METHODOLOGY
CHAPTER - IV

METHODOLOGY

This Chapter deals with the methodology followed in this study. The methodology followed is discussed under different headings namely construction of research tools, research design, development of Computer Assisted Activity Package (CAAP) to teach Mathematics Subject of standard VIII syllabi, teaching through computer assisted instruction, sampling techniques and the statistical techniques employed for analyzing the obtained data.

4.1 RESEARCH DESIGN

Pre test – Post test Equivalent group Experimental design was adopted in the present study. Sixty students of standard VIII of Govt. Higher secondary school Puthamboor were selected for this study. Thirty of them constituted the control group and the rest of them formed the experimental group based on the rank order of half yearly mathematics marks. These two groups were further divided in with equal number of slow learners, average students and above average students. In the experimental group, experimental group I consisted of slow learners, experimental group II contained average students and experimental group III comprised above average students.

4.2 CONSTRUCTION OF RESEARCH TOOLS AND COMPUTER ASSISTED ACTIVITY PACKAGE

4.2.1 DIAGNOSTIC OBSERVATION CHECKLIST FOR IDENTIFICATION OF SLOW LEARNERS

Sixty students of VIII standard were arranged in the order of merit from the half yearly examination. All the odd numbered students constituted the control group, while
the even number students formed the experimental group. Within the group proportionate sampling was done in the sense that it was ensured that each group contained 10 low scorers, 10 average scorers and 10 above average scorers forming experimental group and control group I, experimental group and control group II and experimental group and control group III. The ten low scorers were further subjected to the Diagnostic Observation Checklist prepared by the researcher to identify the students who are slow learners. With the literature base draft pool of items were prepared and given to the panel of experts for validation. The developed checklist was also subjected to a sample of 30 students. The reliability and validity of the checklist was found to be 0.78 and 0.88. The developed diagnostic observation checklist was found to be reliable and valid. After validation, using the diagnostic observation checklist the ten low scorers were observed and identified as slow learners. The developed diagnostic observation checklist is given in the appendix.

4.2.2 DEVELOPMENT OF COMPUTER ASSISTED ACTIVITY PACKAGE (CAAP)

The main objective of the study is to develop Computer Assisted Activity Package (CAAP) was developed to teach selected portion of mathematical concepts to the slow learners at middle school level. Computer Assisted Activity Package (CAAP) is a self contained auto instructional material. It is a learning package which contains everything needed by the student for self instruction. Keeping this view in mind, the primary focus of this study is to apply Computer Assisted Activity Package (CAAP) for triangle section of the geometry in Mathematics of standard VIII. The content was carefully selected and arranged, according to the level. The concept of Triangle and its different kinds, Congruence and Similarity were the main parts. Definition, explanation as well as examples were also formed. These parts have been selected for measuring the
effectiveness of Computer Assisted Activity Package (CAAP). A computer expert was consulted for the purpose and it was discussed with him how to develop software for Computer Assisted Activity Package (CAAP) for the Eighth standard mathematics. Though there are various Computer Assisted Activity Package programme such as “drill and practice programme” “tutorial programme”, the investigator decided to follow the first one i.e., drill and practice programme since this is the most widely used type of computer programme (Slavin, 1986). The purpose of this programme was to provide practice on skills and knowledge so that students can remember and use what have been taught.

The methodology involves repetition of a format in which the computer presents an exercise, the student types in response, and the computer informs the student if the answer is correct. Diagrams and sketches were also incorporated in the software in appropriate places through scanning procedure. For subjects and units different codes were allotted. The software was prepared in such a way that it ensured the following

1. Letting students work at their own place.
2. Providing immediate feedback and reinforcement
3. Measuring performance quickly and giving students information on their performance.

The software had to be developed in Tamil language since it was meant for Tamil medium students. Once the programming was over, it was subjected to tryouts. In the tryouts the students expressed that it was more conducive for learning at their own pace. Also they found it more effective since the interaction with the computer had a motivating
quality of its own. After this, the software for Computer Assisted Activity Package (CAAP) programme was made ready for the use of the experimental group students.

The researcher has developed Computer Assisted Activity Package to teach eighth standard Mathematics, utilizing a few common methods to process a digital image which have a very wide range of application in our modern world. Detailed description regarding the development of the package is as under.

4.2.3 SELECTION OF THE SUBJECT & UNIT

First of all selection of teaching unit should be done. For this, the unit under selection should carry higher dynamic matter so that animation effect could be implied on it. Further, target medium and standard was also kept in mind. For this, the researcher referred various books cited in bibliography and prevailing text-books of CBSE, ICSC and Tamil Nadu State Education Board. With the help of various textbooks different information regarding triangle section of the geometry was collected.

The content was carefully selected and arranged, according to the level and need of the students of high school level so as to fit into all Board’s (CBSE, ICSC and Tamil Nadu State Education Board) syllabus. The concept of Triangle and its different kinds, Congruence and Similarity were the main parts. Definition, explanation as well as examples were also formed.

4.2.4 DETERMINATION OF INSTRUCTIONAL OBJECTIVES

The researcher determined the following instructional objectives after deciding the content and the unit.

1. To make the students aware of the concept of triangle.
2. To enable the students to identify different kinds of triangle.
3. To enable the students to understand the aspects of Congruence of triangle.

4. To enable the students to understand the aspects of Similarity of triangle

5. To clarify the ways of work out the theorems regarding triangle.

6. To make them to comprehend kinds and theorems of triangle by listening, reading and visualizing.

7. To arouse students' curiosity by presenting the unit on computer in multimedia approach.

8. To promote interest of the students in learning triangle.

### 4.2.5 CONSTRUCTION OF THE STORYBOARD

The researcher prepared the storyboard on the basis of the instructional objectives. While selecting the subject matter, the level of the learners, and also the expected knowledge were kept in mind. At the time of analyzing and planning of the content, its style of presentation should be decided. It could be in the form of pictures, graphics or a combination of both. Presentation of content may be in the form of facts, rules, principles or concepts, accordingly information should be provided. For active involvement of the learners some activities like self-evaluation, assignments etc. could also be suggested. All these aspects together build a story board. Story board means planning and presenting the content in proper sequence of the principal points both verbal and non-verbal form. It is just like a blue-print of a building. To make the students familiar with the concept of triangle with related information and examples as well as illustrations were collected.

In the present study, the researcher created the flow chart to get related information and then prepared the story board on the basis of that flow-charts. The flow chart is as shown below.
FLOW CHART

Title
Researcher/Guide/Institute

Main menu
Concept of Triangle
Congruence of triangle

Concept of Triangle
Content Presentation
Testing Understanding
Practice : Work Book
Hope you have enjoyed learning This way

Congruence of triangle
Content Presentation
Testing Understanding
Practice : Work Book
Hope you have enjoyed learning This way
End

Similarity of Triangle
Content Presentation
Testing Understanding
Practice : Work Book
Hope you have enjoyed learning This way

Content Presentation
Testing Understanding
Practice : Work Book
Hope you have enjoyed learning This way

Hope you have enjoyed learning This way
The rough sketch of the story board was prepared. Apart from being a Tamil Medium Mathematics teacher in middle school level and a computer application trained person himself, continuous monitoring, guidance and suggestions from research guide was taken by the researcher regarding each and every matter of content, analysis and sequential order of the story board. The final story board is given as the Appendix No – 1.

4.2.6 DRAFTING OF THE TEXT

On the basis of story board, the text was prepared. - Various prescribed text books and materials and softwares collected by extensive searches on the internet were referred for the purpose. The prepared content was then computerized using a suitable true type font. Microsoft’s PowerPoint software was basically used to prepare the text as well as presentation. However, Microsoft’s Word software was extensively used for making the drawings and diagrams and then those were incorporated into the PowerPoint presentation. Mathematical Equation Editor Software for Windows was extensively used for making the equations which were then inserted into the appropriate position in the original PowerPoint presentation.

4.2.7 DEVELOPMENT OF GRAPHIC FILES

To make the programme more attractive and effective for the students, graphics, and photographs were collected from internet. Pictures and graphics were saved in .jpeg file format as they were smaller in size and faster to load. Geometrical figures were created by the researcher. Total 115 graphics in form of pictures and figures were used. All animations were created using PowerPoint programme’s animation facilities.
4.2.8 DEVELOPMENT OF POWERPOINT SLIDE SHOW

The researcher prepared the slide show utilizing PowerPoint application tool of MS Office 2003 Version on the base of the flow chart, story board, content matter and various graphics the researcher developed the slide show in the order mentioned below:

- The researcher opened the PowerPoint application from the desktop and a blank presentation slide. From the new slide dialog box a title slide option was selected.
- The title „Triangle“ and other sub-titles were entered. The font, page design, colour, shape of the title slide were fixed.
- After arranging design, colour, shape etc. a master slide was prepared.
- The text containing the details regarding researcher, the guide and the institution was created.

A slide with major objectives was created under the name of 'You will be able to learn'. In this slide the objectives were hyperlinked with its content presentation. Objectives were the sections of Triangle i.e. content. They were

1. Concept of Triangle
2. Congruence of Triangle
3. Similarity of Triangle

- Content, graphics and multimedia components pertaining to the section according to the story board were composed in sequential slides. During this process various principles such as from simple to complex, from concrete to abstracts, from known to unknown etc. were utilized. Aesthetic quality of the slides was also taken care of. A “Quit” button was also put to end the programme.
- A slide with instructions for evaluation was created under the title 'Test Your Understanding'.
• A slide with instructions for more practice which was to be given in printed form of workbook was created under the title, 'It's time to work'.

• In almost all the slides buttons designed as ‘Left Arrow” and “Right Arrow” was given to instruct the user to go back to earlier page or move forward to the next page respectively.

• Before ending the show, the last slide to seek the participants' confirmation regarding their interest in learning, that way, was created under the title, 'Hope you would have enjoyed learning this way'.

• After that the presentation was edited and formatted in order to make it more effective.

• Finally all the slides were ordered sequentially and numbered as well.

4.2.9 DEVELOPMENT OF WORKBOOK

One of the objectives of the CAI was to enable slow learners to practice independently and individually. The workbook aimed at the active participation of the slow learners. The repetition and drilling techniques used in the form of the workbook, gave them exercise in their learning. The learners were expected to practice the content learned. The content was divided into various portions. After learning each portion, practice work was planned. For these the researcher prepared a workbook of four worksheets. For each portion of the content a minimum of one worksheet was prepared. At the end of each worksheet self check & correct answer key was given.

A copy of workbook is appended as Appendix No. – 2.
4.2.10 DEVELOPMENT OF USER MANUAL

To make the whole process of learning and teaching, through multimedia package on computer more effective, a user manual was designed. In the user manual basic working steps were explained in an easy user friendly way. The user manual included the following points.

- Objectives
- The CAI Package / CD ROM
- Requirements
- Selection of the room, sitting arrangement
- Orientation towards CAI Package
- Operation of the slide show
- Division of the programme / Time Schedule

A copy of the user manual is given as Appendix No. – 3.

4.2.11 VALIDATION OF COMPUTER ASSISTED ACTIVITY PACKAGE (CAAP)

After the package was developed, the validation was done in two ways.

EXPERTS’ OPINIONS

The prepared package was shown to technical professionals as well as subject experts. Their suggestions were sought regarding the appropriateness of the slide format, fonts, objects, colour background design, animation, slide transition and graphics. For assessing and deciding the content, its coverage, analysis, order of presentation, its methodology and validity, mathematics teachers of few reputed schools of Pudukkottai city were consulted and their suggestions were duly followed.
TRYOUT

The effectiveness of any teaching-learning material can be judged taking the feedback of its user for whom the whole package is designed. Hence for tryout, the whole package was presented to a small group of students and their reactions and responses were noted. Thus the views of both the experts and the users were kept in mind and due weightage was given to them in finalizing the package. Finally CAAP Package was evolved which included the following:

- CD ROM
- Work Book
- User Manual
- Unit Test Booklet
- Answer Key Sheet

The CAAP acquires some unique characteristics.

- It clearly mentions instructional objectives.
- It helps to recall the pre knowledge as well as tests the existing knowledge.
- The content is logically divided into parts and is presented in small steps with ample illustrations which follow the basic laws of learning.
- Self checking facility is also provided.
- Inductive-deductive method is used effectively.
- The verbal content is supported by non-verbal content.
- Designing and colour scheme is pleasing.

For tryout, 10 slow learners from nearby school were identified using the diagnostic observation checklist. The developed CAAP package was used for a period of one week.
The students were encouraged to use the CAAP package. The student’s reflections on CAAP package were noted down. They have stated that the CAAP Package motivated them to learn in a more effective manner. Computer Assisted Activities helped them to understand the mathematical concepts in a more systematic manner. Students pointed out that the CAAP package is useful for self analysis and self checking while learning mathematical concepts. Even though, the design and the colour scheme were pleasing, they have also suggested some modification in the presentation of the content for better understanding. The suggestions were taken care and CAAP package was modified. Thus the final CAAP package was prepared and subjected to the experimentation. Thus for the purpose of validation of the prepared computer assisted activity package it was subjected to the experts’ opinion and it was also followed by the pilot study in which 10 slow learners were trained in computer assisted activity package. It was found that there was a significant improvement in the achievement of slow learners. Thus the computer assisted activity package is found to be valid.

4.3. CONSTRUCTION OF ACHIEVEMENT TEST

To evaluate the effectiveness of Computer Assisted Activity Package (CAAP) used in the study and to compare the achievement of experimental group students taught through Computer Assisted Activity Package (CAAP) with that of control group students taught through traditional lecture method, an achievement test was constructed. The test was constructed covering all the units. Equal weightage was given to all the units selected for the study.
Educational achievement in most courses consists of knowledge and developing ability to perform certain tasks. Knowledge is verbal faculty and to know-how. Abilities are the capabilities of performing an activity or action in practical situations. An achievement test is an instrument designed to measure relative accomplishment in the specified areas of work (Michaels, 1950). According to Anastasi (1961) the principal object of achievement tests is to appraise the effects of a course of instruction or training. A good test requires careful planning while planning the test due consideration was given to factors like content coverage, educational objectives of the topic, coverage of the form of questions, the range of item difficulty level. The investigator examined the mathematics text book of VIII standard. A thorough study of mathematics text books, work books and teachers handbooks of VIII class were done. Old question papers were collected and studied. The process of evaluation and techniques were adopted for the mathematics was discussed with practicing teachers and experts. Items of the test were prepared on the basis of major objectives given in the teacher’s handbook for class VIII. Selection of items was decided based on the due weightage to objectives, form a questions and level of difficulty.

**Weightage to Objectives**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Objectives</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Understanding</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>Application</td>
<td>35</td>
<td>35</td>
</tr>
</tbody>
</table>
The content for the test is based on VIII standard Mathematics subject.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Objectives</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concept of Triangle</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Congruence of Triangle</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Similarity of Triangle</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Objectives</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Objective Type</td>
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</tbody>
</table>

<table>
<thead>
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<th>Sl.No.</th>
<th>Objectives</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Easy</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>Average</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>Difficult</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

**Scoring Procedure**

For each correct answer, a score of 1 was given and zero was given for wrong answer. Totally, there were 100 multiple choice questions in the final achievement test. The duration of the test is 3 hours and the test was administered by the investigator and the answers scripts were scored according to the key.

**ITEM VALIDITY**

Validity is a matter of degree it does not exist on all or none basis. Consequently, we should avoid thinking of evaluation results as valid or invalid. Validity is best
considered in terms of categories that specify degree such as high Validity, moderate Validity and low Validity.

Item validity is determined by calculating the discrimination index and difficulty of each item. The investigator tried to refine the test by finding out the most suitable items to be included in the final test. The item analysis was carried out to find out the discrimination index and difficulty index of each item. The marks of test were arranged in the ascending order. The upper 27 percent of the scores and lower 27 percent of the scores were selected. The upper 27 percent of the cases constitute the upper group and the lower 27 percent of the cases constitute the lower group.

**ESTIMATION OF ITEM DISCRIMINATION INDEX**

The discrimination index of an achievement test item refers to the degree to which it discriminates between the pupils with high and low achievement. In this study, Gronlund’s procedure is followed to find out the discrimination index of each item. An estimate of item discrimination index can be obtained by subtracting the number of pupils in the lower group who got the item right ($R_L$) from the number of pupils in the upper group who got the item right ($R_U$) and dividing by on half of the total number of pupils included in the item analysis ($\frac{1}{2} T$).

\[ R_U - R_L \]

\[ \text{Discrimination Index} = \frac{R_U - R_L}{\frac{1}{2} T} \]

$R_U$ = Number of pupils got the item correct in the upper group.

$R_L$ = Number of pupils got the item correct in the lower group.

$T$ = Total number of pupils included in the item analysis.
ESTIMATION OF ITEM DIFFICULTY

This can be obtained by adding the number of pupils in the lower group who got
the item right ($R_L$) to the number of pupils in the upper group who got the item right ($R_U$)
dividing by total number of pupils included in the item analysis ($T$) and making it to
percentage.

$$ \frac{R_U + R_L}{T} $$

Difficulty Index $= \frac{\text{number of right answers}}{\text{total number of pupils}} \times 100$

To find out the discrimination index and difficulty index of each item in the
achievement test, the following procedure is adopted.

Step- I

After scoring was over the answer scripts were arranged in order from the highest to
lowest scores.

Step-II

The top 27% of answer scripts of achievement test (27) were selected and similarly the
bottom 27% of answer scripts of achievement test (27) were selected.

Step III

The discrimination index and difficulty index of each item was found out by
substituting the above formulas.
If the item has discrimination index as 0.2 or above, it is to be selected, otherwise rejected. In the same way if the item has difficulty index between 25 percent and 75 percent (inclusive of both) the item is to be selected, otherwise rejected.

The index of the items. Discrimination Index and Difficulty Index Values of the Items Achievement Test in Mathematics is given in Appendix -7.

TRYOUT

Tryout of the Achievement test was conducted with a sample of 60 students. They were informed about the test, sufficiently early to prepare themselves for taking this test. The subject areas included in the tests were also intimated to them. The investigator explained the purpose of the study to the students and asked them to complete all the items. The test was administered by the investigator and the answer scripts were collected. After the completion of the test by the students, the answer scripts were scored in accordance with the scoring key prepared. The final version of an achievement test is given in the appendix.

4.4 RELIABILITY OF THE TOOLS

‘Reliability’ may be defined as the level of internal consistency or stability of the measuring device over-time. There are several methods of estimating reliability, most of which call for computing or correlation co-efficient between two sets of similar measurement.

A test score is called reliable when we have reasons for believing the score to be stable and trustworthy. Stability and trust worthiness depend upon the degree to which the score is an index of “true ability” is free of chance error.
The correlation of the test with itself computed in several ways to be described later-is called the reliability co-efficient of the test. There are four procedures in common use of computing the reliability co-efficient of a test. These are 1) test-retest 2) Alternate or parallel forms 3) split-half technique 4) Rationale equivalence. All of these methods furnish estimates of the reproducibility of test scores, sometimes one method and sometimes another will provide the better measure.

The method of rationale equivalence which also provides an estimate of internal consistency is the only widely used technique for calculating reliability that does not require the calculation of a correlation co-efficient. This method gets at the internal consistency of the test through an analysis of the individual basic items. It requires only a single administration of the test. A number of formulas have been developed to calculate reliability using this method. These are generally referred to as the Kuder-Richardson formula. It is often useful to the teachers and others who want to determine quickly the reliability of short objective classroom examination. It reads

\[ r_h = \frac{n\sigma^2 - M(n-M)}{(n-1)\sigma^2} \]

In which

- \( r_h \) = reliability of the whole test.
- \( n \) = number of items in the test.
- \( \sigma^2 \) = SD of the test scores.
- \( M \) = the mean of the test scores.
Rationale equivalence is superior to the split-half technique in certain theoretical aspects, but the actual difference in reliability coefficients found by the two methods is never large and is often negligible.

Hence, the investigator adopted and computed the rationale equivalence for calculating the reliability of the Achievement test. This formula is a labour saver since only the mean, SD and the number of items in the test need be known in order to get an estimate of reliability.

RELIABILITY OF THE ACHIEVEMENT TEST

Substituting the rationale equivalence method formula, reliability of the tool (achievement test) was calculated. The achievement test of 140 multiple choice items was administered to the sample of 60 students. An item answered correctly was scored 1; an item answered incorrectly was scored 0. The mean test score was 89.62 and SD =15.47. Therefore

\[
140(15.47)^2 - 89.62(140-89.62)
\]

\[r_{\eta} = \frac{(15.47)^2 x (140-1)}{89.62(140-89.62)}\]

\[= 0.85\]

The reliability of the present achievement test as measured by Rationale equivalence method is 0.85. This shows that the test scores is highly reliable one for all practical purposes.
REFINED TOOL

The refined tool consisted of 100 items in Achievement in Mathematics. Items with discriminating index 0.20 and above and difficulty index with 25 percent to 75 percent were selected. The final tool is administered to 60 students. The duration of the test is 180 minutes and the test was administered by the investigator and the answer scripts were scored according to key.

4.5. VALIDITY OF THE TOOLS USED IN THE STUDY

A tool is said to be valid if it measures what it is supposed to measure (Best 2007). Validity of the tools used in the study is explained below.

4.5.1 CONTENT VALIDITY

The content validity showed the adequacy of the content of the test. The tools used in the current study possessed content validity. The items in the diagnostic observation checklist, achievement test and CAAP package were based on the relevant literature and consultation with the experts in the field. Their valid suggestions were taken into account while constructing as well as restructuring the tool used in the study. Thus, the above tools possess content validity.

4.5.2 FACE VALIDITY

Face validity refers to the way the test appears to those it is meant, the experts and educationists. This is an estimate of whether a test appears to measure a certain criterion. The tools developed for the present study were given to the experts in the field. Based on the experts consultation and opinion it can be said that the tool used in the study possess face validity.
4.5.3 INTRINSIC VALIDITY

Intrinsic Validity is stated how well the obtained scores measure the test true score components. The Square root of the reliability value of the scale is its intrinsic validity. The intrinsic validity of the diagnostic observation checklist (0.88), achievement test (0.92) was found to be high. Hence, the above tools possess intrinsic validity.

4.6. SAMPLE OF THE STUDY

For the purpose of the investigation 60 students of VIII std. from Government High school, Puthamboor were selected. They were divided into two halves to constitute the experimental group and the control group. They were selected on the basis of their performance in the half yearly examination.

4.6.1. DESCRIPTION OF THE SAMPLE AND SAMPLING TECHNIQUE

All the sixty students studying in VIII standard were selected for the study. They were placed in the order of merit. All the odd number students constituted the control group, while the even number students formed the experimental group. Within the group proportionate sampling was done in the sense that it was ensured that each group contained 10 slow learners, 10 average students and 10 above average students forming experimental group and control group I, experimental group and control group II and experimental group and control group III. The experimental group was taught through computer assisted instruction while the control group was taught through the traditional lecture method. The main focus of this study is to measure the effectiveness of Computer Assisted Activity Package (CAAP) in learning mathematical concepts by middle school slow learners and to assess its advantage over the traditional lecture method pre-test-post-test equivalent group experimental design of slow learners was adopted. To
compare its effectiveness over other categories of students - above average and average students were also taken in the present study. Experimental and control group of above average and average students comparison will also be helpful to know which category of students benefit much out of CAAP package. For strong authentication of the effectiveness of the CAAP package the other categories of students were also included in this study

4.6.2. PROCEDURE FOR EQUATING THE GROUPS

After forming the groups it was necessary to see whether both the groups were matched ones or not. For this purpose Mean and Standard Deviations were calculated for their half yearly examination scores. The ‘t’ test was applied to see whether there existed any significant difference between the control group and experimental group before the experiment. The obtained ‘t’ – value (0.22) reveals that both the groups were matched ones before the experiment.

4.7. TEACHING THROUGH COMPUTER ASSISTED ACTIVITY PACKAGE (CAAP)

The experimental group students were subjected to Computer Assisted Activity Package (CAAP) treatment while the control group students were taught through traditional lecture method. The experiment was conducted for a period of 30 days at the rate of one hour per day. The Computer Assisted Activity Package (CAAP) was given to the students and they were encouraged to make self study with the help of the Computer Assisted Activity Package (CAAP).

Teacher’s role was limited to the extent of clarifying the doubts, and providing adequate guidance to the students in practicum and project activities. Thus better learning
experiences and exposures were ensured to the experimental group students which could ultimately tell upon their performance in the post – test.

4.7.1 OPINIONS REGARDING CAI PACKAGE

After the treatment phase, an opinionnaire was given to the students' of the experimental group to get the feedback regarding Computer Assisted Activity Package (CAAP). Opinionnaire was also developed with three point rating scale, the three points being 'agree', 'undecided' and 'disagree'. The code numbers 1, 2 and 3 were given to the points 'agree', 'undecided' and 'disagree' respectively as nominal scale. After counting the frequencies the analysis was done employing Chi-Square technique.

4.7.1.1 INTERNAL VALIDITY AND EXTERNAL VALIDITY OF THE STUDY

Internal Validity

Internal validity refers to the extent to which the independent variable caused the change in the dependent variable. Internal validity is threatened by the following.

History

Unexpected events affect the dependent variable while the experiment is progress. This may affect the response / behaviour of the subjects which may falsely be attributed as the effect of treatment. During the present experiment no such event occurred.

Selection

Selection of the sample was done by random assignment of students in experimental and control groups based on their half yearly marks. So no selection bias occurred.
Testing

The effect of test upon the subsequent test is called testing threat. In this experiment the tests were conducted in an informal manner. Besides, it was ensured that the subjects were not unduly sensitized on the experimentation process. Hence, this threat was nullified.

Instrumentation

Sometimes the instruments used in an experiment may influence the behaviour of the subjects. This is called instrument reactivity. Instrument can create problem if its nature changes suddenly. The same pattern of instruments was used throughout the study. Hence this threat was eliminated.

Mortality

Sudden death or dropout of a subject in both groups will affect the internal validity but know such causes were reported in the present study. So this threat was eliminated.

Hawthorne Effect

The subjects may show desirable behaviour owing to the special attention given to them. This may be mis constructed as the result of treatment. As all the groups are labeled and treated in a same manner. This threat was eliminated. All the groups were told that they would undergo the same training.

Statistical Regression

This problem refers to the tendency for participants who score at extremes (extremely high or extremely low) during the pre test to produce post test scores regressed
towards the mean. Changes occurring due to this may falsely attributed to the effects of experimental stimulus. For this research no such extreme scores were reported during the pre-test. So this threat was eliminated.

**Diffusion**

This happens when participants in control group know about or get affected by intervention inadvertently and change their behaviour. This threat was eliminated by ensuring both groups maintained the confidentiality of their training.

**External Validity**

External Validity refers to the extent to which the findings can be generalized. If an experiment has a high external validity, its finding can be extended to similar situations. Normally external validity is threatened by multiple treatments, however only one treatment was given. So this threat was nullified.

**4.8. DATA COLLECTION**

At the end of the experimental period, to assess the effectiveness of the experimental treatment an achievement test known as post-test was administered to the experimental group students and the control group students. The responses given by both the groups formed the vital data required for analysis.

**4.9. SCORING PROCEDURE**

The achievement test consisted of 100 objective type questions. The total score of the achievement test is 100. For each correct answer, the score is ‘one’ and for each wrong answer the score is ‘zero’. The answer key to the achievement test is given in Appendix – VIII
4.10 STATISTICAL TECHNIQUES USED IN THE STUDY

The data thus obtained were analyzed by using appropriate statistical techniques such as mean, standard deviation, ‘t’ test, ‘F’ test and Chi- square test.

The details of analysis and interpretations are presented in the succeeding chapter.