# CHAPTER – 5

SUMMARY, FINDINGS, EDUCATIONAL IMPLICATIONS AND SUGGESTION

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CHAPTER – 5

SUMMARY, FINDINGS, EDUCATIONAL IMPLICATIONS AND SUGGESTION

5.1.0 INTRODUCTION

After having presented the data analysis and data interpretation the researcher reach to conclusion through the comprehensive and elaborative depiction of the setting that emerged from the process done in the last chapter. In this chapter the researcher presents the summary, major findings, educational implications and suggestion for the further study.

5.2.0 RATIONALE OF THE STUDY

Education systems around the world face formidable challenges that are taxing conventional strategies. A paradigm shift is taking place in the learning environment from the conventional teacher-centric ‘teaching’ to learner-centric ‘learning’.

Fresh approaches are needed to address persistent problems of the past and provide students with an education appropriate to the needs of a modern, information-based global economy. Now, after more than two decades of unfulfilled promises to revolutionize education, computer and communication technologies are finally able to offer opportunities to significantly improve teaching and learning.

The environments in which students learn, and the ways in which people work and live, are constantly being transformed by existing and emerging technologies, hence computer technology needs to be integrated in the school environment. To be well informed and active participants in our changing society, students will need to be self-directed learners, able to identify issues, pose questions, synthesize ideas, determine solutions to problems and develop capabilities and confidence with a range of technologies.

With the increasing availability and accessibility of microcomputers, instruction that combines sound learning principles with the functionality of computers forms a potentially effective teaching method called Computer Assisted Instruction (CAI).
The discussion of the review of related research given below will make the things more clear. In foreign countries, many computer programs are developing especially in mathematics. But, in India very less work had done in this field. Very few experimental researches are carried out in India.


More over very few studies are carried out in the subject of physics. Most of the researches are done in the field of Chemistry, Mathematics and English. The researcher from the review of the related literature as briefly discussed above did come across only three studies conducted for teaching physics on CAI; Jeyamani (1991), Kadhiravan S (1999) and Patel (2008) therefore to measure the effectiveness of CAI present study has been under taken by the researcher.

The superstitious teacher often leaves the student in such a drastic condition that they ever lived in dilemma. As far as physics is concern it is an important subject in life as well as in study of higher education. So to find out the effectiveness of teaching physics with the help of computer this research work is under taken.

5.3.0 SUMMARY

This research was an experimental study aimed to evaluate the effectiveness of CAI vs. traditional instructional method. The objectives were to compare the learning effects of two groups with traditional instructional method and Computer Assisted
Instruction studying the same curriculum and the effects of CAI. The study was delimited to two schools, one from rural and another from urban area of Surat district. The research was true experimental in nature. The research design followed by researcher is the pre test post test control group design. The software used for CAI group was prepared by the researcher himself consisted of simulation and drill and practice modes of the CAI with the few latest software. The two groups of rural and urban area are consisted of 50 students each, one was called experimental group and another is called traditional group. Initially IQ and pre test was administrated and latterly package was implicated on experimental group. Post test was taken after completed the experiment. The opinion was taken from the student of the experimental group. Statistical analyses were done with the help of ANCOVA and $\chi^2$ test.

5.3.1 STATEMENT OF THE PROBLEM

The statement of the problem could be stated as

Computer Assisted Instruction in physics for the student of standard XII: An Experimental Study

5.3.2 OBJECTIVES OF THE STUDY

Objectives of the present study were considered as follows:

1. To develop CAI package in a unit of wave optics for standard XII science students studying GSTB syllabus.
2. To study the effectiveness of CAI Package in a unit of wave optics for standard XII science students.
3. To compare the corrected means of achievement of controlled groups and experimental groups by considering pre test score and IQ as a co-variable in a unit of optics for standard XII science students.
4. To study the influence of gender, teaching method and their interaction between corrected means of achievement of post test of control group and experimental group by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.
(5) To study the influence of area, teaching method and their interaction between corrected means of achievement of post test of control group and experimental group by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(6) To study the influence of area, gender, teaching method and their interaction between corrected means of achievement of post test of control group and experimental group by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(7) To compare the corrected means of achievement of the boys of experimental group of urban and rural area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(8) To compare the corrected means of achievement of the girls of experimental group of urban and rural area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(9) To compare the corrected means of achievement of the girls and boys of experimental group of urban area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(10) To compare the corrected means of achievement of the girls and boys of experimental group of rural area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(11) To compare the corrected means of achievement of the boys and girls of experimental groups by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(12) To compare the corrected means of achievement of the experimental groups of rural and urban area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(13) To study the opinions of the students of experimental groups regarding effectiveness of used CAI in optics.

(14) To study the opinions of the boys and girls of experimental groups regarding effectiveness of used CAI in optics.
5.3.3 HYPOTHESIS

In this experimental type of study, the researcher has formulated following null hypothesis:

(1) There will be no significant difference between corrected means of achievement of control group and experimental group of rural area by considering pre test score and IQ as a co-variable in a unit of wave optics for standard XII science students.

(2) There will be no significant difference between corrected means of achievement of control group and experimental group of urban area by considering pre test score and IQ as a co-variable in a unit of wave optics for standard XII science students.

(3) There will be no significant difference between corrected means of achievement of control groups and experimental groups of rural and urban area by considering pre test score and IQ as co variable in a unit of wave optics for standard XII science students.

(4) There will be no significant influence of gender, teaching method and their interaction between corrected means of achievement of post test of control group and experimental group by considering pre test score and IQ as covariate.

(5) There will be no significant influence of area, teaching method and their interaction between corrected means of achievement of post test of control group and experimental group by considering pre test score and IQ as covariate.

(6) There will be no significant influence of area, gender, teaching method and their interaction between corrected means of achievement of post test of control group and experimental group by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(7) There will be no significant difference between the corrected means of achievement of the boys of experimental group of urban and rural area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(8) There will be no significant difference between the corrected means of achievement of the girls of experimental group of urban and rural area by
considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(9) There will be no significant difference between the corrected means of achievement of the girls and boys of experimental group of urban area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(10) There will be no significant difference between the corrected means of achievement of the girls and boys of experimental group of rural area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(11) There will be no significant difference between the corrected means of achievement of the girls and boys of experimental groups by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(12) There will be no significant difference between the corrected means of achievement of the experimental groups of rural and urban area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students.

(13) There will be no significant difference between opinions of boys and girls of experimental group.

5.3.4 POPULATION OF THE STUDY

A “Population” is any group of individuals/units that have one or more characteristics in common which are of interest to the researcher, for a particular research. All the students studying standard XII of science stream of Gujarati medium schools of Gujarat Secondary and Higher Secondary Education Board, Gandhinagar, Gujarat constitute the population of the present research.

5.3.5 SAMPLE OF THE STUDY

As per purposive sampling technique one school, M. B. Vamdot Sarvajanik High School, Bardoli, of Higher Secondary Science stream was selected and pilot testing was made on boys and girls of XII Science. For Pilot testing of CAI package students were
selected on the basis of their marks of XI in the Physics subject. Detailed regarding pilot testing is as follows with achievers category.

**Table: 5.1**  
Achievers category for pilot testing

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marks</td>
<td>More than 60 Marks</td>
<td>Less than 60 but more than 45</td>
<td>Less than 45</td>
</tr>
</tbody>
</table>

**Table: 5.2**  
Detail of the sample for pilot testing

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of Students</th>
<th>Total Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Girls</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

As per the topic ‘Computer Assisted Instruction in Physics for the student of standard XII: An Experimental Study’, to check the effectiveness of the CAI package researcher used Multistage sampling technique. For the present study the city and schools was selected purposively. For it the researcher selected two schools, The N. D. Desai Sarvjanik High school, Vankal and B.A.B.S High School, Bardoli. These schools were selected with the purpose of getting all the required facilities as well one school from rural and other is form urban area was selected. From the selected schools, the students are selected randomly using lottery method. In each school two groups are formed having 50 students in each. One group constituted experimental group and other as control group. Thus total 200 students were selected as sample for the present research work. The detail regarding sample is as below.
Table: 5.3
Sample for the experiment

<table>
<thead>
<tr>
<th>No</th>
<th>School Name</th>
<th>Group</th>
<th>Girls</th>
<th>Boys</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The N.D. Desai Sarvjanik High School, Vankal</td>
<td>Traditional Group</td>
<td>17</td>
<td>33</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experimental Group</td>
<td>18</td>
<td>32</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>35</td>
<td>65</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>B.A.B.S High School, Bardoli</td>
<td>Traditional Group</td>
<td>26</td>
<td>24</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experimental Group</td>
<td>26</td>
<td>24</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>52</td>
<td>48</td>
<td>100</td>
</tr>
</tbody>
</table>

Initially pre test was implemented on the students of both the schools. Than IQ test was conducted. These groups are than randomly, by lottery method, divided in to two groups and experimental group learn through computer while traditional group learn with the help of their teacher.

5.3.6 TOOLS FOR DATA COLLECTION

The tools used during the research for collecting data were classified in to two categories
1. Tools developed by researcher

For the present research work following are the tools that are developed by researcher (i) Achievement test (ii) Opinionnaire (iii) CAI package.

2. Standardized tools

(i) Desai Verbal and Non-verbal Group Intelligence test.

5.3.7 DESIGN OF THE STUDY

The present research was a developmental cum experimental research. The researcher has selected the topic “Computer Assisted Instruction in Physics for the student of Standard XII: An Experimental study” for the study. The researcher follows
pre test post test control group design. This study conducted in two phase. During the first phase CAI package was developed on one chapter of physics of standard XII, chapter 11-Wave Optics. In the second phase effectiveness of the developed CAI package was checked. The effectiveness of developed CAI package was checked with pre test post test control group design with replication in terms of students’ achievement.

The purpose of this research design is to find out true effect of the treatment. This design control history, maturation and other factor that threat internal validity. The students of control and experimental group are administrated similar achievement test. The design of the present research is presented in diagram below.
CHART 5.1
PRE TEST POST TEST CONTROL GROUP DESIGN

Area
SURAT DISTRICT

RURAL AREA
N = 100

GROUP -1
CONTROL GROUP
N = 50

GROUP - 2
EXPERIMENTAL GROUP
N = 50

IQ TEST
40 MINUTE
PRE TEST
1 HOUR

TEACHING THROUGH TRADITIONAL METHOD
24 PERIOD

POST TEST
1 HOUR

OPINIONNAIRE
20 MINUTE

URBAN AREA
N = 100

GROUP -1
CONTROL GROUP
N = 50

GROUP - 2
EXPERIMENTAL GROUP
N = 50

IQ TEST
40 MINUTE
PRE TEST
1 HOUR

TEACHING THROUGH CAI PACKAGE
24 PERIOD

POST TEST
1 HOUR

OPINIONNAIRE
20 MINUTE
5.3.8 VARIABLES OF THE STUDY

Variables are the conditions or characteristics that the experimenter manipulates controls or observe. Key elements in a research problem are the variables. For the present research work variables are as below.

Independent variables : 1. learning through CAI package
                       2. Teaching through conventional method
Dependent variables   : 1. Achievement score obtained by the student on post test
Moderator variables   : 1. Area – Rural and urban
                       2. Gender – Boys and girls
                       3. IQ level
Covariant             : 1. Pre test score
                       2. IQ
Control variables     : 1. Standard XII
                       2. Subject – Physics
                       3. Medium – Gujarati
                       4. Time
Intervening variables : 1. Innovation in experiment
                       2. Interest and excitement in subject
                       3. Maturity
                       4. Interaction among student
                       5. Extra coaching

5.3.9 STATISTICAL ANALYSIS

The collected data were analyzed with the help of SPSS 17.0 version. Statistical technique employ for data analysis is as shown in table 3.3
Table 5.4
Objectives and the statistical technique used for the objective

<table>
<thead>
<tr>
<th>No.</th>
<th>Objective</th>
<th>Hypothesis</th>
<th>Applied statistical technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2, 3</td>
<td>1, 2, 3</td>
<td>Analysis of Co-variance (ANCOVA)</td>
</tr>
<tr>
<td>2</td>
<td>4, 5</td>
<td>4, 5</td>
<td>$2 \times 2$ Analysis of Co-variance (ANCOVA)</td>
</tr>
<tr>
<td>3.</td>
<td>6</td>
<td>6</td>
<td>$2 \times 2 \times 2$ Analysis of Co-variance (ANCOVA)</td>
</tr>
<tr>
<td>4.</td>
<td>7 to 12</td>
<td>7 to 12</td>
<td>Analysis of Co-variance (ANCOVA)</td>
</tr>
<tr>
<td>5.</td>
<td>13</td>
<td>-</td>
<td>$\chi^2$ (Chi Square) Test.</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>13</td>
<td>Contingency Table $\chi^2$ (Chi Square) Test.</td>
</tr>
</tbody>
</table>

Above table shows that the objective no. 2, 3, 4, 5 and 6 were analyzed with the help of Analysis of Co-Variance. Objective no. 7 was for the opinion regarding developed CAI, hence its analysis was done through Chi-Square test.

5.4.0 MAJOR FINDINGS

5.4.1 Findings of the obtained data through analysis of Covariance

5.4.1.1 Findings regarding post test score of Control and experimental group by considering pre test and IQ as a Co Variable for rural area.

To compare control group and experimental group of the rural area achievement of the experimental group was compared with the control group. The F-value was found to be 121.15 which was found to be significant at 0.01 level of significance for the degree of freedom 1 and 96. Hence it can be said that there is significant difference between the corrected post test means of control and experimental group. Hence, the null hypothesis 1, “There will be no significant difference between corrected means of achievement of control group and experimental group of rural area by considering pre test score
and IQ as a co-variable in a unit of wave optics for standard XII science students” is rejected.

The obtained difference between corrected mean scores for experimental and control groups was found to be 10.80, which was found to be significant at 0.01 level of significance. It showed that the experimental group scored higher than the control group in the post test which may be due to the effect of CAI. Hence it can be said that teaching physics through Computer Assisted Instruction is comparatively better than traditional method in terms of the achievement of the students.

5.4.1.2 Findings regarding post test score of Control and experimental group by considering pre test and IQ as a Co Variable for urban area.

To compare control group and experimental group of the rural area achievement of the experimental group was compared with the control group. The F-value was found to be 354.95 which was found to be significant at 0.01 level of significance for the degree of freedom 1 and 96. Hence it can be said that there is significant difference between the corrected post test means of control and experimental group. Hence, the null hypothesis 2, “There will be no significant difference between corrected means of achievement of control group and experimental group of urban area by considering pre test score and IQ as a co-variable in a unit of wave optics for standard XII science students” is rejected.

The obtained difference between corrected mean scores for experimental and control groups was found to be 12.20, which was found to be significant at 0.01 level of significance. It showed that the experimental group scored higher than the control group in the post test which may be due to the effect of CAI. Hence it can be said that teaching physics through Computer Assisted Instruction is comparatively better than traditional method in terms of the achievement of the students.

5.4.1.3 Findings regarding post test score of Control and experimental group by considering pre test and IQ as a Co Variable for rural and urban area.

To compare control group and experimental group of the rural area achievement of the experimental group was compared with the control group. The F-value was found to be 395.45 which was found to be significant at 0.01 level of significance for the degree of freedom 1 and 96. Hence it can be said that there is significant difference between the
corrected post test means of control and experimental group. Hence, the null hypothesis 3, “There will be no significant difference between corrected means of achievement of control group and experimental group of rural and urban area by considering pre test score and IQ as a co-variable in a unit of wave optics for standard XII science students” is rejected.

The obtained difference between corrected mean scores for experimental and control groups was found to be 12.43, which was found to be significant at 0.01 level of significance. It showed that the experimental group scored higher than the control group in the post test which may be due to the effect of CAI. Hence it can be said that teaching physics through Computer Assisted Instruction is comparatively better than traditional method in terms of the achievement of the students.

5.4.2 Findings of the obtained data through Factorial analysis of Analysis of Co-variance.

5.4.2.1 Findings regarding post test score of teaching method, gender and their interaction by considering pre test and IQ as a Co Variable.

(A) Teaching Method

For df = 1 and df = 194 table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value for teaching method was 379.83, which was found to be significant at 0.01 level of significance. Hence the null hypothesis 4 “There will be no significant influence of teaching method” was rejected.

From this it can be concluded that by considering IQ and pre test as co-variant there was a significant influence of teaching method on achievement of post test score of experimental group and control group.

It can be concluded that the mean achievement of experimental groups that were taught through CAI is significantly higher than that of the control groups. The experimental group scored higher than the control group in the post test which may be due to the effect of CAI.
(B) Gender

For $df = 1$ and $df = 194$ table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value for gender was 1.033, which was found to be non significant at 0.05 level of significance. Hence the null hypothesis 4 “There will be no significant influence of Gender” was accepted.

From this it can be concluded that by considering IQ and pre test as co-variant there was no significant influence of gender on achievement of post test score of experimental group and control group. It means that the Boy students and Girl students learn at same rate.

(A $\times$ B) Interaction

For $df = 1$ and $df = 194$ table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value was 0.017, which was found to be non significant at 0.05 level of significance. Hence the null hypothesis 4 “There will be no significant influence of interaction among teaching method and gender” was accepted.

From this it can be concluded that by considering IQ and pre test as co-variant there was no significant influence of interaction among teaching method and gender on achievement of post test score of experimental group and control group.

5.4.2.2 Findings regarding post test score of teaching method, area and their interaction by considering pre test and IQ as a Co Variable.

(A) Teaching Method

For $df = 1$ and $df = 194$ table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value for teaching method was 402.40, which was found to be significant at 0.01 level of significance. Hence the null hypothesis 5 “There will be no significant influence of teaching method” was rejected.

From this it can be concluded that by considering IQ and pre test as co-variant there was a significant influence of teaching method on achievement of post test score of experimental group and control group.
It can be concluded that the mean achievement of experimental groups that were taught through CAI is significantly higher than that of the control groups. The experimental group scored higher than the control group in the post test which may be due to the effect of CAI.

**(B) Area**

For df = 1 and df = 194 table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value for area was 52.60, which was found to be significant at 0.01 level of significance. Hence the null hypothesis 5 “There will be no significant influence of area” was rejected.

From this it can be concluded that by considering IQ and pre test as co-variant there was a significant influence of area on achievement of post test score of experimental group and control group. It means that there was a significant influence of area on learning rate of the Boy students and Girl students of the experimental group and control group.

The obtained difference between corrected mean scores for rural area and urban area was found to be 7.91, which was found to be significant at 0.01 level of significance. It can be concluded that the mean achievement of urban area is significantly higher than that of the rural area.

**(A × B) Interaction**

For df = 1 and df = 194 table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value was 3.62, which was found to be non significant at 0.05 level of significance. Hence the null hypothesis 5 “There will be no significant influence of interaction among teaching method and area” was accepted.

From this it can be concluded that by considering IQ and pre test as co-variant there was no significant influence of interaction among teaching method and area on achievement of post test score of experimental group and control group.

**5.4.2.3 Findings regarding post test score of teaching method, gender, area and their interaction by considering pre test and IQ as a Co Variable.**
(A) Teaching Method

For df = 1 and df = 190 table values are F_{0.05} = 3.89 and F_{0.01} = 6.76. The computed F-value for teaching method was 383.93, which was found to be significant at 0.01 level of significance. Hence the null hypothesis 6 “There will be no significant influence of teaching method” was rejected.

From this it can be concluded that by considering IQ and pre test as co-variant there was a significant influence of teaching method on achievement of post test score of experimental group and control group.

It can be concluded that the mean achievement of experimental groups that were taught through CAI is significantly higher than that of the control groups. The experimental group scored higher than the control group in the post test which may be due to the effect of CAI.

(B) Gender

For df = 1 and df = 190 table values are F_{0.05} = 3.89 and F_{0.01} = 6.76. The computed F-value for gender was 1.732, which was found to be non significant at 0.05 level of significance. Hence the null hypothesis 6 “There will be no significant influence of Gender” was accepted.

From this it can be concluded that by considering IQ and pre test as co-variant there was not significant influence of gender on achievement of post test score of experimental group and control group. It means that the Boy students and Girl students learn at same rate.

(C) Area

For df = 1 and df = 190 table values are F_{0.05} = 3.89 and F_{0.01} = 6.76. The computed F-value for area was 44.99, which was found to be significant at 0.01 level of significance. Hence the null hypothesis 6 “There will be no significant influence of area” was rejected.

From this it can be concluded that by considering IQ and pre test as co-variant there was a significant influence of area on achievement of post test score of
experimental group and control group. It means that there was a significant influence of area on learning rate of the Boy students and Girl students of the experimental group and control group.

The obtained difference between corrected mean scores for rural area and urban area was found to be 7.91, which was found to be significant at 0.01 level of significance. It can be concluded that the mean achievement of urban area is significantly higher than that of the rural area.

(A×B) Teaching Method × Gender

For df = 1 and df = 190 table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value was 0.001, which was found to be non significant at 0.05 level of significance. Hence the null hypothesis 6 “There will be no significant influence of interaction among teaching method and gender” was accepted.

From this it can be concluded that by considering IQ and pre test as co-variant there was no significant influence of interaction among teaching method and gender on achievement of post test score of experimental group and control group.

(B×C) Gender × Area

For df = 1 and df = 190 table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value was 2.21, which was found to be non significant at 0.05 level of significance. Hence the null hypothesis 6 “There will be no significant influence of interaction among gender and area” was accepted.

From this it can be concluded that by considering IQ and pre test as co-variant there was no significant influence of interaction among gender and area on achievement of post test score of experimental group and control group.

(A×B×C) Interaction

For df = 1 and df = 190 table values are $F_{0.05} = 3.89$ and $F_{0.01} = 6.76$. The computed F-value was 0.475, which was found to be non significant at 0.05 level of
significance. Hence the null hypothesis 6 “There will be no significant influence of interaction among teaching method, gender and area” was accepted.

From this it can be concluded that by considering IQ and pre test as co-variant there was no significant influence of interaction among teaching method, gender and area on achievement of post test score of experimental group and control group.

5.4.3 Findings of the obtained data of the experimental group through analysis of Covariance.

5.4.3.1 Findings regarding post test score of the boys of experimental group of urban and rural area by considering pre test score and IQ as co-variable.

To compare boys of the rural and urban area of the experimental group achievement of the experimental group was compared with the control group. The F-value was found to be 25.04 which was found to be significant at 0.01 level of significance for the degree of freedom 1 and 52. Hence, the null hypothesis 7, “There will be no significant difference between the corrected means of achievement of the boys of experimental group of urban and rural area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students” is rejected. Hence it can be said that there is significant difference between the corrected post test means of boys of the rural and urban area of the experimental group.

The obtained difference between corrected mean scores for the boys of experimental groups of rural and urban area was found to be 7.69, which was found to be significant at 0.01 level of significance. It showed that the boys of experimental groups of urban area scored higher than the boys of experimental groups of rural area in the post test. As the Hypothesis-7 was rejected, it can be concluded that the mean achievement of boys of experimental groups of urban area is significantly higher than that of the boys of experimental groups of rural area.

5.4.3.2 Findings regarding post test score of the girls of experimental group of urban and rural area by considering pre test score and IQ as co variable.
To compare girls of the rural and urban area of the experimental group achievement of the experimental group was compared with the control group. The F-value was found to be 15.01 which was found to be significant at 0.01 level of significance for the degree of freedom 1 and 40. Hence, the null hypothesis 8, “There will be no significant difference between the corrected means of achievement of the girls of experimental group of urban and rural area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students” is rejected. Hence it can be said that there is significant difference between the corrected post test means of girls of the rural and urban area of the experimental group.

The obtained difference between corrected mean scores for the girls of experimental groups of rural and urban area was found to be 4.74, which was found to be significant at 0.01 level of significance. It showed that the girls of experimental groups of urban area scored higher than the girls of experimental groups of rural area in the post test. As the Hypothesis-8 was rejected, it can be concluded that the mean achievement of girls of experimental groups of urban area is significantly higher than that of the girls of experimental groups of rural area.

5.4.3.3 Findings regarding post test score of the girls and boys of experimental group of urban area by considering pre test score and IQ as co variable.

To compare girls and boys of the experimental group of rural area achievement of the girls of the experimental group was compared with the boys of the experimental group. The F-value was found to be 0.047 which was found to be not significant at 0.01 level of significance for the degree of freedom 1 and 46. Hence, the null hypothesis 9, “There will be no significant difference between the corrected means of achievement of the girls and boys of experimental group of urban area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students” is accepted. Hence it can be said that there is no significant difference between the corrected post test means of girls of the urban area and boys of the urban area of the experimental group.
5.4.3.4 Findings regarding post test score of the girls and boys of experimental group of rural area by considering pre test score and IQ as co variable.

To compare girls and boys of the experimental group of urban area achievement of the girls of the experimental group was compared with the boys of the experimental group. The F-value was found to be 2.059 which was found to be not significant at 0.01 level of significance for the degree of freedom 1 and 46. Hence, the null hypothesis 10, “There will be no significant difference between the corrected means of achievement of the girls and boys of experimental group of rural area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students” is accepted. Hence it can be said that there is no significant difference between the corrected post test means of girls of the rural area and boys of the rural area of the experimental group.

5.4.3.5 Findings regarding post test score of the girls and boys of experimental groups by considering pre test score and IQ as co variable.

To compare girls and boys of the experimental group achievement of the girls of the experimental groups was compared with the boys of the experimental groups. The F-value was found to be 0.695 which was found to be not significant at 0.01 level of significance for the degree of freedom 1 and 96. Hence, the null hypothesis 11, “There will be no significant difference between the corrected means of achievement of the girls and boys of experimental groups by considering pre test score and IQ as co variable in a unit of optics for standard XII science students” is accepted. Hence it can be said that there is no significant difference between the corrected post test means of

5.4.3.6 Findings regarding post test score of the experimental groups of rural and urban area by considering pre test score and IQ as co variable.

To compare experimental groups of rural and urban area achievement of the experimental group of rural area was compared with the experimental group of the urban area. The F-value was found to be 42.48 which was found to be significant at 0.01 level of significance for the degree of freedom 1 and 96. Hence, the null hypothesis 12,
“There will be no significant difference between the corrected means of achievement of the experimental groups of rural and urban area by considering pre test score and IQ as co variable in a unit of optics for standard XII science students” is rejected. Hence it can be said that there is significant difference between the corrected post test means of experimental group of the rural area and experimental group of the urban area.

The obtained difference between corrected mean scores for the experimental groups of rural and urban area was found to be 6.66, which was found to be significant at 0.01 level of significance. It showed that the experimental groups of urban area scored higher than the experimental groups of rural area in the post test. As the Hypothesis-12 was rejected, it can be concluded that the mean achievement of experimental groups of urban area is significantly higher than that of the experimental groups of rural area.

5.4.4 Findings on the opinions of the students obtained through opinionnaire.

5.4.4.1 Findings on the opinions of the students learning through Computer Assisted Instruction.

1. The CAI package presented through the computer was knowledgeable believes by the majority of the student.
2. Most of the students consider that the content presentation was interesting.
3. Majority of the students believe that simulation takes them to the depth of the topic and provide real like experience.
4. The students believe that the figures were properly explained.
5. The students found that the language used in the CAI package was easy.
6. The students found that the picture and text presented for each slide was appropriate.
7. The students think that the question at the end of slides does not break the continuity of the topic.
8. Most of the students disagree with the statement that some information seems to be more confusing.
9. Majority of the student suggested that they like to learn other topics of the physics also with this kind of CAI.
10. Most of the students found that they like to learn through such Self Learning package.
11. The students believe that the content presented in CAI package was arranged properly.
12. Most of the students think that the colored and animated pictures helped them to develop their interest in learning physics.
13. The students think that this type of learning program should be used in other subjects also.
14. The students found that each topic becomes easier while learning through CAI package.
15. The students believe that the learning through Computer is really a captivating experience.
16. Majority of the students thinks that presentation through Such technique reduce the burden of content.
17. The students did not feel that it is long and exhausting to learn through CAI package.
18. Majority of the students found that learning through CAI package is motivating to know more about the subject.
19. The students believes that content was presented at proper pace.
20. The students believes that the explanation given for every topic is proper.

5.4.4.2 Findings on the opinions of the students as per gender learning through Computer Assisted Instruction.

For $\chi^2$ test the table value for df = 4 at 0.01 and 0.05 level are 9.488 and 13.277. It was concluded that $\chi^2$ value for every statement is not significant even at 0.05 level of significance. Hence the null hypothesis “There will be no significant difference between opinion of Boys and girls of experimental group” is accepted. Hence, it can be said that the boys and girls of the experimental group posses the same opinion regarding the learning through CAI package.
5.5.0 EDUCATIONAL IMPLICATIONS

Technology is becoming more and more dominant in our society. Everyday upgrades are being made and new innovations are being discovered. Technology is all around us whether we want it to be or not: it is the vehicles we drive, it can be found in our homes, and can even be found in the Ice cream parlor. Every place we look there is some type of technology. Technology has had a major impact on our school systems and is still impacting it today. There are those who do not agree, though, that technology has impacted our schools. Eric Gormly writes, “In fact, many theorists point out the overall impact of technology on education has been quite small, manifesting little discernible change in the classroom.” Yes, there are some schools that are not as advanced as others, but many of them do have a significant amount of technology in them. It finds it fascinating that so much technology has been incorporated into our classrooms.

Too often, discussions of technology in education centre on comparisons to standard approaches for teaching conventional content. However, the issue is not whether instructional tools are more efficient at accomplishing current goals with conventional methods, but instead how emerging media can provide an effective means of reaching essential educational objectives in the technology-driven evolution of a knowledge-based economy. Just as medical practice has shifted dramatically because of antibiotics, anesthetics, and immunizations, so the skills and knowledge required of educators are rapidly changing. Computers and telecommunications enable all students to master more complex subjects via rich interactions with resources outside of classroom walls just as geographically distributed workers create, share, and master knowledge.

Thus the technology shows the greatest impact on the young mind. This research was just an attempt to find out an innovative way of teaching physics and to check the effectiveness. The following are some of the suggested implications of the present study on the basis of the major findings.

- To increase the effectiveness of teaching Physics the teacher should make use of computer with possibly latest software so that the students get interested in learning.
• Students benefited form the individualization, self pacing and interactive nature of the CAI.
• The teaching through this kind of CAI effects more senses of the students and they make use of the learnt concepts in higher education or in life were necessary.
• Not only the topics which were prepared by the researcher through the CAI but other topic should be prepared on CAI.
• CAI proved to be better mode of instruction than the traditional method of instruction in all the content areas i.e. Chemistry, Biology, Mathematics etc.
• Learners’ active participation in instructional process results for better students’ achievement.
• Teacher should use this kind of package for slow learners, low achievers and wanders as per the need.
• Through computer simulation, students had the chance to conduct real like experiments and see physical facts, which can only be investigated in laboratory settings.
• Tutorial form of Computer Assisted Instruction is found to be feasible and applicable for teaching Physics at Higher Secondary level.
• CAI proved to be reducing the burden of the student as well as teacher.
• Learning through such package increases the curiosity and capabilities of the students.
• For more use of computer technology and advance software system by the students of the rural area Government, NGO and school have to work collaboratively.
• Foreign universities are at the door step of the nation challenging Indian system of education which forces the school system to be more high tech with such kind of software utilization at all level of school system.
• Generally, now all the schools are equipped with computers, it is now necessary that teacher for such subject should be appointed by Government as like wise other subject.
• Government providing grant for such program to DIET, it should be available to school teacher or teacher of such skill must be utilized for such package development program.

• CAI packages are also useful for distance learning, adult education and awareness program.

• Increasing strength of the classroom, burden of the syllabus, heavy competitiveness fetch the lure of the traditional method were such learning enhance the rate and interest of the student.

• To prepare multimedia package in the form of CAI, contemplate training should be given to teacher during the ‘Karmyogi talimi shibir’ organized by Government.

• To aware the teachers with such kind of package demonstration should be made and motivation should be provided to use packages in the classrooms.

5.6.0 SUGGESTION FOR THE FURTHER STUDY.

Based on findings and discussion of the findings of this study, the following are suggested as arras for further study:

• The same CAI can be used with some different modes.

• Other topics of Physics can also be taught with the help of CAI.

• Much more advance package, such as 3D technology, can be developed for teaching same or likewise topics of physics for future research.

• Similar study can be conducted for the students of the other board like CBSE or ICSE.

• Effectiveness of the CAI and traditional method for the students of lower and higher cognitive level.

• A comparative study of the effectiveness of CAI program on the students of higher achievers and lower achievers.

• Similar experiment can be done with more variable.

• To check the effectiveness of the CAI package with elementary and secondary level of the student.
• This study was limited to students of standard XII –Gujarati medium. Similar study can be conducted for the students of other standard and medium also.
• This research work can be expanded to various fields.

5.7.0 CONCLUSION

This chapter deals with summary, major findings, educational implications and suggestions for the further study.

This research unveils that students’ learn through CAI perform better then student taught through traditional method. The developed CAI was found to be effective in terms of the students’ achievement. In comparison to traditional method teaching through CAI has enhanced the learning of the students. The present study also reveals that the CAI was equally effective in teaching the boy students and girl students. This research found that the achievement of the students of urban area is significantly higher than the achievement of the rural area. Findings of the study suggest that the CAI can be used for self learning so that students can learn at their own pace, convenience and interest.