CHAPTER-VI

SUMMARY
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6.1 INTRODUCTION

Education is an engine for the growth and progress of any society. It is a powerful tool for social change, social mobility. It is a continuous process which transfers the morals, values; of our culture to the next generation (Yashpal, 2011). Education in general is undergoing rapid transition from the traditional teacher dominated teaching to the more self motivated mode, constructivism. It has become a complex process with time because of complex nature of modern industrial civilization and explosion of knowledge due to scientific discoveries of inventions. In order to understand the progressive nature of society and to meet the challenges of time and educational aspirations of society, there is a need for effective system of education in the country. It has contributed to the destiny of societies in all phases of development (Bala, 1995). Education cultivates us into mature individuals, and makes us capable to plan our future and take the right decisions. It is the process of learning that broadens a person’s cognitive horizons and arms us with an insight to look at our lives and learn from every experience. It instills a sense of pride about the knowledge one has and prepares him/her for life as the true purpose of education is to bring about profoundness to one's emotions, to broaden one's perspectives and to lead to a healthier approach of looking at life.

6.2 ACADEMIC ACHIEVEMENT

In the present scenario, the main concerns of all educational efforts is to see what the learner achieves as achievement is considered as end product of all educational endeavors (Gupta & Kapoor, 2012). Academic achievement refers to marks or grades obtained in subject taught in school after an examination, be it written or oral. Achievement tests in educational system are designed to assess the educational objectives. Such assessment reveals how far the objectives specified have been achieved. In this situation, when the focus is on the achievement of objectives, teacher’s main concern is with the average students to increase the scholastic achievement of the students. Academic achievement itself depends upon various factors like study habits, attitude, aptitude, mental health, self-concept, socio-
economic status, motivation, intelligence, learning style and the students' knowledge in a particular subject etc. Various other organic and environment factors like gender, birth order, locality, type of institution, home environment & digital school environment (smart class) and method of teaching etc. also determine the academic achievement of students. These cognitive and non-cognitive variables though basically and inevitably being a personal matter cannot be studied in isolation. The quality of education we provide to our children depends to a large extent upon the quality of teachers we inject into the education system, which in turn depends on the quality of teachers' preparations through emergence of innovative tools. Preparing students to be successful in an innovation based economy is a function of empowering educators to teach 21st century content in a 21st context using 21st century tools (Marurizio, 2004). Smart education is therefore a paradigm shift from teacher centered education to learner centered education whereas the child is empowered to create knowledge and develop competencies and ability for lifelong learning. Various studies shown that ICT is also a significant factor in enhancing achievement level of students. Thus, in the present study an attempt is made in the direction of exploring the impact of IT-Enabled Instructional Package on academic achievement in science of school students.

6.3 ICT AND EDUCATION

ICTs stands for Information and Communication Technologies and are defined, for the purposes of this study, as a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. These technologies include computers, the internet, broadcasting technologies and telephony. It refers to a range of technologies including computers, computer workstations, display facilities, hardware, software, recording and processing system for sound, still and moving pictures, graphic calculator and wide range of communication facilities present in world. ICT is a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economical and cultural matters.” (Chidnandappa & Dharmendra, 2006). It may be defined as the use of hardware and software for efficient management i.e. storage, retrieval, processing, communication and sharing information for social, economical and cultural
upliftment. As we know, the teaching – learning technology has progressed from classroom lectures, seminars to video disks and CD-ROMs to web based training and wireless communication through various learning objects. The demand of new technologies and the global environment cannot be satisfied with the only source of classroom instructions, with its inherent classroom limitations. The students can do self learning using enormous potentials of internet and proving them with several online exercises. Given the importance of IT in interactive learning, it is most important that the teacher must be educated and trained more thoroughly about IT, its importance and how it can be infused in teaching. One word of caution though is that the undoubted tremendous potential of IT be harnessed in wise and conscious way (Varinder, Monica & Parul, 2011).

6.4 DEVELOPMENT OF IT-ENABLED INSTRUCTIONAL PACKAGE

The development of IT-enabled Instructional Package involves various phases as shown in Fig.1. It is clear from the Fig. 1 that, first of all subject matter for which IT-enabled Instructional Package is developed, has to be selected. In next phase, after selection of the subject matter, it is divided in the form of sub-units and chapters, so that it should become simple, motivational and highly informative. After the completion of second phase, instructional package is developed with the help of appropriate software by using text, picture, animations, sound and bright colors for simulations. The last phase of the package with its different steps has been shown in Fig.2.

![Fig.1: Phases of Development of IT-Enabled Instructional Package](image-url)
6.5 RATIONALE OF THE STUDY

An important progress in computer technology and software has been realized in recent years. Use of computer in education as well as the infusion of Multimedia in teaching learning has altered considerably the instructional strategies in our educational institutions. The traditional teacher-centered method of teaching used for decades in our educational system has been modified and enhanced. There is nothing which is untouched with the use of technology. It plays a vital role in all spheres of human activities. Education sector is also not an exception either. ICT is doing a commendable job in almost all subjects, especially in sciences. Students can have access for all the necessary information in the form of text, pictures and videos on Internet. It is supposed to be used as a tool where and when considered useful. In the realm of science education, there has been a strong link between computer and science. Kiboss (2004) also studied the effectiveness of computer mediated simulations programmes in Biology on pupils learning outcomes in cell theory. The study concluded that the use of the CMS programme to augment conventional biology teaching has major implication for secondary biology instruction in this area. Ponraj & Sivakumar (2010) conducted a study to examine the effect of CAI software on the achievement in zoology. The study has shown that teaching the
zoology by using CAI is more effective than conventional strategy. Oguz Serin (2011) revealed that there is statistically significant increase in the achievement and problem solving skills of the students in the experimental group that received the Computer-Based Science & Technology instruction. Research exploring the use of technology in science classrooms clearly indicates that the use of technology has positive influence on the wide variety of student learning outcomes including understanding of science and development of scientific reasoning skills (Dani & Koenig, 2008; Schroeder, Scott, Tolson, Huang, & Lee, 2007; Songer, 2007). These studies proved that ICT could be a potent tool in teaching-learning process of Science. Also appropriate educational technologies have the potential to make the science concepts more accessible through visualization and multiple representations and students can be engaged in more powerful scientific activities and they are able to perform investigation that would not be possible without the use of technology. Also Computer based Multimedia learning environment consisting of text, graphics, pictures, audio, video and animation offer a potentially powerful venue for improving students' understanding.

Integration of multimedia in education is still far from desired. The use of multimedia in teaching and their integration in the classroom and in the teaching training institutes have remained almost unexplored. A very few studies have been conducted in this direction that too in limited disciplines. Many linked queries and issues have remained unfold. Thus a lot of work is to be done in this direction to answer such problems. Therefore it is significant to conduct a study to evaluate the impact of multimedia package for a subject like Science at school stage. Keeping in view, the above factors, the researcher decided to develop IT-enabled Instructional Package to teach Science to School Students in an interesting and Effective way.

6.6 STATEMENT OF THE PROBLEM

**DEVELOPMENT OF IT-ENABLED INSTRUCTIONAL PACKAGE IN SCIENCE AND ITS IMPACT ON ACADEMIC ACHIEVEMENT OF SCHOOL STUDENTS**
6.7 OPERATIONAL DEFINITIONS OF KEY TERMS

The terms used in the statement are defined as under:

1. Development: In the context of the present study development of IT-enabled Instructional Package means Subject matter analysis, script designing, plan and production of multimedia package. It also includes validation of programme by subject teacher and subject expert.

2. IT-Enabled Instructional Package: In the context of the current study, IT-enabled Instructional Package refers to the package which provides an integrated form of text, graphics, colors, animation (3D), pictures, X-ray features, audio and video with interactivity on the same screen. To develop the package text, animations, pictures and figures were prepared by using software such as Swish 2.0, Adobe Photoshop, Adobe Illustrator, Adobe After Effects, Adobe Sound booth (for recorded sound/ narration) and Frutiloop (for music). It was developed to achieve the specific objectives.

3. Academic Achievement: In the present study, to know the Achievement in Science of the students of class X, an achievement test in Biology based on the Science syllabus of class X was developed.

6.8 OBJECTIVES OF THE STUDY

The present study is designed to realize following objectives:

1. To develop IT-enabled Instructional Package in Science for X class students.
2. To develop an Achievement Test in Science (Biology) for X class students.
3. To develop an Opinionnaire for effectiveness of IT-Enabled Instructional Package.
4. To analyze the opinions of subject experts towards the effectiveness of IT-Enabled Instructional Package.

Before Experimental Treatment

5. To compare the mean achievement scores in science of Experimental and Control group (E & C) of tenth class students to be taught through IT-Enabled Instructional Package (ITEIP) and conventional method teaching before experimental treatment.
6. To compare the mean achievement scores in science of boys of Experimental and Control group (BE & BC); and girls of Experimental and Control group (GE & GC) to be taught through IT-Enabled Instructional Package (ITEIP) and conventional method of teaching before experimental treatment.

**After Experimental Treatment**

8. To study the effect of treatment on achievement in Science of tenth class students after experimental treatment.


10. To study the interaction effect of treatment and gender on achievement in Science of tenth class students after experimental treatment.

11. To study the effect of treatment on mean gain achievement scores in Science of tenth class students after experimental treatment.

12. To study the effect of gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

13. To study the interaction effect of treatment and gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

6.9 **HYPOTHESES OF THE STUDY**

**Before Experimental Treatment**

H\(_{01(a)}\) There exists no significant difference in the mean achievement scores in Science of the two groups (E and C) of tenth class students taught science through IT-Enabled Instructional Package and conventional method before experimental treatment.

H\(_{01(b)}\) There exists no significant difference in the mean achievement scores in Science of the two groups of boys (BE and BC) taught science through IT-Enabled Instructional Package and conventional method before experimental treatment.

H\(_{01(c)}\) There exists no significant difference in the mean achievement scores in Science of the two groups of girls (GE and GC) taught science through IT-Enabled Instructional Package and conventional method before experimental treatment.
**After Experimental treatment**

H_{02(a)} There exists no significant effect of treatment on Achievement in Science of tenth class students after experimental treatment.

H_{02(b)} There exists no significant effect of gender on Achievement in Science of tenth class students after experimental treatment.

H_{02(c)} There exists no significant effect of treatment and gender on Achievement in Science of tenth class students after experimental treatment.

H_{02(d)} There exists no significant effect of treatment on mean gain achievement scores in Science of tenth class students after experimental treatment.

H_{02(e)} There exists no significant effect of gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

H_{02(f)} There exists no significant effect of treatment and gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

6.10 DELIMITATIONS OF THE STUDY

Keeping in view the constraints of the time and available resources, the study is delimited to:

1. Students of class X only.
2. Students of private schools affiliated to CBSE only.
3. Students belonging to urban area.
4. English medium schools only.
5. Biology in Science subject of class X.

6.11 DESIGN AND PROCEDURE

The present study is experimental in nature. The objective of the present study is to see the effect of IT-Enabled Instructional Package (ITEIP) and Gender (Independent Variables) on achievement in Science (Dependent Variable) among class X students.

In this study, the investigator has employed **Pre-test Post-test Control Group Design**. Instructional treatment was studied at two levels namely experimental group (E) which was taught Science (Biology) through IT-Enabled Instructional Package (ITEIP), and control group (C) which was taught through conventional method. The design comprised of three phases. (Table 1)
Table-1
Design of the Study

<table>
<thead>
<tr>
<th>Treatment Phases</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test Phase</td>
<td>Measurement of</td>
<td>Measurement of</td>
</tr>
<tr>
<td></td>
<td>1. Intelligence</td>
<td>1. Intelligence</td>
</tr>
<tr>
<td></td>
<td>2. SES</td>
<td>2. SES</td>
</tr>
<tr>
<td></td>
<td>3. Achievement in</td>
<td>3. Achievement in</td>
</tr>
<tr>
<td></td>
<td>Science(Biology)</td>
<td>Science(Biology)</td>
</tr>
<tr>
<td>Treatment Phase</td>
<td>Teaching Science through IT-Enabled Instructional Package (ITEIP) for 6 weeks</td>
<td>Teaching Science through Conventional Method for 6 weeks</td>
</tr>
<tr>
<td>Post-test phase</td>
<td>Measurement of Achievement in Science(Biology)</td>
<td>Measurement of Achievement in Science(Biology)</td>
</tr>
</tbody>
</table>

**VARIABLES INVOLVED**

In the experimental research, the effect of independent variable on dependent variable has been studied. Independent variables are the cause while dependent ones are the effects. Besides, there are some intervening variables also. All these three kinds of variables, identified for the study have been mentioned below:

**Dependent Variable**

The dependent variable or the criterion variable used in the current study was Achievement in Science (Biology).

**Independent Variables**

For the present study, the independent variables were IT-Enabled Instructional Package (ITEIP) and Gender.
**Intervening Variables**

Different intervening variables in the present study are type of school (English medium private schools affiliated to CBSE Board), grade of class (X), subject to be taught (Science), intelligence of students (moderate intelligence) and socioeconomic status (middle SES level) of students, which were controlled up to greatest extent to equate the sample or to form the matched group.

**POPULATION**

A population is any group of individuals that have one or more characteristics in common that are of interest to the investigator. It may be all the individuals of a particular type or a restricted part of that group. The population of the study comprised of Class X students studying in English medium private schools (affiliated to CBSE Board) located at Gohana city of Sonipat District.

**SAMPLE**

In all types of researches, there are some inferences regarding a well-specified and identifiable group known as population and the selected number of persons or objects known as sample. The sample for the present study was selected through Multistage Random Sampling Technique. At first stage of the sampling, the investigator has obtained the list of private schools affiliated to CBSE board located in Gohana city. After this, by using lottery method two English medium private schools namely Bal Bharti Vidyapeeth Sr. Sec. School & Satyanand Public School were selected for the purpose of the present study. Each school was having three sections of X class. At second stage, two sections of X class {Sec-A (38), Sec-B (42)} of Bal Bharti Vidyapeeth Sr. Sec. School and two Sections {Sec-A (39), Sec-B (41)} of Satyanand Public School were taken. In this way 160 students have been selected. The sample (160) was equated on the basis of socio-economic status (middle level) i.e. students belonging to middle level (63 to 54) and their intelligence (moderate) i.e. students of moderate intelligence (87 ≤ IQ ≤ 112) were taken. At the end, 140 students (70 from each school) were taken as the final sample of the study. Remaining 20 students of very high & low intelligence and socioeconomic status were not considered for the present study. However they were made sit along with other students in the class so that their feelings may not get hurt.
By keeping in view the feelings of the parents and students, one school was treated as Experimental group (Bal Bharti Vidyapeeth Senior Secondary School) and the other school was treated as Control group (Satyanand Public School). The detailed description of the sample is given below in Table 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>Name of School</th>
<th>Class</th>
<th>No. of Students Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Bal Bharti Vidyapeeth Sr. Secondary School, Gohana</td>
<td>X</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35 from Sec. A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35 from Sec. B</td>
</tr>
<tr>
<td>Control</td>
<td>Satyanand Public School, Gohana</td>
<td>X</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35 from Sec. A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35 from Sec. B</td>
</tr>
<tr>
<td>Total Sample</td>
<td></td>
<td></td>
<td>140</td>
</tr>
</tbody>
</table>

TOOLS USED
Following tools were used for the purpose of collecting data related to different variables covered in the study:

A. Standardized Tests

1. General Intelligence test (GIT) by Mohsin (1990) to measure the intelligence of students.

2. Socio-Economic Status Scale developed by Kalia and Sahoo (2010).

B. Self Developed Tools

1. Opinionnaire for effectiveness of IT-Enabled Instructional Package (ITEIP)

2. Achievement Test in Science (Biology) to measure the achievement of students in Science.

3. IT-Enabled Instructional Package in Science (Biology).

EXPERIMENTAL PROCEDURE
The subjects in the present study were 140 X class students from the two English medium private schools affiliated to CBSE board of Gohana city. For the Experimental Group, which was subjected to IT-Enabled Instructional Package, a
total of 70 students were taken from Bal Bharti Vidyapeeth Sr. Secondary School, Gohana. The control group which was exposed to conventional method of instruction, was also consisted of 70 students chosen from Satyanand Public School, Gohana and hence no novel treatment was given. The investigator studied literature and books on multimedia strategies deeply and consulted various experts for the execution of multimedia learning strategies. Hence all the lessons for all groups were taught by the investigator herself. A detailed description of the design of the experiment has been given in the table 3.

The experiment was conducted in three phases:

- Phase I: Administration of the Pre-Test
- Phase II: Conducting the Instructional Programme
- Phase III: Administration of the Post-Test

**Table 3**

**Description of Experimental Procedure**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Phase</th>
<th>Duration</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Treatment</td>
<td>6 Weeks</td>
<td>Teaching Science with IT-Enabled Instructional Package</td>
<td>Teaching Science through Traditional Method</td>
</tr>
<tr>
<td>3.</td>
<td>Post-Test</td>
<td>2 Days</td>
<td>Achievement Test in Science(Biology)</td>
<td>Achievement Test in Science(Biology)</td>
</tr>
</tbody>
</table>

**1. Pre-Test Phase**

Before the start of the experiment, subjects were contacted and rapport was established with them. They were oriented to the tests to be used with them and also with the methodology of the treatment to be followed viz. IT-Enabled Instructional Package and conventional method. In the very beginning, Intelligence test and
Socio-Economic Status Scale were used to equate all the groups in terms of socio-economic status and intelligence level. After this achievement test in Science (Biology) was administered to the students of both the groups. The investigator himself with co-operation of class teachers administered all the tests. The instructions pertaining to the tests were explained verbally in clear terms to the students before administering the test. The administration of these tests was carried out as per norms and instructions contained in their manuals. Separate response sheets were provided. The answer sheets were scored with the help of scoring key. The scores in achievement test indicated the previous knowledge possessed by the students. This all took time of Seven days.

1. Conducting the Instructional Programme
To find the effectiveness of the treatment variable, the instructional treatment was manipulated in the form of teacher directed instructions followed by using self-developed ITEIP to the experimental group. The instructional treatment was given for about six weeks, which included 12 sub-units, twenty four chapters and twenty four formative tests to experimental group, whereas the control group was taught through conventional method only. Same content was taught to both the groups. The treatment was conducted by the investigator herself in both groups so as to avoid teacher variable and maximum precision.

Teaching through IT-Enabled Instructional Package (ITEIP)
Students of experimental group were given an orientation lecture about IT-Enabled Instructional Package in the beginning of experiment. Students were motivated to learn through the novel method of instruction and were encouraged to participate in the experiment by explaining the objectives. The lessons were presented by the teacher through self developed ITEIP. The teacher taught the lessons on the guidelines of prepared lesson plans to achieve the formulated objectives. The teacher well explained the complex concepts of science like Photosynthesis experiments (Sunlight, Chlorophyll, CO₂) specially working of Heart, Human Digestive System, Functions of Nephron, process of Respiration in human beings through videos in ITEIP. It was very easy for students to understand these concepts in a stimulating way. The complex system of animals like Amoeba, Paramecium, Fishes and Earthworm has also been well elucidated by the teacher. Proper feedback was given
to students to motivate and reinforce them positively. Following the teacher instruction, students were evaluated at the end of each lesson with the help of Multiple Choice Questions (MCQ) designed appropriately accordingly to the topic. As a result, a total of 24 lesson plans were delivered in 6 weeks to Experimental Group.

**Conventional Method of Teaching**

On the other hand, for teaching students of control group, conventional method based on whole class teaching was used. In this setting, regular instructional method - unit presentation and tests were used. For control group, same books and curriculum objectives were retained as in experimental groups. The lecture-cum-demonstration method, laboratory method and activity method frequently applied in science lessons throughout the world were used. The method includes explaining the concepts, doing the experiments, demonstration of materials like leaves, specimens, transpiration activity etc. During the application procedure, sufficiently many activities were performed in line with course objectives, and the stages of experiment were explained in detail. Meanwhile, the students under control group were given the opportunity to ask questions to clarify the parts that they could not understand. For each question the teacher provided an appropriate solution. Later, an activity was performed by the students in class as well as in laboratory according to the need of topic. While the students were trying to perform the activity, the teacher walked among the students and helped the students make their own corrections. In science drawing the diagrams with appropriate labeling is very important part. To develop drawing skill among students they are asked to draw the well labeled diagrams in their note-book first. After that blackboard test was taken to draw diagrams by the students. At the end of lesson, the students were given homework and practical assignments which were discussed the next day in class.

2. **Post-Test Phase**

Immediately after the treatment was over, the subjects were assessed on criterion measures on Science (Biology) to know the effect of treatment. The Achievement Test in Science (Biology) was administrated to both the experimental and control group. The same criterion test as taken in pre-test was taken. Both the groups of
sampled students were subjected to those post-test. In this way, post-test scores were obtained on achievement test in Science of both the groups.

STATISTICAL TECHNIQUES EMPLOYED

To achieve objectives of the study, the data collected was statistically analyzed by using the following techniques:

1. Descriptive statistics such as mean and S.D. were worked out on the scores of achievement.
2. Two way Analysis of variance (ANOVA) with 2x2 factorial design was employed to study the main effects and interactional effects of independent variables (treatments and gender) on dependent variable (Science Achievement) supplemented by t-test. To test the assumption of homogeneity of variance for ANOVA, Hartley's test was employed.
3. To test the assumption of homogeneity of variance for ANOVA, Hartley’s test was employed.

6.12 FINDINGS OF THE STUDY

The main findings of the study are given below:

1. OPINION ABOUT EFFECTIVENESS OF IT-ENABLED INSTRUCTIONAL PACKAGE IN SCIENCE(BIOLOGY)

Section wise analysis of opinionnaire has been done by the investigator to know the experts opinion about acceptance of IT-Enabled Instructional Package (ITEIP). The findings obtained from analysis of opinionnaire are being explained here.

- It is elicited by 90% subject experts that the examples given in the package were relevant & interesting and topics chosen were well explained. It was further asserted by 80% experts that the level of language distribution, arrangements of topics and sub-topics and color combination is really appreciable. 70% subject experts have agreed with the number of slides and extent of animation and audio-visuals used in the package. Furthermore it was shown that the 84% experts given their agreement, only 6% of experts disagreed and the rest 10% remain undecided about the statement given in the scale in Part-A i.e. Presentation of Content’.
- The analysis also revealed that it is highly useful for students. 90% subject experts opined that ITEIP is quite successful in capturing the attention of
students, enhance their concentration level, self-pace learning, elaboration of complex concepts, recollect all the points easily and can use as and when required. Also 80% subject experts have acknowledged the accessibility of previous content, real-life element, motivates students learning, removal of fear from learners for science and virtual demonstration of activities with the help of package. 70% of subject experts recognized the development of scientific outlook of the students and remove their difficulties with the help of package. It has been found that 82.66% experts given their agreement, only 6.67% of experts disagreed and the rest 10.67% remain undecided about the statement given in the scale in Part -B i.e. ‘Utility for Students’.

- It has been further asserted that 90% of subject experts have positively acknowledged the provision of innovative techniques of teaching to the teachers, monitoring learning progress of students frequently and take feedback effectively through MCQs at the end of each lesson given in the package. 80% experts have agreed that ITEIP is quit helpful in developing potential of teachers to discover learning together, in maintaining decorum, providing revision of important points and effectively facilitate the students learning. It can further be concluded that 86% experts in agreement, only 4% of experts disagreed and the rest 10% remain undecided about the statement given in the section-C i.e. ‘Utility for Teachers’.

- On analysis of total opinion of experts regarding overall selection of content indicated that 84% of the experts agreed for the effectiveness of IT-Enabled Instructional Package (ITEIP) in Science. Only 6% of experts disagreed and the rest 10% remain undecided about the statement given in the scale.

Thus findings obtained from analysis of opinionnaire revealed that most of the experts accepted the effectiveness of IT-Enabled Instructional Package (ITEIP). It is also determined that through using ITEIP, students would be able to apply the knowledge of science concepts to real life situation and helpful in developing their scientific outlook. It is also helpful in increasing their achievement level at own pace in motivating and fascinating way in today competitive education system. In last experts suggested that ITEIP should be made an inseparable part of normal classroom teaching-learning process then only we can make maximum benefit from this approach.
2. COMPARISON OF MEAN ACHIEVEMENT SCORES OF EXPERIMENTAL AND CONTROL GROUP IN SCIENCE (Before Experimental Treatment)

- It has been found that there was no difference in the achievement level of two groups namely experimental and control before conducting experiment. It leads to the conclusion that there is no difference in the achievement scores of two groups (E & C) i.e. initially experimental group and control group were similar in their performance.

- No significant difference was found in Pre achievement scores of boys of experimental group & control group of tenth graders to be taught through IT-Enabled instructional strategy and conventional method before experimental treatment. It leads to the inference that boys of two groups (E & C) were similar in their performance on achievement test before giving the experimental treatment.

- No significant difference was found in the achievement scores of experimental group girls and control group girls to be taught through IT-Enabled instructional strategy and conventional method before experimental treatment. It leads to the conclusion that there is no difference in the achievement scores of girls of two groups (E & C) i.e. initially experimental and control group girls were similar in their performance.

3. EFFECT OF INSTRUCTIONAL TREATMENT AND GENDER ON ACHIEVEMENT IN SCIENCE (After Experimental Treatment)

- There was found a significant effect of treatment on mean achievement scores in Science of tenth class students leading to the inference that experimental treatment yielded difference in achievement scores in Science (Biology). After comparing the mean achievement scores of experimental and control group with the help of t-test, a significant difference was found in both the groups. It discloses the fact that students of experimental group have higher achievement in science than the students of control group. It can therefore be inferred that students who are taught science through IT-Enabled instructional strategy show significant improvement in their achievement than the students who received instructions through conventional method of teaching.
• Gender was found to have a significant effect on achievement scores in science of tenth class students but there was no significant difference in achievement between boys and girls. However, in context of mean scores it was found that the boys achieved better than their female counterparts.

• There was a significant interaction effect of treatment and Gender on achievement in science of tenth class students leading to the inference that two variables interact with each other. Further investigation with the help of t-test revealed that

a) A significant difference was found in the performance of boys and girls when exposed to teaching through IT-Enabled Instructional Package (ITEIP). In context of mean scores it was found that mean scores of boys of experimental group was higher than the mean scores of control group girls which revealed that boys achieved more than girls.

b) Whereas no significant difference was found when we compare post-test mean achievement scores in science of boys and girls of control group, leading to conclusion that boys and girls learning through conventional method of teaching were equal in their performance. However when we compare the mean scores of boys and girls of control group, it was found that boys had higher achievement than their female counterparts.

c) The post-test achievement scores in science of boys of experimental group and control group of tenth graders differ significantly in favor of experimental group boys. This implies that boys who were taught science through IT-Enabled instructional strategy illustrated significant improvement in their achievement than the boys who received instructions through conventional method of teaching. A close inspection of mean scores indicated that boys of experimental group performed better than boys of control group.

d) The post test achievement scores of girls of experimental group was found significantly higher than the post test achievement scores of control group. This leads to inference that the girls who were taught through IT-Enabled instructional package showed significant improvement in their achievement in science than the girls who received instructions through conventional method. However, in the context of mean scores, girls of experimental group had higher achievement in science with the girls of control group.
4. EFFECT OF INSTRUCTIONAL TREATMENT AND GENDER ON ACHIEVEMENT IN SCIENCE (in terms of Mean Gain Achievement Scores)

- Instructional treatment had a significant effect on mean gain achievement scores in Science of tenth class students leading to the conclusion that experimental treatment yielded difference in mean gains on achievement scores in Science (Biology). The mean gain achievement scores in Science (Biology) of experimental group and control group of tenth graders differ significantly in favor of experimental group. It suggests that students who are taught Science through IT-Enabled instructional package strategy show significant improvement in their achievement than the students who received instructions through traditional method of teaching.

- Gender was found to have a significant effect on mean gain achievement scores in science of students. But after comparing the mean gain achievement scores of boys and girls with the help of t-test, no significant difference was found between boy and girls. This leads to conclusion that Boys and Girls learning through IT-Enabled Instructional Package (ITEIP) are equal in their performance. However, an examination of means indicated that Boys group performed better than Girls group after being exposed to experimental treatment.

- Treatment and Gender had a significant interaction effect on mean gain achievement scores in science of tenth class students leading to the inference that two variables interact with each other. After comparing the mean gain achievement scores for the experimental and control group with the help of t-test following conclusion were drawn:
  a) There was found to be a significant difference in the performance of boys and girls when exposed to teaching through IT-Enabled Instructional Package (ITEIP). An examination of means leads to conclusion that gain achievement scores of boys is more than girls. It can be said that boys were more benefited by instructional strategy (ITEIP).
  b) Whereas no significant difference was found when we compare mean gain achievement scores of boys and girls of control group, this leads to
conclusion that boys and girls learning through conventional method of teaching were equal in this context.

c) However when we compare the mean scores of boys and girls of control group, it was found that boys had higher achievement than their female counterparts. After the comparison of boys of experimental and control group in terms of mean gain achievement scores, it was found that boys of both the groups differ significantly in mean gain science achievement in favor of experimental group boys. It can be revealed that IT-Enabled instructional strategy is more effective than conventional teaching strategy in raising the achievement of boys in science.

d) A significant difference was found in mean gain science achievement scores between the girls of experimental group and control group. When girls of experimental and control group were compared on mean gain achievement score it was found that mean gain achievement score of experimental group girls is higher than that of control group girls. This entails that the girls exposed to IT-Enabled instructional package strategy benefited more in their achievement in comparison to the girls exposed to conventional method of teaching.

6.13 CONCLUSION

ICT plays a key role in the modern systems of education. Students find it easier to refer to the internet than searching for information in fact reference books. Modern technologies are improving the students and teachers knowledge and give the innovative techniques. Education is a lifelong process and it should meet the needs of variety of learners. Multimedia will provoke radical changes in the teaching system because it is a woven combination of text graphic art sound animation and video elements. It represents the second wave in educational technology. Development in computers, communication and consumer electronics is compared to the first wave that is technology development in audio, video, and TV media which occurred many decades ago. Today, CD-ROM, Drives, Video Disk Player, Video Data Projectors, Animation Packages, Speech, Music are known as second wave in educational technology. It puts learning into the controls of the learner. It benefits both the students as well as the teachers. The purpose of the present study was therefore to ascertain the effectiveness of using IT-enabled instructional strategy as compared to Conventional
classroom strategy. The findings clearly suggest that the inclusion of IT-enabled instructional package in science for class X students is very effective. It was also found that both the gender i.e. male and female has shown significant improvement in their achievement level after giving experimental treatment with ITEIP. Precisely, it can be said that IT-enabled instructional package (ITEIP) provides greater opportunities for the students to learn. It is better than the traditional method of learning. It brings an enhancement in achievement and provides new multisensory learning experiences.

6.14 EDUCATIONAL IMPLICATIONS

Teaching at school as well as higher level mostly concentrates on giving information which is not the sole objective of teaching. Along with giving information, the other objectives are: developing understanding & application of the concepts; developing expression power; developing reasoning & thinking power; development of judgment & decision making ability; improving comprehension, speed and vocabulary and developing tolerance and ambiguity, risk taking capacity, scientific temper, etc. With the present infrastructure, class size, availability of teachers, quality of teachers, training of teachers, etc., it is difficult to achieve all the objectives. Further, most of the teachers use Conventional Method which does not have potentiality of achieving majority of above mentioned objectives. The objectives are multi-dimensional in nature, so for their achievement multiple methods should be used in an integrated fashion. It is a well known fact that not a single teacher is capable of giving up to date and complete information in his own subject. The ICT can fill this gap because it can provide access to different sources of information. It will provide correct information as comprehensive as possible in different formats with different examples. IT-Enabled instructional package also provides online interaction facility. Students and teachers can exchange their ideas and views, and get clarification on any topic from different experts, practitioners, etc. It helps learners to broaden the information base.

The package provides variety in the presentation of content which helps learners in concentration, better understanding, and long retention of information which is not possible otherwise. The learners can get opportunity to work on any live project with learners and experts from other countries. The super highway and cyber space also
help in qualitative improvement of Teaching-Learning Process. ITEIP provides flexibility to learners, which is denied by the conventional process and method. Flexibility is a must for mastery learning and quality learning. On Internet, many websites are available freely which may be utilized by teachers and students for understanding different concepts, improving vocabulary, developing reasoning and thinking, etc. The present study has a wide range of implementation in the field of education. Some of the implications are given below:

- **For Schools:** School organization should be considered as a useful tool so that teachers can successfully integrate technology into their teaching. Teachers with the goal of using technology in classroom instruction could not achieve technology integration in schools if technology will be treated as an unnecessary tool. Students can learn better through electronic media and communication technologies because they work as a live teacher and guide the learners more effectively. IT-Enabled instructional package if find a permanent place in school time table can be proved as a boon in today's overcrowded classrooms. With the help of it, pupils can manipulate information on computers so that they can develop better understanding of the relationship between different types of information. Students should be encouraged to use computers and Internet facility to learn more and more and enhancing knowledge. Apart from this information technology course should be given due place in the curriculum.

- **For Planners:** Potential of IT-Enabled instructional package should be utilized to enhance quality of education at all the levels of education viz Primary, Secondary and Higher. Government should also establish IT-Enabled instructional package portal in various organisations such as Institutes of Education and Research, Curriculum Wing, Test Book Boards, Curriculum Research and development Centres, and Education University. Private organizations can step forward to educational software development if copyright act prevails and a system to check the software piracy is established. Government should also offer incentives for teachers who contribute to such type of instructional package. Steps should be taken to meet the needs of the literature about IT-Enabled instructional package in the libraries of our
institutions. There are a number of IT-Enabled instructional package learning journals, which can be purchased or subscribed for the libraries.

- **For Administrators:** The administration should allow enough flexibility for teachers to make decisions regarding the use of technology in the classroom instruction. Neither administrators nor colleagues forced them to use a particular tool in a certain way in classroom instruction. Also, the presence of professional collaboration seems to be crucial to the technology integration. All teachers expressed that designing technology-rich lesson plans takes time. Collaboration with other teachers through online or face-to-face discussions help teachers decrease the amount of time that they need to spend in designing technology enrich lesson plans. Thus, administrators might allow teachers time to design lesson plans that incorporate technology. It also seems important that teachers need to attend professional development opportunities to learn innovative lesson plans and to update their knowledge of technology. Thus, administrators should also provide teachers high-quality professional development.

- **For Teacher Educators:** Finally, teacher education programs would motivate teachers on adopting technology use in their classroom when teaching. They will required to take content specific technology course where they will learn about the use of particular technology tools in science classrooms and pedagogical issues related to technology integration into teaching and learning, it would be beneficial for them to make their teaching more impressive and effective. Learning these courses will decrease their fear of use of technology. For this purpose teachers should be provided opportunities to explore and practice with various technology tools in technology courses. More practice and self exploration might help them increase their comfort level with the technology tools. Another aspect is that teachers should be allowed to check out educational technology tools that they practice within their technology courses to explore them more on their own time.

- **For Teachers:** This study implies that having access to the technology outside the school seems impact teachers’ technology integration efforts. Teachers used technology in their personal lives. It is easier for them to use some of those tools in their classroom since they do not need to spend extra time to learn about those tools for classroom instruction. With the help of ITEIP, the teacher is freed of
the administration burden. They thus, would be able to devote more time to the task of helping students for which they are trained. Moreover, the students will also enjoy their course of study. Again ICT used learning sessions like solving puzzles and riddles, holding group discussions on some general topics in class may act as a source of edutainment (education plus entertainment) which makes the teacher more resourceful.

- **For Students:** The use of IT-Enabled instructional package (ITEIP) leads to positive attitude of teachers as well as students towards ICT. Thus, when taught through ITEIP the students feel more involved in studies, which help significantly in raising their achievement. Traditional method of teaching if supplemented with IT-Enabled instructional package can prove to be more effective in enhancing their achievement. It would be helpful in enhancing the aspects of teaching through presentation of information in different ways and forms. IT-Enabled instructional package mode of teaching needs to be introduced for teaching science as it significantly enhance academic achievement among pupils. Important skills such as critical thinking, creative problem solving, Psycho motor skills and synthesis of knowledge can easily be attained through use of ITEIP. So, the careful incorporation of computer for teaching science course will help the students to grasp the basic concepts of science.

### 6.15 SUGGESTIONS FOR FURTHER RESEARCH

No research is perfect and complete in all aspects. Every research has got its own limitations. Due to paucity of time and resources at the disposal of the investigator, all the aspects of the problem cannot be expected to deal with. Therefore, the present study opens up certain avenues for further research which are briefly mentioned below:

- The present study has been carried out only on limited topics of Science syllabus; more studies may be conducted involving larger content of the curriculum and different subjects.

- There is need to compare multimedia method of instruction learning with other method of instruction at different grade level.
• The present study has been conducted on class X. To confirm the findings of present study, it is desirable to investigate the effect of IT-Enabled instructional package on achievement of learners of different grade level and subject area.

• Further research can be conducted to explore the effectiveness of IT-Enabled instructional package on disadvantaged groups such as backward, low achievers, mentally retarded and gifted.

• Effectiveness of IT-Enabled instructional package may be studied in relation to other variables, such as group size, creativity, intelligence, economic background, age, cognitive style, personality and classroom environment etc.

• The study indicates that IT-Enabled instructional package is an effective intervention for improving student's academic achievement. Further, research is needed to predict and explain how such type of strategy can become more effective instructional tool.

• Research is needed to compare the combination of various mediums/elements (text, audio, video, animation and graphics) of ITEIP i.e. up to what extent a medium is superior to others.

• The researches could be conducted on the perceptual changes in the students, on being taught through ITEIP using different scales.

• The study may be replicated on rural, tribal and slum population, where chances of drop outs and failures are high.

The list which has been given above is, however, not exhaustive but illustrative. There are vast areas in this field which have not been explored so far and any attempt in this direction may both be rewarding and instructive. If the present study is able to provide thinking in this direction, the efforts of the investigator would be amply rewarded.