SUMMARY

7.1 INTRODUCTION

The advancement in the field of Science and Technology has influenced each and every sphere of life. The impact of technology in human lives is unmeasurable. There are many examples of using technology to accomplish many tasks of day to day life with ease. So, many educationists call this present world a ‘digital-world’, in which each and every person is surrounded by various modern digital gadgets. Even a small child in this digital world is capable of accomplishing multiple tasks using modern gadgets. Such children are called as ‘Digital-natives’ of 21st century.

This influence of Science and technology is very well visible in the field of education too. It has revolutionized the education world at each and every level. The digital natives are more adaptable towards technology supported or technology mediated instructions, as they have opened eyes in the world of highly sophisticated digital world. So, technology is being integrated in the classroom for better learning outcomes and it is a growing phenomenon worldwide. Countries are devoting a considerable amount of time and money for making technology available to the students for better learning and better achievement of the students. Especially computers are being used as teaching tools with better outcomes as compared to traditional teaching.

Thus, with the advent of computers, when the 21st century was approaching, a new term has been evolved, i.e. Information and Communication Technology (ICT). This information age has promoted use of ICT in instructional process and it has gradually become a global phenomenon. Educational reforms included successful integration of ICT in teaching learning process for improving learning outcomes.

Tella, et.al. (2007) define ICTs as “information handling tools that are used to produce, store, process, distribute and exchange information”.
World Bank (2007) defines ICT “as a form of technology comprising the use of the following: hardware, software, networks and media for the collection, storage, processing in transmission, as well as presentation of information”.

So, in school reference ICT can be defined as a collection of technological tools with vast diversity which are used for creating, communicating, disseminating, storing and managing information. Schools, powerful agencies of social development are greatly influenced by rapid developments in ICT. Computers laboratories have become now essential features of school infrastructure and study of computers has emerged as a compulsory component of school curriculum. Use of computers in classrooms resulted in improved teaching-learning and supported technology related educational reforms. It has also helped in improving school management and enhanced school-community partnership.

Government of India has taken major initiatives to promote technology supported instructions in classrooms for enhancing the quality of education at all levels i.e. school as well as higher university level. Some of the programs like; Computer Literacy and Studies in Schools (CLASS) project, IT Task Force with School Computer Scheme, Shikshak Computer Scheme and Vidyarthi Computer Scheme; Vaidya Vahini Project, World Links India program initiated with Intel Corporation, Information and Communication Technology in Schools (ICT) Scheme etc. are some of the major initiatives taken by the Government to promote technology supported education.

Science occupies a unique position in the school curriculum and it has been given due place in our school education programme by being made as a compulsory subject. Now more and more emphasis is being given to scientific and technical education. By doing so a right step has been taken to push our country forward and to enable us to compete with other progressive nations. It has necessitated laying emphasis on teaching of Science right from the primary stage. Realizing such need, Kothari commission (1964-66) has rightly remarked in their recommendations: “Science and mathematics should be taught on a compulsory basis to all pupils as a part of general education during first ten years of schooling”. In our schools till secondary level
Science is being taught as an integrated subject, including Physical Sciences (Physics and Chemistry) and Life Sciences/ Biology (Zoology and Botany), whereas at Higher secondary stage Life Science has been given a separate place and being taught as a subject Life Science/Biology.

The importance and significance of Life Sciences in our daily life is enough to justify providing its due place in the school curriculum. It helps our future citizens to have adequate background of knowledge, skills and applications of the subject Life Science for making them adjusted on one hand in this progressive world of developed biotechnological advancements and on the other hand to have wide opportunities for entering into many professions and vocations.

Computer technology has revolutionized the scope of Science instructions tremendously. Started with the simple Teaching Machines of Skinner it has taken its most modern form as multimedia. In the contemporary Science education the term Multimedia is becoming more and more popular term. Multimedia supported instruction have enhanced the scope and impact of Science teaching and it has been proved as a replacement of conventional method in various schools across the globe. The journey of computers as an educational tool has gained its supremacy with the advent of multimedia. Through their studies various researchers have suggested that multimedia technology has manifold advantages over conventional instruction in Science subjects as pictures, sound and animations all collectively stimulate the learners’ senses and it is easy to comprehend the concept.

As the new policy pointing towards digital education clearly indicates the importance and utility of Multimedia Modules for self-learning of the learners and as an aid for the teacher to make his lessons more effective. Keeping in view the enormous potential of computer technology Government of India has initiated various projects, which have been mentioned earlier, for school as well as for higher education level. So it is well understood that in the present age where Science and technology has shown its influence in every sphere of classroom instruction, conventional method is not enough to induce interest among the learners.
Various researchers have conducted experimental studies related to the effectiveness or impact of multimedia learning packages on students’ achievement like; Sindhi (1996) prepared a multimedia package for the students of XI class in Physics and found that teaching through multimedia package is more effective and resulted in better retention of learning in comparison to conventional method of instruction; Jayaraman (2006) studied the impact of Multimedia Learning Packages on performance and behavioural outcomes of students of different age groups and found them effective; Singh (2010) found that irrespective of sex students’ achievement receives a significant effect of multimedia program; Pal, Sana and Ghosh (2012) established the supremacy of multimedia courseware in Physical Science over traditional chalk and talk method in learning outcomes of students; Rani (2012) showed that using E-Content in Science instructions have given a significantly higher achievement by the students as compared to conventional strategy; Suman (2014) found a significant effect of multimedia package on cognitive and affective outcomes of elementary students in environmental Science etc. Findings of all these empirical researches clearly show that multimedia technology and multimedia packages have a tremendous scope in the field of Science education.

7.2 NEED AND SIGNIFICANCE OF THE STUDY

The Life Science/ Biology curriculum over the years is being delivered through lecture method which introduces a sense of boredom in the classrooms. Lecture, being teacher centred instructional method is not suitable for Science subjects in the present age. One or more hour lecture, which consists purely of a verbal presentation, is seldom effective in holding attention, stimulating interest or encouraging student to analyze, evaluate and think critically. This traditional method of teaching is based on giving information as bits. It includes rote memorization of concepts facts and principles, which do not realize objective of teaching Life Science at secondary level. Teacher and teaching methods have a major influence on students’ academic achievement. Poor instructional methods used by the teacher in the classroom lead to students’ poor academic growth. It was discovered that, despite of governments numerous initiatives to promote Science education in the secondary schools of our country the learning
outcomes of the students are not up to the mark. Reason may be attributed to the poor and traditional instructional methods employed by the teachers with no or poor quality instructional material for teaching Science. It is an alarming fact that in the present scientific and technological age traditional instructional method is not sufficient to arouse interest of the students for learning difficult concepts of Science. The teachers should be provided with modern instructional tools to aid them in classroom teaching.

So, new interesting and innovative instructional methods should be devised and adopted for effective teaching because teaching strategies play an important role in enhancing the learning abilities of the students. Findings of various research studies revealed that out of many reasons behind the poor academic performance of students in Life Science one distinguished reason is that in some cases our teachers are not equipped with good quality instructional material, whereas in some other cases the instructional material is there but is not being effectively utilized. So, there is a dire need of directing researches not only towards finding out the suitable and effective instructional method, according to learners’ interest and mental level but also developing innovative instructional material to aid teaching of Science. In this world of Science and technology, it is not possible for a single method, technique or medium to make teaching learning process effective and to fulfill the needs of the students and society. The involvement of more than two media of communication in instructional procedure can bring fruitful results. For qualitative improvement in teaching learning process, Multimedia instructional method may prove as big breather as it is capable of sustaining the interest of students, through visuals and audio inputs. It also brings the element of outer world into the classroom. It can also help students in understanding the complex concepts in a very simple way.

So, keeping this in view, the investigator decided to develop a multimedia instructional package in Life Science for class X students and check its validity.

7.3 STATEMENT OF THE PROBLEM

Development and Validation of Multimedia Instructional Package in Life Science for Students of X Standard.
7.4 OPERATIONAL DEFINITIONS OF THE TERMS USED

Development:

According to Cambridge Advanced Learner’s Dictionary & Thesaurus (Cambridge University Press); development (noun) means process of developing something new.

Validation:


Here by validation the investigator means, establishing the efficacy of the procedures on the basis of empirical testing.

Multimedia:

Integrated use of the different instructional media including film, slides, computer, tape, picture, text, graphics etc.

The term multimedia appeared in the 1990s and was defined by Reddi and Mishra (2003) as:

“an integration of multiple media elements (audio, video, graphics, text, animation etc.) into one synergetic and symbiotic whole that results in more benefits for the end user than any one of the media element can provide individually”.

Mayer (2005) extended the definition:

“a multimedia instructional message is a presentation consisting of words and pictures that is designed to foster meaningful learning”.

Instructional Package:

It is a set of strategies used in the instructional process so as to make teaching learning process more easy and simple.
Multimedia Instructional Package (MMIP):

Multimedia Instructional package means “an instructional material prepared using multiple media elements viz, text, audio, video, sound and animation; including set of strategies”.

7.5 OBJECTIVES

For the present study following objectives were framed:

1. To develop Multimedia Instructional Package in Life Science for X standard students.
2. To validate the developed Multimedia Instructional Package in Life Science for X standard students.
3. To conduct descriptive analysis of data with respect to various variables viz, Socioeconomic status (SES), Intelligence, Science achievement and Science attitude of the present study.
4. To compare the mean scores of control and experimental groups with respect to various variables viz, Socioeconomic status (SES), Intelligence, Science achievement and Science attitude of the present study at pre-test stage (before the experiment).
5. To compare the mean scores of control and experimental groups on Science achievement and Science attitude at post-test stage (after the experiment).
6. To compare the mean gain scores of control and experimental groups on Science achievement.
7. To compare the mean gain scores of control and experimental groups on Science achievement with respect to gender of the students.
8. To compare the mean gain scores of control and experimental groups on Science achievement with respect to intelligence of the students.
9. To compare the mean gain scores of control and experimental groups on Science attitude.
10. To compare the mean gain scores of control and experimental groups on Science attitude with respect to gender of the students.
11. To compare the mean gain scores of control and experimental groups on Science attitude with respect to intelligence of the students.
12. To study the effect of treatment, gender and their interaction on post-test Science achievement scores of students by considering pre-test Science achievement scores as covariate.
13. To study the effect of treatment, intelligence and their interaction on post-test Science achievement scores of students by considering pre-test Science achievement scores as covariate.

14. To study the effect of treatment, gender and their interaction on post-test Science attitude scores of students by considering pre-test Science attitude scores as covariate.

15. To study the effect of treatment, intelligence and their interaction on post-test Science attitude scores of students by considering pre-test Science attitude scores as covariate.

16. To study the opinion of students of experimental group towards Multimedia Instructional Package.

17. To compare the opinion of male and female students of experimental group towards Multimedia Instructional Package.

7.6 HYPOTHESES

In the present study, following null hypotheses were formulated:

**H₀ 1(a)** There is no significant difference between mean Science achievement scores of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

**H₀ 1(b)₁** There is no significant difference between mean Science achievement scores of male students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

**H₀ 1(b)₂** There is no significant difference between mean Science achievement scores of female students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

**H₀ 1(b)₃** There is no significant difference between mean Science achievement scores of male and female students of control group (to be taught through TTM) before the experimental treatment.

**H₀ 1(b)₄** There is no significant difference between mean Science achievement scores of male and female students of experimental group (to be taught through MMIM) before the experimental treatment.

**H₀ 1(c)₁** There is no significant difference between mean Science achievement scores of low intelligence category students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.
H_0 1(c)_2 There is no significant difference between mean Science achievement scores of average intelligence category students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

H_0 1(c)_3 There is no significant difference between mean Science achievement scores of high intelligence category students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

H_0 1(c)_4 There is no significant difference between mean Science achievement scores of control group (taught through TTM) with respect to intelligence of students before the experimental treatment.

H_0 1(c)_5 There is no significant difference between mean Science achievement scores of experimental group (taught through MMIM) with respect to intelligence of students before the experimental treatment.

H_0 2(a) There is no significant difference between mean Science attitude scores of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

H_0 2(b)_1 There is no significant difference between mean Science attitude scores of male students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

H_0 2(b)_2 There is no significant difference between mean Science attitude scores of female students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

H_0 2(b)_3 There is no significant difference between mean Science attitude scores of male and female students of control group (to be taught through TTM) before the experimental treatment.

H_0 2(b)_4 There is no significant difference between mean Science attitude scores of male and female students of experimental group (to be taught through MMIM) before the experimental treatment.

H_0 2(c)_1 There is no significant difference between mean Science attitude scores of low intelligence category students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.
$H_0 \ 2(c)_2$ There is no significant difference between mean Science attitude scores of average intelligence category students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

$H_0 \ 2(c)_3$ There is no significant difference between mean Science attitude scores of high intelligence category students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

$H_0 \ 2(c)_4$ There is no significant difference between mean Science attitude scores of control group (taught through TTM) with respect to intelligence of students before the experimental treatment.

$H_0 \ 2(c)_5$ There is no significant difference between mean Science attitude scores of experimental group (taught through MMIM) with respect to intelligence of students before the experimental treatment.

$H_0 \ 3$ There is no significant difference between mean Science achievement scores of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 4$ There is no significant difference between mean Science attitude scores of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 5(a)$ There is no significant difference between mean gain Science achievement scores of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 5(b)_1$ There is no significant difference between mean gain Science achievement scores of male students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 5(b)_2$ There is no significant difference between mean gain Science achievement scores of female students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 5(b)_3$ There is no significant difference between mean gain Science achievement scores of male and female students of control group (taught through TTM) after the experimental treatment.
$H_0 \ 5(b)_4$ There is no significant difference between mean gain Science achievement scores of male and female students of experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 5(c)_1$ There is no significant difference between mean gain Science achievement scores of low intelligence category students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 5(c)_2$ There is no significant difference between mean gain Science achievement scores of average intelligence category students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 5(c)_3$ There is no significant difference between mean gain Science achievement scores of high intelligence category students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 5(c)_4$ There is no significant difference between mean gain Science achievement scores of control group (taught through TTM) with respect to intelligence of students after the experiment.

$H_0 \ 5(c)_5$ There is no significant difference between mean gain Science achievement scores of experimental group (taught through MMIM) with respect to intelligence of students after the experimental treatment.

$H_0 \ 6(a)$ There is no significant difference between mean gain Science attitude scores of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 6(b)_1$ There is no significant difference between mean gain Science attitude scores of male students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 6(b)_2$ There is no significant difference between mean gain Science attitude scores of female students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

$H_0 \ 6(b)_3$ There is no significant difference between mean gain Science attitude scores of male and female students of control group (taught through TTM) after the experimental treatment.
\( H_0 \ 6(b)_4 \) There is no significant difference between mean gain Science attitude scores of male and female students of experimental group (taught through MMIM) after the experimental treatment.

\( H_0 \ 6(c)_1 \) There is no significant difference between mean gain Science attitude scores of low intelligence category students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

\( H_0 \ 6(c)_2 \) There is no significant difference between mean gain Science attitude scores of average intelligence category students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

\( H_0 \ 6(c)_3 \) There is no significant difference between mean gain Science attitude scores of high intelligence category students of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment.

\( H_0 \ 6(c)_4 \) There is no significant difference between mean gain Science attitude scores of control group (taught through TTM) with respect to intelligence of students after the experimental treatment.

\( H_0 \ 6(c)_5 \) There is no significant difference between mean gain Science attitude scores of experimental group (taught through MMIM) with respect to intelligence of students after the experimental treatment.

\( H_0 \ 7(a) \) There is no significant effect of treatment on adjusted means of post-test Science achievement scores by considering pre-test Science achievement scores as covariate.

\( H_0 \ 7(b) \) There is no significant effect of gender on adjusted means of post-test Science achievement scores by considering pre-test Science achievement scores as covariate.

\( H_0 \ 7(c) \) There is no significant interaction effect of treatment and gender on adjusted means of post-test Science achievement scores by considering pre-test Science achievement scores as covariate.

\( H_0 \ 8(a) \) There is no significant effect of treatment on adjusted means of post-test Science achievement scores by considering pre-test Science achievement scores as covariate.
**H₀ 8(b)** There is no significant effect of intelligence on adjusted means of post-test Science achievement scores by considering pre-test Science achievement scores as covariate.

**H₀ 8(c)** There is no significant interaction effect of Treatment and Intelligence on adjusted means of post-test Science achievement scores by considering pre-test Science achievement scores as covariate.

**H₀ 9(a)** There is no significant effect of Treatment on adjusted means of post-test Science attitude scores by considering pre-test Science attitude scores as covariate.

**H₀ 9(b)** There is no significant effect of gender on adjusted means of post-test Science attitude scores by considering pre-test Science attitude scores as covariate.

**H₀ 9(c)** There is no significant interaction effect of treatment and gender on adjusted means of post-test Science attitude scores by considering pre-test Science attitude scores as covariate.

**H₀ 10(a)** There is no significant effect of treatment on adjusted means of post-test Science attitude scores by considering pre-test Science attitude scores as covariate.

**H₀ 10 (b)** There is no significant effect of intelligence on adjusted means of post-test Science attitude scores by considering pre-test Science attitude scores as covariate.

**H₀ 10(c)** There is no significant interaction effect of Treatment and Intelligence on adjusted means of post-test Science attitude scores by considering pre-test Science attitude scores as covariate.

**H₀ 11** There is no significant difference between the opinions of male and female students of experimental group regarding the effectiveness of MMIP.

### 7.7 DELIMITATION OF THE STUDY

In this study delimitations have been observed in the following aspects:

1. The study was delimited to one English medium school, affiliated to CBSE, Delhi only.
2. The study was delimited to X standard students only.
3. The study was delimited to a sample size of 80 students of class X only.
4. The study was delimited Science subject only.
5. The study was delimited to only two topics of Life Science.
7.8 METHOD OF THE STUDY

The main objective of the present study was to find out the effect of Multimedia Instructional Package on Students’ achievement in Life Science. Therefore to achieve the objectives of present study Experimental method has been used by the investigator. According to the nature of the study, the investigator has employed Quasi-experimental: pre-test post-test Experimental group and Control group design; as it was difficult to use randomization for the selection of samples for experimentation and thus the researcher took the sample purposively.

The experimental design of the study is following figure:

![Experimental design of the study](image)

The experimental and control group consisted two intact sections of class X of a school. The experimental group was taught through Multimedia Instructional Method (MMIM) using Multimedia Instructional Package (MMIP) whereas the control group was taught through Traditional Teaching Method (TTM).

7.9 VARIABLES OF THE STUDY

Following types of variables have been included in the present study:

1. **Independent Variable:** As per the objective of the study effect of MMIM and TTM was to be studied on achievement of students in Life Science an on Science attitude of the students. For this experimental group was taught by MMIM and the control group through TTM. So, MMIM and TTM were the independent variables of the present study.
2. **Dependent Variable**: In the present study achievement in Life Science and Attitude towards Science were taken as dependent variables, which were measured twice during the course of study; first at pre-test stage and second time at post-test stage.

3. **Intervening Variable**: It is that factor which affects the observed phenomenon but cannot be seen, measured or manipulated; its effects must be inferred from the effects of the independent and moderator variables on the observed phenomenon. So, it can be seen as a variable that explains a relation or provides a causal link between other variables.

4. **Control Variables**: All the variables cannot be studied at the same time. Hence suitable control was employed to control variables. Control employed for each of this was as follows:
   i. **Nature of school**: The sample was taken from a single school; Maharaja Agrasen Model School, Delhi affiliated to C.B.S.E.
   ii. **Grade level**: X class was selected for the present study and it was kept constant during the study.
   iii. **Teacher**: Both the groups; experimental and control were taught by the same teacher.
   iv. **Subject content**: Both the groups were taught the same two units of Science.
   v. **Socioeconomic Status**: Both groups belonged to same milieu.
   vi. **Intelligence level**: Both the groups belonged to same intelligence level.

7.10 POPULATION OF THE STUDY

Population for the purpose of the present study has been defined as all students studying in class X CBSE affiliated English medium schools of Delhi.

7.11 SAMPLE AND SAMPLING TECHNIQUES

*Purposive sampling technique* was used for the selection of the sample considering the experimental nature of the present study and bearing in mind the feasibility aspect of the experimentation, data collection and with the objective of
getting all the required facilities. 80 students of X standard belonging to two sections (40 students in each section) of Maharaja Agrasen Model School, Delhi were selected as a sample for the present study. These sections were assigned randomly as Experimental group and Control group. The experimental group was exposed to MMIM and the control group was taught through TTM.

7.12 TOOLS USED

For the selection of the suitable tools the investigator reviewed related testing material and discovered that tools for the assessment of Intelligence, Attitude towards Science and Socioeconomic Status were readily available whereas according to the need of the study some of the tools were developed by the investigator herself. So, for the present study following tools were selected and developed:

A. Standardized Tests
   1. G.C. Ahuja Group Test of Intelligence (GGTI) by Dr. G.C. Ahuja (2005)

B. Self-Developed Tools
   1. Life Science Achievement Test (LSAT)
   2. Multimedia Instructional Package Opinionnaire for Teachers (MMIPOT)
   3. Multimedia Instructional Package Opinionnaire for Students (MMIPOS)
   4. Multimedia Instructional Package (MMIP)

Description of Self-developed tools:

1. Life Science Achievement Test for Class- X (LSAT-X)

   LSAT was developed and standardized by the investigator with the help of the supervisor to measure the achievement of students in Life Science. The final form of the achievement test was consisted of 100 multiple choice questions having four objectives for each question. One mark for each correct answer has to be awarded. The test- retest reliability of the test was found to be 0.867 (significant at 0.01 level). The split-half reliability: Spearman-Brown (0.850) and Guttman (0.850). Cronbach's Alpha (α) was found to be 0.845.
2. Multimedia Instructional Package Opinionnaire for Teachers (MMIPOT)

For the present study the investigator has prepared a Multi Media Instructional Package (MMIP) for two topics of class X Science textbook. Before using this package it was important to validate it in terms of its appropriateness for the age and mental level of the target students and usability for the teachers. A thorough literature survey was made to find out a scale or opinionnaire which can be used for validating the MMIP. But there was no such opinionnaire available in the selected topics of the present study. So, the investigator developed and standardized an opinionnaire to validate the Multimedia Instructional Package.

- **Reliability of MMPIOS:** The internal consistency reliability of the opinionnaire was established using **Split Half** methods: Spearman-Brown Coefficient = 0.889 and Guttman Split-Half Coefficient = 0.876. Further, Cronbach’s Alpha was found to be 0.953 which indicated a good internal consistency of the opinionnaire (MMIPOT).

- **Validity of Opinionnaire:** The validity of the opinionnaire was well established by taking into consideration the suggestion made by various experts at different stages of development of the opinionnaire.

- **Description of the Final form of MMIPOT:** The final form of MMIPOT consisted of 44 items belonging to nine different areas viz. Content Quality, Learning Objectives Alignment, Presentation Design & Multimedia Aspect, Creative and Innovative Aspect, Language Aspect (Spelling & Grammar), Interaction & Navigation Usability, Evaluation Tool, Motivation Aspect, Usability for Teachers.

- **Scoring:** All the items of the opinionnaire are positively worded. Items were given a score of 5,4,3,2 and 1 for ‘Strongly Agree’, ‘Agree’, ‘Undecided’, ‘Disagree’ and ‘Strongly Disagree’ respectively. The sum of the values assigned to responses categories can be used for interpreting the effectiveness of MMIP. Thus, the opinionnaire can have total score ranging from 44 to 220, showing least effective to highly effective.

3. Multimedia Instructional Package Opinionnaire for Students (MMIPOS)

The Multimedia Instructional Package was developed to find the empirical evidence of effectiveness of learning through multimedia packages over traditional
method of teaching. So, views of the students who are the target group for using the developed MMIP should also be considered for assessing its effectiveness. The investigator reviewed various literature but could not find any such tool which can fulfil the requirement. So, an opinionnaire- Multimedia Instructional Package Opinionnaire for Students (MMPIOS) was developed and standardized to assess the usability and effectiveness of MMIP for students.

- **Reliability of MMPIOS**: The internal consistency reliability of the opinionnaire was established firstly by Split Half method. The split half reliability coefficient of MMIP was found through Spearman-Brown formula and Guttman formula using SPSS 20: Spearman-Brown Coefficient = 0.919 and Guttman Split-Half Coefficient = 0.913. Further, Cronbach's Alpha for MMPIOS was found to be 0.944 which indicated a good internal consistency of the opinionnaire.

- **Validity of Opinionnaire**: The validity of the MMPIOS was established by taking into consideration the suggestion made by various experts at different stages of development of the opinionnaire.

- **Description of the Final form of MMPIOS**: The final form of MMPIOS consisted of 28 items arranged in five point rating scale having response categories; strongly agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD).

- **Scoring**: As, all the items were positively worded so items were given scores of 5,4,3,2,1 for Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), Strongly Disagree (SD) respectively. Thus, the total score for the opinionnaire can vary from 28 to 140, which can be used to know the effectiveness of MMIP.

1. **Multimedia Instructional Package (MMIP)**

Development of Multimedia Instructional Package is the heart and soul of this experimental research. For the development of the MMIP steps of ADDIE model of the instructional design were followed.
7.13 EXPERIMENTAL PROCEDURE

It was a quasi-experimental research so the procedure followed for the conduction of research consisted of following three stages:

2. **Stage I: Pre-testing Stage:** At this stage two intact sections of the class X of the experimental school were chosen as sample and one section was assigned as Experimental Group and another as a Control Group by tossing the coin. After establishing rapport with the students of experimental and control group GGTI-G C Ahuja Group Test of Intelligence and SESS- Socio Economic Status Scale were administered on the students of both the groups. The scores of students on both tests were analyzed by t-test and found that both the groups were equivalent in terms of intelligence and socioeconomic status of the students.

   After ensuring the equivalence of the groups Life Science Achievement Test (LSAT) and Science Attitude Scale (SAS) were administered on both the groups.

3. **Stage II: Treatment Stage:** After conducting pre-test at the first stage of experiment, treatment was given to the experiment group i.e. the experimental group was taught two units of Life Science through Multimedia Instructional Method (MMIM) using Multimedia Instructional Package (MMIP) developed by the investigator herself. The control group was taught the same units through Traditional Teaching Method (TTM).

4. **Stage III: Post-test Stage:** As soon as the instructional treatment was over Life Science Achievement Test (LSAT) and Science Attitude Scale (SAS) were administered on both the groups. To know the opinion of the students of regarding Multimedia Instructional Package Opinionnaire for Students (MMIPOS) was also administered on experimental group.

7.18 STATISTICAL TECHNIQUES EMPLOYED

For analysis and interpretation of data various statistical techniques such as: differential statistics- mean, standard deviation, skewness and kurtosis, percentage analysis; and inferential statistics- t-test, ANOVA, ANCOVA were employed. All the analysis was made by using SPSS version 20.0.
7.19 FINDINGS OF THE STUDY

1. No significant difference was found between mean Sciences achievement scores of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

2. No significant difference was found between mean Science achievement scores of male students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

3. No significant difference was found between mean Science achievement scores of female students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

4. No significant difference was found between mean Science achievement scores of male and female students of control group (to be taught through TTM) before the experimental treatment.

5. No significant difference was found between mean Science achievement scores of male and female students of experimental group (to be taught through MMIM) before the experimental treatment.

6. No significant difference was found between mean Science achievement scores of students having low intelligence of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before experimental treatment.

7. No significant difference was found between mean Science achievement scores of students having average intelligence of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before experimental treatment.

8. No significant difference was found between mean Science achievement scores of students having high intelligence of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before experimental treatment.

9. A significant difference was found among the students of different categories of intelligence (low, average and high) of control group (to be taught through
TTM) with respect to Science achievement scores before the experimental treatment.

10. No significant difference was found among the students of different categories of intelligence (low, average and high) of experimental group (to be taught through MMIM) with respect to Science achievement scores before the experimental treatment.

11. No significant difference was found between mean Science attitude scores of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

12. No significant difference was found between mean Science attitude scores of male students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

13. No significant difference was found between mean Science attitude scores of female students of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

14. No significant difference was found between mean Science attitude scores of male and female students of control group (to be taught through TTM) before the experimental treatment.

15. No significant difference was found between mean Science attitude scores of male and female students of experimental group (to be taught through MMIM) before the experimental treatment.

16. No significant difference was found between mean Science attitude scores of students having low intelligence of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

17. No significant difference was found between mean Science attitude scores of students having average intelligence of control group (to be taught through TTM) and experimental group (to be taught through MMIM) before the experimental treatment.

18. No significant difference was found between mean Science attitude scores of students having high intelligence of control group (to be taught through TTM)
and experimental group (to be taught through MMIM) before the experimental treatment.

19. No significant difference was found among the students of different categories of intelligence (low, average and high) of control group (to be taught through TTM) with respect to Science attitude scores before the experimental treatment.

20. No significant difference was found among the students of different categories of intelligence (low, average and high) of experimental group (to be taught through MMIM) with respect to Science attitude scores before the experimental treatment.

21. A significant difference was found between mean Science achievement scores of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment in favor of experimental group suggesting the effectiveness of the teaching using multimedia package as compared to the traditional method in improving achievement of the students in Science.

22. A significant difference was found between mean Science attitude scores of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment in favor of experimental group suggesting the effectiveness of multimedia package in developing positive attitude towards Science as compared to TTM.

23. A significant difference was found between mean gain Science achievement scores of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment in favor of experimental group further confirming the effectiveness of the teaching using multimedia package as compared to the traditional method in Science achievement.

24. A gender wise comparison (between group and within group) of mean gain Science achievement scores of the control and experimental group was conducted and found that:
   
   a. Both the male and female students of experimental group were benefitted by the MMIP and scored significantly higher as compared to their control group counterparts.
b. And no significant difference was found between mean gain Science achievement scores of male and female students of control group (taught through TTM); and male and female students of experimental group (taught through MMIM) after the experimental treatment which revealed that TTM as well as MMIM, both the teaching methods were found to be equally beneficial for the students of both the genders (male and female).

25. A comparison (between group and within group) of mean gain Science achievement scores of students in control and experimental groups with respect their intelligence was made using t-tests and ANOVA.

i. The between group comparison (between control and experimental groups) revealed that the students of experimental group belonging to all three categories of intelligence i.e. low, average and high have shown a significant higher mean gain in Science achievement as compared to their control group counterparts.

ii. The within group comparison (within control and experimental groups) revealed that by traditional teaching the average students were benefitted most, then high and it was least effective for the low category students in terms of mean gain Science achievement. MMIP was found to be most effective for students having average intelligence and least effective for the students having high intelligence. So, it can be concluded that that the students of average intelligence learn and achieve more as compared to the high and low intelligence students when exposed to the multimedia instructional package.

26. A significant difference was found between mean gain Science attitude scores of control group (taught through TTM) and experimental group (taught through MMIM) after the experimental treatment in favor of experimental group suggesting that multimedia package was effective as compared to the traditional method in in developing positive attitude towards Science.

27. A gender wise comparison (between group and within group) of mean gain Science attitude scores of the control and experimental group was revealed that:
iii. The MMIM was found to be very effective in developing favorable attitude towards Science as compared to TTM for male students whereas no significant difference was found between mean gain Science attitude scores of female students of control group (taught through TTM) and experimental group.

iv. In within group comparison (within control and experimental group) no significant difference was found between mean gain Science attitude scores of male and female students of control group (taught through TTM); and male and female students of experimental group (taught through MMIM) after the experimental treatment suggesting that TTM as well as MMIM, both the teaching methods were found to be equally beneficial for the students of both the genders (male and female).

28. A comparison (between group and within group) of mean gain Science attitude scores of students in control and experimental groups with respect their intelligence was made using t-tests and ANOVA.

iii. The between group comparison (between control and experimental group) revealed that:

a. MMIM is more effective as compared to TTM in developing favorable attitude towards Science for the students having low and average intelligence.

b. Science attitude of students belonging to high intelligence category is independent of the teaching intervention as the students taught by traditional method and exposed to MMIP have shown similar mean gain with respect to their Science attitude.

iv. A within group comparison (within control and experimental groups) among the mean gain Science scores of three different categories of intelligence for each group, i.e. control and experimental group was made by conduction one way ANOVA.

a. TTM was found to be most beneficial for the students of high intelligence category and least for the low intelligence category in terms of development of favorable attitude towards Science.
b. No significant difference was found between mean gain Science attitude scores of experimental group (taught through MMIM) with respect to intelligence after the experiment.

29. The main effect of treatment on the post-test scores of students in Science achievement considering pretest Science achievement scores as covariate was found to be statistically significant favoring experimental group further confirming the effectiveness of MMIM over TTM in improving achievement in Science.

30. The main effect of gender on the post-test Science achievement scores of students considering pre-test Science achievement scores as covariate was found to be statistically significant in favor of male students indicating that males performed significantly better after being exposed to treatment in form of teaching through MMIP as compared to females.

31. The interaction effect of treatment and gender on post-test Science achievement scores by considering pre-test Science achievement scores as covariate was found to be statistically not significant suggesting that males and females both respond to the teaching strategy in the same way.

32. The main effect of Intelligence on post-test scores of students in Science by considering the pre-test Science achievement scores as covariate was found to be statistically significant. Difference between adjusted means of post-test scores of students of High and Average intelligence was found to be statistically significant leading to the inference the students who were in Average Intelligence category scored significantly higher in Science achievement test as compared to High Intelligence category.

Also the difference between adjusted means of post-test Science achievement scores of students of Low and Average intelligence was found to be statistically significant indicating significantly good performance by the students in Science achievement test possessing average intelligence as compared to low intelligence.

33. The interaction effect of Treatment and Intelligence on post-test scores of students in achievement in Science by considering the pre-test Science achievement scores as covariate was found to be statistically not significant
indicating that overall students having different intelligence levels respond to the teaching strategy in the same way.

34. The main effect of Treatment on post-test scores of students in Science attitude by considering the pre-test Science attitude scores as covariate was found to be statistically highly significant in favor of experimental group suggesting the effectiveness of MMIM over TTM for the X class students in the development of positive attitude towards Science.

35. The main effect of gender on post-test Science attitude scores of students by considering the pre-test Science attitude scores as covariate was found to be statistically not significant indicating that there is no significant main effect of gender on Science attitude of students. By this result it can be inferred that development of favorable attitude towards Science is independent of gender.

36. The interaction effect of treatment and gender on post-test Science attitude scores by considering the pre-test Science attitude scores as covariate was found to be statistically not significant indicating that these two independent variables do not interact with each other, hence there is no interaction effect of Treatment and Gender on attitude of students in Science when pre-test scores in Science attitude were taken as co-variate.

37. The main effect of Intelligence on post-test Science attitude scores of students by controlling the pre-test Science attitude scores was found to be statistically significant. The students having high intelligence exhibited significantly higher favorable attitude towards Science as compared to students having average and low intelligence.

38. The interaction effect of treatment and intelligence on post-test Science attitude scores by considering the pre-test Science attitude scores as covariate was found to be statistically not significant.

39. Overall opinion of students of experimental group regarding MMIP was found to be positive as they showed a good percentage of agreement i.e. 90% towards the effectiveness of the MMIP.

40. No significant difference was found between the opinion of male and female students of experimental group regarding the effectiveness of MMIP.
7.20 CONCLUSIONS

The main aim of the present study was to develop a Multimedia Instructional Package (MMIP), and assess its effectiveness as compared to the traditional teaching method. The MMIP was prepared for two topics of Life Science (Life processes; and Control and Coordination) for X standard students based on CBSE curriculum. The developed MMIP was validated through a rigorous process with the help various educationists, technology experts and subject experts. To, compare the effectiveness of the MMIP a quasi-experimental pre-test post-test control group and experimental group design was adopted. The control group was taught through TTM and the experimental group through MMIM. The comparison of TTM and MMIM is not only comparison of two modes of instructions but two theoretical paradigms. In the traditional teaching method the learner is a passive recipient of the knowledge given by the teacher whereby making teacher a very important component of this strategy. Whereas MMIM represents a paradigm where the learner is the creator and innovator of knowledge. Thus role of a learner is very active in MMIM and the learning is self-paced. Since the past decade, the use of computers in educational field has been increased dramatically and it is now being considered as very effective for better learning and retention of the subject knowledge. The present study was conducted to find an empirical proof that, whether multimedia package was effective in enhancing achievement of X standard students in Science and how far this was helpful in developing favorable attitude of students towards Science.

On the basis of discussion of results following conclusions can be derived:

1. Teaching using MMIP improved the Science achievement of the students of experimental group as compared to the control group which was taught through traditional teaching method.

2. MMIP was found to be more beneficial for the male students as compared to the female students in terms of achievement in Science when pre-test Science achievement scores were taken as covariate.
3. MMIP was found to be most effective for the students belonging to average category of intelligence in terms of Science achievement when pre-test Science achievement scores were taken as covariate.

4. The interaction effect of treatment and gender on post-test Science achievement scores by considering pre-test Science achievement scores was found to be not significant.

5. No interaction effect of Treatment and Intelligence was found on post-test Science achievement by considering pre-test Science achievement scores as covariate. This result suggest that overall students having different intelligence levels respond to the teaching strategy in the same way.

6. Teaching using MMIP improved Science attitude of the students of experimental group as compared to the control group which was taught through traditional teaching method when pre-test Science achievement scores were taken as covariate.

7. MMIP was found to be equally beneficial for male as well as for female students in developing favorable attitude towards Science when pre-test Science attitude scores were taken as covariate.

8. MMIP was found to be most effective for the students of high intelligence category when pre-test Science attitude scores were taken as covariate in terms of Science attitude i.e. students in high intelligence group were benefited the most by the multimedia package in terms of development of favorable attitude towards Science.

9. No interaction effect of Treatment and Gender on attitude of students towards Science was found when pre-test scores in Science attitude were taken as co-variate.

10. No interaction effect of Treatment and Intelligence on attitude of students towards Science was found when pre-test scores in Science attitude were taken as co-variate.

11. Overall the students of experimental group were found to have favorable attitude towards developed MMIP.

12. Male and female students of experimental group were found have similar attitude towards the developed MMIP.
Precisely, it has been concluded by the researcher that use of multimedia technology in the field of education can enhance capacity of the teacher as well as of learner. If the multimedia is used with balance it can revolutionize the sphere of Science education by giving more and more space to the learner for exploration and self-paced learning. As, Science achievement and Science attitude both were found to have positively impacted through the use of multimedia package, it can also be concluded that the appropriately developed multimedia package in Science subjects may contribute to prepare a sole new generation of learners having positive attitude towards Science and having high achievement in Science.

7.21 EDUCATIONAL IMPLICATIONS

At school level or higher level, giving information to the students is emphasized which is not the sole objective of teaching. Along with giving information about various concepts of the topics given in the text books the other objectives of the Science education include: developing understanding, power of expression, reasoning and thinking power, value concepts and value clarification, tolerance, risk taking capacity and scientific temper among students etc. With the limitation of the infrastructure of the schools, large class size, non-availability of teachers, quality of teachers and their inadequate training it is difficult to achieve all the major and minor objectives of teaching. The traditional teaching method does not have potential to achieve majority of the objectives. Whereas it has been observed that by teaching using these multimedia packages a teacher can successfully achieve most of the teaching objectives efficiently. The learners are no more passive rather they become active and explore the knowledge with their own pace by understanding each and every minute concept. When the complexities of the Science subject become easily understandable by the simple explanation with relevant examples and interesting because of the element of animation, video and narration etc. students gradually start taking interest in Science. This interest slowly develops their positive attitude towards Science. So, multimedia package not only improves Science achievement but it also contributes towards the development of positive attitude towards Science.
The present study has a wide range of implications in the field of education. Some of them are given as follows:

1. Multimedia packages make teaching and learning process more interesting and interactive for the teachers as well as for learners.

2. The multimedia instructional package changes the role of a teacher, as it is no longer only dispenser of information but has got transformed as a facilitator for the better learning and understanding of concepts by the students.

3. The results of the study indicate that by using multimedia package as an aid the achievement of the students in Science improved significantly. Thus, teachers are suggested that they should create a suitable environment in the classroom which could motivate and support the students to participate in the learning by understanding. Appropriate guidelines should also be provided to the teachers about the effective use of the multimedia package.

4. Multimedia instructional packages should be introduced as an essential aid in schools for teaching Science as they have a significant effect on students’ achievement as well as on their attitude towards Science.

5. The use of computers in education is gaining momentum in present era. Government of India has also initiated various projects at national and state level and has set up labs for higher and senior secondary schools. But the infrastructure is of no use without the appropriate courseware of multimedia packages. So, in the field of education development of packages should be also given consideration. Government should also take initiative to get the packages developed in collaboration with different agencies like NCERT, SCERT, IGNOU, and CIET etc.

6. Teachers should also be given training in development of multimedia packages so as it will help them to create customized packages according to the need of their students and according to their situational requirements. In this way they will not be dependent on the external agency or aid for the multimedia package. So, in-service programs can also be planned for the training of the teachers.
7. Pre-service programs should also be devised so as the future teachers can equip themselves with the necessary skills required for the planning and development of need based multimedia packages.

8. The Department of Education of each state should organize workshops and seminars for teacher educators so that they can persuade the pupil teachers for developing and using multimedia programs for making their classroom teaching more effective.

9. Private organizations should also be encouraged to develop appropriate multimedia programs, softwares and packages in various subjects for the students and teachers.

10. Local subject and technical experts should also be encouraged to contribute towards development of quality multimedia packages of various subjects and for various standards.

7.22 SUGGESTIONS FOR FURTHER RESEARCH

All the aspects of the present problem could not be covered due to scarcity of time and resources. The study can be further elaborated on various aspects, as given below:

1. The present study was confined only to Science subject; so further researches may be directed for various other subjects.

2. The present study was delimited to the X standard only, so further researches may be conducted for other standards also.

3. The present study was confined to only two topics of Life Science. So, further studies may be conducted by developing multimedia packages for various other topics of Science.

4. The sample of the present study was confined to 80 students only from one school. Studies may also be conducted by taking larger samples from various schools.

5. The present study was delimited to only one type of school i.e. private, so further research may be conducted by taking different types of schools like government, Kendriya Vidalaya, Navodaya Vidalaya etc.

6. A comparative study between different types of schools may also be conducted.
7. The sample school was taken from urban area of Delhi, so further researches may be conducted by taking sample from rural area.

8. A comparative study of effectiveness of multimedia package on achievement of urban and rural Science students may also be conducted.

9. The present study was conducted to compare the effectiveness of the teaching using multimedia package and traditional method. Further comparative studies may be conducted with various other modern teaching methods like project, discussion and tutorial etc.

10. The present study was confined to studying the effect of multimedia package on Science achievement and Science attitude only, further studies may be conducted to see the effect of multimedia package on various other variables like self-concept, creativity, problem solving, decision making etc.

11. Studies may also be conducted to see the effect of multimedia package on the various dimensions of objectives i.e. knowledge, understanding, application etc.

12. Further studies may also be conducted to know the cost benefit analysis of educational multimedia packages, their development and use.

13. The study was conducted using quasi-experimental design. Further researches may be conducted by employing true-experimental designs using randomized sample.