CHAPTER-I

INTRODUCTION

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1.1 Introduction

In the beginning of the last century, children were taught in a rigidly formal and stereotyped way. Education was then conceived as a process of transmission of factual knowledge only. The teacher adopted an authoritarian attitude. The facts learned by children were tested from time to time but such tests were neither concerned with conceptual understanding nor effective performance. The emphasis was on testing memory. They very often used the lecture method which was not much effective for meaningful learning. The teacher did not use other visual material to supplement the oral teaching.

The teacher of today does not consider the student as a vessel waiting to be filled up with facts nor as a pliable plastic material, which can be transformed into any shape enabling to project his ideas on it. The modern teacher considers each student as akin to plant and helps the student to grow according to their abilities and aptitudes. Teacher can help the student to learn. Teacher realizes that 'to teach is to nourish or cultivate the growing student or to give
intellectual exercise or to train in the horizontal sense of directing or 
guiding the growth'. The modern teacher sees education as a process 
of interaction between the student and his environment. Student 
learns by doing and learns how to learn in groups and individually, 
as well.

Increase in population and explosion of knowledge are affecting 
the pattern of human life and also inflicting its full impact on 
education. The explosion of population and knowledge has raised the 
serious question of both quantity and quality of education. 
Educationists are of the opinion that the educational problems 
relating to the quantity and quality could be tackled by applying 
systematic approach of instructional technology. Therefore, there has 
been a rapid development of communication technology in education 
at all levels with a purpose of extending educational facilities and 
upgrading instructions. Instructional technology aids to improve the 
process of human learning. Instructional technology is a field made 
up of elements of other fields. There is very little content, which is 
unique. It has taken elements of cognitive psychology, perception 
psychology, measurement, evaluation, communication, management, 
media and systems engineering. These elements are arranged 
synergistically to a point where the whole is greater than sum of its
parts. The field has rapidly evolved from audio-visual education through educational communications to instructional technology. There is overlapping of ideas mainly between three terminologies namely, educational technology, instructional technology and communication technology.

Though the term instructional technology is often used interchangeably with educational technology, it presents certain refinements that are not found in the meaning of educational technology. Venkataiah (1996), describes instructional technology as 'The media born of the communications revolution which can be used for instructional purposes alongside the teacher, text book and blackboard', and 'A systematic way of designing, carrying out and evaluating the total process of learning and teaching in terms of specific objectives based on research in human learning and communication, and employing a combination of human and non human resources to bring out more effective instruction'. Venkataiah (1996) further stated 'technology of instruction can make an ordinary person capable of superior performance and a means, either printed or electronic, to distribute that instruction'.

Instructional technology as considered by Leedham (1967) concerns the systematic use of modern methods and technologies in
teaching and learning. It involves teachers in a variety of roles, some of which are traditional, some still emerging. In this definition, special consideration is given to the adaptive role of the teacher. One purpose of studying instructional technology is surely to help to make the best use of capabilities of individual teachers. Instructional technology is fundamentally aimed at improving the efficiency of the educational system by increasing the rate, depth, precision, and value of the learning, which takes place.

As the major field of education, bio-science was taught in an authoritarian manner as a 'dogma' of facts, principles and laws to be memorized and handed back during the examinations. Characteristics of bio-science that is excitement of discovery and critical thinking, were missing in bio-science teaching. There was considerable reliance on chalk-talk method for teaching bio-science and very little emphasis on laboratory activities and that was without the use of low cost inexpensive instructional materials.

Therefore, Bruner (1969) gave a word of caution when he said, 'I do not restrict discovery to an act of finding out something that before was unknown to mankind, but rather include all forms of obtaining knowledge for oneself by the use of ones own mind'. One cannot, therefore, expect the pupils at secondary level to make
original contributions to the accumulated scientific knowledge of the world. What will be found, no doubt, is already known and probably found in some textbook. In short, discovery does not mean to discover something new and completely unknown.

When the students are helped or guided to discover a generalization imposed, student may develop the rational powers, gaining understanding of content and the process of learning. Authoritarian teaching consists of imposing upon the students the generalizations which are truly their own. Students who learn science by discovery approach will discover for themselves the true structure of the discipline in complete harmony with modern philosophy of science education.

The new trends towards biotechnology again are increasing and the students at the secondary level are at the threshold of selecting Biology based careers by and large.

The objectives of Bio-Science are:

- To introduce students to a body of knowledge investigating living things and studying work of scientists.
- To develop in students the habit and ability of independent study.
The teaching learning resource material on secondary school Biology consists of textbook, students’ manual and teachers guide for secondary school students. There is no denying the fact that knowledge is a universal commodity but the matter of its presentation is an individualized effort.

Teaching method which is traditionally used for teaching Biology in secondary schools is a combination of lecture method, textbook recitation method and to some extent, chalk board is used. The lecture method is a teaching procedure with one way channel of communication. The instructor makes an oral presentation of information to which students’ role is passive. The student is never put into the situation from where one can move to logical reasoning and critical thinking that reduces the learning process.

Instructional technology can enhance learning process. Instructional technology is made up of the things of learning, the devices and the materials, which are used in the process of learning and teaching. Instructional technology emphasizes the interaction between student and relative environment, which is the basic requirement of Biology syllabus. The teaching of Biology is very important because the knowledge of Biology helps in improving the quality of life, Biology covers all aspects of life, so it goes without
saying that Biology should be taught in order to succeed in life. Knowledge of Biology helps in solving many social problems relating to health, poverty, food shortage and crop production and environmental conservation.

1.2 Computers in Education

Indian experiments in taking computers to schools involved the participation of a large number of institutions for tasks such as the supply of hardware and software, the development of Computer Assisted Learning (CAL) packages, and the training of teachers. A project called Computer Literacy and Studies in School (CLASS) launched in 1984 was a joint initiative of MHRD, Department of Electronics, and NCERT. It covered 42 Resource Centres and 2,582 schools. It made use of microcomputers provided by the BBC. The evaluation of the project by SAC revealed the need for greater interaction between resource centers and project schools, the need to reduce the time gap between the training of teachers, the installation of systems, and the initiation of activities in schools, the imparting of adequate hands-on experience to teachers and students, and the provision of computer literacy programmes in the timetable. The project had only a limited success, and has been described at best as a “spectator sport”.

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A revised CLASS project during 1993–2004 saw the introduction of PC machines in keeping with broad global trends. Subsequently, the government initiated the CLASS 2000 programme with the aim of providing computer literacy in 10,000 schools, computer-assisted learning in 1,000 schools, and computer-based learning in 100 schools. These 100 schools were called smart schools, and were designed to be agents of change seeking to promote the extensive use of computers in the teaching-learning process. This, too, has not yielded the expected results. In the words of Mallik (1993), "Ambiguity of purpose, tentative policies and faltering practices marked the major computing initiatives in India during the last two decades . . . Schools are using IT as an add-on, not as an integral part of a new pedagogy."

Though all these interventions did make some impact, where the schools and teachers went the extra mile to avail of the facilities provided using their own ingenuity, many of these schemes have been half-hearted attempts even at the conceptual level. Computer literacy is not so much about knowing the technical jargon, but rather learning to use computers in a meaningful way, which is, meaningful to children.
Two programmes illustrate this fact quite well. The first project—which the media has dubbed the Hole in the Wall, uses the method of Minimal Invasive Education (MIE).

The second programme was carried out by the TelNet, Mukhopadhyay et al. (1993) Utilization of media facilities in schools: An evaluative study of the ET scheme of the Ministry of HRD. Mukhopadhyaya describes his study not as a study of an educational technology scheme, but rather as a study of the utilization of media facilities. A study of CLASS, as part of a larger international study entitled “Schools, Teachers, Students, and Computers: A Cross-national Perspective, IEA 1993. University of Twente.

1.3 Multimedia in Education

The world in which we live is changing rapidly and the field of education is experiencing these changes in particular as it applies to Media Services. The old days of an educational institution having an isolated audio-visual department are long gone! The growth in use of multimedia within the education sector has accelerated in recent years, and looks set for continued expansion in the future.

Teachers primarily require access to learning resources, which can support concept development by learners in a variety of ways to
meet individual learning needs. The development of multimedia technologies for learning offers new ways in which learning can take place in schools and homes. Enabling teachers to have access to multimedia learning resources, which support constructive concept development, allows the teacher to focus more on being a facilitator of learning while working with individual students. Extending the use of multimedia learning resources to the home represents an educational opportunity with the potential to improve student learning.

The elements used in multimedia have all existed before. Multimedia simply combines these elements into a powerful new tool, especially in the hands of teachers and students. Interactive multimedia weaves five basic types of media into the learning environment: text, video, sound, graphics and animation. Since the mode of learning is interactive and not linear, a student or teacher can choose what to investigate next. For example, one does not start on the first page of a linear document and read to the end. Interactive multimedia learning mode is more like constructing a spider's web, with one idea linked to another, allowing choices in the learner's path.

The multimedia technologies that have had the greatest impact in education are those that augment the existing curriculum,
allowing both immediate enhancement and encouraging further curriculum development. For example, the www serves as a storehouse of information that individual learners can search for subject matter content that specifically fits their learning agendas. Multimedia applications for computers have been developed for single computing platforms such as the personal computer.

1.4 The Elements of Multimedia in Education

It is very tempting to use the latest computer wizardry to represent information and develop computer enhanced learning materials. However, the instructional design of these systems should be based on a careful examination and analysis of the many factors, both human and technical, relating to visual learning. When is sound more meaningful than a picture? How much text is too much? Does the graphic overwhelm the screen? For a student, this allows them to test all of their skills gained in every subject area. Students must be able to select appropriate multimedia tools and apply them to the learning task within the learning environment in order for effective learning to take place.

A Multimedia learning environment involves a number of components or elements in order to enable learning to take place.
Hardware and software are only part of the requirement as mentioned earlier, multimedia learning integrates five types of media to provide flexibility in expressing the creativity of a student and in exchanging ideas.

Text

Out of all of the elements, text has the maximum impact on the quality of the multimedia interaction. Generally, text provides the important information. Text acts as the keystone tying all other media elements together. It is well written text that makes a multimedia communication wonderful.

Sound

Sound is used to provide emphasis or highlight a transition from one page to another. Sound synchronized to screen display, enables teachers to present lots of information at once. This approach is used in a variety of ways, all based on visual display of a complex image paired with a spoken explanation (for example, art-pictures are 'glossed' by the voiceover; or math a proof fills the screen while the spoken explanation plays in the background). Sound used creatively, becomes a stimulus to the imagination; used inappropriately it becomes a hindrance or an annoyance. For instance, a script, some still images and a sound track, allow
students to utilize their own power of imagination without being biased and influenced by the inappropriate use of video footage. A great advantage is that the sound file can be stopped and started very easily.

**Video**

The representation of information by using the visualization capabilities of video can be immediate and powerful. While this is not in doubt, it is the ability to choose how to view, and interact, with the content of digital video that provides new and exciting possibilities for the use of digital video in education. There are many instances where students, studying particular processes, may find themselves faced with a scenario that seems highly complex when conveyed in purely text form, or by the use of diagrams and images. In such situations the representational qualities of video help in placing a theoretical concept into context.

Video can stimulate interest if it is relevant to the rest of the information on the page, and is not 'overdone'. Video can be used to give examples of phenomena or issues referred to in the text. For example, while students are reading notes about a particular issue, a video showing a short clip of the author/teacher emphasizing the key points can be inserted at a key moment; alternatively, the video clips
can be used to tell readers what to do next. On the other hand, it is unlikely that video can completely replace the face-to-face lecture: rather, video needs to be used to supplement textual information.

One of the most compelling justifications for video may be its dramatic ability to elicit an emotional response from an individual. Such a reaction can provide a strong motivational incentive to choose and persist in a task.

The use of video is appropriate to convey information about environments that can be either dangerous or too costly to consider, or recreate, in real life. For example: video images used to demonstrate particular chemical reactions without exposing students to highly volatile chemicals, or medical education, where real-life situations can be better understood via video.

**Animation**

Animation is used to show changes in state over time, or to present information slowly to students so they have time to assimilate it in smaller chunks. Animations, when combined with user input, enable students to view different versions of change over time depending on different variables.
Animations are primarily used to demonstrate an idea or illustrate a concept. Video is usually taken from life, whereas animations are based on drawings. There are two types of animation: Cell based and Object based. Cell based animation consists of multiple drawings, each one a little different from the others. When shown in rapid sequence, for example, the operation of an engine’s crankshaft, the drawings appear to move. Object based animation (also called slide or path animation) simply moves an object across a screen. The object itself does not change. Students can use object animation to illustrate a point—imagine a battle map of Gettysburg where troop movement is represented by sliding arrows.

**Graphics**

Graphics provide the most creative possibilities for a learning session. They can be photographs, drawings, graphs from a spreadsheet, pictures from CD-ROM, or something pulled from the Internet. With a scanner, hand-drawn work can be included. Standing commented that, “the capacity of recognition memory for pictures is almost limitless”. The reason for this is that images make use of a massive range of cortical skills: color, form, line, dimension, texture, visual rhythm, and especially imagination.
Multimedia is woven combination of text, graphic art, sound, animation and video elements. When an end user is allowed the viewer of a multimedia project to control what elements are delivered and when, it is **interactive multimedia**.

When a structure is provided of linked elements through which the user can navigate, interactive multimedia it becomes **hypermedia**.

### 1.5 Multimedia Hardware Components

As already know, by the definition of multimedia is a simple one, making it work can be complicated. Not only does it need to understand how to make each multimedia element stand up and work, but it is also needed to know how to use multimedia computer tools and technologies and weave them together.

**Figure: 1.1 Multimedia Hardware Components**
Figure 1.1 shows the components of hardware for a multimedia application. While producing any multimedia application hardware is required for various multimedia components available in the form of input, processor and output devices, then only multimedia application can be produced.

1.6 Educational Requirements

Employing multimedia tools into the learning environment is a rewarding, but complex and challenging task. All the multimedia formats available: text, sound, video, animation and graphics, already exist in one form or another in most libraries. Students can explore an almost infinite variety of information. All these explorations can certainly lead to new discoveries, but unless consumption is followed by production, the story has not end. Without a chance to use the new discoveries and demonstrate what has been learned, the knowledge gained soon becomes the knowledge forgotten.

Giving students an opportunity to produce multimedia documents provides several educational advantages. Students work with the same information from four perspectives: 1) as researcher, student must locate and select the information needed to understand the chosen topic; 2) as authors, student must consider their intended
audience and decide what amount of information is needed to give their readers an understanding of the topic; 3) as designers, students must select the appropriate media to share the concepts selected; and 4) as writers, students must find a way to fit the information to the container including the manner of linking the information for others to retrieve.

When defining the appropriate medium to use it is vital to 'know' the audience and the technical specification of users' machines. There may be technical reasons for choosing which multimedia element will best communicate certain concepts. Whatever medium is chosen, to apply a principle mentioned earlier to all digital media elements, visuals must be congruent, relevant, and consistent with other information presented in order to be effective. Whatever the latest technological advance, instructional design principles apply. For example, care needs to be taken when using visuals for aesthetic reasons. The misuse of a single visual element can cause misrepresentation of information and become a barrier to content and impede learning, even if the program overall may, in all other aspects, follow the principles of instructional design. It is important to bear in mind the nature of the audience, especially their age group and culture mix.
**Human-Computer Interface**

Multimedia applications like any other application, appliance or tool, benefit from being easy to use, with minimal training or self-learning. The need for a well designed human – computer interface, which may be screen or audio based is well accepted. The standards for computer-based publications are set by the publishers of books, music, Walt Disney cartoons and television producers. With the development of High Definition TV and beyond, it is likely that there will be a continual increase in the demands placed on computer based multimedia systems.

**Access, Delivery, Scheduling and Recording**

On demand access times to computer information need to be below one second to be usable in real time. Alternatively the delivery of information at a later time is acceptable if it can be scheduled, as in a TV broadcast schedule. Scheduling can have advantages for users over on demand delivery. In open learning situations learners can control their program by requesting a multimedia unit at a convenient time. Computer users will wish to record a film, session, or learning experience for future reference.
Interactivity

Computer based multimedia needs the same degree of interactivity that a school exercise book or a laboratory experiment has in order to remain credible as a learning medium. Educationists have shown that certain forms of learning becomes easier, and is retained more permanently if the learner participates in some way with the learning material. The generation of computer based virtual reality is an extension of this process. The incorporation of interactivity is really the job of the application designer. The incorporation of interactivity is assisted if the network is capable of two-way communication, and for some applications the sense of interactivity is aided by the ability to deliver a moving picture, or a sound very quickly, so that a sense of two-way human participation can be generated. Real time video conferencing is an example.

1.7 Multimedia in Schools

Multimedia finds place in lot of applications. Multimedia is appropriate whenever a human interface connects a person to electronic information of any kind. Multimedia enhances traditional text only computer interfaces and yields measurable benefit be
gaining and holding attention and interest. Multimedia improves information retention, when properly woven.

Schools are perhaps the neediest destination for multimedia. Traditional teaching methods are changed. Teachers are becoming more like guides and mentors along a learning path, not the primary providers of information and understanding the students, not teachers, become the core of the teaching and learning process. Various advanced electronic teaching tools are designed and developed due to multimedia.

1.8 Multimedia in the Classroom

Numerous technologies provide multimedia integration and education in the classroom (Mayer and Moreno, 2003). This includes a tremendous influx of technologies such as personal computers, PDAs, cell phones, integrated and interactive power point presentation slides, integrated audio, ipod casting, instant messaging, along with integrated multimedia applications and features inherent to these products. Almost 100% of the secondary and college level classes use some form of multimedia instruction (Marrison and Frick, 1993; Johnson, and Stanne, 1985). However, Mayer (2002) states that students seem to lack the ability to navigate
multimedia lessons and directions such as those provided in the MTE (Modular Technology Education) program. This is important since a majority of the modular multimedia learning experience presentations are presented in a self-instructional format which was first coined by Russell (1974).

1.9 Multimedia in Biology Teaching

The use of multimedia in teaching the growing popularity of, in the process of using high school Biology teaching-related issues have emerged, and to reflect on these aspects: processing good teachers, computers, student relationship, properly handle the screen, blackboard, and student relationship. All parts of content creation production of courseware and courseware interactive use, there must be selective use of courseware authoring software. Multimedia-assisted instruction is computer technology, network technology, multimedia, and the integration of modern educational theory, who, it is illustrated, the picture dynamic, visual image, to enable students to audio-visual synchronization, mind and used to optimize the teaching environment and atmosphere, and greatly enhanced the student learning interest. Students can fully mobilize the enthusiasm and initiative, to develop students awareness of innovation, to improve classroom efficiency and reduce the burden on students. "To
the teaching content, textbooks, the reform of systems and methods based on educational technology platform." With the rapid development of computer technology, the population gradually through the peaks and the continuous development of socio-economic and long-term with multimedia devices are increasingly affected by the pro-gaze of classes, and will increasingly reflect its advantages.

The multimedia teaching equipment, after-school classes of biological problems encountered with the thoughts, mainly the use of multi-media aspects:

First, deal with teachers, computers, student relationship in terms of equipment multimedia classes, teaching advanced equipment, teachers can direct care to each student. Changed the original "classroom-centered, teacher-centered, to textbook-centered" teaching system, students from a passive position, give full play to their principal role. Should be said that classes in multimedia equipment, regardless of mode of instruction, teaching content, teaching methods, teaching methods, or in the mobilization of students, sensory, and raise their interest in both cognitive and physical and mental development of students consistent with the law, but in practice, or there are many problems to be discussed. In
conventional teaching, Biology teachers to teach directly to their knowledge to their students. In the equipment, multimedia classes, teachers are teaching through their own understanding of the presets to the computer and then pass on to students. In the teaching process, first teaching content is preset and cannot be adjusted according to actual classroom work; it is likely to cause the actual teaching and the students out of touch. Second, since the content is a pre-built, not very flexible, and easy to put the students detained in the computer program is not conducive to the cultivation of creativity of students. Third, the lesson in the manner often used to complete the courseware, teachers, easy to own most of the time spent on the operation of multimedia devices, the relative shortening the time for emotional communication teachers and students. As time goes by, will alienate teacher-student relationship is not conducive to the establishment of the students of biological study and emotion.

Thus equipped with multimedia teaching of Biology classes to deal with good teachers, computers, the relationship between the students can not evade reality.

How to deal with these three relationships? First, teachers must be clear of modern teaching media is an extension of traditional teaching media, and development, it has many advantages, but it is
after all not a "panacea." In traditional teaching media, there are deficiencies; there are many aspects that can never be outdated and invalid. One thing is certain, the most advanced teachers teaching media cannot be replaced. Second, the Biology teacher in lesson preparation must better understand the students' practical, taking into account each student to occur, resulting in a comprehensive consideration to the problem and set to the courseware to prevent the teaching out of touch. Third, we must provide more heuristic problem, so that every student in the class had answered, participation, and fully utilizing the opportunity of thinking. Teachers should allow students to feel that teachers have their eyes every where. As long as Biology teachers pay more attention in class and this is easily done in. Fourth, in order to go to the students, teachers must be able to skillfully use and operation of multimedia equipment. For example, the use of remote control mouse both teachers go to students, but also manipulate the teaching platform to control the teaching content. Essential and timely consolidation of practice Biology lessons, teachers, students to practice manipulating the stage when you can not just stand, can not be completed immediately after the students through the courseware, or other media player results. But in practice the process of view, to guide, and to discover in the course of inspection of various issues and students the correct
answers through in-kind projector to display and compare students to discover and summarized. This will not only eliminates the distance between teachers and students, but also played the main role of the students. Fifth, the use of courseware in the classroom teacher is best not to voice input, as fully play courseware is easy to enable students to become the audience, ignoring the dominant position of students, restrict student explorations of abstract thinking ability and innovation. Through the screen and teachers direct talks and to achieve better results. Modern teaching and learning process in the classroom, should be familiar with the characteristics of modern educational technology, must skillfully use these technical features, in order to achieve the teaching objectives. Only by continuously summing up multimedia equipment, teaching classes, dealing with good teachers, computers, and the relationship between the students can really play a large area to improve the quality of Biology teaching effect.

This is an age of knowledge explosion where traditional methods of verbal instruction could not help to keep pace with the development of knowledge. The word has crossed the threshold of new information, multimedia era, which is the mantra of today. Multimedia is the latest buzzword in the educational process.
Multimedia is extensively used in education, especially in schools, and at class rooms. Multimedia education facilitates one to proceed at his or her pace. Television programmes combine sound, video, graphics and text. While the multimedia has all these facilitate. It also has special capacity to interact. A multimedia user is able to decide what information should be delivered by the newscaster and in what sequence. The user controls the programme by pressing a key or clicking a mouse button or touching a screen.

There are two kinds of interactivity: functional interactivity and intentional interactivity. While functional interactivity manages the human to machine interface and describes with a machine and its software and in intentional interactivity the communication takes place between the investigator and his target, describing the reconstruction of a dialogue between a physically absent investigator and his interlocutor. Obviously, television and video programmes seem less interactive than the computer at a functional level.

The books read the content written and the television watched, lack creativity. With the inclusion of key board and mouse, a computer can easily accept a users input. Here, the user is allowed to take control of program execution. When the user clicks the ‘hotspot’ (hypertext/hypermedia), it will display another file in the program,
which is linked (hyperlink) file, which can be sound file, a digital video clip or image file with new information. In this way, a personal computer is becoming the interactive multimedia today.

Multimedia comprises computer graphics, images, sound, motion, animation, text and text reproductive system (Sullivan, 1955). Heim (1993) maintains that the key aspect of multimedia is offering a replica of real environment of objects that fools our senses into perceiving the multimedia as real. Computer multimedia is built from real world situations. Because reality is complex, models are built to simplify the reality so that it can be easier to study its most important features. Students can never write well about something until they had thought well about it. Multimedia are opportunities to work with how to think well about fairly complex matters. Thus, multimedia exemplifies how to enhance the learning effectiveness by utilizing various technologies and methods.

Educational multimedia is metaphors designed to focus learners attention towards concepts, which allow them to explore artificial environment, imaginary based on reality. The educational multimedia also provides a good opportunity for exploration, experimentation and interaction. The learners can experience the consequence of their actions without facing a risk. Leon and Leon
(1990) maintain that with a multimedia, the students are in control of the learning environment. It is up to them to find and use information in order to draw conclusions. Multimedia allow students to have experiences that would not be possible otherwise. Instead of simply spewing facts, multimedia provide a context for knowledge. Thus these multimedia technologies offer an opportunity to bring elements of active practices into the classroom.

Biology occupies a unique position in the school curriculum. Biology is central to many science related courses such as medicine, pharmacy, agriculture, nursing, biochemistry, and genetics so on. It is obvious that no student intending to study these disciplines can do without Biology. These factors, among others, have drawn attention of researchers and curriculum planners towards Biology as a subject in the school curriculum (Kareem, 2003). In spite of the importance and popularity of Biology among students, performance at secondary school level had been poor (Ahmed, 2008). The desire to know the causes of the poor performance in Biology has been the focus of researchers for some time now. It has been observed that poor performance in the sciences is caused by the poor quality of science teachers, overcrowded classrooms, and lack of suitable and adequate science equipment, among others (Abdullahi, 1982; Bajah, 1979;
Kareem, 2003; Ogunniyi, 1979). Students perform poorly in Biology because the Biology classes are usually too large and heterogeneous in terms of ability level. In addition, the laboratories are ill-equipped and the Biology syllabus is over loaded (Ahmed, 2008; Ajayi, 1998).

As multimedia teaching technologies become more widely advocated and employed in education, researchers strive to understand the influence of such technologies on student learning. Advances in technology enable pedagogical enhancements that some believe can revolutionize traditional methods of teaching and learning (Gatlin-Watts, Arn, Kordsmeier, 1999; Persin, 2002). Studies of multimedia-based instruction report a variety of outcomes (Cabrero, Rodriguez-Conde, Juanes, and Cabrero, 2005; Dimitrov, McGee, and Howard, 2002; Everhart, Harshaw, Everhart, Kernodle, and Stubblefield, 2002; Feeg, Bashatah, and Langley, 2005; Homer et al., 2000; Kealy, 2003; Liao, 1999; Mayer, 1997; McKethan and Everhart, 2001; Moreno and Valdez, 2005; Neuhoff, 2000; Smith, 1997; Smith and Woody, 2000; Sneddon, Settle, and Triggs, 2001; Trindade, Fiolhais, and Almeida, 2002; Welsh, 1993). When viewed collectively, these studies reported that advanced technologies, especially multimedia instruction, which often involves introducing or enhancing the visual aspects of the presentation of course contents,
created an active learning environment, improved students' performance, fostered positive attitudes toward learning complex concepts, increased communication, and could be adapted to all learning styles and levels of instruction (Harris, 2002). Researchers suggest that, compared to classes with a traditional teacher-leading approach, those using multimedia are better liked by students and yield slight but statistically significant improvements in student learning as measured by both student self-report and objective outcome testing (Dimitrov et al.; Feeg et al.; Mayer, 1997; McKethan and Everhart; Moreno and Valdez; Sneddon et al., 2001; Worthington, Welsh, Archer, Mindes, and Forsyth, 1996). Such encouraging findings have precipitated the adoption of these technologies on a widespread basis. Despite many studies suggesting that multimedia instruction benefits students, there are also some that found no significant differences between multimedia classes and traditional classes (Everhart et al., 2002; Homer et al., 2000; Lee, Gillan, and Harrison, 1996; Stoloff, 1995). Therefore, there is a need to further educators' understanding of the effect of multimedia technologies on students' learning quality.

Thus to ascertain the effectiveness of Multimedia it would be reasonable to compare it with classroom instruction. A number of
studies (cited in Najjar, 1996) have been conducted in the area to ascertain the effectiveness of multimedia instruction. Analysis has been done by Bosco, 1986; Fletcher, 1989, 1990; Khalili and Shashaani, 1994; Kulik, Bangert, and Williams, 1983; Kulik, Kulik, and Bangert-Drown, 1985; Kulik, Kulik, and Cohen, 1980; Kulik, Kulik, and Schwalb, 1986; Schmidt, Weinstein and Niemic, and Walberg, 1985 by examining 200 over studies. The information included sciences, foreign languages and electronics. The control group normally learnt the information via classroom or lecture combined with hands-on experiments. The comparison group learnt information via interactive videodiscs or computer based instruction. The achievement of learning was measured via tests taken at the end of the lessons. Over this wide range of students, meta-analysis found that learning was higher when computer-based education was used. Learning also appeared to take less time when multimedia instruction was used.

1.10 Need and Significance of the Study

Whether it is the teacher or a trained instructional designer, understanding when multimedia use can be effective and recognizing why it is effective, is essential. As research exposes more understanding about human perception, cognition, and learning,
current educational multimedia design principles can be polished and new more effective principles can be developed (Najjar, 1998). The existing guidelines for education multimedia design, according to Najjar, are based almost entirely on the opinions of experts (Allen, 1973; Arens, Hovy, and Vossers, 1993; Feiner and McKeown, 1990, 1991; Reiser and Gagne, 1982) rather than on the results of empirical research. Therefore, the foundation is weakened on which to make effective educational multimedia design decisions.

Since the recommendation s of the Secondary Education Commission Reports of 1952-53 Science (Biology) has been taught on compulsory basis throughout the school stages (from primary to secondary level) because of its multifarious and many sided values to human beings. The new curriculum in Biology at secondary school level demands rapid learning and clear understanding of concepts. In this curriculum more concepts, and theories have to be taught and students have to be trained in remembering and understanding indelth of the concepts and theories.

The researcher has ten years of teaching experience and has observed the achievement of the students in Biology at secondary level. It is researcher's experience that the achievement of some students may be optimum in science (Biology) and at the same time
the rate of failure in science and in different examinations is considerably second higher than the other subjects. The same case is observed in the Karnataka Secondary Education and Examination Board (KSEEB) results of Secondary School Living Certificate (SSLC). The pass percentage in science is second lowest compared to other school subjects as shown in Table-1.1

Table-1.1: The Karnataka Secondary Education and Examination Board (KSEEB) 10 Years Results of Secondary School Living Certificate (SSLC)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total % of result</th>
<th>Subject wise result in %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>II Language</td>
</tr>
<tr>
<td>2001</td>
<td>50.92</td>
<td>67.50</td>
</tr>
<tr>
<td>2002</td>
<td>50.91</td>
<td>72.03</td>
</tr>
<tr>
<td>2003</td>
<td>55.11</td>
<td>75.50</td>
</tr>
<tr>
<td>2004</td>
<td>64.66</td>
<td>79.44</td>
</tr>
<tr>
<td>2005</td>
<td>62.46</td>
<td>85.39</td>
</tr>
<tr>
<td>2006</td>
<td>68.46</td>
<td>92.37</td>
</tr>
<tr>
<td>2007</td>
<td>73.21</td>
<td>93.61</td>
</tr>
<tr>
<td>2008</td>
<td>66.37</td>
<td>88.61</td>
</tr>
<tr>
<td>2009</td>
<td>70.22</td>
<td>87.94</td>
</tr>
<tr>
<td>2010</td>
<td>68.77</td>
<td>76.21</td>
</tr>
</tbody>
</table>

Source: http://www.kseeb.kar.nic.in
Table-1.1 clearly shows that, the students' achievement in science is second lowest compared to other school subjects.

Here, it is the teacher in the classroom on whom the greatest responsibility lies. The success of this system of education largely depends upon the dedication and patience of the teachers towards their service. Presently the teachers are struggling and also not satisfied with the traditional modes of communications, as there is no systematic method of teaching existing specially in teaching of core subjects like science. Oral communication is not appropriate in all situations, sign language is not universal and total communication method is not at all effective in its fullest measures to convey the messages. So learning is not properly enjoyed by the students. Therefore, it is time for the educators of the science to evaluate seriously the effectiveness of traditional procedures in the context of latest technological developments.

A variety of technologies support literacy development and hence achievement of students lack behind in an average achievement. Multimedia offers students alternative ways to access knowledge and information. Technologies and media range from simple graphics to integration of text, photographs, video, images, animation, sound, hyperlinks and hypermedia in multimedia
technology. Increasingly, teachers are discovering multimedia projects that can tap undiscovered strengths and talents that enable students with learning disability to more fully participate in the learning process. These projects address the needs of the students with various learning styles, many of whom experience repeated failures with mono media- talk and hear or pencil and paper.

Media like computers can link text, visual imagery and other effects in a hyperlinks and hypermedia with hyper text presentation. It can engage students prior knowledge and help them to form mental images and hence to deepen their conceptual understanding. Multimedia encourage learning disabilities students to use all of their senses and reflect on the ways they learn best. Surely, good instruction coupled with the multimedia can yield success in the teaching of Biology.

Technology can change how tasks are performed day today. Schools across the country are gravitating towards technology driven classrooms, which offer multimedia instructional tools for every day use. The integration of various technologies including electronic media has changed the learning environment from a teacher centred one to a learner centred one. The challenges of integrating technology into educational environment must be examined from the human
angle rather than from the technological. It can change the attitude as well as the performance of each individual with respect to the specific educational need.

A tolerant approach in the education of Biology teaching is the need of today. Individuals differ widely in their cognitive experiences, psychomotor skills, success and failure in learning, interest and perception. It can be said that no two learners are alike physically, mentally or intellectually. Since learners differ in their prior learning experiences, and in what they already know, they differ in what they need to learn. So learners should be allowed to learn independently at their own pace and according to their interest and abilities.

The most effective method of teaching is through individual instruction, where the teacher is able to provide every student individual attention. Naturally this kind of attention can be given to relatively very few students, perhaps at the expense of others. It is impossible for one or two teachers to give each student the amount of attention that individualized instruction implies, or to keep track of the many details involved in each student's performance.

Most efforts at individualizing instruction have concentrated on allowing students to work at their own pace, which require
individualized scheduling. Since learning is visually oriented, a visually structured and activity based system of education which is self monitoring would help them. The introduction of 'learner autonomy' based on individualized instructing system with the help of advanced educational technological media in ordinary curriculum is more advisable and feasible.

Research on education in various subject areas indicate that few science teachers working with innovative practices for students learning. Many teachers felt that their students are not being adequately prepared for college level science and technology courses (Ghate, 1999).

A close reviews of the related literature reveals that most of the studies on the psychological aspects. Very few scientific studies have been focussed on the core subjects like science and mathematics. It is imperative that every student be a successful science learner. If the learning needs cannot be met by standard school curriculum, alternative teaching and learning strategies based on educational technology have to be developed to meet the challenges of aspirant science students. Studies and research works on different instructional strategies in core subjects in the specific area are rarely touched by investigators especially in India. The learners' cognitive
and psychomotor make-up needs and multimedia are the key points in the development of any system of education that is relevant to them.

Considering the existing demands, an attempt has been made by the present investigator to develop and validate multimedia oriented instructional packages that could help to realise the educational needs of science students to meet the challenges in the curriculum. It is also designed to move beyond theory and to research hands-on instructional activities with typical students to prove that certain multimedia interventions reduce cognitive load and make learning more efficient when presenting information through multimedia.

1.11 Statement of the Study

The present study is entitled "Development and Validation of Multimedia Package in Biology".

1.12 Operational Definitions of the Key Terms Used

Development (In general)

It is a dynamic process of improvement, which implies a change, an evolution, growth and advancement.
Validation

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

Validation is the process of checking if something satisfies a certain criterion.

Multimedia

Multimedia is woven combination of text, graphic art, sound, animation and video elements. When the viewer of a multimedia project is allowed to control what elements are delivered and when, it is interactive multimedia.

Multimedia Package

By multimedia package investigator means, an organised learning system for auto instructional purpose which includes an interrelated use of different media from modern communication methods, and various learning and teaching strategies to create effective learning experiences. This package may have several media that uses multiple forms of information content and information processing (for example Text, Audio, Graphics, Animation, Video and Interactivity) to inform the target audience.
Biology

A division of the natural sciences dealing with life is known as Biology. It is the science of living organisms.

Research Reviews Reveals the Multimedia Definition

Multimedia is a term that has been used by educators and those in the industry for many years. It has numerous definitions throughout the literature. In the 1960's, the term multimedia meant the use of several media devices in a coordinated fashion (for example synchronized slides with audiotape); it also described the combined use of several media, such as films, video, and music. Najjar (1996) described multimedia as the simultaneous presentation of information using more than one mode of information transmission. It combines the use of various media such as text, graphics, animation, pictures, video, and sound, to present information. The term also has been used to refer to everything from slide shows to extravaganzas complete with multiple monitors, animation, video, sound, and text. Borsook and Higginbotham-Wheat (1992) state: It would be easy to remember that multimedia stands for multiple media except that the term media can mean many things. 'Media' can include slides, audio tapes, videotapes, videoconferencing, animation, films, music, voice, paper, or even someone shouting through a
megaphone. Media can be instructional or not; it can be interactive or not; and it can be computer-based or not.

Poole (1995) explains that multimedia has become closely associated with the computer controlled instructional delivery systems. Instead of using several devices to present multiple forms of media, these media are now presented using one device (Kozma, 1987). Moore et al. (1996) augment this point by noting obviously that the computer plays a central role in the organization of the learning environment. Lee (1996) describes computer-mediated multimedia (CMM), as the integration of two or more communication media, controlled or manipulated by the user via a computer, to present information. CMM can be combinations of text, images, animation, sound, color, and video in a single, computer-controlled presentation. The computer also allows the element of interactivity. Therefore, there has been a virtual explosion of the use of computer-based multimedia learning (Bagui, 1998). It can then be speculated that as technology and software continue to improve and costs decrease, multimedia usage will continue to increase.
1.13 Objectives of the Study

1. To develop and validate a multimedia package on the topics: The Living World and The Study of Cells, in IX Standard Biology (science part-2) of the Karnataka State Board Text Book.

2. To find out the significant difference between post-test mean scores of students under multimedia method of instruction and conventional method of instruction in Biology.

3. To find out the significant difference between post-test mean scores of boys under multimedia of instruction and conventional method of instruction in Biology.

4. To find out the significant difference between post-test mean scores of girls under multimedia of instruction and conventional method of instruction in Biology.

5. To find out the significant difference between post-test mean scores of boys and girls students under conventional method of instruction and multimedia method of instruction in Biology.

6. To find out the significant difference between pre-test and post-test mean scores of students under conventional method of instruction and multimedia method of instruction in Biology.
7. To find out the significant difference between pre-test and post-test mean scores of boys students under conventional method of instruction and multimedia method of instruction in Biology.

8. To find out the significant difference between pre-test and post-test mean scores of girls students under conventional method of instruction and multimedia method of instruction in Biology.

9. To find out the significant difference between pre-test and post-test mean scores of boys and girls students under conventional method of instruction and multimedia method of instruction in Biology.

10. To find out the significant difference between post-test mean scores of conventional method of instruction of the boys and girls students on the topic of The Living World.

11. To find out the significant difference between post-test mean scores of multimedia method of instruction of the boys and girls students on the topic The Living World.

12. To find out the significant difference between post-test mean scores of conventional method of instruction of the boys and girls students on the topic of the Study of Cells.

13. To find out the significant difference between post-test mean scores of multimedia method of instruction of the boys and girls students on the topic The of Study of Cells.
14. To find out the significant difference between pre-test and post-test mean scores of conventional method of instruction of the boys students on the topic of The Living World.

15. To find out the significant difference between pre-test and post-test mean scores of multimedia method of instruction of the boys students on the topic of The Living World.

16. To find out the significant difference between pre-test and post-test mean scores conventional method of instruction of the girls' students on the topic The of Living World.

17. To find out the significant difference between pre-test and post-test mean scores of multimedia method of instruction of the girls students on the topic of The Living World.

18. To find out the significant difference between pre-test and post-test mean scores of conventional method of instruction of the boys students on the topic of The Study of Cells.

19. To find out the significant difference between pre-test and post-test mean scores of multimedia method of instruction of the boys students on the topic of The Study of Cells.

20. To find out the significant difference between pre-test and post-test mean scores conventional method of instruction of the girls' students on the topic of The Study of Cells.
21. To find out the significant difference between pre-test and post-test mean scores of multimedia method of instruction of the girls students on the topic of The Study of Cells.
22. To find out the significant difference between pre-test and post-test mean scores of students under conventional method of instruction on the topic of The Living World.
23. To find out the significant difference between pre-test and post-test mean scores of students under multimedia method of instruction on the topic of The Living World.
24. To find out the significant difference between pre-test and post-test mean scores of students under conventional method of instruction on the topic of The Study of Cells.
25. To find out the significant difference between pre-test and post-test mean scores of students under multimedia method of instruction on the topic of The Study of Cells.
26. To know students' opinions towards multimedia method of instruction (multimedia package software).
27. To know teachers' observation towards multimedia package.

1.14 Scope and Limitations of the Study

This study is an attempt to development and validation of multimedia package in Biology. The experiment was conducted on a.
specified group of sample of high school students of IX standard of a recognized institution that is BDE Society's PDJ High School 'A' in Bijapur city, in the state of Karnataka, India.

Utmost care was taken in the preparation of lessons by the investigator in consultation with experts in the field of research, specialist of general science, teacher educators, high school teachers and grammar experts in the field of general education, before and during the present study to make the concepts more clear and vivid. Considering the background of the students, special care was taken to make the mode of presentation in simple language. Multimedia presentations are the modified versions of the modular lessons with text, audio, animation, image and graphics with hyperlinks (hypertext), the package is useful for future purposes too. Expert technical assistance was also sought for the smooth functioning of the system. A standardized achievement test was used for measuring the performance of students.

Most of the studies conducted in this field are generally in developed countries. But this study has been modified to suit Indian classroom conditions. It is expected that the findings of this investigation will help the educational experts, teacher educators, teachers of secondary schools and teachers in general classrooms
who stand for mainstreaming and curriculum framers to take necessary changes in the teaching of science to the secondary school students.

The responsibility of the researcher is to see that the study is conducted with maximum care and to avoid faults, in order to be reliable. However, the following limitations have entered in the present study.

A state wide sample representing high school students of Karnataka is ideal for the study. But due to practical constraints, the study was confined to students of studying in IX standard science part-2 (Biology) of the Karnataka State Board Text Book. Assuming that it is the representative of the three standards of high school education. The investigator limited the area of investigation to only one branch of science, which is Biology. The investigator was able to prepare multimedia package focussed on two chapters in Biology of IX standard. Considering the availability of the sample, the study has been concentrated on IX standard high school students of Bijapur city of Karnataka State in India. The investigator is a postgraduate in both Information Technology and Education with specialization in Educational Technology and also master of philosophy in Computer Science and Education, even though not competent in producing
multimedia packages as professional multimedia programmer, this problem is overcome by consulting professional multimedia programmer during the development of multimedia package.

Although these are some limitations, the investigator feels that these may not affect the scope and validation of the present study. Possible precautions and care was taken by the investigator to attain the highest degree of accuracy in respect of these factors.

1.15 Organisation of the Report

The report of the study has been structured into five chapters based on the materials presented in each of them.

**Chapter One:** The introduction chapter contains the need and significance of the study, statement of problem, operational definitions of key terms, objective of the study, scope and limitations of the study and organisation of the report.

**Chapter Two:** An account of literature and studies related to the areas of media based instructional strategies, computer assisted instruction, and multimedia based instruction and multimedia in Biology instruction are included in this chapter.
Chapter Three: The methodology chapter details on the study in retrospect, method adopted, experimental design, details of the sample, development of multimedia package, description of the materials and tools used and administration of the tools, the procedure followed and the description of the statistical technique adopted.

Chapter Four: This chapter has information regarding organisation, compiling, and analyses of data and the interpretation.

Chapter Five: The summary and conclusions based on the findings of the study, tenability of hypotheses, educational implications of the study, suggestions for improving educational practices and suggestions for further studies are grouped in this chapter.

Thus it is hereby hoped that the net result of this work would be useful to the students and the teacher at large.