning activities, and evaluation procedures (testing as follows)

![Diagrammatic Representation of Evaluation Procedure](image)

<table>
<thead>
<tr>
<th>Content</th>
<th>Curriculum, Syllabus, Courses etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>Well defined purpose of education</td>
</tr>
<tr>
<td>Learning activities</td>
<td>Methods, Experiments, Discussions, questions, demonstration etc.</td>
</tr>
<tr>
<td>Evaluation Procedures</td>
<td>Written tests, oral tests, observation etc.</td>
</tr>
</tbody>
</table>
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Evaluation is an act or process that allows one to make a judgement about the desirability or value of a measure.

The results of the peer tutoring program require careful evaluation to guide the future planning.

4.6.11.5(2) Assess Students Learning

Tutoring results can be determined using both formal and informal assessment tools. These include pre-testing/post-testing, review of the tutor’s diary, measuring outcome before each class based on the present knowledge etc.

During the tutoring session the teacher needs to observe the tutors and tutees frequently and assess the quality of the tutoring. This will guide tutor to understand the need for re-training and track the development of the tutor-tutee relationships for possible adjustments.
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In Peer Tutoring Model, emphasis is given to achievement test in Mathematics based on Bloom’s taxonomy of educational objectives. If the scores obtained by the tutee in achievement test are low, it indicates that peer tutoring program is not a good method; otherwise, it indicates the importance of Peer Tutoring Model in teaching-learning process.

Learning and assessing both are equally important in the sense that assessing gives an idea of how far the learning has taken place. Also, assessing is suitably made use in feedback and remedial teaching. Thus assessing is properly done, leads to good learning. Assessing should be pre-planned, systematic and scientific (Lavin et al., 1991).

The major functions of an achievement test are to measure students achievements and thus to contribute to the evaluation of educational progress and attainments. Here, the investigator prepared an achievement test on the unit,'Area'. The same achievement test was administered as pre-test and post-test for assessment purpose.

4.6.11.5(3) Collect Responses of Tutors and Tutees.

After the tutoring session, the evaluation is done on the basis of the responses of the tutor and tutees, collected using a format prepared for the purpose (Tutors’/ Tutees’ Diary). All the relevant information will be collected with regard to various aspects in the tutoring session. Each member in the tutoring session is expected to reach in anyone of the following categories, viz., 'excellent', 'good', 'average', 'poor' and 'very poor' for each aspects of tutoring session.

Response of result is an important part of any peer tutoring programme for several significant reasons. As a motivator, students,
parents and teachers will respond in giving more collaborative support, if they have a feeling that real progress towards student’s learning is happening on a daily basis. Another compelling need for collection of response is that everyone has the right to know how well they are doing in specific skills.

In a peer tutoring programme, assessment is used for the purpose of better guidance in order to find out what a student knows, define strength and weakness and plan how to better individualize future leaning. The most valuable component of assessment for a peer tutoring programme can often come from the tutors/tutees themselves in the form of Tutor Diary, Tutees’ Achievements etc. Assessment done by the researchers/teachers and experts in educational field can also be considered as very important.
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4.6.11.5(4) Provide Feedback and Make Necessary Modifications

Each tutoring session may be observed by the concerned Mathematics teacher to give feedback to the students with regard to its effectiveness. The evaluation can be done on the basis of a check list containing a few relevant aspects of the process of tutoring.

The teacher can also suggest necessary modifications, if found necessary. The result of peer tutoring generally depends on the evaluation of the same by the participating students and also the Mathematics teacher who organizes the same.

It is expected that peer tutoring will be effective in encouraging the students who are poor in Mathematics learning. As suggested by various authors and investigators in the field, the program will be benefited not only the tutees but also the tutors.
Both tutors and tutees need feedback on their performances. After completing the peer tutoring session, meet the tutor and tutee individually and try to discuss both the positive and negative experiences. Students should also receive information about their improvements in scores or achievement gains. Administrators, educational experts and parents should also be informed about the improvements. A newsletter created by students is an effective way to take ownership of their hard work and to show off their skills.

4.6.12 Lesson Designs Based on Prevaling Teaching Method

4.6.12.1 Content Taught

The topic selected for curriculum transaction through the select Peer Tutoring Model was 'Area' from the textbook of Standard VIII of Kerala state syllabus. This topic was selected because of its importance in daily life. Geometry, a most important branch of Mathematics, is useful in other branches of Mathematics. Hence 'Area', which has its root in Geometry, has also many applications.

Geometry is a combination of two words: 'Geo' and 'metry' which means measurement of earth. It has two fold values; it provides knowledge and enables students to do things logically and to develop logical thinking (without which geometry cannot be understood).

The world of Mathematics is the world of measurement. The process of measurement is incomplete and meaningless without geometry. In fact, whole of the measurement consisting of distances, area and volume is only possible through geometry and the study of
geometry thus equips a person to understand and perform so many tasks requiring such measurement.

Nature is a great geometrician. One can understand and appreciate the equality, symmetry, congruency, similarity and proportionalities of the things found in nature with the knowledge of geometry. The knowledge of geometrical facts and skills help in the learning of almost all the branches of Mathematics and also other subjects like Physics, Chemistry, Biology etc.

(i) Practical work and direct experiences dominate the learning of geometry in the beginning especially in the lower classes. Therefore geometry helps in creating interest of students in learning of the subject, Mathematics.

(ii) Study of geometry develops the ability to draw accurate plans.

(iii) It is useful in engineering, machine shop, construction industries, landscape architecture, interior decoration and other areas of appreciation. Hence the investigator selected this content for her study.

One unit was selected and 10 lesson transcripts were prepared in the usual way as most of the teachers preparing. A detailed lesson plan of one of the topics of this type is attached in Appendix 9.

4.6.13 Achievement Test

An achievement test was prepared by the investigator in accordance with definite design after a thorough analysis of the selected topics from the text book of Mathematic for standard VIII. Test consisting of items based on the topic 'area' was prepared. The
same achievement test was administered as post-test in both groups. The test consisted of multiple choice questions; each question carries one mark. The details regarding Achievement Test are attached in Appendix 10.

After consulting with experts, modification was made in the blue print. The steps considered in designing test were

1. Curricular objectives
2. Design of the test
3. Preparation of Blue print
4. Scoring key
5. Question-wise analysis

The detailed description is given below.

4.6.13(1) Curricular Objectives

- To develop the concept of drawing altitude to one side on a triangle
- To find out the area of a triangle of one side 'b' and altitude to that side 'h' is \( A = \frac{1}{2} bh \)
- To find out the area of a triangle with three sides as 'a', 'b' and 'c'
  \[
  A = \sqrt{s(s-a)(s-b)(s-c)}, \text{ where } s = \frac{a+b+c}{2}
  \]
- To recognize the area of congruent triangles are equal.
- To find out the area of a parallelogram of one side 'b' and distance to the opposite side 'h' is \( A = bh \)
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- To find out the area of a rhombus of diagonals \(d_1\)' and \(d_2\)' is \(A = \frac{1}{2} d_1d_2\)
- To find out the area of a trapezium of parallel sides 'a' and 'b' and the distance between them as 'h' is \(A = \frac{1}{2} h(a+b)\)
- To find out the area of a diagonal 'd' and altitude from other vertices to the diagonal are 'h_1'and'h_2'is \(A = \frac{1}{2} dh_1h_2\)

4.6.13(2) Design of the Test

4.6.13(2) a. Weightage to Curricular Objectives and Content

When the test was prepared due weightage was given to each sub-unit of content. The entire content was divided into eight sub-units. A detailed description of weightage given to each sub-unit is presented in table 4.7

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Curricular Objectives</th>
<th>Content</th>
<th>Number of questions</th>
<th>Score</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,2,3,4</td>
<td>Are of triangle</td>
<td>11</td>
<td>11</td>
<td>44</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Area of parallelogram</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>Area of rhombus</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>Area of trapezium</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>Area of quadrilateral</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>25</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.7 Weightage to Curricular Objectives and Content
4.6.13(2)b. Weightage to Domain

The behavioural objectives selected for the preparation of the achievement test were knowledge, process and application. The weightage given to each domain is shown in table 4.8.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Domain</th>
<th>Number of questions</th>
<th>Score</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge</td>
<td>7</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>Process</td>
<td>8</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>Application</td>
<td>10</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>25</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

4.6.13(2)c. Weightage to Difficulty Level

A good question will contain different difficulty levels. The weightage given to different difficulty levels namely 'easy', 'average' and 'difficult' is given below in Table 4.9.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Difficulty Level</th>
<th>Number of questions</th>
<th>Score</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Easy</td>
<td>7</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>Average</td>
<td>12</td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>Difficult</td>
<td>6</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>25</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
4.6.13(3) Blue Print

A three-dimensional chart, the blue print specifying the content covered by the test in relation to the weightage assigned for different objectives, content, difficulty level and the form of questions was prepared by the investigator as shown in table 4.10.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Curricular objectives</th>
<th>Content Domain</th>
<th>Knowledge</th>
<th>Process</th>
<th>Application</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1, 2, 3, 4</td>
<td>Area of triangle</td>
<td>(1)²</td>
<td>(1)⁴</td>
<td>(1)⁵</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Area of parallelogram</td>
<td>(1)¹</td>
<td>(1)²</td>
<td>(1)²</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>Area of rhombus</td>
<td>(1)³</td>
<td></td>
<td>(1)²</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>Area of trapezium</td>
<td>-</td>
<td>(1)¹</td>
<td>(1)¹</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>Area of quadrilateral</td>
<td>(1)¹</td>
<td>(1)¹</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>

The number inside the bracket shows the mark and the number outside the bracket indicates the number of questions.

After preparing the blue print the actual question papers were set which consisted of objective type.
In the preparation of achievement test, ample care should be taken to avoid all loop holes that might reduce the acceptability of the test results. With this end in view, a final and detailed analysis of the test is attempted before releasing it. This is done by making an analysis of each item, considering all the aspects from objectives to the time required. It is given in Appendix 10 A.

**4.6.13(5)Scoring Key**

The investigator with respect to the tasks prepared scoring keys. The tests were scored. The prepared scoring is given in Appendix 10 B.

The tools thus prepared were scrutinized by experts, to ensure content validity.

**4.7 DATA COLLECTION PROCEDURE**

After finalizing the sample and tools to be used, the investigator approached the authority of the schools to seek the permission for conducting the study. Prior section was sought by the investigator from the heads of the school from Thiruvananthapuram and Kollam districts. The teaching and testing commenced from March 2008 and finished by the end of August 2008. The data collection was carried out through three phases namely,

1. Pre-testing
2. Treatment
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(3) Post-testing

4.7.1 Phases of the Study

The study included three phases. Pre-testing was the first phase. In this phase pre-test scores, socio-economic status, multiple intelligence, mathematical interest, achievement motivation and self-concept of pupils were tested. The second phase was the treatment phase. Here the experimental and control group were taught one unit of Standard VIII Mathematics. Post-testing was the third phase in which the students were tested on post achievement in Mathematics, mathematical interest, self-concept and achievement motivation. The three phases of the study are summarized in Table 4.11.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Phase</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Treatment</td>
<td>Teaching the units based on Peer Tutoring Model</td>
<td>Teaching the units based on prevailing method of teaching</td>
</tr>
</tbody>
</table>
4.8 **STATISTICAL TECHNIQUES USED FOR ANALYSIS**

The pre-test scores and the post-test scores of the experimental and control groups were consolidated for statistical analysis. As the investigator wanted to find out the impact of peer tutoring in Mathematics of pupils studying in VIII standard, the test of significance of difference between means was applied and critical ratio were found out. The Multiple Intelligence Test scores and SES scores were utilized for equating the control and experimental groups in terms of the variables like component of Multiple Intelligence and SES. The mean and standard deviation of the scores for each test were found out and ensured the equivalence of the two groups by adopting critical ratio test. A preliminary analysis was done using the method of critical ratio and test of significance to compare the performance of experimental and control groups.

Even though the control and experimental groups were equated in terms of intelligence and SES, many other intervening variables could not be controlled. Analysis of Covariance (ANCOVA) is a method that enables the researcher to equate the pre-experimental status of the groups in terms of relevant known variables. Difference in the initial status of the groups can be removed statistically. So that they can be compared as though their initial status had been equated (Best& Khan 1999). Thus in the present study the researcher decided to adopt the technique of ANCOVA for sharper experimental comparison of performance between experimental and control groups. The investigator also used chi-square test for analyzing the data obtained.
from tutors’ diary, tutees’ diary and the opinion of experts, for evaluating the Peer Tutoring model. The details of the analysis of data using relevant statistical methods have been complied in the next chapter.

4.9 CONCLUSION

Since the teaching-learning process in the present age requires modern and innovative instructional strategies in order to meet the challenges of today’s teaching-learning situations, a strategy has been developed and the important facets of its organizations has been outlined in this chapter. This method can be easily implemented in our modern classroom situations. As our classroom situations are highly flexible, without disturbing the classroom situations we can implement this strategy. Motivating students to learn how to learn and to internalize the need to learn are the major reasons that the teachers and those who are interested in this field support peer tutoring.