B. Ed. Spl. Ed. (M. R. / H. I. / V. I)-
ODL Programme

AREA - C

C - 15 : TECHNOLOGY AND EDUCATION OF THE VISUALLY IMPAIRED

A COLLABORATIVE PROGRAMME OF
NETAJI SUBHAS OPEN UNIVERSITY
AND
REHABILITATION COUNCIL OF INDIA

AREA - C
DISABILITY SPECIALIZATION
COURSE CODE - C-15 (V.I.)
TECHNOLOGY AND EDUCATION OF THE VISUALLY IMPAIRED

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The Self Instructional Material (SIM) is prepared keeping conformity with the B.Ed.Spl. Edn.(MR/HI/VI) Programme as prepared and circulated by the Rehabilitation Council of India, New Delhi and adopted by NSOU on and from the 2015-2017 academic session.

Mohan Kumar Chattopadhyay
Registrar

Netaji Subhas Open University

From the Vice-Chancellor's Desk

Dear Students, from this Academic Session (2015-17) the Curriculum and Course Structure of B. Ed.- Special Education have been thoroughly revised as per the stipulations which featured in the Memorandum of Understanding (MoU) between the Rehabilitation Council of India (RCI) and the National Council for Teacher Education (NCTE). The newly designed course structure and syllabus is comprehensive and futuristic has, therefore, been contextualized and adopted by NSOU from the present academic session, following the directives of the aforesaid national statutory authorities.

Consequent upon the introduction of new syllabus the revision of Self Instructional Material (SIM) becomes imperative. The new syllabus was circulated by RCI for introduction in the month of June, 2015 while the new session begins in the month of July. So the difficulties of preparing the SIMs within such a short time can easily be understood. However, the School of Education of NSOU took up the challenge and put the best minds together in preparing SIM without compromising the standard and quality of such an academic package. It required many rigorous steps before printing and circulation of the entire academic package to our dear learners. Every intervening step was meticulously and methodically followed for ensuring quality in such a time bound manner.

The SIMs are prepared by eminent subject experts and edited by the senior members of the faculty specializing in the discipline concerned. Printing of the SIMs has been done with utmost care and attention. Students are the primary beneficiaries of these materials so developed. Therefore, you must go through the contents seriously and take your queries, if any, to the Counselors during Personal Contact Programs (PCPs) for clarifications. In comparison to F2F mode, the onus is on the learners in the ODL mode. So please change your mind accordingly and shrug off your old mindset of teacher dependence and spoon feeding habits immediately.

I would further urge you to go for other Open Educational Resources (OERs) - available on websites, for better understanding and gaining comprehensive mastery over the subject. From this year NSOU is also providing ICT enabled support services to the students enrolled under this University. So, in addition to the printed SIMs, the e-contents are also provided to the students to facilitate the usage and ensure more flexibility at the user end. The other ICT based support systems will be there for the benefit of the learners.

So please make the most of it and do your best in the examinations. However, any suggestion or constructive criticism regarding the SIMs and its improvement is welcome. 1 must acknowledge the contribution of all the content writers, editors and background minds at the SoE, NSOU for their respective efforts, expertise and hard work in producing the SIMs within a very short time.

Professor (Dr.) Subha Sankar Sarkar
Vice-Chancellor, NSOU

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C-15 : TECHNOLOGY AND EDUCATION OF THE VISUALLY IMPAIRED

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C - 15 ❐ TECHNOLOGY AND EDUCATION OF THE VISUALLY IMPAIRED

Unit-1 ❑ Introducing Educational and Information Communication Technology

Structrue :

1.1 Introduction

Technology in the form of adaptive ans assistive devices, plays a crucial role in the education of the visully impaired. This course brings into sharp focus the need and importance of such technology both for the practicing teachers and the visually

imparied learners. While highlighting the significance of addressing the users point of view/feedback and involving mainstream professionals in developing required technologies, the course also dwells upon how best students with visual impairment get access to the printed text/material. The course also acquaints the student-teachers with various devices for making the teaching-learning process for important school subjects meaningful, exciting and rewarding for all concerned. The educational needs of children with low vision and related technological perspectives are addressed, too, along with critical contributions of computer-aided learning and interventions.

1.2. Objective :

After the cmpletion of the Unit, learners would be able to–

- Acquire knoledge about the Importance and Scope of Educational Technology.
- Diffentiate between Educational Technology and Technology in Education.
- Understand the importance of Technology for the Educastion of children with Visual Impairment;
- Relate the Concept and Nature of Educational Technology and ICT to the Education of Children with Visual Impairment;
- Evaluate concepts of ICT on the basis of the UN Convention on the Rights of Persons with Disabilities.

1.3. Educational Technology–concept, importance & scope

Modern age is the age of science and technology. The world of today is very dynamic. The life of man in the primitive age was altogether different from his life in the sputnik age. There have been tremendous changes in the life style of human beings which may be attributed to the contribution of science and technology, science has extended the forntiers of our knowledge in varouos wasy and directions. Science is considered to be a blessing to be a blessing to the mankind.

Nothing better has happened than the adent of science in man's life. The contribution of science and technology has been experienced in almost all the spheres of human life including education.

Before understanding the meaning of educational technoloyg, it is essential to know the meaning of technology. The word 'Technology' derived from Greek word (techniques) which means an art which is related with skill and dexterity.

1.3.1 Concept of Educational Technology

Education technology cannot be taken as a synonym to audio-visual aids, and technology in education emphasizes the concept of service, i.e. the use of different equipment, gadgets and mass media. It must mean technology of education presenting itself as a system for bringing improvement in the total process of teaching-learning by carefully analyzing its problems and obtaining the optimum results. Educational technology cannot be viewed in terms of its part of precesses. Instructional technology, teaching technology, behaviour technology, programmed learning, micro-teaching, system analysis, management of teaching-learning, teacher or pupil's bahaviour, etc. are all its constituents and resources.

● **Definitions :** Educational Technoloyg is the systematic application of scientific knowledge about taching-learning and condition of learning to improve the efficiency of teaching and training. **(Leith, 1967)**.

Educational Technology can be conceived as science of teachniques and methods by which educational objectives could be realized. **(Mitra, 1968)**

Educational Technology can be defined as the application of the laws as well as the recent discoveries of science and technology to the process of education. **(Kulkurni, 1969)**

Educational Technology is concerned with the application of modern skill and techniques to requirements of educational training. This includes facilitation of learning by manipulation of media and methods, and the control of environment is so far as this reflects on learning. **(Unwin, 1969)**

Educational Technology is concerned with problmes of education and training context and it is charecterized by the disciplined and systematic apporach to the organization of resources for learning. **(Davis, 1971)**

Educational Technology is concerned with providing appropriately designed learning situations which, holding the view of objecties to teaching or training, brings to bear the best means of instruction. **(Richmond, 1979)**

Educational Technology has to be seenas a part of a persistence and complex endeavor of bringing pupils, teachers and technical means together is an effective way. **(Ford Foundation Team, 1971)**

These definitions initailly encompass the whole range of educational technology activities from the analytic methods of psychology of learning and teaching the audio-visual communication and mass media technology. The view propagated by these definitions may help us to conclude about the meaning and nature of educational technology as follows :

- Educational technology is concerned with the systematic application of science and technology in the field of education and thus maybe defned as the application of technology to education in order to further the case of the latter.
- Just as science and technology help in carrying out the practical task in general, educational technology helps in providing efficiency to the task of teaching and learning.
- Educational technology provides technical guidance and solution to the problems of education.
- Teaching is communication and educational technology can play an effective role in the communication between teacher and student.
- Educational technology encompasses the total teaching and learning process involving the elements like the following :
  - Specification of goals and behavioral objectives.
  - Analysis of the characteristics of learner.
  - Selection and organization of the content or subject matter to be learned.
  - Methods and strategies of the presentation of the content.
  - Use of aid-materials, software and hardware, mass media and communication technquies.
  - Effective arrangement of learning situation and learning environment.
  - Effective classroom control and management.
  - Continuous feedback and evaluation of the result.
- Educational technology is not limited to the use of audio-visual and does not symbolize merely educational hardware such as sophisticated gadgets and mechanical devices used in education. For the effective management of the total teaching learning process it tends to utilize the results of all goods, experiments and researches in the field of human laerning and the art of communication and employs a combination of all possible human and non-human resourdces to achieve the desired educational objectives.

In brief, eucational technology should stand for a wide application of the available human and non-human resources for providing appropirate solution to the educational problems and to improve the process and proudcts of education.

- **Characteristics Of Educational Technology :**

Characteristics of Educational Technology are as follows :

- It is based on scientific and technological advancements.

- It is more a practical discipline and less a theoretical one.
- It is a fast growing modern discipline.
- It makes use of the research findings of psychology, sociology, engineering, sciences and social psychology etc. and applies the same to the field of education.
- It brings pupils, teachers and technical means together in an effective way.
- It is the science of techniques and methods. It locates the problems in the field of education, remedies them and ultimately aims at improving the education system.
- It is bound to improve the teacher, the learner and the teaching learning process.
- **Nature of Educational Technology :**
  - The basis of educational technology is science.
  - Educational Technology studies the effect of science and technology upon education. In other words, science and technology are used under educational technology. Hence, it is the practical aspect of science.
  - Educational Technology is a continuous, dynamic, progressive and effect-producing method.
  - New conceptions are possible only due to educational technology such as programmed learning, micro-teaching, simulated teaching, interaction analysis, video-tape, tape-recorder, projector and computer, etc.
  - Educational Technology accepts schools as a system. In this system, the school-building, furniture and teachers act as input while various methods, techniques, strategies and the teaching and examination with the help of audio-visual aids function in th from of a process. Lastly, the output is in of form of ability of the pupils.
  - Audio-visual aids cannot be termed as educational technology. It is because its concern is only with the process-aspect of educational technology and not with the input and output aspects. But if these A.V. aids are used to achieve educatioanal objectives, then it can be put in the category of Educational Technology.
  - Progrmmed Instruction is also different from Educational Technology. Its main causes are that the student learns himself during the programmed instructions. It does not allow interaction between pupil and teacher.

Hence, it can be used only for limited objectives and limited subject-matter. Therefore, programmed instruction is merely a part of educational technology.

- Engineering Technology is not the educational technology because the engineering technology has manufactured radio, tape-recorder, video-tape and T.V., etc., which are used in teachers as audio--visual aids, but still engineering technology

is different from educational technology. In education, it is accepted as hardware approach only.

- Educational Technology cannot solve each and every problem of education. It can be used successfully in teaching and instructional system only.
- Some people assume that educational technology will replace the teacher which will make the teacher unemployed one day. It is their mistake. Educational technology can never replace the teacher. It is because of three aspects of educational technology. These are 1. Input, 2. Process and 3. Output. Input is the teacher's job and therefore, edcational technology cannot snatch the place of a teacher. In spite of this, educational technology develops cognitive domain only and not the affective domain. Affective domain can only be developed when an interaction between teachers and pupils takes place. Hence, educational technology cannot replace the teacher.

● Objectives of Educational Technology :

Educational technology, in the capacity of technology of education, provides valuable help in the total teaching-learning process for achieving the possible results in an economic way through the availabe human and non-human resources. In this respect, the major objectives of education technology can be summarized as follow :

Objectives at the Macro Level

In view of the broad educational goals. i.e., the macro level, the objectives of educational technology can be listed in the following way :

- To identify educational needs/aspiration of the community.
- To determine the aims of education, broad strategies and structure of education.
- To develop a sustainable curriculum with interaction with science, at and human values.
- To identify man-material resources and strategies for achieving the stipulated aims of education.
- To develop certain models leading to improvement of the process of teaching and learning.
- To develop the appropriate aids and equipment to meet the educational purposes.
- To identify the major constraints in the environment and the ways and means to tackle those.
- To help in extending educational opportunities to the masses especially the neglected section of the community.
- To manage the whole educational system covering planning, implementation and the evaluation phases.

Objectives at the Micro Level

In view of specific classroom teaching i.e., the micro level, the objectives of educational technology are as follows :

- To identify and analyze the charcteristics and educational needs of the pupils.
- To determine the specific classroom objectives and state them in behavioural terms.
- To analyze the contents of instruction and organize it in proper sequence.
- To identify the available teaching-learning materials and resources.
- To identify the nature of the interaction of the sub-systems like students, teachers, teaching-leaning materials, content of instruction and methodologies.
- To plan the teaching strategies and utilize the man-material resources for achieving specific classroom objectives.

Approaches of Educational Technology :

Educational Technology or hardware approach

This type of educational technology has its origin in physical science and engineering and is based on the concept of service, i.e., using technology in education (Silverman 1968). While teaching in a big hall, teacher uses a microphone for making his voice audible, he may be said to approach such type of education technology for making his teaching effective. Such type of mechanical and teaching revolution has almost mechanized the teaching-learning process. Almost all the mateirals and equipment of hardware approach originally belong in areas other than education and are being borrowed and utilized for educational pruposes.

Educational Technology II. or Software approach

Psychology of learning provided solid technology for bringing the desirable behaviour changes in the students and thus serves the cause of education by laying down definite instructional procedure, teaching behaviour and behaviour modification devices. The second type of educational technology is sometimes referred to as instructional technology, teaching technology or behavioural technology. This type of technology tries to adopt a process-oriented tachnique for production of suitable teaching learning mateiral, teaching-learning stratageis, and evaluating techniques for the optimum results in the process of teaching and learning. Educational technology basically stands for the techniques of developing and utilizing software and, that is why, it is referred to as the software approach. The materials, such as programed material and teaching-learning strategies based on psychology of learning are usually known as software and the equipment and gadgets are called hardware.

Distinction between hardware and software technologies :

Hardware technology	Software technology
Hardware technology has its origin in physical sciences and applied engineering.	Software technology has its origin in behavioural sciences and their applied aspects concerning psychology of learning.
It is more oncerned with the production and utilization of audio-visual aid material and sophisticated instruments, and mass media learning for the helping the teacher and learners in their task.	It makes use of psychology of learning for the production and utlization of software techniques and materials in terms of learning materials, teaching learning strategies, and other devices for smoothing the task of teaching learning.
It tries to adopt product-oriented approach. What is produced through software technology in the shape of teaching-learning material and strategy gets utilized by the hardware instruments and gadgets for effective teaching-learning.	It tries to adopt process-oriented technique or approach for the production of teaching-learning material. What is produced here is made available for beign used by the hardware appliances.

Educational Technology III. or System Approach

This type of educational technology is related to the concept of system engineering which owes its origin to computer science. It represents the latest concept in educational technology of education. This systems approach takes education as a system having a set of inputs which are subjected to a process, design to produce certain outputs which are intended tomeet the stipulated objectives of the system. Thus, in system approach, one has to make a continuous comparison of the different roles played by man, machine and media in a system of education and develop an appropriate instructional design and strategy in relation to the stipulated objecties.

1.3.2 Importance of Educational Technology

Keeping an eye over such broad concepts of educational technology, one is able to map out the areas of its operation in terms of topic or aspects covered through its study or application. In brief, they may be summarzed as below :

- *Analysis of the process of teaching and learning* : Educational technology tries to discuss the concept of teaching, analysis of the teaching process, variable of the teaching, phases of teaching, levels of teaching, theories of teaching, principles and maxims of teaching, the concept of learning, relevance of the theories, the relationship between teaching and learning.

- *Spelling out the educational goals or objectives :* Educational technology tries to discuss the topics such as identification of education needs and aspirations of the community, survey of the resources available for satisfaction of these needs.
- *Development of curriculum :* This aspect of educational technology is concerned with the designing of a suitable curriculum for the achievement of the stipulated objectives.
- *Development of teaching – learning material :* This area of educational technology is concerned with the production and development of the suitable teaching-learning material in veiw of stipulated objectives, design curriculum and available resources.
- *Teaching preparation or teaching – training :* Teacher is a key figure in any process of teaching and learning. Educational technology, therefore, takes care of the proper preparations of teachers for exercising their complex responsibilities.
- *Development and selection of the teaching learning strategies and topics :* This aspect deals with the central problems of teaching learning act. Here educational technology tires to describe the ways and discovering, selecting and developing suitable strategies and tactics of teaching.
- *Development, selection and use of appropriate auido visual aids :* Teching-learning is greatly influenced and benefited by the use of appropirate audio-visual aids. Educational technology covers this aspets by discussing various types of audio-visual used for educational purpose, their proper select suiting to a particular taching-learning situation.
- *Effective utilization of the bardware and mass media :* Various sophisticated instrument, equipment, gadget and communication devices through mechanization ane electronics revolution playing an effective role in the attainment of educational objectives by helping the teachers and learners in their respective roles.
- *To work for the effective utilization of the subsystem of education :* Educational technology considers education as a system orperating, in a systematic and scientific way, for the achievement of educational objectives.
- *To provide essential feedback and control through evaluation :* Educational technology is essentially concerened with the task of exercising appropriate control over the process of teaching and learning by planning and devising suitable tools and devices for the continuous evaluation of the process and products of the teaching-learning activities.

Thus, educational technology is concerned with all variables, phases, levels, and aspects of the teaching-learning process. In breif, it works for overall planning and organization of the system or subsystem of education.

In above discussion, an attempt has been made to identify the importance of the subject educational technology by mapping out its field of operation, but in true sense, it is unwise to put hedge and boundaries around such a developing and fast growing subject.

1.3.3 Scope of Educational Technology

Educational Technology is as wide as Education itself. Educational Technology implies the use of all educational resources–Men, Materials, Methods and Techniqus, Means and Media in an integrated and systematic manner for optimized learing. Educatioal Technology is comprehensive. It is associated with all aspects of educative process-methods, teaching strategies, learning materials, handling of various euqipment etc.

The following 4M's are the major components of Educational Technology :

- *Methods :* It is concerned with the devices such as Programmed Learning Team Teaching, Micro Teaching and Personalized System of Instruction in Teaching Learning situations.
- *Materials :* Instructional materials such as Programmed Text book the material of this type may be handwritten or printed.
- *Media :* The media used here are audio, or visual or audiovisual. A few examples are radio, tape recorder, charts, films, educational television etc.
- *Man Power :* Man power controls educational technology in every way. Educational Technology without man is zero.

The technologies included in it are mentioned below :

- *Behavioural Technology :* Behavioural technology is the important component of Educational Technology. It puts emphasis on the use of psychological principles in learning and teaching so that the behaviour of the teacher and pupils may be modified in accordance with the teaching objectives.
- *Instructional Technology :* Instrucitional Technology means a network of techniques or devices employed to accomplish certain defined set of learning objectives. Instructional technology implies the application of psychological, sociological and scientific principles and knowledge to instruction for achieving the specific objectives of learning.
- *Teaching Technology :* Teaching is the social and professional activity. It is a process of development. Teaching is a system of actions which induce learning

through interpersonal relationship. Teaching technology is the application of philosophical, sociological and scientific knowledge to teaching.

- *Instructional Design :* In order to bring desired changes in the pupils' behaviour, the teaching situatios, working tools and new approaches were considered important in addition to the learning princples. The composite form of all these is instructional design.
- *Training Psychology :* Training Psychology is an important method of teaching and learning. Its development resulted out of the research work carried out on the complicated training problems and situations. Training psychology emphasizes that the whole training task should be divided into three parts.

  These are :

  Preparing outline of the task.

  Task analysis

  Putting the task in sequence.

  The main role of training psychology is in Teacher Education.
- *Cybernetic Psychology :* It's part of training psychology. Cybernetic psychology accepts human beings as machine. Cybernetic psychology emphasizes the fact that all the methods of feedback bring the desired changes by controlling the behaviour of the pupil.
- *System Analysis :* System Analysis is a problem solving process in which the needs of the management are diagnosed and by using an appropriate method for solving the problem, evaluation is carried out.

If you consider the working areas, Eductional Technology includes the following : Curriculum Construction, Teaching-Learning Strategies, Audio-Visual materials, Determining Educational Objectives, Training the teachers, Feedback, Hardware and Software etc. In short, the scope of Educational Technology extends to all resources (human and non-human) for the augmentation and development of education. Thus Educational Technology has a wide scope.

Use and Significance of Educational Technology (in the Indian context) :

In India, before the 1960's the term educational technology was almost unknown to the educational system. It was used as synonym to audio-visual teaching aids. The role of educational technologist in India, today, is not merely that of an audio-visual aid master, hardware expert, media expert or programmed text writer, but of one who is concerned with the information of an overall design to carry out an evaluation of the total process ofe education in terms of specific objectivs. Educational technology, as we find it today, has a meaningful present and promising future in our country. Some of the significant development in this direcition may be summarized as follows :

- There has been a wider and more effective utilization of radio for braodcasting educational programmes througout the country. These will planned programmes are now broadcast throughout the country for both in-school and out-of-school groups.
- Another significant development in the use of educational technology is concerned with the development of television programmes.
- The third important area where educational technology has been useful is the probelem of-training and re-training a large number of school teachers in an effective way.
- Another application of educational technology is being used in our country relates to language instruction.
- Another field of operation of educational technology in our country is concerned with the correspondence education.
- Another use of which education technology is being put in our country is concerned with preparation, development and utilization of audio-visual material, and handling as well as maintenance of the hardware applicances and sophisticated gadgets.
- In the latest trend, educational technology is providing its worth by utilizing the services of computers and advanced form of ICT technology in the field of education.

Thus educational technology has been providing its worth in our country by guiding, planning, implementing and evaluating various programmes of formal as well as non-fromal educaiton.

1.4. Difference Between Educational Technology and Technology in Education

The term "technology in education" refers to the use of technological advancement such a various equipment, meterials and machines for educational purpose. It invokes the increasingly complex range of audio-visual equipment, hardware and sophisticated electronic devices like projectors, films, radio, televisiona, tape recoder, recording machines, tele-text and computer aided instructions for individualized and group learning. The term technology in educationa is thus a service concept like technology in the service of farming and agriculture or science in the service of mankind. In this sense, educational technology can provide its services to the teachers of the following grounds :

- For explaining the purpose and functions of different forms of appliances, equipment and audio-visuals materials and mass media.
- For providing training and acquiring the material and handling the equipment to overcome their reluctance to use new media and materials.
- For showing the relevance to the use of equipment and material in the context of individualized and group learning for achieveing the goals of formal or non-formal education.

Educational Technology

The term "technology of education" or "educational technology" cannot limit itself to the role of service as confined in the case of technology in education. The term, technology of the education, does not represent something added or helped from outside as sounded in the case of technology in education. It signifies a system of tchnological approach to the problems of education. Emphasizing on this point of view, T. K., Robinson (1976) writes".

The strongest protagonist for educational technologies are not, however satisfied with a role limited to technology in education and the provision of audio-visual aids. They see themselves as crucially involved in the design and evaluation of systems of learning involving an understanding of the psychology of learning and communication and information theory to be used to establish a rational for a good teaching practice which uses a variety of media and modes and which enables the teachers to deploy his skills more effectively and apply them more widely. This is technology of education.

In veiw of the discussion carried out in the above pages, the following conclusion can be drawn about the concepts of educational technology :

- Educational technology cannot be taken as a synonym to audio-visual aids, and technology in education emphasizes the concept of services, i.e. the use of different equipment, gadgets and mass media.
- Educational technology must mean technology of education presenting itself as a system for bringing improvement in the total process of teaching-learning by carefully analyzing its problems and obtaining the optimum results.
- Educational technology cannot be viewed in terms of is part or processes. Instructional technology, teaching technology, behaviour technollgy, programmed learning, micro-teaching, system analysis, management of teaching-learning, teacher or pupiols behaviour, etc. are all its constituents and resources.

1.5. Special Significance and Goals of Technology for the Education of Children with Visual Impairment

1.5.1 Special Significance of Technology for the Education of Children with Visual Impairment

1.5.2 Goals of Technology for the Education of Children with Visual Impairment

In order to gurantee equal opportunities to all students, the accessibility of ICT educational tools is worldwide considered a major issue. Nowadays, visually impaired students can take advantages of a large number of effective assistive technologies but, while using electronic material for leaning purposes, they often encounter a number of different accessibility and usability problems. The variety of obstacls they may find on their way is quite large mainly because the term "visually impaired" encompasses a wide range of deficits, ranging from blindness to a number of other multifaceted, although less severe, visual impariments. The accessibility requirements for e-learning products established by the laws in force can be considered an important step onwards; further measures, nevertheless, are still needed to foster the actual "usability" of such products by sight impaired people.

The Charter of Fundamental Rights of the European Union [2000] states that : "Any discrimination based on any ground such as gender, race, colour, ethnic or social origin, genetic features, language, religion or belief, political or any other opinion, membership of a national minority, property, birth, disability, age or sexual orientation shall be prohibited."

In the field of education, the basic concept of "Non-discrimiation" entails the ability of all people to have "equal opportunity in education, regardless of their social class, ethnicity, background or physical disabilities" [Klironomos et al., 2005]. Students with disabilities have, then, the right to except the same standard of education as their schoolmates and, in this view, they also have the right toaccess and use mainstream educational tools, including ICT based ones, which are generally referred to as "e-learning tools".

Such tools are worldwide considered powerful tools to foster teaching [Hitchcock et al., 2003] but, at the same time, it is well known that, due to the widespread use of technological tools, "disavantaged or excluded groups, including the unskilled, disabled and the elderly, face the danger of further marginalization [...]", in fact, "with the advent of the digital computer, and its broad penetration [...], disabled and elderly people face serious problems in accessing computing devices" [Stephanidis and Savidis, 2001] Anderson [2006] underlines that, in the field of education,

“while....technologies are benefical and have been shown to help with educational tasks, their desgin and usability are an issue”. Students with disabiliities may, in fact, face relevant difficuties both in “accessing and in “using” e-learning tools and, depending on the type of impairment, the types of obstacles encountered may very considerably.

In the following, the issue of the accessibility and usability of e-learning tools by visually impaired students is tackled, taking into account the fact that in almost all the developed countries they represent a significant part of the school population. In recent years, the World Health Organization [2004] has emphasized that “childhood blindness remains a significant problem, with an estimated 1.4 million blind children below age 1.5”, the problem appears even more relevant if we consider also the students with visual impairments other than blindness (the incidence of low vision being generally estimated three times greater than blindness). In the same report, in fact, it was found that, in 2002, there were 161 million (about 2.6% of the world population) visually impaired pepole in the world, of whom 124 million (about 2%) had low vision and 37 million (about 0.6%) were blind. Data of the World Health Organization seem to confirm, then, that sight impaired students are a relevant percentage of the overall population of the students with disabilities [Viisola, M., 1999].

Such students, in principle, could highly benefit from using [ICT for educational purposes but they actually, despite the availability of a growing number of technology-enhanced and sophisticated assistive devices, face a number of accessibility problems [Burzagli et al., 2004]. The task of listing all such problems is not easy, mainly because students with visual disabilities are a highly dishomogeneous category showing a wide range of different specific abilities, disabilities and needs; blind and low vision students, for instance, despite the fact that they are both often simply referred to as “visually impaired”, present very different visual problems, find different obstacles and ask for different kinds of help and support. What’s more, even the category of low vision students is a higlly heterogeneous one : it encompasses a wide veriety of different visual charcteristics. In this perspective, the different instructional tools (those ICT based, as well as ones), may meet or not to the needs of each single user, depending on her/his specific impairment.

After a brief review of the-e-learning tools that are widely used for educational purposes, examples are provided of some problems encountereed by students with visual disabilities in accessing and using e-learning material. Such problems often result into obstacles for the effective use of the tools and may also have a negative influence on the overall learing process.

In the end, a glance is taken to the accessibility requirements addressing the specific

needs of visually impaired people established by the Italian law in force, which directly recalls the Section 508 Rehabilitation Act 1.

Different E-learning Tools for Different Visual Needs :

While affording the choice of the e-learning tools to be used in concrete educational settings by visually impaired students, from one side, it is important to consider the nature, the specific features and the functionalities of the technological tools at hand; from the other side, it is necessary to take into account the actual, specific needs of the potential user/s (which are, of course, related to their impairments).

To this end, in the following, an overview and a basis classification of the main tools used in the field of e-learning is proposed; subsequently, a quick look is taken to the different needs of the different categories of visually imparied students and to the main obstacles that they may encounter.

- **E-learning tools :** Anohina, [2005] deifnes "e-learning" as a learning process that "takes places via any electronic medium". In a global perspective, such a term refers, then, to any educational process making use of technological/electronic media and applications such as : "web-based teaching materials, hypermedia in general, multimedia CEFOMs, web sites, discussion boards, collaborative software, e-mail, wikis, computer aided assessment, educational animation, simulations, games, learning management software, etc...." [Wikipedia] in this veiw, the term "e-learning tools" ecompasses at least those tools used for :
  - ❑ **Online learning :** those educational resources made available through interconnected computer networks, comprising also synchronous and asynchronous communication tools, when used in an educational perspective.
  - ❑ **Computer-based learning :** those learning mateirals locally available on the user's PC and used when the computer is not connected to a network.
  - ❑ **M-learning :** those educational tools made available through "mobile devices" such as palmtops (or handhelds), Personal Digital Assistants (PDAs), tablet PCs mobile or smart phones; such tools, may also take advantage of the connection to the net via "wireless transmission" [Hoppe et al, 2003]. The concept of "e-leaning tool" is, then, linked both to the media (hardware devices) employed and to the programs (sofrtware applications) used to support the educational process. Such software applications can be roughly divided into :
  - ❑ **E-learning platforms :** those internet-based environment expressly addressed to the delivery of integrated electronic educational contents and to the management of a variety of educational activities aimed at fulfilling specific

educational objectives 1 Section 508 of the Rehabilitation ACT Subpart C-Functional Performance Criteira § 1194.31)[Lin and Kuo, 2005]. All the digital contents made available by and through such platforms, are generally called "learning objects".

- ❏ **Web based applications :** those applications (both designed for educational purposes and used to fulfil educational objectives) which are directly accessible using any available browser and which don't need to be installed on the user PC.
- ❏ **Stand-alone applications :** those products (both "educational" and "used for education") which cannot be used directly via browser but that need to be installed locally, on the user machine; this category includes also products "dowloadable" from the Web, but that still need to be installed on the computer.

- **E-learning tools and the needs of visually impaired students :** Examples of what kind of accessibility and usability problems can be found in the different categories of software applications are provided in the following, keeping aside, for the moment, all the possible problems linked to the use of computers in their standard configuration and of other specific hardware devices. While considering such obstacles, it is important to reflect on the fact that they are strictly related to the type of user impairment. Blind and low vision students encounter different types of obstacles : in order to fully access the contents, in fact, the first category needs necessarily to rely on screen readers, while the second category, thanks to optical aids and/or to specific customization options, may access a much wider variety of software applications, including, often, those with graphic interface. Other significant differences can be found among the needs of the different categories of low vision students due to the wide variety of their visual impairments [Dini et al, 2006].

1.6. Information and Commuication Technology (ICT)-Concept and Special Significance for Teaching-Learning of the Visully Impaired

■ 1.6.1 Concept of ICT

Information and Communication Technology (ICT) is an extended term for information technology (IT) which stresses the role of unified communications and the

integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual system, which enable users to access, store, transmit, and manipulate information.

The term ICT is also used to refer to the covergence of audio-visual and telephone networks with computer networks through a single cabling or link system. There are large ceonomic incentives (huge cost savings due to elimination of the telephone network) to merge the telephone network with the computer network system using a single unified system of cabling, signal distribution and management.

However, ICT has no universal definition, as "the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis. The broadness of ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in digital form, e.g. personal computers, digital television, email, robots. For clarity, Zippo provided an ICT hiearchy where all levels of the hiearchy "contain some degree of commonality in that they are related to technologies that facilitate the transfer of information and various types of electronically mediated communications". Skills Framework for the Information Age is one of many models for describing and managing competencies for ICT professional for the 21st century.

The phrase information and communication technology has been used by academic researchers since the 1980s, and the abbreviation ICT became popular after it was used in a report to the UK government by Dennis Stevenson in 1997, and in the revised National Curriculum for England, Wales and Northern Ireland in 2000. But in 2012, the Royal Society recommended that ICT should no longer be used in British schools "as it has attracted too many negative connotations", and with effect from 2014 the National Curriculum uses the word computing, which reflects the addition of computer programing into the curriculum.

Information and Communication Technology can contribute to universal access to education, equity in education, the delivery of quality learning and teaching, teachers' professional development and more efficient education management, governance and administration. UNESCO takes a holistic and comprehensive approach in promoting ICT in education. Access, inclusion and quality are among the main challenges they can address. The Organization's Intersectral Platform for ICT in education focuses on these issues through the joint work of three of its sectors : Communication & Information, Education and Science.

In modern society ICT is ever-present, with over three billion people having access to the Internet. With approximately 8 out of 10 Internet users owning a smartphone, information and data are increasing by leaps and bounds. This rapid growth, especially

in developing countries, has led ICT to become a keystone of everyday life, in which life without some facet of technology renders most of clerical, work and routine tasks dysfunctional. The most recent authoratative data, released in 2014, shows "that Internet use continues to grow steadily, at 6.6% globally in 2014 (3.3% in developed countries, 8.7% in the developing world); the number of Internet users in developing countries has doubled in five years (2009-2014), with two thirds of all pepole online now living in the developing world".

However, hurdles are still at large. "Of the 4.3 billion people not yet using the Internet, 90% live in developing countries. In the world's 42 Least Connected Countries (LCCs), which are home to 2.5 billion people, access to ICTs remains largely out of reach, particularly for these counteries, with many developing countries dearth of any type of Internet. This also includes the availability of telephone lines, particularly the availability of cellular coverage, and other forms of electronic transmission of data. The latest "Measuring the Information Society Report" cautiously stated that the increase in the aforementioned cellular data coverage is ostensible, as "many users have multiple subscriptions, with global growth figures sometimes translating inot little real improvement in the level of connectivity of those at the very botton of the pyramid; an estimated 450 million people worldwide live in place which are still out of reach of mobile cellular service".

Favourably, the gap between the access to the Internet and mobile coverage has decreased substantially in the last fifteen years, in which "2015 is the deadline for achievements of an UN Millennium Development Goals (MDGs), which global leaders agreed upon in the year 2000, and the new data show ICT progress and highlight remaining gaps." ICT continues to take on new form, with nanotechnology set to usher in a new wave of ICT electronics and gadgets. ICT newest editions into the modern electronic world include smart watches, such as the Apple Watch, smart wristbands such as the Nike + Fuel Band, and smart TVs such as Google TV. With desktops soon becoming part of a bygone era, and laptops becoming the preferred method of computing, ICT continues to insnuate and later itself in the ever-charging globe.

Information communication technologies play a role in facilitating accelerated pluralism in new social movements today. The internet according to Bruce Bimber is "accelerating the process of issue group formation and action" and coined the term accelerated pluralism to explain this new phenomena. ICTs are tools for "enabling social movement leaders and empowering dictators" in effect promoting societal change. ICTs can be used to garner grassroots support for a cause due to the internet allowing for political discourse and direct interventions with state policy as well as change the way complaints from the populace are handled by governments.

1.6.2 Significance of ICT for Teaching-Learning of the Visullay Impaired

For many blind or partially sighted learners, information and communication technology (ICT) computers can enable access to the curriculum by providing alternative methods of reading and recording work.

It is likely that pupil with visual impairments may need to use ICT across most of the curriculum and that they will be following the same curriculum as their peers. There is range of different ways in which ICT can provide support for these learners. These include :

- Tools to support communication
- Improve access to information
- Curriculum tool to develop concepts in subject areas
- A means of production of learning materials in alternative formats.

Key to effective learning is assessement of a large of factors. This may involve input from a range of professionals in order to assess :

- The learners functional vision.
- Mobility needs
- Curriculum needs
- Whether it is appropriate to use ICT.

The success in the information society demands computer literacy. It is more or less impossible to complete an education let alone get and maintain a position on the job market without IT skills. Likewise, the ability to utillise information technology is important in most other aspects of life. Consider email for correspondence, home-banking, access to public services, access to library services, e-commerce, access to traffic information, the ability to book theatre tickets-just to name a few examples.

As such, information technology, computer literacy and information access in important to eveyone in information society, the visually impaired not excluded. In fact, these competencies may be even more important to people with visual disability. To some extent, IT competencies may eventually reslove some of the issues of underemployment and unemployment amongst the visually disabled.

Information technology offers a range of possibilities to the blind and partially sighted : The computer can be used as an intelligent interface between the visually impaired and the sightedl; inforamtion that would otherwise be inaccessible or require manual processing to become accessible can be automatically transformd into formats better suited for the visually impaired; as technologies emerge and mature, technologies

that were used solely as enabling technologies in the past are becoming mainstream, thus affecting price as well as quality; and finally, the abiligy to establish a virtual framework through the use of computers, geography and physical location matters less, hence increasing the opportunities in terms of employment and education.

At the same time, however, information technology and the ways in which the technology is deployed represent an equal range of challenges. Althoug the Internet-in theory-makes information available to anyone who can use a computer, poor web-design raises new barriers. Furthermore, the short learning curve combined with relatively inexpensive solutions based on speech synthesis may further erode basic skills such as Braille literacy.

Visually impaired have been able to command the user interfaces of computers using screen readers, speech synthesis, Braille displays and screen magnification systems. Furthermore, the visually impaired have access to the vast majority of all business applications, personal productivity tools, office applications, email system and web-browsers. Using enabling technology in combination with general-prupose computer system, the blind and partially sighted have been able to transform information form formats aimed at the sighted into formats more suitable to meet the needs of the visually impaired. Enabling technologies for such automatics transformation include Braille translation system, screen magnification system and text-to-speech engines.

Today, all inforamation is produced electronically and is-at least in theory-available directly from the publisher. A number of issues still reamain, especially in the areas of copyright and copy protection. In addition to information publisehd in print, vast amounts of information are available directly on the Internet and on CD ROM and DVD. Finally, electronic books (or eBooks) are emerging in the mainstream market. A recent survey estimated that, by 2005, electronic books will account for as much as 10 percent of the total American market for published books.

1.7. ICT and the UN Convention on the Rights of Persons with Disabilites

The Convention on the Rights of Persons with Disabilities (CRPD) is the first international human rights treaty to place an obligation on States Parties to focus on mechanism for monitoring-Article 33(2). The provision does not seek to replace international monitoring, however, but rather to complement the work of the U.N. Committee on the Rights of Persons with Disabilities-whose mandate and functioning are set out in Articles 3,4 34, 36 and 37 of the CRPD and in the Optional Protocol.

The report by the Global Intiative on Inclusive Information and Communication Technologies (G3ict) and Disabled People's International (DPI) is but one example of how voluntry monitoring can be effected.

This third edition of the *CRPD ICT Accessibility Progress Report* covers 76 countries including 74 ratifying countries, South Sudan (formatly part of ratifying country-Sudan) and the United States as a benckmark country. Those 76 countries represent 72 percent of the world population and 81 percent of tht total population of ratifying countries. This report offers disability advocates, governments, civil soceity and international organizations monitoring the progress of the implementation of the CRPD by States Parties, a unique benchamarking tool that collects data on country laws, policies, and programs pertanining to accessible and assistive information and Communication Technologies (ICTs) around the globe.

Based on the findings from the 2010 and 2012 editions of the *CRPD ICT Accessibility Progress Report*, it was clear that digital accessiblity is not merely about greater use of technology by persons with disablilities. It is about transforming information-based policies and the ICT econsystem. Addressing the ICT arena is part of a larger effort to build an inforamtion society based on ensuring people's right to communicate, use knowledge for their own ends, and overcome barriers on freedom to use, share and modify ICTs and information content. This comports with the theme of this year's High-Level Meeting on Disability and Development of the General Assembly on the realization of the Millennium Development Goals and other internationally-agreed development goals for persons with disablilities.

The 2010 and 2012 editions of the *CRPE ICT Accessiblity Progress Report* described how a disability inclusive development agenda is possible only if the multiple actors in the ICT arena commit to work in coordination, cooperation and collaboration. Developing a shared vision of a world information society that contributes to human development based on agreed upon principles, including persons with disabilites' right to access information, is a long-term undertaking. Strategic wisdom needs to inform future action, particularly in the negotiation of the empowerment of persons with disabilities through ICTs.

ICT policies and programs should be seen not as one-time interventions, or solely as check-offs to demonstrate complience with global treaties, but as processes whcih promote learning and human development from trial and error, and create spaces for the engagement of different social groups. Civil soceity actors, including NGOs and DPOs need to build their own capacities, develop perspectives, lobby with government and business, participate in national and interantional ICT policy-making processes, and

build constituencies among a wide cross-section of society on the role of ICTs for the promotion of equlity for persons with disabilities.

In 2013, the two sets of surveys from the *CRPE ICT Accessibility Progress Report* (3rd edition) were filled out by 86 local correspondents in 76 countries. Data collection for the third edition of the Progress Report was completed in cooperation with Disabled People's International (DPI) and various disabled person's organizations and experts in countries wher DPI correspondents were not available.

Convention on the Right of Persons with Disabilities 2013 ICT Accessibility Progress Report Where do we stand on CRPD implementation and disability-inclusive development in 2013? The data and information in the chapters ahead reflect the :

- Degree to which each of the dispostions of the CRPD on Assistive Technologies (ATs) and ICT is actually enacted by ratifying countries in local laws, policies and regulations and their actual impact.
- Nature and type of disability inclusive practices used by ratifying countries in local policies and programs.

The report concludes with a brierf set of recommendations that CRPD ratifying countries, DPOs and NGOs, national, regional and international development agencies could take to ensure increased progress in CRPD implementation and digital saccessibility. Thse three recommendations are to :

- Provide a legal foundation for ICT accessibility and reasonable accommodation in the country legislation which then can support and ligitimize specific policies and programs;
- Promote disability-inclusive policies and programs identified as priority areas by key stakeholders; and
- Address gaps in capacity building through disability-inclusive cooperative development practices.

- **Introduced to ICT Accessibility in the CRPD :** The significance of ICT accessibility for persons with disabilities is best described by the language found in paragraph (v) of the Preamble of the convention on the Rights of persons with Disabilities (CRPD), which recognize "the importance of accessibility to the physical, social, economic and cultural environment, to health and education and to information and communication, in enabling persons with disabilities to fully enjoy all human rights and fundamental freedoms".

While the Preamable clearly defines accessibility as an enabler for persons with disabilities to exercise their rights, Article 3(f) of the Convention also identifies accessibility as one of its eight "General Priciples". Article 9 is dedicated to accessibility and stipulates : "To enable persons with disabilities to live independetly and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons eith disabilites aceess, on an equal basis with others, to the physical environment, to transportation, to inforamation and communications, including information and communication technologies and system, and to other facilities and services open on provided to the public, both urabl and in rural areas".

Furthermore, Article 2 describes reasonable accommodation and the lack thereof as discrimination. In the case of information and communication technologies, because many accessiblity and assistive solutions are available and already implemented, it can be inferred that the CRPD dispostions on reasonable accommodation apply in most cases. For example, an inaccessible website may not allow persons with disabilities to obtain information or use a service on an equal basis with others. Yet, methods to create accessible websites are well documented and if implemdnted correctly, do not cost more nor constitute a disproportionate or undue burden.

Therefore, while the CRPD does not define accessibilility at large as a right, it carries language which establishes the accessibility of information and Communication Technologies ("ICTs") as an obligation of States Parties and soceity at large. The notion that discrimination occurs when ad ICT based service is inaccessible is consistent with emerging jurisprudence in the United States and the United Kingdom : inaccessible websites or inaccessible ATMs for instance do constitute discrimination against persons with disabilities because equal access is not provided while it could.

The obligation to provide accessible ICT based products and services and ensure equal access is also reflected in many advanced policies and programs launched or promoted by States Parties around the world. Examples of such programs include :

- Captioning or signing of television programs (implemented to some extent by 71 percent of the countries);
- Offering relay services for deaf and speech imparied users of telephony (implemented by 26 persent of the countries);
- Implementation of computer-based Assistive Technologies in schools and universities (52 percent of the countries have some levelof implementation);
- Providing accesible government websites (implemented by 45 percent of the countries); and,
- Accessible public electronic kiosks or ATMs deployed (implemented by 39 percent of the countries).

While the above list cannot be exhaustive in the context of this introduction, it confirms that State Parties have in some areas acknowledged and acted upon the obligation to provide equal access to information and communication technologies and services, setting benchamarks for what constitutes resonable ICT accommodation for persons with disabilities.

● Treaty Implemenatation and the G3ict CRPD ICT Accessibility Progress Report :

The G3ict CRPD ICT Accessibility Progress Report (3rd edition) is uniquely suited to address key aspects of treaty implementation, as well as seving as a path finding framework for the U.N. to adpot or adapt within its disability-inclusive development agenda towards 2015 and beyond. The G3ict CRPD Progress Report identifies the degree to which each of the dipositions of the CRPD on accessible ICTs and Assistive Technologies is actually enacted in local laws, policies and regulations and their impact. It includes 57 data points relative to the status of ICT and AT accessibility for each country surveyed. Data is collected and presented within the following three clusters of data points :

- State Party CRPD legal and programmatic commitments;
- State Party capacity for implementation;
- Assessment of the State's implementation and actual results for persons with disabilities.

By drawing links between State's commitments and implementation/impact on persons with disabilities and comparing data from various countries including from other international information and rsearch sources.

16 significant findings, benchmarks and recommendations may be derived from the G3ict CRPD ICT Accessibility Progress Report for policy makers, international institutions business and industry, nongovernmental organization, disabled person's organization, and others.

Results may be used by ratifying countries in order to improve their cmpliance with the CRPD. For example, governments may use the results to improve the consultation and participation process of Non-Governental Organizations (NGOs) to the development and implementation of legislation.

Furthermore, States could use CRPD results to request targeted training and support from their Institutions of Higher Education (IHE). Those IHEs could provide training to government entities on critidcal ICT and AT issues in whcih the country was deemed to be out-of-compliance.

The data may also be used by international bodies as a baseline against which those bodies can estimate or judge, in part, the adequacy and focus of their own CRPD responsibilities and comitments. International organizations can use the data to foster international cooperation and monitor existing needs for ICT and AT accessibility in communities. Furthermore, and in keeping with the conceptual framewrok and capacity building approach for the U.N. human rights treaty body system, G3ict has standardized its global survey using a structure-process-outcome data collection strategy.

Convention on the Rights of Persons with Disabilities 2013 ICT Accessibility Progress Report For example, U.N. agencies such as UNDP, UNESCO, ILO, ITU or WHO in their role of providing technical assistance may use the data to identify policies and programs required by the CRPD and determine how to best engage State Parties in the implementation of those policies.

On a regional level, DPOs and NGOs can also use the data to gauge the lack of CRPD compliance by governments in order to raise the awarness of the challenges and oppotunities of ICTs and ATs for persons with disabilities and facilities the sharing of lessons learned, good practices, tools and products.

Results could also help DPOs and NGOs to determine which actions need to taken to facilities the implementation of the CRPD.

What further steps can CRPD ratifying countries, DPSs and NGOs, national, regional and international development agencies take to ensure increased progress in CRPD implementation and digital accessibility? G3ict offers the following three recommendations :

(a) Establish a legal foundation for successful CRPD implementation (of the ICT and AT provisions of the CRPD)

(b) Promote disability inclusive policies and programs identified in priority areas by key stakeholders; and

(c) Address gaps in capacity building through the use of diasbility-inclusive cooperative development practices.

1.8. Let Us Sum Up

It is absolutely essential for any person to take appropriate decision in life. Subsequently access to information becomes essential for leading a meanigful life. ICT have revolutionzied the manner in which access to information is provided to the

citizen. Technology advancements have also permitted disabled persons reach out and gain access to inforamtion through the computer equipped with specific provisions. Traditionally ICT has been a great boon to the disabled persons, having providing them with reading aids, audio books and other communication methods.

Technonogy can also be used to reach out to a large number of persons with disabilities who are currently deprived of any educational and vocational opportunities. At present, the technological innovations have made the mode of communication effective, and the process and dissemination of information faster and opened up large aveunes for successful employment. The prupose of assistive technology is to enable persons with VI, Hi, loco motor difficulties, MR, etc. to acheive greater participation, choice and self-reliance in roles and activities that are importnat to them. The success in the application of assistive technology has many parameters. Firslty, the persons with disabilities should know what types of adaptation in technology are available in the field. Secondly, he/she should know in what ways it would empower him/her in mainstreaming, and thirdly, the individual should also understand his/her own potential for the better use of the technology.

1.9. Check Your Progress

1. What do you mean by educational technology?
2. State the basic natures of educational technology?
3. Discuss the importance of educatioal technology?
4. What are the scopes of educationall technology?
5. What do you mean by technology in education?
6. State the differences between educational technology and technology in education.
7. What do you mean by technology in education?
8. State the differences between educational technology and technology in education.
9. What do you mean by information and communication technology?
10. What is the significance of ICT for teaching learning of visually impaired Students?
11. What is UNCRPD?
12. Write a short note on ICT accessibility in the UNCRPD.

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Unit - 2 ❑ Adaptive Technologies

2.1 Introduction

This chapter describes the developmental efforts related to adaptive technologies, which can be combined with other technologies and processes to form an adaptive system. The goal of an adaptive system, is to create an instructionally sound and flexible

environment that supports learning for students with a range of abilities, disabilities, interests, backgrounds, and other characteristics. After defining key terms and establishing a rationale for adaptation, we present a general framework to discuss about adaptive technologies.

2.2 Objective

After the completion of the Unit, learners will be able to -

- Acquire Information about the Concept and Purposes of Adaptive Technology;
- Acquire Knowledge about the Basic Considerations of the Adaptive Technologies;
- Understand User's Perspective for the Development of Adaptive Technologies;
- Consider the Role of IIT's and the other Scientific Community to Promote Adaptive Technologies;
- Evaluate the Concepts of Universal/ Inclusive Design.

2.3 Adaptive Technology - Concept and Purposes

Adaptive Technology is a broad term often used to describe both the products and services for people with special needs. It enhances the vocation, recreation, education, and independence of the user.

Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities. The next thing that comes to mind is the question of who, how, where and when does one require and should be entitled to adaptive/assistive technology as well as to what extent and at what cost should it be available? Adaptive Technology can provide equality between visually impaired individuals and their sighted peers within the emerging information society. With the aid of the appropriate technological devices, visually impaired persons can independently access, process, store and transmit the same information handled by sighted people. Both use computers to manipulate this information. The only difference lies in the form in which the information is displayed. The vast proportion of employment, education and daily living activities require access to electronic information. Technology can, in innumerable instances, assist individuals who are blind or visually impaired to become active participants in their societies. There are essentially five methods of output that can render computers and printed materials accessible for individuals who are blind or visually impaired:

Screen Reader, Braille Printer, reading device, electronic Braille displays, and text magnification.

2.3.1 Concept of Adaptive Technology

The term adaptive technology is often used as the synonym for assistive technology; however, they are different terms. Assistive technology refers to "any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities", while adaptive technology covers items that are specifically designed for persons with disabilities and would seldom be used by non-disabled persons. In other words, "assistive technology is any object or system that increases or maintains the capabilities of people with disabilities," while adaptive technology is "any object or system that is specifically designed for the purpose of increasing or maintaining the capabilities of people with disabilities." Consequently, adaptive technology is a subset of assistive technology. Adaptive technology often refers specifically to electronic and information technology access.

Adaptive technology is any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities.

- It can be low-tech: communication boards made of cardboard or fuzzy felt.
- It can be high-tech: special-purpose computers.
- It can be hardware: prosthetics, mounting systems, and positioning devices.
- It can be computer hardware: special switches, keyboards, and pointing devices.
- It can be computer software: screen readers and communication programs.
- It can be inclusive or specialized learning materials and curriculum aids.
- It can be specialized curricular software.
- It can be much more-electronic devices, wheelchairs, walkers, braces, educational software, power lifts, pencil holders, eye-gaze and head trackers, and much more.

Adaptive technology helps people who have difficulty speaking, typing, writing, remembering, pointing, seeing, hearing, learning, walking, and many other things. Different disabilities require different assistive technologies.

2.3.2. Purpose of Adaptive Technology

An adaptive system adjusts itself to suit particular learner characteristics and needs of the learner. Adaptive technologies help achieve this goal and are typically controlled by the computational devices, adapting content for different learners' needs and sometimes preferences. Information is usually maintained within a learner model (LM), which is a representation of the learner managed by an adaptive system. LMs provide the basis for deciding how to provide personalized content to a particular individual and may include cognitive as well as noncognitive information. LMs have been used in many areas, such as adaptive educational and training systems (e.g., intelligent tutoring systems), help systems, and recommender systems. Adaptive systems may consist of hard or soft technologies (e.g., devices vs. algorithms). Hard technologies are devices that may be used in adaptive systems to capture learner information (e.g., eye-tracking devices) and thus can be used to detect and classify learners' performance data or affective states such as confusion, frustration, excitement, and boredom. Hard technologies also can be used to present content in different formats (e.g., tactile tablet to accommodate visual disabilities). Soft technologies represent algorithms, programs, or environments that broaden the types of interaction between students and computers. For instance, an adaptive algorithm may be employed in a program that selects an assessment task or learning object most appropriate for a learner at a particular point in time. The effectiveness of adaptive technologies hinges on accurate and informative student or learner models. For the remainder of this paper we use the terms student model (SM) and learner model (LM) interchangeably. Because this focuses on the educational functions of adaptive systems, we limit our modeling discussion to the context of students or learners, rather than more broadly defined users.

Four-Process Adaptive Cycle is the success of any adaptive technology to promote learning requires accurate diagnosis of learner characteristics (e.g., knowledge, skill, motivation, persistence). The collection of learner information then can be used as the basis for the prescription of optimal content, such as hints, explanations, hypertext links, practice problems, encouragement, metacognitive support, and so forth. Our framework involves a four-process cycle connecting the learner to appropriate educational materials and resources (e.g., other learners, learning objects, applications, and pedagogical agents) through the use of a LM . The components of this four-process cycle are

(a) capture,

(b) analyze,

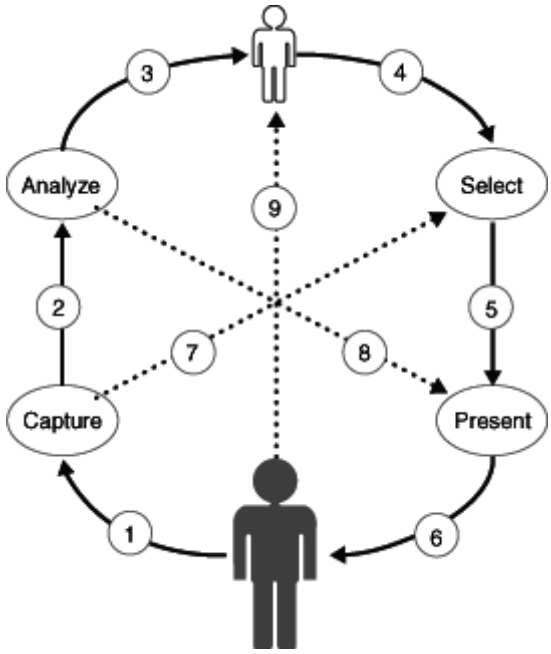
(c) select, and

(d) present.

Capture - The capture process entails gathering personal information about the learner as he or she interacts with the environment, depicted by the larger human figure. Relevant information can include cognitive as well as noncognitive aspects of the learner. This information is used to update internal models maintained by the system.

Analyze - The analyze process requires the creation and maintenance of a model of the learner in relation to the domain, typically representing information in terms of inferences on current states. This is depicted as the smaller human figure (i.e., the SM).

Select - Information (i.e., content in the broadest sense) is selected according to the model of the learner maintained by the system and the goals of the system (e.g., next learning object or test item). This process is often required to determine how and when to intervene.



Four-process adaptive cycle.

Present - Based on results from the select process, specific content is presented to the learner. This entails appropriate use of different media, devices, and technologies

efficiently to convey information to the learner. This model accommodates alternative scenarios. It describes some of these scenarios that involve different types of adaptation, starting with a completely adaptive cycle and continuing to a nonadaptive presentation.

2.4 Basic Consideration - Access, Affordability and Availability

Before we begin our discussion on adaptive technologies that support learners in educational settings, we briefly define relevant terms. Most generally, to adapt means an adjustment from one situation or condition to another (e.g., software programs and persons are capable of adaptation). Technology refers to the application of science (methods or materials, such as electronic or digital products or systems) to achieve a particular objective, like the enhancement of learning. A system in this context refers to a network of related computer software, hardware, and data transmission devices.

2.4.1 Access as the Basic Consideration of Adaptive Technologies

Accessibility and usability of adaptive technology are closely related. Their goals, approaches, and guidelines overlap significantly.

In most situations, such as when designing and developing websites and applications or other uses of technologies, it is most effective to address them together.

There are a few situations when it is important to focus specifically on one aspect, such as when addressing discrimination against people with disabilities and when defining specific accessibility standards.

Accessibility

Accessibility addresses discriminatory aspects related to equivalent user experience for people with disabilities, including people with age-related impairments. Accessibility means that people with disabilities can perceive, understand, navigate, and interact with technologies, and that they can contribute equally without barriers.

Usability

Usability and user experience design is about designing products to be effective, efficient, and satisfying. Specifically, ISO defines usability as the "extent to which a product can be used by specified users to achieve specified goals effectively, efficiently and with satisfaction in a specified context of use" (in ISO 9241-11).

Inclusion

Inclusive design, universal design, and design for all involves designing products, such

as websites, to be usable by everyone to the greatest extent possible, without the need for adaptation. Inclusion addresses a broad range of issues including access to and quality of hardware, software, and Internet connectivity; computer literacy and skills; economic situation; education; geographic location; and language - as well as age and disability.

Accessibility and Usability

While accessibility focuses on people with disabilities, many accessibility requirements also improve usability for everyone. Accessibility especially benefits people without disabilities who are in limiting situations, such as using the web on a mobile phone when visual attention is elsewhere, in bright sunlight, in a dark room, in a quiet environment, in a noisy environment, and in an emergency. Accessibility includes both:

- Requirements that are more specific to people with disabilities - for example, they ensure that websites work well with assistive technologies such as screen readers that read aloud web pages, screen magnifiers that enlarge web pages, and voice recognition software that is used to input text. Most of these requirements are technical and relate to the underlying code rather than to the visual appearance.
- Requirements that are also general usability principles - which are included in accessibility requirements because they can be significant barriers to people with disabilities. For example, a website that is developed so that it can be used without a mouse is good usability; and use without a mouse is an accessibility requirement because people with some physical and visual disabilities cannot use a mouse at all. In defining accessibility requirements, care is usually taken to not include aspects that impact all people similarly, and only include aspects that put person with a disability is at a disadvantage relative to a person without a disability.

Usability and user experience design significantly overlap with accessibility when "specified users" includes people with a range of disabilities and "specified context of use" includes accessibility considerations such as assistive technologies. However, the needs of people with disabilities are often not sufficiently addressed in usability practice and research.

Additionally, accessibility includes a technical aspect that is usually not a focus of usability. In practice, basic accessibility is a prerequisite for usability.

Accessibility and Inclusive Design

Several accessibility requirements also benefit people and situations that are a focus of inclusive design. For example, Web Accessibility Benefits People With and Without

Disabilities describes accessibility benefits to:

- people with low literacy or not fluent in the language
- people with low bandwidth connections or using older technologies
- new and infrequent users

However, accessibility focuses on disability and does not try to address broader issues. Other efforts, such as internationalization, address other inclusion issues.

While people with disabilities are generally included in the scope of inclusive design, it is important to also maintain a specific focus on people with disabilities through accessibility so that the needs of people with disabilities are not diluted or overshadowed in the broader scope of inclusion. Keeping accessibility focused on disabilities encourages research and development on the specific needs of people with disabilities, and solutions that are optimized for these specific needs.

Accessible Design

The goal of web accessibility is to make the web work well for people with disabilities. Accessible design has both a technical component and a user interface component.

There are guidelines, standards, and techniques, such as the Web Content Accessibility Guidelines (WCAG), which is the international standard ISO/IEC 40500. If designers, developers, and project managers approach accessibility as a checklist of meeting accessibility standards, the focus is only on the technical aspects of accessibility, and the human interaction aspect is often lost.

Combining accessibility standards and usability processes with real people ensures that web design is technically and functionally usable by people with disabilities. This is referred to as usable accessibility or accessible user experience.

Usable Accessibility

Web designers and developers can use usability processes, methods, and techniques, such as user-centered design (UCD) process and user experience design, to address the user interface component of accessibility. While the considerations of people with disabilities are not always included in common practices, they can be easily integrated into existing usability processes, methods, and techniques.

Key aspects incorporating real people in design, including:

- Ensuring that everyone involved in web projects understands the basics of how people with disabilities use the Web,
- Involving users with disabilities early and throughout the design process, and
- Involving users in evaluating web accessibility.

Accessibility standards also have an important role in accessible design. For example, understanding the basic Accessibility Principles and using the guidelines for developing early prototypes helps the development team provide basic accessibility so that when users do evaluations, they are able to use the prototype enough to provide useful feedback.

Usability processes and user involvement alone cannot address all accessibility issues. Even large projects cannot cover the diversity of disabilities, adaptive strategies, and assistive technologies. Accessibility guidelines, standards, and techniques ensure that the wide range of issues are adequately covered.

Accessibility practitioners and researchers can incorporate usability techniques to improve 'usable accessibility'. User experience designers and researchers can incorporate accessibility to make their designs work better for more people in more situations. Addressing accessibility, usability, and inclusion together can more effectively lead to a more accessible, usable, and inclusive web for everyone. Resources to help are linked throughout this page.

The role of accessibility in a universal web is a related resource that:

- provides a more in-depth exploration of the importance and benefits of accessibility as a distinct discipline continuing to focus on people with disabilities,
- encourages increased communication and coordination between accessibility, usability, and inclusion research and practice in the design and development of guidelines, websites, browsers, assistive technologies, and other web tools.

One of the largest problems that affect people with disabilities is discomfort with prostheses. An experiment performed in Massachusetts utilized 20 people with various sensors attached to their arms. The subjects tried different arm exercises, and the sensors recorded their movements. All of the data helped engineers develop new engineering concepts for prosthetics.

Assistive and adaptive technology may attempt to improve the ergonomics of the devices themselves such as Dvorak and other alternative keyboard layouts, which offer

more ergonomic layouts of the keys. Assistive technology devices have been created to enable people with disabilities to use modern touch screen mobile computers such as the iPad, iPhone and iPod touch. The Pererro is a plug and play adapter for iOS devices which uses the built in Apple VoiceOver feature in combination with a basic switch. This brings touch screen technology to those who were previously unable to use it. Apple, with the release of iOS 7 had introduced the ability to navigate apps using switch control. Switch access could be activated either through an external bluetooth connected switch, single touch of the screen, or use of right and left head turns using the device's camera. Additional accessibility features include the use of Assistive Touch which allows a user to access multi-touch gestures through pre-programmed onscreen buttons.

For users with physical disabilities a large variety of switches are available and customizable to the user's needs varying in size, shape, or amount of pressure required for activation. Switch access may be placed near any area of the body which has consistent and reliable mobility and less subject to fatigue. Common sites include the hands, head, and feet. Eye gaze and head mouse systems can also be used as an alternative mouse navigation. A user may utilize single or multiple switch sites and the process often involves a scanning through items on a screen and activating the switch once the desired object is highlighted.

2.4.2 Affordability as the Basic Consideration of Adaptive Technologies

Students with visual impairment face unique challenges in the educational environment. Not only must they be able to access text information across all curricular areas, but they also need to be able to participate fully in instruction that is often rich with visual content. Adaptive technology is one way of supporting them in that process.

"Adaptive technology" refers to a range of tools, devices, and strategies that allow a student to accomplish a task that they would otherwise be unable to do, or would have difficulty accomplishing effectively. Adaptive technology can be simple or complex. Examples of low tech tools for students with visual impairment might include enlarged text or raised line paper, while high tech tools may encompass digital tools that "read" to the student, connect to a braille display, or even incorporate GPS.

The term "visual impairment" describes a broad range of visual abilities and needs. Because each child is unique, what works well for one student may not work well for another. Selection of adaptive technology should be the result of a team process that takes into consideration feedback from family, educators, paraprofessionals, and the

student. It is important to remember that "high-tech" is not always the best solution for a student. Selected tools should reflect the student's unique strengths and needs, the activities he needs to be able to accomplish, and the environment in which he will be working. A student's need for assistive technology will likely change and evolve throughout his or her education, and in most cases, no single tool will meet all of a student's needs.

The purpose of this resource guide is to provide an introduction to the types of adaptive technology that may benefit students with visual impairment. Specific products and their features are not described here. Instead, a general overview of tools will help raise your awareness so that you are able to determine what tools to investigate further. A list of additional resources and vendors is provided at the end of this guide if you'd like to learn more. There is also a glossary of terms if you are unfamiliar with some of the terminology related to adaptive technology and visual impairment.

2.4.3 Availability as the Basic Consideration of Adaptive Technologies

Technology for Reading

Reading is not only an essential part of the English Language Arts curriculum, but is also a key component of all other subject areas. Students rely on textbooks in science and social studies, complete word problems in math, and complete assessments that are often text-based. Assistive technology tools to support reading should reflect the student's level of visual functioning, their literacy development, as well as the environmental and task demands.

Environmental Considerations consider lighting and positioning of materials for optimal visual function.

For students with some existing visual function, providing text information in enlarged format may be the simplest strategy. As a general rule of thumb, 18 point or 24 point font size is good, but enlarging beyond that may not be efficient. Enlarged text can be acquired through a variety of sources, including publishers and vendors, or materials modified through the magnification feature of copy machines, while text size of most digital materials can be easily adjusted to a user's preference.

Handheld Magnifiers : These handheld magnifiers low-tech, portable tools allow students with some vision to access not only text, but other objects in their environment as well. They are available in a range of magnification power, are relatively inexpensive, and eliminate some material modification. However, selection of magnification power

should be based on the recommendations of a low vision specialist. A video magnifier can be used for other objects as well. It may be in the form of handheld device, a stand-alone device, or work with a computer, TV or projection system.

Braille for students who requires so : Braille is an essential tool for teaching literacy skills and will serve as a lifelong skill. Learning Braille allows students to experience aspects of written language such as spelling, grammar and sentence structure, and will provide a valuable foundation for written language. Braille products can be obtained commercially or can be created using specialized software and a braille embosser.

Braille Labelling items throughout the student's environment will not only reinforce vocabulary, spelling and reading but will also promote independence and assist with orientation.

Audio books are generally recorded using human voice, and can be accessed through the use of specialized computer software, devices, or mainstream tools like MP3 players. The various devices allow options in features such as searching and navigating an audio file. While many students will find the use of audio books useful, educators warn not to rely solely on audio books for access to text. Students who are still developing literacy skills need continued access to print or braille, while preferences of older students vary.

The use of digital text provides one of the widest ranges of options to students with varying needs. Visual aspects of documents and text can be customized, a variety of supports can be easily integrated, and digital text can be obtained through numerous resources. Digital text materials can be obtained commercially, through providers of accessible instructional materials, or created by instructors and students themselves, and can be accessed through a variety of tools including computers, mobile devices, or specialized devices such as braille notetakers.

1. Digital text generally allows user to adjust the visual display including font size, color, and contrast.
2. Digital text can be viewed on an enlarged monitor.
3. Computer magnification software can be used to view digital text, and can be customized by magnification level, area of the display being magnified, and visual qualities of display.
4. Text-to-speech software allows the computer to "read" digital text to the student in a digitized voice. Some programs will highlight words as they are read, allowing students to follow along.

5. Refreshable braille displays can be connected to the digital text source, providing students with the option to read the text tactually.
6. Scanners with optical character recognition (OCR) can be used to create digital text that can then be used with any of the above tools. OCR scanners can be handheld or freestanding.

Technology for Writing

Writing Tools: Using bold felt-tip markers or soft lead pencils can provide greater contrast on paper, allowing students with low vision to read with greater ease.

Adaptive Paper: Specialized paper with darkened lines, raised lines, or using colour can significantly improve the writing of students with low vision.

A slate and stylus can be equated to paper and pencil for individuals who are blind. This simple low tech tool allows students to quickly and efficiently complete simple tasks like creating labels or writing notes to themselves. The slate and stylus is not practical for longer writing tasks.

A handheld digital recorder allows the student to record lectures, dictate assignments, or make notes to self.

Writing with traditional paper and pencil under a video magnification camera allows the student to view their work in real time through the use of a large monitor.

Word processors are readily available and are highly adaptable. Text size and font can be customized or built-in operating system accessibility features can be used to enhance the visual display. The use of adaptive keyboards with high contrast or enlarged keys can also be utilized.

Text-to-speech software can create a "talking word processor" which provides feedback to the student about what they have typed, while speech recognition software allows the student to dictate into a microphone, which the computer translates into text. Screen magnification software can enlarge the entire display or only selected portions and may or may not provide audio feedback.

For students with no vision, a refreshable braille display can be used in conjunction with the word processor, which will display the text tactually allowing the student to reread and edit their own work. This strategy can be used with or without audio feedback, which supports multisensory learners and allows the student to choose the access method. The incorporation of braille has the potential to significantly improve the editing process.

A manual braillewriter is similar to a typewriter and is a simple, yet rugged device that is often introduced to students who are emergent readers and writers. As students progress, they may transition to an electronic braillewriter before beginning to use a braille notetaker.

A braille notetaker is a portable word processing device that utilizes the eight key braille input system and has an integrated refreshable braille display. This tool encompasses many functional areas in addition to writing. Students can use a braille notetaker to complete assignments, read textbooks, and navigate the Internet. Although products and their features vary, many are available with speech output, Wi-Fi connectivity, access to e-mail, calculators, calendars and other personal organizational tools, or GPS navigation systems. The braille notetaker is a lifelong tool and should be introduced as soon as the student demonstrates readiness.

A braille embosser allows the student to print out their completed work in braille format.

Technology for Computer Access

Skills and competence in computer use are essential to every student in the 21st century, and will significantly increase a student's success in their pursuit of higher education, vocation and independent living after graduating from high school. Instruction in basic keyboarding and word processing skills should begin early. As students grow older, use of social media tools should also be explicitly taught as key to participation and inclusion in higher education, many vocational settings, and society in general.

Adaptive Hardware - Hardware such as enlarged, large print or high contrast keyboards, as well as enlarged monitors may provide adequate supports to students with low vision, allowing them to use the computer independently.

Operating System - Accessibility Whether using a Mac, PC, desktop or mobile device, all operating systems have built-in accessibility features that may make the device easier to use. These include changes to visual display (i.e. high contrast, colour scheme, font size), enlarged icons, screen magnification, enlarging the cursor or pointer, or a built-in screen reader.

Specialized Accessibility Software - When built-in accessibility features do not provide adequate support, specialized software can be used to create a highly customized computer environment. This may include features such as text-to-speech feedback with and without text highlighting, the ability to customize what is magnified on the screen, greater customization of visual displays, voice navigation, and advanced

screen reading features.

Refreshable Braille Display - A refreshable braille display can be used as a peripheral device with a desktop, laptop or mobile computing device, providing braille translation of documents, websites, and other text information.

In conclusion, we can say that to ensure that adaptive technologies enhance users' quality of life, future emphases should focus on consumer involvement in the selection and evaluation of appropriate assistive technology, and ways to make technologies more widely available and affordable.

2.5 Addressing User's Perspective in Developing Adaptive Technologies

Technology-particularly multimedia and ubiquitous computing-can help to enrich life, enhance productivity and promote independent living for people across the entire spectrum of abilities. People with visual impairment rely heavily on their sense of hearing. If an adaptive device provides auditory feedback, it could drown out important situational information. In the case of missed conversation, this would be inconvenient. In a situation like a traffic crossing, it would be hazardous. As a result, developing a wearable device that uses tactile cues such as pattern of vibrations to convey information.

Truly revolutionary technologies require engagement with users throughout the design and development process. While it's helpful to get feedback and ideas from focus groups on users' needs, short sessions don't give a full understanding of the challenges and opportunities in developing adaptive technology solutions. It is imperative that people with disabilities play a leading role in envisioning, conceptualizing, developing, implementing, deploying, testing, and validating potential solutions, tools, and technologies.

David Hayden was a freshman double-majoring in math and computer science, and he also was visually impaired. Even sitting at the front of the class couldn't get him the access to the board to understand the process being enumerated in solving math problems or designing an algorithm by his professors.

In his sophomore year, he began working at the CUbiC lab, developing an application on a tablet connected to a camera with a pan-tilt-zoom feature. He could take the device to his classes and have the video of the blackboard piped into his laptop. Then he did something even more clever-he split the screen into two halves. One side of the screen

showed the video of the blackboard while the other was used to design a "notes" interface. He linked sections of the class notes to individual frames from the video.

David took the prototype to the classroom and shared it with other visually impaired students for obtaining their feedback, which he then used to further improve the device. At the end of his junior year, he submitted his invention to the worldwide Microsoft Imagine Cup competition in the "touch and tablet" category. He won both the national and world competitions in that category.

After graduation, David received an internship opportunity at NASA and is now pursuing a Ph.D. at MIT. He's also manufacturing his Note-Taker prototype for use by others.

Once visually impaired students started using Note-Taker in classrooms, something truly remarkable happened. Sighted students began asking for the technology for their own use. This is not actually uncommon among well-designed adaptive devices. For example, the first commercially successful typewriter, the Hansen Writing Ball, was designed to help blind people write through touch-typing. The QWERTY keyboards we use with our computers today are descendants of this accessibility tool.

In reality, we are all looking for ways to enhance our abilities. Forn reality, we are all looking for ways to enhance our abilities. For instance, a soldier on the battlefield needs better access to information at night or in stressful environments. One could argue that blindness is not only a disability but a concept. We are all blind from a touch perspective to distant environments like exploring the surface of Mars. Assistive technologies have the power to transcend our limitations and enrich our lives.

There are the components of user's perspective:

PURPOSE:

The purpose of this work was to contribute to a better understanding of challenges and solutions to equitable provision of assistive technologies in resource limited environments by (i) describing sources of awareness, types of providers and costs of adaptive technologies; (ii) describing common reasons for not possessing adaptive technologies; and (iii) comparing these sources, providers, costs and reasons among younger and older men and women living in urban and rural settings.

RESULTS:

Major sources of awareness, types of providers and costs paid varied between users of different types of adaptive technology. Lack of affordability was the main reason for not

possessing adaptive technology. Outcome differences were found between younger and older groups, men and women, and literate and illiterate respondents, while no differences related to place of living were identified.

Age, gender, type of impairment and socioeconomic status need to be considered when planning and implementing equitable provision of assistive technologies. Implications for Rehabilitation Provision of assistive technologies needs to be made affordable as lack of affordability was the major reason for not possessing such technologies. To ensure equitable provision of assistive technology, services ought to consider age, gender, impairment and socioeconomic status of their target groups. This includes offering a range of products of different sizes provided by culturally appropriate personnel at affordable cost, which to many may be at no or reduced cost. To cater to the assistive technology needs among the most vulnerable groups, assistive technology providers may learn from CBR strategies, such as, awareness raising and service delivery at community level, the use of local resources, collaboration and coordination, and the consideration of cultural factors.

2.6 Role of IIT's and the Scientific Community

2.6.1 Role of IIT's in Developing Adaptive Technologies

The Indian Institutes of Technology play a vital role in India's social and economic development. IITs are apex institutions for engineering education and research. At present, there are twenty three Indian Institutes of Technology (IITs) viz. at Bombay, Delhi, Kanpur, Kharagpur, Madras, Guwahati, Roorkee, Hyderabad, Patna, Bhubaneshwar, Ropar, Jodhpur, Gandhinagar, Indore, Mandi, Varanasi, Tiruppati, Palakkad, Goa, Jammu, Dharwad, and Bhilai. All are governed by The Institutes of Technology Act, 1961 which has declared them as "Institutions of national importance", and lays down their powers, duties, framework for governance etc.

The main objective of IITs is to impart world class education in engineering and technology; to conduct research in the relevant fields, and to further advancement of learning and dissemination of knowledge,to develop, apply and transfer the required concepts and skills to solve problems and to design and develop technology-enhanced learning systems to promote students' pan-domain thinking skills. It deals with engineering and science domains, using disciplinary content as a vehicle to develop the relevant thinking skills. These Institutes are also contributing significantly to education and research in basic sciences and humanities.

The Goals and Objectives were derived from the Sarkar Committee Report and embodied in the IIT Act. In addition to the Sarkar Committee report, the IIT act and the Statutes of the IITs indicate the lines along which IITs should develop. According to these documents IITs are expected:

- to be higher technical institutions and research in some branches of Engineering;
- to provide for instruction and research in some branches of Engineering and Technology, Science and Arts for the advancement of learning and dissemination of knowledge in specific branches.
- to ensure the advancement of knowledge through education and research, in both Pure and Applied Science, in engineering, Social science and Humanities;
- to serve the community and nation (which are referred to as Extension activity) through the use of their resources both intellectual and material, particularly through Continuing Education for professionals working in Industry.

The Science Policy Resolution (SPR) of the Government of India (1958) is a basic document of relevance to the IITs. The SPR resolves:

- to foster, promote and sustain scientific research in all aspects - pure, applied and educational;
- to ensure adequate supply of research scientists of higher quality;
- to recognize the work of research scientists as an important component of the strength of the nation;
- to encourage programmes for the training of scientific and technical personnel to fulfill the country's needs in science and education, agriculture and industry, and defense;
- to encourage dissemination and discovery of knowledge in an atmosphere of scientific freedom.

IITs also constitute a major source for research scientists of high caliber; they also are expected to serve the people of India and provide the country with benefits of application of their discovery and knowledge and as such are entitled to academic freedom and research support as implied in the SPR.

Much in the same manner as IITs are part of the successful implementation of the SPR, they now have a greater responsibility for fulfilling the relevant goals of the Technology Policy Statement as well. As Institutes of Technology, their charter, is to resonate the expectations spelt out in the Technology Policy Statement.

The Technology Policy Statement (1983) affirms that, technology must relate to our people's aspirations and to our local needs to cover both manufacturing and servicing sectors.

The Statement affirms that the base for this consists of trained manpower, which IITs are charged to develop. It envisages special attention to the promotion of newly emerging and frontier areas and encouraging research in these areas.

IITs have a specific role to implement these avowed objectives of the Technology Policy Statement within their general charter of education, research and extension.

Such goals require that IITs must

- excel in all aspects of academic activity and produce a high quality science based engineering students;
- survive on specialization, work increasingly in front-line areas that transcend disciplines;
- have a perception and a value system appropriate to the pursuit of high science and high engineering science to meet the critically evaluated needs of the society in terms of products and processes using indigenous resources in close collaboration with manufacturing service sectors;
- programme into their activities the emerging technological needs with a futuristic outlook;
- accept extension and public services as a third dimension to their role in addition to education and research;
- attain a stature that enables them to provide leadership with credibility. They should be the "think tanks" for higher education and research;
- aim at preparing more of "creative engineers", "innovative thinkers" and "engineer entrepreneurs";
- develop a special nexus with rural development mainly by way of involvement in technology based solutions for problems in rural areas;
- maintain and foster interactive linkages with leading technological institutions and centers of research in India and abroad
- to develop in each student mastery of fundamentals, versatility of mind, motivation for learning, intellectual discipline and self-reliance which provide the best foundation for continuing professional achievement;

- to provide a liberal; as well as a professional education so that each student acquires a respect for moral values, a sense of their duties as a citizen, a feeling for taste and style, and a better human understanding. All these are required for leadership;
- to send forth men and women of the highest professional competence with a breath of learning and a character to deal constructively with issues, and problems anticipated in the next decade relevant to the programmes of development of our country.

IITs must seek through their research activities to create an atmosphere of intellectual excitement, a climate of inquiry and innovation in which a student develops a consuming interest for understanding issues of his own volition.

- should not the IITs mainly concentrate on forging links with organized industrial sector for import and diversification of its technology?
- should IITs commit their resources for developing appropriate rural technology for mass impact?
- should not the Institutes strive for an optimal blend of a limited number of objectives in order that they do not spread their resources thinly?

As Indian Institutes of Technology, they must recognize their inherent obligation to serve students and alumni, the profession of engineering, the world of scholarship, the nation and the society at large. IITs should seek to serve the community directly through the use of their facilities, wherever there is a need, to which they can respond easily . These objectives are derived from the original goals and not construed de-novo.

The Report of the Committee on Post Graduation Engineering Education lays stress on the thrust areas such as Fibre Optics, Micro-electronics, Materials Science, Reliability Engineering, Robotics, Ocean Engineering, Computer Science etc. IITs have a significant role to build a superstructure in the form of Postgraduate Programmes in such thrust areas that go to influence the quality of Undergraduate Curriculum. In order to develop a curriculum they need to interact and develop linkages with their surroundings specially within the manufacture and service sectors.

We are clear in our minds that the Technology Policy Statement and the Science Policy Resolution demand a conscious integrated approach covering technology assessment, technology acquisition, absorption, utilization and diffusion. This responsibility cannot be solely placed on the IITs. But IITs cannot escape participation in one or more aspects

of Technology development along with others . Technology policy studies may be initiated in or more IITs to enable them to to have a proper appraisal of modern technologies, and arrive at an assessment of their relevance to the needs of our society. Such studies will help orient research and curriculum to produce engineers alive to the needs of the nation . IITs would no longer be accused of training to the needs of the developed.

2.6.2 Role of Scientific Communitiesin Developing Adaptive Technologies

Rehabilitative and adaptive technology refers to tools, equipment, or products that can help a person with a disability to function successfully at school, home, work, and in the community. Disabilities are disorders, diseases, health conditions, or injuries that affect an individual's physical, intellectual, or mental well-being. Rehabilitative and adaptive technologies can help people with disabilities to function more easily in their everyday lives and can also make it easier for a caregiver to care for a disabled person. The term "rehabilitative technology" is sometimes used to refer to aids used to help people recover their functioning after injury or illness. "Adaptive technologies" may be as simple as a magnifying glass to improve visual perception or as complex as a computerized communication system.

Some of these technologies are made possible through rehabilitative engineering research, which is the application of engineering and scientific principles to study how people with disabilities function in society. It includes studying barriers to optimal function and designing solutions so that people with disabilities can interact successfully in their environments.

The NICHD houses the National Center for Medical Rehabilitation Research (NCMRR) : The NCMRR has helped to advance scientific knowledge about disabilities and rehabilitation, while also providing vital support and focus for the field of medical rehabilitation to help ensure the health, independence, productivity, and quality of life of all people.

Within the overall goals outlined some specific goals should be spelled out. It is that the scientific communities must continue to engage in manpower development. The students must be an agent of change of Technology practice in the country, and initiate a new working culture in our industry, with a view to increasing productivity and bringing to industry the capacity to innovate. Some technical graduates should, therefore, become entrepreneurs themselves for starting new science based, technology

oriented industries. They are thus to be so trained to build into their value system, a sense of responsibility to their country and a desire to serve for the society. Their perception should preclude Hi-Tech. as an important tool to solve ground level problemsspecially for the child with different needs.

Some of the institutes, who have locational advantages, can involve themselves in the tasks related to the development of CWSN by means of supplying competent technical manpower and by offering laboratory solutions to the problems faced by them. Their method of instruction should be innovative and qualitatively different. For instance, Micro-electronics may be taught in other colleges as an educational programme, but who have research excellence in their proximity, on the other hand, would bring in a practical bias and illustrate a number of case studies relevant to their curricula. Their functions of teaching, research and extension would be perceived as an integrated block and not as separate identities. Without such an integration, a teacher cannot develop the personality of the taught in a wholesome fashion, relating what is taught to actual experience. The teacher's activity in extension activity will improve the quality of his research, in turn improving his teaching content. The students will then see him as the leader in research whose work is relevant. Some of the alumni settled abroad while responding to our questionnaire mentioned that a major cause of their migration abroad is the baseness of academic and research leaders.

As the information Age is ushering in, thanks to the technological advancements in the area of Microelectronics, Materials Engineering and Bio-technology etc.,the country will look towards to be lead-agents for promoting training, research support and technology development in many such thrust areas. The goals of these institute,therefore, must specifically include helping such changes happen in this country in a programmed manner and faster. It is for each institute to decide on what priority areas they need to emphasize, from time to time to plan for them.

2.7 Universal/ Inclusive Design - Concept, Advantages and Limitations

2.7.1 Concept of Universal/ Inclusive Design

Universal Design

Universal design (close relation to inclusive design) refers to broad-spectrum ideas

meant to produce buildings, products and environments that are inherently accessible to older people, and people with disabilities.

The term "universal design" was coined by the architect Ronald L. Mace to describe the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life. However, it was the work of Selwyn Goldsmith, author of "Designing for the Disabled" (1963), who really pioneered the concept of free access for people with disabilities.

Universal design emerged from slightly earlier barrier-free concepts, the broader accessibility movement, and adaptive and assistive technology and also seeks to blend aesthetics into these core considerations. As life expectancy rises and modern medicine increases the survival rate of those with significant injuries, illnesses, and birth defects, there is a growing interest in universal design. There are many industries in which universal design is having strong market penetration but there are many others in which it has not yet been adopted to any great extent. Universal design is also being applied to the design of technology, instruction, services, and other products and environments.

Curb cuts or sidewalk ramps, essential for people in wheelchairs but also used by all, are a common example. Color-contrast dishware with steep sides that assists those with visual or dexterity problems are another. There are also cabinets with pull-out shelves, kitchen counters at several heights to accommodate different tasks and postures, and, amidst many of the world's public transit systems, low-floor buses that "kneel" (bring their front end to ground level to eliminate gap) and/or are equipped with ramps rather than on-board lifts.

The Center for Universal Design at North Carolina State University expounds the following principles:

1) Equitable use
2) Flexibility in use
3) Simple and intuitive
4) Perceptible information
5) Tolerance for error
6) Low physical effort
7) Size and space for approach and use

Each principle above is succinctly defined and contains a few brief guidelines that can

be applied to design processes in any realm: physical or digital. These principles are broader than those of accessible design and barrier-free design.

Inclusive Design

The British Standards Institute (2005) defines inclusive design as "The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible ... without the need for special adaptation or specialised design."

The UK government has defined inclusive design as '…a process that ensures that all buildings, places and spaces can be easily and comfortably accessed and used by everyone

Every design decision has the potential to include or exclude customers. Inclusive design emphasizes the contribution that understanding user diversity makes to informing these decisions, and thus to including as many people as possible. User diversity covers variation in capabilities, needs and aspirations.

Inclusive design focuses on the diversity of people and the impact of this on design decisions. However, the complete set of performance indicators should consider a wider set of aspects concerned with People, Profit and Planet. The performance indicators should examine how the different aspects have an impact across the whole life-cycle of the product. This life-cycle typically involves the stages:

1. Develop it
2. Make it
3. Distribute& sell it
4. Use it
5. Pass it on
6. Reprocess it

For most current products, the user 'Passes it on' by throwing it in the bin, and 'Reprocess it' involves storage in landfill. However, recycling and refurbishment represent other alternatives for these stages.

Definition of inclusive design

The British Standards Institute (2005) defines inclusive design as:

'The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible ... without the need for special adaptation or specialised design.' Inclusive design does not suggest that it is always possible (or appropriate) to design one product to address the needs of the entire population. Instead, inclusive design guides an appropriate design response to diversity in the population through:

Comparison with 'Universal design'

'Design for all' and 'Universal design' philosophies both have the same literal meaning. These philosophies originated from design of the built environment and websites, and were initially applied in the context of government provision (Design for All Foundation; Preiser and Ostroff, 2001).

In the context of product design, both 'Design for all' and 'Universal design' approaches pragmatically accept that it is not always possible for one product to meet the needs of the entire population. Nevertheless, these approaches maintain that all mainstream products should be accessible to as many people as technically possible (Preiser and Ostroff, 2001).

In contrast, inclusive design originated with product design, and focuses on choosing an appropriate target market for a particular design, and making informed decisions to maximise the 'Product performance indicators' for that target market. While inclusive design intends to extend the reach of mainstream products, it acknowledges the commercial constraints associated with satisfying the needs of the target market.

2.7.2 Advantages of Universal/ Inclusive Design

The case for making our society more universally accessible and usable to all is a compelling one on many fronts. Universal/ Inclusive Design proposes a progressive and evolving approach to the development of inclusive environments that can be accessed, understood and used to the greatest extent possible. Not only does Universal/ Inclusive Design make good business sense, it also has many compelling social and legal drivers. The human-centered approach to design that Universal Design supports is user-friendly and convenient, but is also respectful of user dignity, rights and privacy. The degree of difficulty that people experience when using a product, service or environment can vary, Such as:

A person who has no significant problems but who would appreciate a well-designed accessible and usable product, service or environment;

1)A person who has little difficulty with all features; 2) A person who has difficulty with some features; 3) A person who has trouble with most features; 4) A person who is unable to use the product at all.

The degree of personal benefit will vary accordingly. Therefore, if a product, service or environment is well designed, with accessibility and usability in mind, all of the people in the categories above will benefit.

The age-distribution of the world's population is changing dramatically. People are living longer as a result of medical developments in the last century and healthier lifestyle changes

The number of people living with physical, sensory, mental health or intellectual impairments is increasing, as is the life expectancy of people with particularly severe or multiple impairments.

Universal design/ Inclusive Design improves access and outcomes for everyone in a variety of situations. The goals of it are:

1. **Equal Access** - In order for a design to be truly universal, it must be useful to people with all kinds of conditions and abilities. This includes people with disabilities or activity limitations.

2. Flexibility - It's important that the design is flexible enough to apply to all different kinds of people who have a huge variety of different abilities or disability. An example might be providing information in Braille underneath signs so that people who are blind can read them.

3. Simplicity - The design should be easy to understand so that people with varying levels of education and experience can use it.

4. Effective communication - The design must convey the needed information to the user, even if they have limitations in their sensory capabilities or ability to process this information.

5. High tolerance for error - If a user accidentally makes a mistake while using the design, it's important that they are not harmed or their situation is not made more difficult as a result.

6. Minimal effort required - A person should be able to apply the design easily, even if they have limits to their physical or mental capabilities.

7. Suitable space and size for use - No matter what size a person is or how mobile they are, they should have enough space and the ability to effectively use the design. It

is by considering each of these seven principles that we help our clients ensure that they attain universal design on all types of projects.

Other things that help the person to deal with:

Independent Living

Universal Design creates inclusive design solutions and promotes accessibility and usability, allowing people with all levels of ability to live independently. The ability of a person to remain as independent as possible can be influenced by how accessible and usable products, services and environments are. Factors that promote independent living, such as universal design, have a key role to play in dealing with this global phenomenon.

Ability as a Continuum

No two people are the same and no two people have exactly the same ability. The considerable variation that exists between people can be influenced by both external and internal factors. Ability can vary according to the type of activity in which a person is participating or the environment in which that person is carrying out the activity. Every person experiences reduced functioning at some stage during his or her lifetime. For example "noisy environments impair anyone's hearing;

A Universal Design approach therefore requires an appreciation of the varied abilities of every person and to design in such a way that the resulting product, service or environment can be used by everyone regardless of age, size, ability or disability.

Participation in Society

In this technological age, the skills required to participate in society are becoming increasingly complex. As each technological innovation is adopted the risks to people who do not adopt of being excluded from accessing a whole range of financial, state, social or cultural services or amenities increases. Technology is increasingly embedded into the built environment and products so that the lines of what is specifically product, ICT or building design have become blurred. In order the facilitate people with differing abilities, of differing ages and sizes within society, systems and building must be designed with the user at the center of the design process. A universally designed environment promotes equality and makes life easier and safer for everyone.

2.7.3 Limitations of Universal/ Inclusive Design

1) There is still pressure to prepare students for success on standardized tests.

2) Standardized tests are not differentiated.
3) Students and teachers are evaluated based on how well students are able to read random passages, make sense of them, and write their responses all within a given time limit. The content itself is often not engaging, the format is even less engaging, and the stakes are high, which create stress for all.

States and districts are having trouble in attempting to retrofit existing tests to be more inclusive. However, this difficulty will be eliminated or reduced if tests are developed from the beginning to be inclusive of all students.

Inclusive design is nothing new but designing to accommodate the widest possible range of users in using fundamental principle of ergonomics and has been an integral part of our user-centered philosophy from the start. It is also not just aimed at older or disabled users. People of all ages and abilities can benefit from a more inclusive approach to design, for example those at a temporary disadvantage, such as mothers with prams, people travelling with luggage, tourists and non-English speakers.

However, the two main drivers in universal/ inclusive design are undoubtedly the ageing population and the desire to better integrate into society those with disability. Inclusive/ universal design addresses accessibility to products, services and the built environment and the need to do this is enshrined in legislation.

The term Universal/ Inclusive Design emphasizes the special purpose of learning environments-they are not created to provide information or shelter but to support and foster the changes in knowledge and skills that we call learning. While providing accessible spaces and materials is often essential to learning, it is not sufficient. Success requires that the components of pedagogy- the techniques, methods, scaffolds, and processes that are embedded in classrooms and curricula-are also accessible, and that the measure of their success is learning. Its framework is based in the neuroscience of learning, and its principles emphasize three key aspects of pedagogy: the means of representing information, the means for the expression of knowledge, and the means of engagement in learning (Rose & Meyer, 2002).

2.8 Let Us Sum Up

Overall, adaptive technology aims to allow people with disabilities to "participate more fully in all aspects of life (home, school, and community)" and increases their opportunities for education, social interactions, and potential for meaningful employment. It creates greater independence and control for disabled individuals. For example, in one study of 1,342 infants, toddlers and preschoolers, all with some kind

of developmental, physical, sensory, or cognitive disability, the use of adaptive technology created improvements in child development. These included improvements in cognitive, social, communication, literacy, motor, adaptive, and increases in engagement in learning activities. It has been found to lighten caregiver load. Both family and professional caregivers benefit from adaptive technology. The time needed caring for a patient significantly decreases for a family member or friend with the use of adaptive technology. Studies show that care time for a professional caregiver's increases when adaptive technology is used, however their work load is significantly easier with adaptive technology taking over some of the jobs that a care giver would have to provide.

2.9 Check Your Progress

1. What do you mean by adaptive technology?
2. State the basic natures of adaptive technology.
3. Discuss the purpose of adaptive technology.
4. What are the basic consideration of Adaption Technologies?
5. Name some adaption technologies for Complete Access?
6. What do you mean by adaptive technology in the view point of users?
7. What are the components of user's perspective in developing adaptive technologies?
8. Point out the major notes on of IITs in the development of adaptive technologies?
9. What are the Primary notes of scientific communities for teaching learning of visually impaired students?
10. What do you mean by Universal Design?
11. What am the advantages of Inclusive design?
12. What are the significance of Universal/ Inclusive Design for visually impaired students?

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Unit 3 ❑ Access to Print for the Visually Impaired

Structure :

3.1 Introduction

It is not difficult for a sighted person to imagine how being blind or visually impaired could make using a computer difficult. Just close your eyes and you will instantly experience that even processing text is impossible or, impossible without additional software at least. Now a range of software is available that can help to make using a computer an easier, more enjoyable and more productive experience for blind or visually impaired users.

There is a lot of work and research being done to find ways to improve life of persons with low vision or blindness. Reading and recognition devices could make smartphones, tablets, and smart glasses into indispensable aids for the visually impaired. A variety of high-tech tools exists to help people who are blind or visually impaired get access to the printed information that others can read without assistance. If a child has low vision, he or she may use a video magnifier (also known as a closed-circuit television system) to help him see the print more easily. If he does not read print, there are devices that can convert print to electronic files that can be read with Braille or listened to. Some of these assistive technology tools are described here. Technology in the form of adaptive and assistive devices, plays a crucial role in the education of the visually impaired. This unit brings into sharp focus the need and importance of such technologies both for the practicing teachers and the visually impaired learners. While highlighting the significance of addressing the user's point of view, the unit also dwells upon on how best students with visual impairment get access to the printed text/ material. The unit also acquaints the student-teachers with various devices for making the teaching-learning process for important school subjects meaningful, exciting and rewarding for children with visual impairment.

3.2 Objectives:

After completing this unit learners will be able to:

- ***Describe*** screen readers and screen magnifiers with its features which are significant for children with visual impairment.
- ***Explain*** the importance of braille translation software and braille embossers for education of children with visual impairment.
- ***Illustrate*** how accessibility in local or indigenous language is important for technologies meant for children with visual impairment.

- Understand the role of open software resources for the persons with visual impairment.
- Acquire knowledge of the daisy books & recordings, online libraries technology and explain underlying features and characteristics.

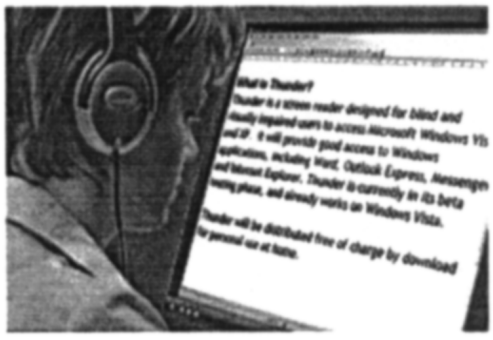
3.3 Screen Readers and Screen Magnifying Software

Screen magnifiers and screen readers are the two main or key computer accessibility tools for persons with visual impairment. If one has little to no usable vision he/she will be best served with screen reading software while using computers. It reads aloud all of the text and text-based elements displayed on a computer screen. If persons with visual impairment have some usable sight, they might find screen magnification software, which enlarges the information displayed on a computer screen, helpful on its own or used in concert with a screen reader.

Built-in versions of screen readers and screen magnifiers are included on operating systems of present day computers. In addition, there are both free and paid options available that could be installed or configured in the computer to work more efficiently.

3.3.1 Screen Readers

Screen readers are software programs that allow blind or visually impaired users to read the text that is displayed on the computer screen with a speech synthesizer or Braille display. A screen reader is the interface between the computer's operating system, its applications, and the user. Screen readers speak letters, words, numbers, punctuation, and elements aloud, sending the voice output to your computer speakers or connected headphones. Screen readers are the default computer access method for people who are unable to see the computer screen. Screen readers use one of a growing number of computer voices, also called text-to-speech engines, to speak text. The user sends commands by pressing different combinations of keys on the computer keyboard to instruct the speech synthesizer what to say and to speak automatically when changes occur on the computer screen. A command can instruct the synthesizer



to read or spell a word, read a line or full screen of text, find a string of text on the screen, announce the location of the computer's cursor or focused item, and so on. In addition, it allows users to perform more advanced functions, such as locating text displayed in a certain color, reading pre-designated parts of the screen on demand, reading highlighted text, and identifying the active choice in a menu. Users may also use the spell checker in a word processor or read the cells of a spreadsheet with a screen reader. The voices are usually customizable, giving you the ability to set volume, pitch, tone, and speed. One can start out with a slow voice, then, grow accustomed to the program, speed it up to the point where you may be able to read text faster than a computer user with sight.

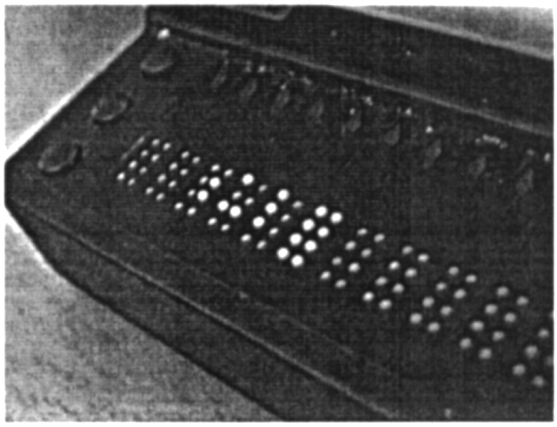
Screen reader must do a lot more than simply read the computer screen. As one enters data, clicks links, or issues other commands, the computer screen changes. If one had to wait for the software to read the full screen each and every time a single letter or graphic changed, you would never get much done. Screen reader uses a bit of artificial intelligence to determine what information you may wish to hear at any given time. Full-feature screen readers include dozens of screen reader keyboard shortcuts that will read highlighted text, characters, words, paragraphs, and any number of other text elements. Screen readers can announce each keystroke as anyone presses it, decode and describe icons, and even describe certain graphic images. Screen readers also include special mouse navigation keys that allow anyone to manipulate the mouse pointer, moving it wherever on the screen, and to press other keys to perform a mouse click or double click.

Screen readers are currently available for use with personal computers running either on Linux, Windows, mac and others. Each screen reader incorporates a different command structure, and most support a variety of speech synthesizers. Here are some points to be considered while purchasing or acquiring a screen reader:

- Is the screen reader compatible with your computer's operating system?
- Does it work with the applications you plan to use?
- Does it work with your Braille display?
- What keystrokes or gestures are used for the program's basic and advanced functions?
- Are the keystrokes easy to remember?

If anyone is learning to read and write Braille, most screen readers offer an additional useful option. Instead of having your screen read out loud, information could be obtained through a refreshable Braille display and using screen reader without audible speech.

A screen reader is an essential piece of software for a blind or visually impaired person. Simply put, a screen reader transmits whatever text is displayed on the computer screen into a form that a visually impaired user can process (usually tactile, auditory or a combination of both). While the most basic screen readers will not help blind users navigate a computer, those with additional features can give people with visual impairment much more independence. Whilst most screen readers work by having a synthetic voice that reads text aloud, others can also communicate data via a refreshable Braille display. Such screen readers make use of crystals that can expand when exposed to particular voltage levels, allowing visually impaired users to use their fingers to read the text that is displayed on screen. But while screen-reading software can be affordable, such hardware is usually very expensive. *JAWS, Zoom Text, Window-Eyes, NVDA, VoiceOver*, *System Access or System Access To Go*, and *Chrome Vox* are popular among screen readers.



- **JAWS (Job Access With Speech)**

JAWS is a computer screen reader program for Microsoft Windows that allows blind and visually impaired users to read the screen either with a text-to-speech output or by a refreshable Braille display. *JAWS* is produced by Freedom Scientific, St. Petersburg, Florida, USA. It is believed to be most popular screen reader used by persons with visual impairment. There are two versions of the program: the home use edition for non-commercial use and the professional edition for commercial environments.

- **SuperNova**

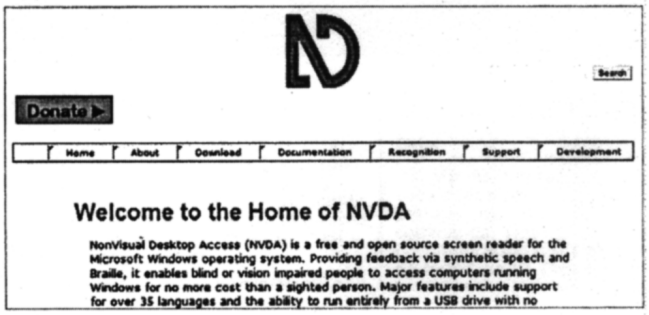
Supernova is the world's first screen magnifier and screen reader, delivering access

to Windows tablets, laptops and desktops for people with visual impairments. Available as a download, on CD or on a SuperNova USB, SuperNova is also a popular screan reader cum screen magnifier across the globe.

Many people with visual impairment could not afford the expensive screen reader like JAWS and other more sophisticated screen readers. The following is a list of free and open screen readers that one can download:

- **NVDA**

NVDA (Non Visual Desktop Access) has been designed by a blind software engineering graduate, James Teh, for use with Windows computers. This free and open source screen reader has a synthetic voice that reads whatever the cursor hovers over, and can be used directly from a USB stick, making it ideal for students.



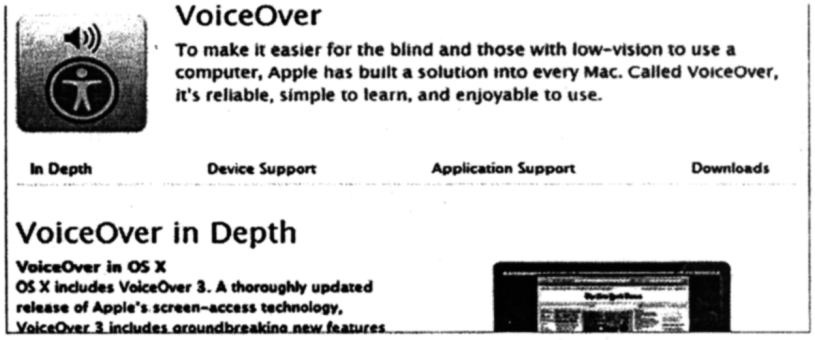
- **Serotek System Access**

This downloadable and complete screen reader can be used even outside your browser, thus making it one of the quickest ways of getting a screen reader up and running on your system. Serotek offers extended versions for a fee, although it is much cheaper than other screen readers.

- **Apple VoiceOver**

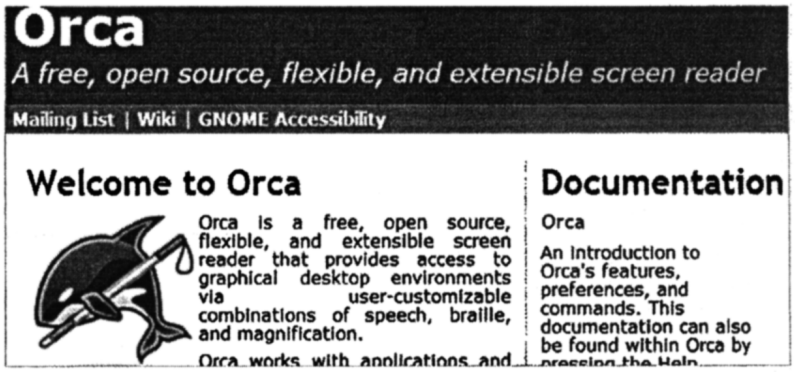
Apple VoiceOver includes options to magnify, keyboard control and verbal descriptions in English to describe what is happening on screen. It also reads aloud file content as well

as web pages, E-mail messages and word processing files whilst providing a relatively accurate narrative of the user's workspace. This covers a wide array of keyboard commands that enable user navigation of the Mac OS X interface.



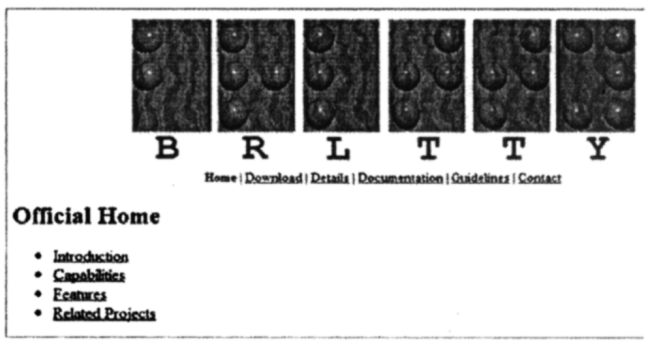
- **ORCA** (Linux)

ORCA is a Linux based screen reader which has also been evolving for the past number of years. Although it is not the sole Linux-based screen reader, ORCA is definitely the most popular. Recently it has been included with the Ubuntu installation CD, and with a couple of initial key presses it allows blind people to have audible interaction during the installation process.



- **BRLTTY** (Linux)

BRLTTY is a background process (daemon) which provides access to the Linux/Unix console (when in text mode) for a blind person using a refreshable braille display. It drives the braille display, and provides complete screen review functionality. Some speech capability has also been incorporated.

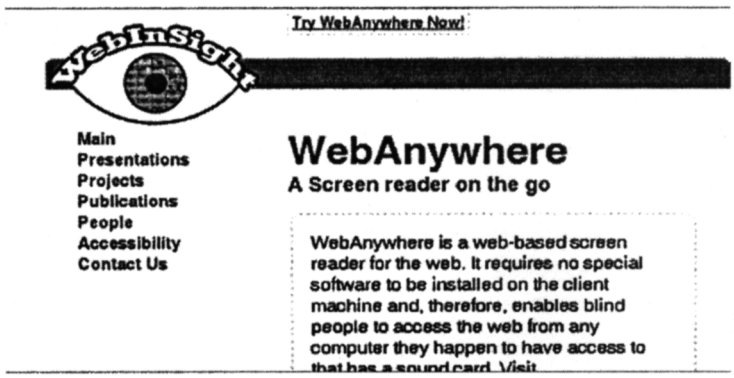


- **Emacspeak**

Emacspeak is a free speech interface and that allows visually impaired users to interact independently and efficiently with the computer. Its technology enables it to produce rich aural representation of electronic information. Emacspeak offers audible interface of the different aspects of the Internet such as browsing and messaging as well as local and remote information via a consistent and well-integrated user interface.

- **WebAnywhere** (All ass, Web browsers)

WebAnywhere is a web-based screen reader for the web. It requires no special software to be installed on the client machine and, therefore, enables blind people to access the web from any computer they happen to have access to that has a sound card.

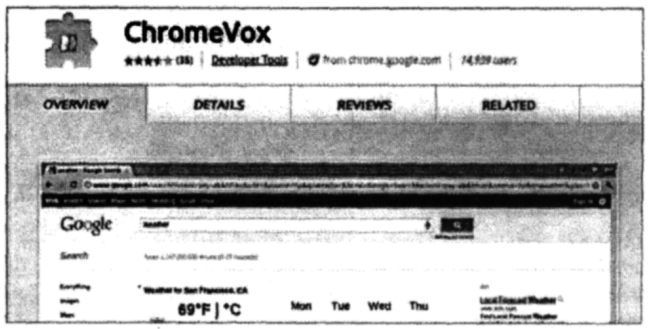


- **Spoken Web** (Internet Explorer)

Spoken-Web is a Web portal, managing a wide range of online data-intensive content like news updates, weather, travel and business articles for computer users who are blind or visually impaired. The site provides a simple, easy-to-use interface for navigating between the different sections and articles. Using the keyboard to navigate, a person who is blind or who has a visual impairment can hear the full range of an article content provided in a logical, clear, and understandable manner.

- **ChromeVox** (Google Chrome)

Google ChromeVox is a Google Chrome screen reader extension for visually impaired users.



- **ChromeVox** (Google Chrome)

Google Chrome Vis is a Google Chrome extension that magnifies any selected text on a webpage. The magnified text is displayed inside of a separate lens and preserves the original page layout. Users can change both the lens text colour and the lens background color.

3.3.2 Screen Readers with Special Reference to Indian Languages

SAFA (Screen Access for All) Reader is a screen reader for Indian languages. Advances in synthetic speech have lead to the development of screen reader software, which can capture text from the computer and transform it into the audio form, which is then used by the visually impaired persons or person with low vision. This technology has provided numerous opportunities to the visually impaired persons including the jobs as programmers, call centers, venturing in to new fields such as science & math, and others. SAF A can detect the text language on the fly and calls the relevant TTS for speaking it. So now one can have a multilingual document and read it with SAFA at one go without having to change or install TTS again & again. The latest version of SAFA is supporting following languages:

- Hindi.
- English.
- Sanskrit.
- Tamil.

- Marathi.
- Bengali.
- Nepali.
- Gujarati.
- Kannada.
- Telugu.

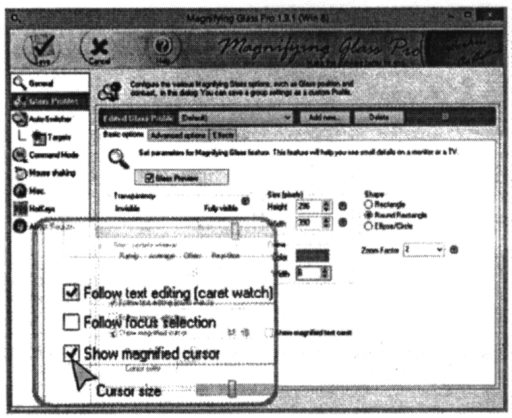
3.3.3 Magnifying Software

The most basic task of screen magnification software is to magnify the screen. Some screen magnifiers enlarge text, icons, and other graphics up to 20 times or more. If anyone typing an e-mail while using a screen magnifier, for example, the program will enlarge the words you type to make them easier to read. As one types characters, issues keyboard commands, or moves your mouse, a magnified screen view will keep up with what you are doing and where you are focused on the screen. Screen magnifiers can also enlarge and enhance mouse and text cursors to make them easier to see and track. Magnifiers can also sharpen edges, increase contrast, and change colour combinations to make things easier to see.

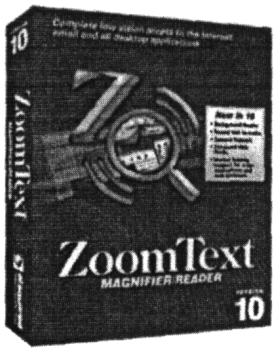
Since vision acuity differs from person to person, screen magnifiers give users many options to customize what to magnify and what to highlight or sharpen. User should spend considerable time at the beginning optimizing various settings as per his/her particular needs. Once settings are saved, they will be available until person changes it further.

- **Magnifying Glass Pro**

The Magnifying Glass Pro utility is a virtual magnifier (virtual lens, screen-zoomer) that enables user to enlarge (magnify) text and graphics as they are displayed on your computer monitor. As one passes your mouse cursor over a section of the viewing area, the display is magnified making it instantly more readable and accessible. In addition, you can apply a variety of visual effects and enhancements to display.



- **ZoomText**

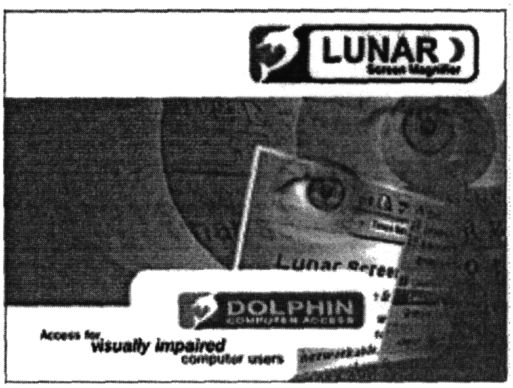


Text Express is screen magnifier designed for those who squint at the computer screen and lean in to read the fine print. It provides a gentle boost of magnification so that hard to read text is larger, clearer and easier to see. You can also apply a soft tint to white areas of the screen or reverse all colors to eliminate that familiar blinding glare.

- **Lightning**

Magnifies everything up to 36 times. One can choose what is magnified, including the cursor, and you can choose what colours are most comfortable. Lightning Plus adds more customization and enables you to choose the type of magnification from full screen, lens or strip magnifier. User can also choose from vertical or horizontal split screen, change brightness and specify the colours that suit you best.

- **Lunar**



Lunar can magnify 1.2 to 32 times and incorporates many features including full color image smoothing, separate adjustment of horizontal and vertical magnification and pre-set or custom colour schemes are included. A trial version is available to download from Dolphin Computer Access.

3.3.4 Open Source Software

The term open source refers to something people can modify and share because its design is publicly accessible. The term originated in the context of software development to designate a specific approach to creating computer programs. Today, however, open source designates a broader set of values. Open source projects, products, or initiatives embrace and celebrate principles of open exchange, collaborative participation, rapid prototyping, transparency, meritocracy, and community-oriented development.

Open source software is software with source code that anyone can inspect, modify, and enhance. Source code is the part of software that most computer users don't ever see; it's the code computer programmers can manipulate to change how a piece of software - a program or application - works. Programmers who have access to a computer program's source code can improve that program by adding features to it or fixing parts that don't always work correctly. People prefer open source software to proprietary software for a number of reasons and advantages including:

- **Control:** Many people prefer open source software because they have more control over that kind of software. They can examine the code to make sure it's not doing anything they don't want it to do, and they can change parts of it they don't like. Users who aren't programmers also benefit from open source software, because they can use this software for any purpose they wish-not merely the way someone else thinks they should.
- **Training:** Other people like open source software because it helps them become better programmers. Because open source code is publicly accessible, students can easily study it as they learn to make better software. Students can also share their work with others, inviting comment and critique, as they develop their skills. When people discover mistakes in programs' source code, they can share those mistakes with others to help them avoid making those same mistakes themselves.
- **Security:** Some people prefer open source software because they consider it more secure and stable than proprietary software. Because anyone can view and modify open source software, someone might spot and correct errors or omissions that a program's original authors might have missed. And because so many programmers can work on a piece of open source software without asking for permission from original authors, they can fix, update, and upgrade open source software more quickly than they can proprietary software.
- **Stability:** Many users prefer open source software to proprietary software for important, long-term projects. Because programmers publicly distribute the source code for open source software, users relying on that software for critical tasks can be sure their tools won't disappear or fall into disrepair if their original creators stop working on them. Additionally, open source software tends to both incorporate and operate according to open standards.

3.4 Braille Notetakers and Stand-alone Reading Machines

3.4.1 Braille Notetakers

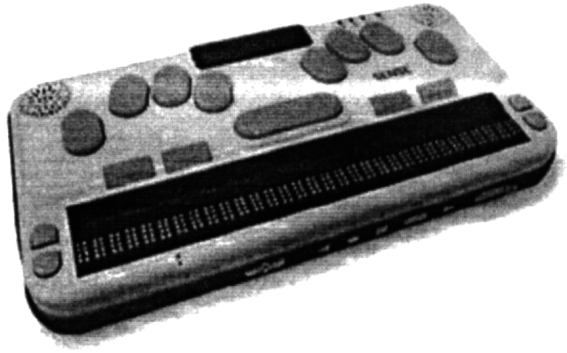
Braille Notetakers are personal digital assistants for individuals who are blind or visually impaired. Input is through a Perkins-style Braille keyboard or a standard QWERTY keyboard. Output is through an adjustable speech synthesizer and some models include refreshable Braille displays which can also provide refreshable Braille when connected to a computer running popular screen reading programs. There are various type of notetakers are available in the market:

- **The VoiceNote Apex**

  The VoiceNote Apex is a practical, portable and affordable productivity tool designed for users who are blind and are accustomed to using speech output. The VoiceNote Apex is simply perfect for keeping track of appointments, creating grocery or to-do lists, printing or embossing letters, notes or recipes, surfing the Web, listening to audio books, and exchanging information and documents with other computer users. The VoiceNote Apex can access email and the Internet with built-in Wi-Fi and Ethernet. It's easy to use and can store electronic books using one of the multiple storage options, including 8 GB of internal memory and support for high capacity SDHC cards or USB thumb drives.

- **Braille Sense**

  The line of Braille Sense notetakers provide the power and speed in a notetaker. Check email from a server anytime using IMAP, and access EML files easily. Students and teachers will appreciate our unique Calculator support featuring support for fractions and Nemeth code entry. Professionals will value the privacy and security of file encryption. The BrailleSense U2's are power-packed for the office environment. Users can create and read documents in any of five languages and use multiple bilingual dictionaries to ensure accuracy and style. Highlight



your most important points with advanced font and style options. Always have complete and up-to-date access to your email with IMAP access, and open EML files directly from the File manager. Secure your valuable information with file encryption.

- **The BrailleNote**

The BrailleNote Touch is the first certified Braille tablet providing Play; Store access. It is easy to learn for both students and teachers, combining the benefits of KeySoft and Braille literacy of a traditional note taker with the efficiency and power of a modern tablet. The BrailleNote Touch is for teachers who want an easy and interactive approach to help their students learn Braille, and for students who need the most efficient tool to accomplish their everyday tasks, from writing documents and sending emails, to downloading and reading books.

3.4.2 Stand-alone Reading Machines

Stand alone reading machine is a combination of scanner, optical character recognition, narrator and other applications. All the components configured into one standalone machine. It enables visually impaired persons to get access of printed materials and books. As they have been specifically designed, they tend to be very easy to use with little or no set up and are perfect for someone who has little knowledge of computers. These machines can be quicker overall at turning a document into speech in comparison to a computer as they need less time to start up. The first commercial reading machine for the blind was developed by Kurzweil Computer Products (later acquired by Xerox Corporation) in 1975.

- **Eye Pal Solo**

This is a simple reading machine on the market. It is made up of a solid base which is just larger than an A4 page and a camera held on an arm about 30cm above it. To read a document, simply place it under the camera and it will automatically begin reading using

synthetic speech. If one wants to change to a new document, simply remove and place the new document in its place. You can also pause playback by simply waving your hand under the camera then repeat to start again.

- **ScannaR**

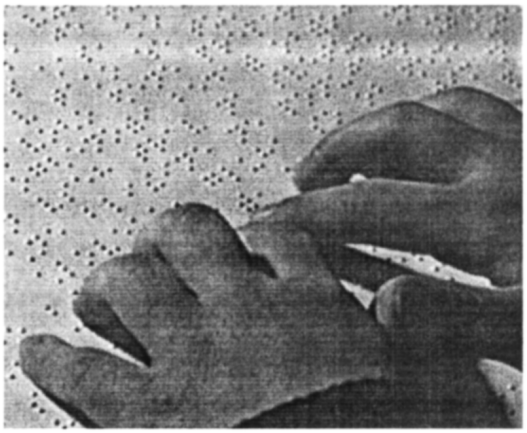
The ScannaR looks very similar to a flat bed scanner, being just a little thicker. This is less automated than the Eye Pal Solo but still only has a few buttons. It has a built-in hard drive to store scanned documents and a microphone to add your voice title to each so they can be found easily at a later date. It is also compatible with the BrailleNote and VoiceNote notetakers so you can, if you wish, read the document in Braille rather than listening to the synthetic speech.

- **CleaReader**

The CleaReader is very similar in form and features to the ScannaR. It has a number of buttons which are raised and each shaped differently to help make finding the correct one easier. It has a built-in hard drive to store scanned pages, but you can also save scanned pages to a USB memory stick so they can be uploaded on to a computer. You can also add a number of additional languages.

3.5 Braille Translation Software and Braille Embossers

There is no substitute for the ability to read. For blind people, Braille is an essential tool that aids in the process of becoming literate. Tape recorders and synthesized speech are useful tools, but they are inadequate substitutes for reading and writing. Braille literacy plays the same key role in a blind person's life that print literacy does in a sighted person's. It increases various opportunities to get information.



Research shows that Braille literacy directly correlates with academic achievement and employment. The correlation is clear that Braille is an extremely important tool for blind people to become literate, and it is a critical component that supports educational advancement and increases employment prospects. Here we are going to explore Braille translation software and Braille embossers.

3.5.1 Braille Translation Software

A Braille translator takes a document and converts it into a Braille file. The Braille file can then be sent to a Braille printer/embosser or read on a Braille display or a personal digital assistant. The first step in converting a computer file into a Braille document is to choose the type of Braille required computer Braille, a one-to-one representation of what appears on the computer screen; non-contracted (grade 1) Braille, which consists of letters, numbers, and punctuation marks; or contracted (grade 2) Braille, which includes contractions of common combinations of letters and words. To create a contracted Braille file, a Braille translation program takes the computer text file, inserts the propel contractions, and formats the document properly for the Braille page. Some Braille translation programs are also available free of cost and may be downloaded from the Internet. Some famous Braille translation software are as follows:

- **Duxbury**

  Duxbury Braille translation software is most popular Braille translatior software. It allows anyone who mayor may not be Braille literate to translate text to Braille. The program (sample provided below from Duxbury) displays the Braille translation prior for review and allows the user to select a line of Braille and see the text. After review you can save the Braille file, print on a normal page printer and/or emboss on a Braille printer. Output on a normal page printer does not result in raised dots but it does produce raised dot like images which are useful for sighted individuals to preview Braille output.

- **BrailleMaster**

  BrailleMaster is good, functional, proven Braille translation software. After over a

decade since its original introduction, BrailleMaster is still the only Braille translation software which allows you to customise your own Braille rules, using Robotron's proprietary Rule-based Braille Construction Language LOUIS. Unlike with conventional Braille transcription or translation packages, the Braille rules are not hard-coded in the program, but rather contained in a readable form in a rule definition file. This means that as Braille code changes or develops, the program does not need to change - rather, a small modification in the definition file is all that is necessary. The user can also create his/her own complete Braille code. In educational establishments, BrailleMaster is also an indispensable tool for studying Braille.

- **Toccata**

  Toccata translates printed music of any complexity, including single-line instrumental music, songs with lyrics, piano music, and orchestral scores, into Braille. It has its own built-in music notation editor and Braille editor. It can import music from MIDI files. Automatically translates the entered music into Braille, then displays it in a Braille editor that supports six-key entry.

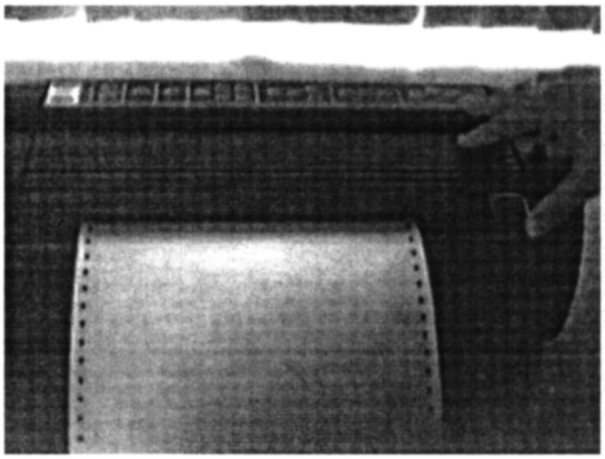
3.5.2 Braille Translation Software with Particular reference to Indian Languages

- Duxbury (DBT 11.2 SR4) contains support for the languages of India. Includes all major languages including Indian languages: such as Hindi Marathi, Gujarati, Punjabi, Haryanvi, Bengali, Bangia, Tamil, Telugu Kannada, Assamese, Oriya, Nepalese, Sinhala, Urdu, etc. It runs on 32-bit as well as 64-bit versions of Windows and supports all commercial Braille embossers. It can also import from many other word-processors and other kinds of files from various sources. This translator can also perform similar functions for Moon, a raised-line tactile system that can be used as an introduction to Braille or as an alternate reading method in some limited circumstances. It is also compatible with JAWS Screening Reading software for easy access by the visually challenged using the program for producing Braille.

3.5.3 Braille Embossers

A Braille Embosser is a hardware device for printing a hard copy of a text document in Braille. A Braille translation software program is required to translate the electronic text

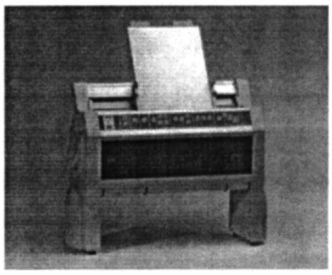
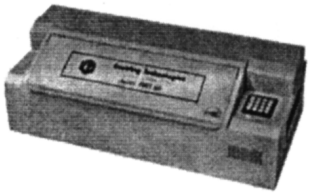
from the computer into Braille. Braille printers/embossers receive data from computer devices and emboss that information in Braille onto paper through the use of solenoids that control embossing pins. Braille printers typically print on heavyweight paper and use up more pages for the same amount of information than pages printed on a regular printer. They are usually slower and noisier. Interpoint printers are Braille printers that emboss Braille on both sides of a page. The price of a Braille printer is directly related to the volume of Braille it produces. Here are some possible questions to ask when purchasing Braille printers:



- How does the printer connect to your computer?
- What is its embossing speed (measured in characters per second [CPS])?
- Is the height of the Braille dots adjustable?
- Is the printer portable?
- How loud is it? Is a soundproof case needed?
- Does it print single-sided or double-sided?
- Do you need a printer that can produce both print and Braille?

So many Braille embossers are available in assistive technology market. Major embossers are as follows:

Embosser	Description
Braille BookMaker	Interpoint printer in a transportable case used for commercial purpose.
Braille Express	Portable interpoint braille printer.
Braillo 200	High-speed compact interpoint printer for large-volume production.

Braillo 400s	High-speed compact interpoint printer for large volume production. 
ET Braille Printer	Interpoint embosser that prints at a speed of 60 characters per second.
Gemini	Single-sided Braille embosser.
Index Basic D	Double-sided interpoint embosser that produces Braille at a speed of 100 characters per second.
Index Everest-D	Everest-D V4 is the best-selling single-sheet Braille embosser in the world. The Everest-D is a double-sided single sheet Braille embosser and prints both horizontally and in magazine format. Being an up-right standing printer, Everest-D has an enhanced flowing paper path and takes up less desk space. 
Juliet Pro	Interpoint Braille embosser that comes standard with a single side printing. 
Marathon Brailler Mountbatten Brailler	High-speed, single-sided embosser with a capacity of 200 characters per second. The Mountbatten Brailler is an electronic machine used to write Braille. The Mountbatten incorporates the traditional "Braille typewriter keyboard" of the Perkins Brailler with modern technology

3.6 On-Line Libraries and Bookshare

3.6.1 On-line Libraries

Libraries have long served crucial roles in learning. A library is fundamentally an organized set of resources, which include human services as well as the entire spectrum of media. Libraries have physical components such as space, equipment, and storage media; intellectual components such as collection policies that determine what materials will be included and organizational schemes that determine how the collection is accessed; and people who manage the physical and intellectual components and interact with users to solve information problems. Online and digital libraries are evolving to meet the needs of teaching and learning and identifies issues for continued development. We distinguish formal, informal, and professional learning and argue that digital libraries will allow teachers and students to use information resources and tools that have traditionally been physically and conceptually inaccessible.

Online or, digital libraries combine technology and information resources to allow remote access, breaking down the physical barriers between resources. Although these resources will remain specialized to meet the needs of specific communities of learners, digital libraries will allow teachers and students to take advantage of wider ranges of materials and communicate with people outside the formal learning environment. A library with online system which provides resources and databases to support distance learners to conduct research or to consult information is known as online library. It provides access to an amazing range of online resources to explore the subjects one can be passionate about. The online library may give users an access to quality-assured and trusted resources that are selected and assessed by subject specialists and academics. There may be an extensive range of journals and magazines, academic books, newspapers, images, dictionaries and encyclopedia which you can use to:

- Find information for your assignments or projects
- Explore further reading for your module
- Carry out in-depth research or explore specific subjects

3.6.2 Bookshare

Bookshare is claimed to be the world's largest accessible online library for people with print disabilities. More than 425,000 people in 70 countries have access to Bookshare's of 565,124 titles. More than 820 U.S. and international publishers contribute to Bookshare

by donating their digital files. In 2006, experts estimated that merely 5% of print materials worldwide were produced in formats accessible to those with print disabilities-people with visual impairments, physical disabilities and/or learning disabilities that prevent them from reading a printed book. Bookshare, in collaboration with education, technology, publishing, student, parent and volunteer communities, changed that reality by becoming the world's largest online library of accessible books. It all making possible for Bookshare to serve users around the world and ensuring that content is available to people with print disabilities at the same time as their peers.

Bookshare is an initiative of Benetech, a nonprofit California-based technology company that supports projects for social change and is currently funded through a grant from the U.S. Department of Education, Office of Special Education Programs. As a result, membership is free to qualifying students in public and private schools in the U.S. Eligible users of Bookshare fall into three categories and must be certified by competent authorities as having one of the following types of disabilities:

- visual impairments i.e., blind or have low vision making the individual unable to read standard print
- physical disabilities i.e., unable to read standard print and the physical disability "significantly interferes with reading," and
- learning disabilities.

Bookshare is also operational in India. Student members can search Bookshare's catalogue and download an unlimited number of e-books and use free reading tools such as Bookshare Web Reader.

3.7 Daisy Books, Recordings, and Smart Phones.

3.7.1 Daisy Books

Digital Accessible Information System, or DAISY, is a means of creating digital talking books for people who wish to hear and navigate written material presented in an audible format; many such listeners have print disabilities including visually impaired, dyslexia or other issues. Using DAISY, a talking book format is presented with enabled navigation within a sequential and hierarchical structure consisting of (marked-up) text synchronized with audio.

DAISY assists people who, for different reasons, have problems using regular printed media. DAISY books have the benefits of regular audio books, but they are superior because DAISY provides up to six embedded "navigation levels" for content (i.e. other objects such as images, graphics etc) and for displaying synchronized text to speech. DAISY Multimedia can be a talking book, computerized text or a synchronized presentation of text and audio.

As a result, DAISY books allow the visually Impaired listener to navigate an encyclopedia; this is almost impossible using conventional audio recordings because they lack search and navigation features and they require linear listening. While reading a DAISY book, a reader can go to the next or previous page, chapter or sentence. DAISY is for everyone who needs accessible information and for everyone who loves to read.

DAISY books can be heard on standalone DAISY players, computers using DAISY playback software, mobile phones, and MP3 players - with limited navigation. DAISY books can be distributed on a CDIDVD, memory card or through the Internet. A computerized text DAISY book can be read using refreshable Braille display or screen-reading software, printed as Braille book on paper, converted to a talking book using synthesised voice or a human narration, and also printed on paper as large print book. In addition, it can be read as large print text on computer screen.

There are also a wide range of hardware products available that can play DAISY content, usually in a portable form factor. Some of these devices are dedicated to playback of books, while others focus on other functionality, such as PDA or mobile Internet access, and offer DAISY playback as either a feature of the unit or as a software add-on.

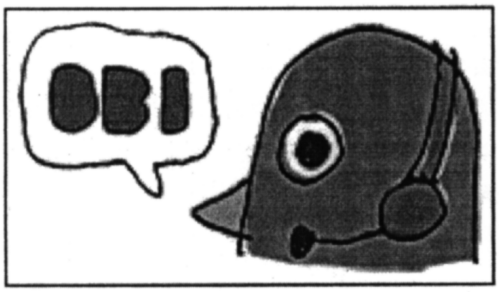
There are three types of DAISY books. One is audio-only DAISY, which is the most common. This format provides minimal text content and a set of recordings that the reader hears when the book is played. Audio only is commonly used for recreational reading employing live human narration. Text-only DAISY books have no audio recording but provide the text of the book itself. These books are read with either text-to-speech systems or Braille displays. Bookshare.org produces text-only DAISY books. Their chief advantage

is their very small file size as compared to books with audio files. The disadvantage is that these books require a text-to-speech system in the playback device, which means they cannot be played using the NLS player and that users must be willing and able to read tactilely or tolerate less than human-sounding speech. The Cadillac in DAISY books is found in the full-text, full-audio DAISY book. In this kind of book both the text and the audio are present and can be synchronized so the reader can listen to human narration and hear the text-to-speech voice at will to determine spelling, punctuation, and other information that may not be clearly conveyed through the narrated audio. These books work in players that do not support text-only books, and, while it is possible to have a human-narrated book, it is also possible to use quite human-sounding voices that are generally not found in products available to the individual blind user but that are used by producers of materials for the blind.

DAISY marks a significant advancement in the production of talking books for people who are blind or have a print disability. The standard and the new technology provide a better reading experience and have the potential to bring many more books to the ears and fingertips of the blind.

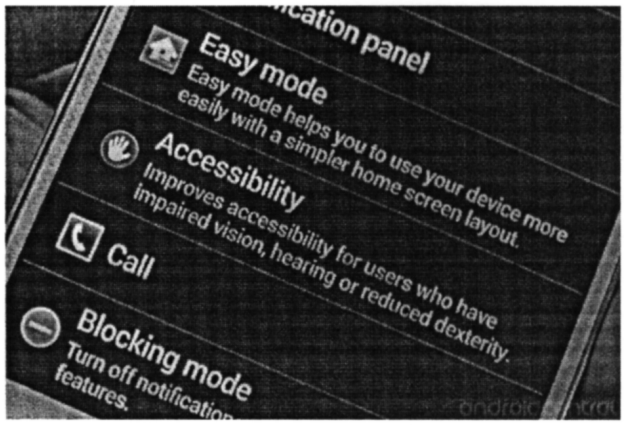
3.7.2 DAISY Recording

Obi is an open source audio book production tool that produces digital talking books (DTBs) conforming to DAISY & Accessible EPUB standards. Obi is easy to learn, highly accessible, and powerful navigable audio book production tool that enables anybody to produce accessible and rich DAISY/EPUB content with minimal amount of training. Obi is designed for diverse range of users, from the large scale production houses to the home users. It is one of the preferred tools of the new generation distributed production systems, which are built on vast network of volunteers who record at their homes & offices using the cutting edge technologies. Obi is distributed absolutely free to maximize the dissemination of benefits of the DAISY & accessible EPUB technology. It is released under the open source license which means that not only the tool comes for free, but its source code is available for anyone to run, modify and redistribute.



3.7.3 Smartphone

When a sighted person uses a touch-screen smartphone or tablet, he or she taps icons or slides a finger across the display in order to make things happen. But, the same may be very challenging with persons with visual impairment. But, built-in accessibility features for people with visual impairments in all the three major touchscreen platforms (operating systems) from Apple (ios), Google (android), and Microsoft (windows mobile), enable them to use smartphones with the help of screen magnifier or, screen reader.



Smartphone screen readers use human-sounding, synthesized voices to read and review the elements displayed on the smartphone touch-screen. Computer screen readers respond to keyboard commands. A smartphone touch-screen is composed of a pane of glass with a thin membrane layered on top. This membrane is smart, just like your phone. For a sighted person, touching a finger to an icon on a smartphone display causes a control to be activated. When you use a screen reader, that touch instead causes the device to speak the information located on the display directly beneath your fingertip. Touch the display in different places and you will hear the names of different icons, or snippets of descriptive text.

Person with low vision can use a screen magnifier on a mobile device. After reading the section below on screen readers, you may decide you also want to enable your device's built-in screen reader for even greater accessibility. There are many other gestures that enable users with visual impairments to use a touch- screen phone or tablet, but Apple, Google, and Microsoft use slightly different commands to accomplish the various screen reading functions.

3.8 Let us sum up

Screen magnifiers and screen readers are the two main or key computer accessibility tools for persons with visual impairment. If one has little to no usable vision he/she will be best served with screen reading software while using computers. It reads aloud all of the

text and text-based elements displayed on a computer screen. If persons with visual impairment have some usable sight, they might find screen magnification software, which enlarges the information displayed on a computer screen, helpful on its own or used in concert with a screen reader. Built-in versions of screen readers and screen magnifiers are included on operating systems of present day computers. In addition, there are both free and paid options available that could be installed or configured in the computer to work more efficiently. *JAWS, Zoom Text, Window-Eyes, NVDA, Voice Over, System Access or System Access To Go, and Chrome Vox* are popular among screen readers.

Open source software is software with source code that anyone can inspect, modify, and enhance. Source code is the part of software that most computer users don't ever see; it's the code computer programmers can manipulate to change how a piece of software - a program or application - works. Programmers who have access to a computer program's source code can improve that program by adding features to it or fixing parts that don't always work correctly. Braille Notetakers are personal digital assistants for individuals who are blind or visually impaired. Input is through a Perkins-style Braille keyboard or a standard QWERTY keyboard. Output is through an adjustable speech synthesizer and some models include refreshable Braille displays which can also provide refreshable Braille when connected to a computer running popular screen reading programs. Stand alone reading machine is a combination of scanner, optical character recognition, narrator and other applications. All the components configured into one standalone machine. It enables visually impaired persons to get access of printed materials and books.

Online or, digital libraries combine technology and information resources to allow remote access, breaking down the physical barriers between resources. Although these resources will remain specialized to meet the needs of specific communities of learners, digital libraries will allow teachers and students to take advantage of wider ranges of materials and communicate with people outside the formal learning environment. A library with online system which provides resources and databases to support distance learners to conduct research or to consult information is known as online library. It provides access to an amazing range of online resources to explore the subjects one can be passionate about. Bookshare is claimed to be the world's largest accessible online library for people with print disabilities. More than 425,000 people in 70 countries have access to Bookshare's collection of 565, 124 titles. More than 820 U.S. and international publishers contribute to Bookshare by donating their digital files. Digital Accessible Information System, or DAISY, is a means of creating digital talking books for people who wish to hear and navigate written material presented in an audible format; many such listeners have print

disabilities including visually impaired, dyslexia or other issues. Using DAISY, a talking book format is presented with enabled navigation within a sequential and hierarchical structure consisting of (marked-up) text synchronized with audio. Obi is an open source audio book production tool that produces digital talking books (DTBs) conforming to DAISY & Accessible EPUB standards. When a sighted person uses a touch-screen smartphone or tablet, he or she taps icons or slides a finger across the display in order to make things happen. But, the same may be very challenging with persons with visual impairment. But, built-in accessibility features for people with visual impairments in all the three major touchscreen platforms (operating systems) from Apple (ios), Google (android), and Microsoft (windows mobile), enable them to use smartphones with the help of screen magnifier or, screen reader.

3.9 Check your progress

1) Which one is not a screen reader:
   a. JAWS
   b. ZoomText
   c. NVDA
   d. Magic
2) anyone can _____ open source software:
   a. inspect
   b. modify
   c. enhance
   d. all of the above
3) SAF A stands for:
   a. Screen Access for All
   b. System Access for All
   c. Screen Allocation for All
   d. System Access for Autism
4) _____ translates printed music scores to Braille:
   a. Tycon

b. Toccata

c. Marathon

d. Averest

5) Duxbury is a :

a. Screen Reader

b. Screen Magnifier

c. Braille Translator

d. All of the above

6) A Braille Embosser is a

a. hardware device

b. software

c. courseware

d. None of the above

7) DAISY stands for:

a. Digital Acceptable Information Synchronization

b. Digital Accessible Information System

c. Data based Accessibility In System

d. Domestic Accessories Indexing System

8) Obi is:

a. Open source video production tool

b. Close source audio production tool

c. Open source audio book production tool

d. None of the above

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Unit 4 ❑ Assistive Technologies for the Visually Impaired with reference to School-Subjects and Low Vision

Structure

4.1 Introduction

Assistive technology refers to a range of tools, devices, and strategies that allow a student to accomplish a task that they would otherwise be unable to do, or would have difficulty accomplishing effectively. Assistive technology can be simple or complex. Examples of low tech tools for students with visual impairments might include enlarged text or raised line paper, while high tech tools may encompass digital tools that ¡§read¡¨ to the student, connect to a Braille display, or even incorporate GPS.

As we are aware that students with visual impairments face unique challenges in the educational environment. Not only must they be able to access text information across all curricular areas, but they also need to be able to participate fully in instruction that is often rich with visual content. Assistive technology is one way of supporting them in that process. This is to ensure that students with visual disabilities have the tools necessary to fully access and participate in the curriculum, with the greatest possible level of independence. Even more important, use of assistive technology helps prepare students for independent living, vocational pursuits, or higher education. A student¡¦s need for assistive technology will likely change and evolve throughout his or her education, and in most cases, no single tool will meet all of a student¡¦s needs for any learning concepts of a particular subject. This unit is to provide an introduction to the types of assistive technology that may benefit students with visual impairments. Subject specific assistive technologies are also being discussed in this unit.

Some low vision aids are more specific to the job or task at hand, including the features and equipment options provided by the devices to perform visual tasks. Individuals with specific low vision needs might prefer certain visually supportive features such as

stronger magnification, additional lighting options, and portability of device. Therefore, this unit also explores the assistive technologies for students with low vision.

4.2 Objectives:

When you will complete this unit, you will be able to:

- Sensitize about need of assistive technologies for children with visual impairment to complete various academic activities.
- Demonstrate general techniques of using assistive technologies designed for children with visual impairment.
- Explain importance and significance of various assistive technologies for children with visual impairment.
- Illustrate how assistive technologies could compensate the limitations imposed by the visual impairment to complete various subject specific tasks at school as well as at home.

- Understand different optical, non-optical and other electronic aids and appliances meant for students with low vision.

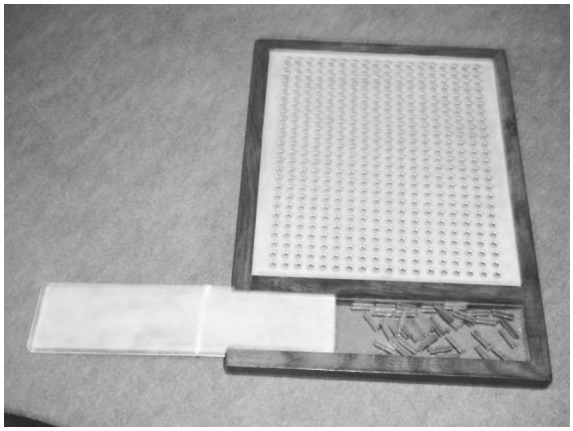
4.3. Assistive Technologies for Mathematics

Learning mathematics has been always being found crucial for learners with visual impairment. There are two essentials concerns related with learning mathematics. The first is a comprehensive system of notation, capable of expressing all mathematical relationships neatly and concisely. The second is apparatus (also including paper pencils), which enables the students to draw the picture (mathematical signs and notions) of the problem, and so to have something concrete before him. Students with visual impairment faces challenges in both above said concerns. First problem is being resolved through mathematical sign, symbols and notations in braille etc. Whereas second concern mainly resolved through assistive technologies. Here we are going to discuss various assistive technologies related with learning support to students with visual impairment while learning Mathematics.

4.3.1 Taylor Frame & Algebra and Arithmetic Types

The Taylor Frame or, Taylor Mathematical Slate is a device used to teach Mathematics to blind students. Developed by William Taylor in England in the mid 19th century. It

was in common use until the early 1970's. The main purpose of this device is to aid in the teaching and working of problems of long division, multiplication of large numbers, subtraction, and addition. The Taylor Frame or Taylor Mathematical Slate consisted of an aluminum frame and a set of metal pegs or type with the patterns.Set of types are used that are moulded from hard yellow vinyl plastic, or are made up with lead. The



frame has rows of opening each set out as an eight pointed star. The pegs could therefore be placed in the frame in one of eight orientations which could be used to represent numbers, letters or signs. Math can be composed in linear, vertical or in algebraic notation.

At one end of arithmetic type, there are are two dots placed along one side, at the other a solid raised bar along one side. By placing the type into the octagonal holes in the frame, the digits 0-9 and the mathematical signs of operation can be represented. The surface of this aluminum frame is divided into star shaped holes with eight angles, thus allowing the double-ended metal types to be placed in different positions according to a set system. With the help of these two types of type or, peg, there are total thirty two orientations (each peg has 16 orientation; 8 from each side) are available as follows:

The digits

Peg Orientation	Keyboard
◇	1
◧	2
◈	3
▭	4
◈	5
◨	6
◈	7
▭	8
◇	9
◘	0

Type one signs

Peg Orientation	Keyboard
◇	+
◘	-
◇	*
◘	/
◇	.
◘	=

Type two (algebra) signs

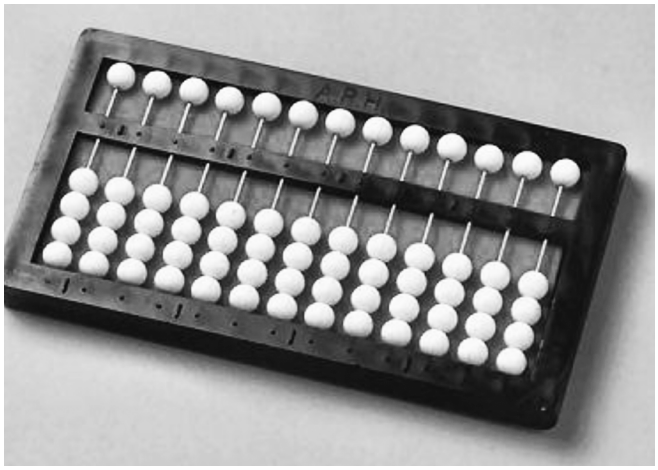
Peg Orientation	Keyboard
	Aa
	Bb
	Cc
	Dd
	Xx
	Yy
	Zz
	(
	)
	[
	]
	}
	}
	i
	r
	√

Algebra types are symbols made up of metal to represent algebraic variables like x, y, z, a, b, c, d and others like, brackets, square root and index. These are used in Taylor frames. Similarly, arithmetic types are symbols made up of metal to represent numbers like 1, 2, 3, 4, 5, 6, 7, 8, 9, 0 along with comparison signs like =, +, ¡Ò, decimal point etc.

4.3.2 Abacus

Abacus is a device used by visually impaired children for doing basic mathematical calculations. Abacus is rectangular in shape. Abacuses with varied columns are used in different countries. This instructional material is written specifically for the abacus generally with 13 columns. The common operations for this abacus are same with those of the abacuses with fewer columns, but the number of columns matters especially when fraction problems are solved.

A bar is separating the abacus horizontally cutting across all the columns, leaving 2/3 rd of the area below and 1/3 rd of the area above. The lower portion is known as lower abacus and the upper portion is known as upper abacus. Each column in the lower abacus has four beads, each bead assumes the value of one. Each column in the upper

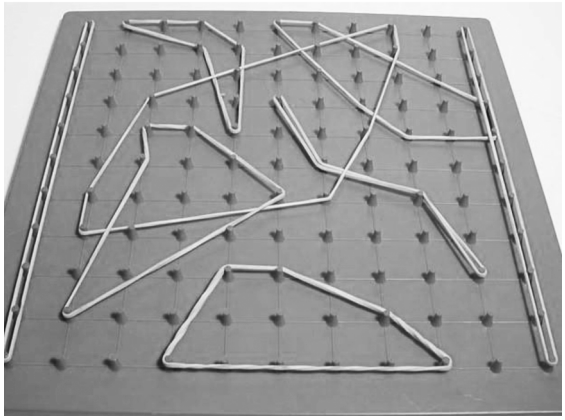


abacus has one bead and assumes the value of five.

It is a simple instrument for performing rapid arithmetical calculations. In the early 1960s, T.V. Cranmer, then director of the Division of services for the blind, Kentucky Department of Education, adapted an abacus that blind individuals could use. He added a foam backing to put tension on the beads and keeping them stable. He also increased the length of the rods to give more distance between beads and make them easily read by touch. Abacus generated enthusiasm among blind people and teachers of those with visual impairment. The Hadley School, USA also offeres a correspondence course in the use of the abacus for blind people throughout the world. The abacus is an efficient and accurate tool that enables persons with visual impairment to perform mathematical calculations. It affords more speed and ease of manipulation than Braille writers, Taylor slates, pegboards and other cumbersome tools. But, in abacus one cannot retain the intermediate steps of the sum.

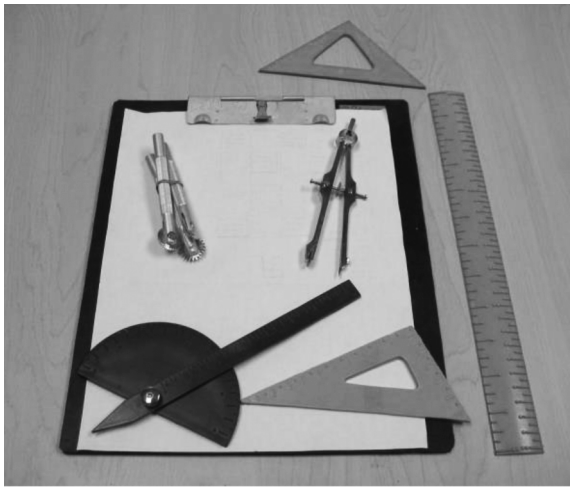
4.3.3 Geo Board

The geo-board is a multi-purpose board for children with visual impairment. This can be used for showing geometrical figures and graphs. It is a peg board, square or rectangular in shape with nails at equal distance, both lengthwise and width wise. The distance between the nails can be determined according to the levels of the students. The distance can be brought down when a child entered to higher classes in the school. It is suggested that it should be at least one inch in the case of primary school children. It is a amazing tool for the teachers of visually impaired children for teaching of mathematical concepts. Rubber bands are used to show various shapes; eg. Triangle, rectangles,



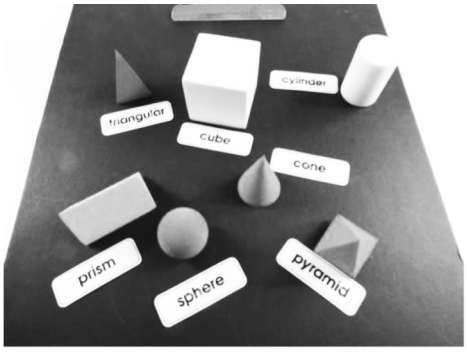
square, etc. If the distance between the nails is smaller, even circles can be shown.

4.3.3 Geometric Kit



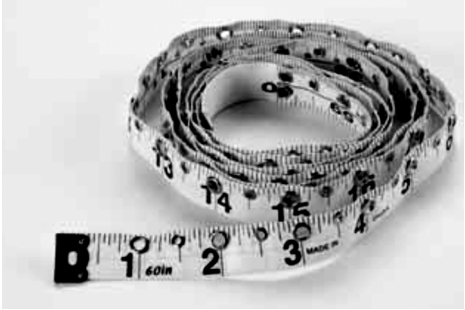
Geometry kit is available with many sellers which consist a draw board, different geometrical shapes, compass set to frame angles and shapes, spur wheels etc. Spur wheels are serrated wheel revolving in a plated metal handle. It is used for making continuous embossed lines on the reverse side of the paper.

Geometry mat may also be included in the kit which is a sheet of rubber for use as a base in conjunction with the spur wheel and Braille paper for making geometrical drawings. Compass set may include a foot ruler, a protractor and a set square in nylon. It enables visually impaired students to use the same techniques as his sighted counterpart. The foot ruler and set square have embossed markings for their convenience. The compass has a removable component fitted with a toothed wheel for drawing embossed dotted lines on the reverse of the Braille paper. Comprehensive or extended part of kit also includes different three dimensional shapes to get proper concept of shapes in space or three-dimension.



4.3.4 Measuring Tapes and Scales

Measuring tape is designed to indicate measurements by touch. An adapted measuring tape could be of any size. Generally it is available in sixty inches size (Five feet). It is a plastic coated fabric (as in other measuring tape) to reduce wear and tear. The measuring tape has different tactile marks for . inch, 1inch and 1 foot increments. This adapted measuring tape is known as tactile measuring tape. Similarly, Metal scales are also available for mathematical school



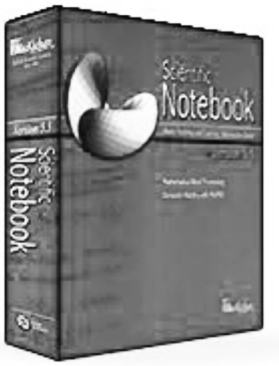
work; eg. Drawing a line of specific size etc.

4.3.5 Soft-wares for teaching Mathematics

There are several mathematics learning software packages are available for strengthening of mathematical concepts among students with visual impairment. Few are listed as below:

- **Scientific Notebook**

Scientific Notebook (SN) is a software package. When installed on a laptop, the student has a very portable device, which is more than just a graphing scientific calculator. It is also a math/text processor, so the student can do all assignments, calculations, and graphs in one document directly on the laptop. It has onscreen magnification up to 400%, or additional magnification software may be used. With the right techniques, it is also possible for a blind student to work with matrices using Scientific Notebook and a screen reader to solve systems of equations and find regression lines. Furthermore, math teachers can enter all their worksheets, tests, etc. on this software, and the teacher of the visually impaired can easily translate them into Nemeth code.



- **Graph-It PC**

Graph-It PC is designed for use with PCs and this is a product by Freedom Scientific. The student can type in an equation and produce a tactile graphic on most embossers. An audio representation of the graph can also be played through the speaker for a quick, sound-picture of the graph. The software is quite limited, however, and the tactile graphics and audio graph lack precision.

- **Accessible Graphing Calculator (AGC)**

The Accessible Graphing Calculator (AGC) from ViewPlus Software Inc. is a self-voicing graphing scientific calculator software program. Unlike a hand-held calculator, it displays results through speech and sounds, as well as visually presenting numbers and graphs. This program is intended to have capabilities comparable to a full-featured hand-held scientific and statistical graphing calculator. The onscreen graphics are easily seen by a low vision student via an enlargement feature, and the graph can be listened to by using the sophisticated audio wave feature.

4.4. Assistive Technologies for Science

Student with visual impairment typically need some accommodations in order to safely and fully access to the science curriculum. It is important to meet with the Teacher of Students with Visual Impairments to discuss the curriculum and objectives and content that will be covered during the school year. This is important for students following the standard course of study as well as those following a modified curriculum. The student¡¦s unique visual needs should be taken into consideration when determining how to make materials accessible. Science materials may include measuring devices, charts, reading materials, and equipment. Following are few important science related assistive technologies to facilitate the learning of science concepts among students with visual impairment:

4.4.1 Tactile Thermometers

The tactile demonstration thermometer allows students to independently read, set, and compare temperatures. Popular tactile thermometer by APH, USA has a two-textured, two-colored adjustable mercury column with an easy-grip tactile indicator. It usually includes both Fahrenheit and Celsius scales presented in both large print and braille. Tactile degree markings every 5 and 10 degrees. The mercury column slides up and down to demonstrate temperature reading.

Usually talking clinical thermometer makes temperature-taking fun and easy for kids and adults. It's also an indispensable tool for the blind or visually impaired individual. This model's two-button design makes it extremely easy to use. Simply press the left button to turn the unit on, wait for the confirming beeps, then press the right button to begin taking your temperature. In about thirty seconds, you'll hear four beeps, followed by your body temperature announced in a very clear voice. The temperature will then be repeated once more, and the unit will automatically shut off after eight minutes, if you forget to turn it off yourself, that is. The thermometer is intended for oral or underarm use, and announces and displays your temperature in either Fahrenheit or Celsius.

4.4.2 Colour probes

Colour probes or colour detectors can be used by person with visual impairment or

those with little colour perception to distinguish colours. This may assist them to identify the colours. With the help of this device the affected person may be able to identify the colour of clothing or furnishings, distinguish between items such as food or check the ripeness of fruit.

4.4.3 Scientific and Mathematics Talking Calculators

Talking calculator is a very useful device for various calculation by students with visual disabilities. A talking calculator is an inexpensive and invaluable device for students with disabilities struggling with math at school. A talking calculator can verify the accuracy of keys pressed and give feedback to the user while making calculations. Talking calculators look and function like common calculators. However, this assistive technology devices has a built in speech synthesizer so that each key pressed is spoken out loud. This can help the user to verify that the numbers and operands have been entered correctly. The calculator also speaks the answer to the math problem.

Talking calculators can be used at home, for everyday calculations such as balancing a checkbook, grocery shopping, or calculating a recipe. For these uses, a basic model may be all that is needed. Talking calculators are capable of advanced mathematical operations, making it possible for the blind or visually impaired to perform these operations without the use of pen and paper. Various models are available for learning basic adding and subtracting operations at school to enabling students to complete more advanced subjects such as trigonometry.

4.4.4 Light probes

Light probes or light detectors can be used by person with visual impairment or those with little light perception to get informed about how light or dark it is. The light probe is a handy device used for detecting of lights are on or off, from ceiling lights to small LED lights on appliances. It does this by emittring different tones. It can also be used to detect which side of the paper writing is on when scanning, faxing or photocopying.

4.4.5 Weighing scales

A talking scale announces weights and are available in a variety of sizes and styles. Kitchen scales may be the most valuable for science education, although bathroom scales and other types of scales are also available in talking formats.

4.4.6 Software and web resources for teaching Science

- **Access STEM:**

AccessSTEM is the ¡¥Alliance for Access to Science, Technology, Engineering, and Mathematics Disabilities, Opportunities, Internetworking & Technology (DO-IT)¡¦. The AccessSTEM website is a space where K-12 teachers, postsecondary educators, and employers learn to make classroom and employment opportunities in science, technology, engineering and mathematics (STEM) accessible to individuals with disabilities, and share promising practices.

- **Independence Science**

Independence Science provides talking and sensory products to increase accessibility in the science lab. This is a robust portal of technological and tactile solutions or experimentation and modeling.

- **National Science Teachers Association (NSTA)**

NSTA "is the largest organization in the world committed to promoting excellence and innovation in science teaching and learning for all." The site contains resources for parents and information on teaching students with visual disabilities.

- **Entrypoint!**

ENTRY POINT! is a program of the American Association for the Advancement of Science offering outstanding internship opportunities for students with apparent and non-apparent disabilities in science, engineering, mathematics and computer science. This association has developed unique partnerships with IBM, NASA, Merck, Google, Lockheed Martin, CVS, NAVAIR, Pfizer, Infosys, Shell, Procter & Gamble and university science laboratories to meet their human resources needs. Working with its partners, this association identifies and screens undergraduate and graduate students with disabilities who are pursuing degrees in science, engineering, mathematics, computer science, and some fields of business, and places them in paid summer internships.

4.4.7 Models

Three-dimensional models are beneficial to all students when learning about science. This is particularly true for students with visual impairments. Students with visual impairment should be provided with models that they could be touched, explored, examined and communicated real concept. For students with visual impairment, it is

better to start with either the real object or, when this is not possible, it should be facilitated by a three dimensional model or object. There are abundant resources related with tactile models and diagrams in science. Tactile Astronomy is a web resource from Amazing Space, is a downloadable tactile image library for microcapsule paper. The tactile graphics consists of vacuum-formed raised-line drawings that are intended to supplement the graphics in a students adapted textbook. It depicts objects, concepts, and relationships that are covered in nearly all elementary science textbooks. The drawings use several types of lines and textures, as well as different heights.

4.5. Assistive Technologies for Social Science

In inclusive setting, it is essential for classroom teachers and the special education teacher to collaborate and work together closely. Special education teacher to engage himself/herself in creating or developing accessible maps and materials. Materials need to be ready in a timely manner so they will be ready when classmates are presented with similar materials. The special education teacher may also need to provide models (eg. a model of a volcano, historical objects, etc.), depending on the topic. It is important that students first receive instruction in reading maps and other materials such as pie charts, bar graphs, and timelines.

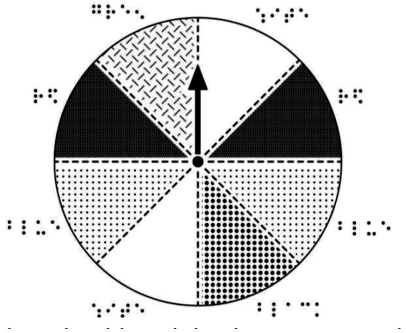
4.5.1 Tactile/Embossed Maps

The use of maps is an important skill for all children to learn. For students who have visual impairments, learning to read a map is an important step towards independence, as well as a way to participate more fully in the regular geography and social studies curriculum. Teaching could be stimulated by using tactile maps, from the most basic object books to more complex tactile graphics. It should be also remembered that apart from assistive technologies fieldtrips are also very helpful in teaching social science.

4.5.2 Charts & Diagrams

Tactile resources are essential component, while teaching students with visual impairment. Teacher should be competent enough in developing tactile chart and diagram to elaborate social science concepts. Learning to use tactile diagrams is a skill which should be overtly taught, with plenty of time for practice. Exploring a tactile

diagram systematically is the key to making sense of it. It is a very crucial task to cover whole concept in a single diagram. Teacher should encourage the students with visual impairment to explore a tactile chart (bar, pie, etc.). The student should read the data represented from each bar. Sticking to a routine method helps students to make sense of their tactile diagrams.



4.5.3 Models of Different Types

Models in two dimension and three dimension are important tool to facilitate concept formation among students with visual impairment. While producing diagrams and handouts, teacher should think about whether all the information is necessary. He/she may be able to simplify the diagram and cut out some of the text, making it easier for a visually impaired students to access. Make sure that the work is printed on the correct colour paper, some students may prefer things on a certain paper or in a certain type face. Making models or presenting the same increase a visually impaired students understanding and appreciation.

4.5.4 Auditory Maps

Human beings navigate through their environment by developing an orientation or, mental understanding of spatial relationships known as a spatial cognitive maps. Spatial cognitive maps for most people involves using visual information to development an understanding of the spatial relationship between the person and other objects. For mobility of persons with severe visual impairments, scope of taking visual clues and landmark is restricted. Other senses such as hearing, are used to collect information in order to build a spatial cognitive map. Therefore, an auditory maps could be a wonderful tool to get comprehension of geographical concepts among persons with visual impairment.

4.5.5 Talking compass

Talking compass is a hand held device mainly helpful for getting around and taking physical measurements by persons with visual impairment. It is a compact and easy-to-

use talking compass. User simply points in the required direction, press the button, and the unit will speak the compass point. It includes the four major compass points, as well as the four interim compass points. Compass also features clear, digitized speech and ceramic piezoelectric speaker.

4.5.6 GPS system

Survival and success depend on good orientation skills. This is an especially challenging fact for people who are blind, because they must use only auditory and tactile queues to determine their position in relation to other objects or places. For thousands of years, people used landmarks and line-of-sight to return home after a long day on the hunt, but these techniques became less effective the further they travelled. Eventually, explorers discovered consistent heavenly bodies that could aid with orientation. For example, early sailors kept a constellation to the left side of the ship to help with navigation. They could use this technique to reliably travel hundreds of miles.

With the introduction of the Global Positioning System (GPS), the power to quickly and accurately determine one¡¦s place on earth) is available to anyone. It does not require any training. When combined with an accessible interface, and customizable and current information about points of interest, the tools provide a compelling picture of the locality and its characteristics.

4.6. Low vision Devices:

Low-vision devices are designed to improve visual performance in children or individuals with low vision, thus enabling academic and social adaptation and providing enrichment of daily experiences. These devices could be categorized into following categories:

a. Optical

b. Non-optical

c. Projective

d. Mobile & Computer based

4.6.1 Optical Devices

Low vision optical devices are devices which basically support vision through lenses. We can say these devices are based on magnification done by magnifiers. Optical devices could be grouped into two categories: 1) supporting near vision tasks, eg. Handheld magnifiers, stand and hand-held magnifiers, strong magnifying reading glasses; 2) supporting distance vision tasks, eg. small telescopes. Because these devices can provide greatly increased magnification powers and prescription strengths, along with higher-quality optics, they are different from regular glasses and commercially available magnifiers. These devices are also available with light source to support further.

4.6.2 Non-Optical Devices

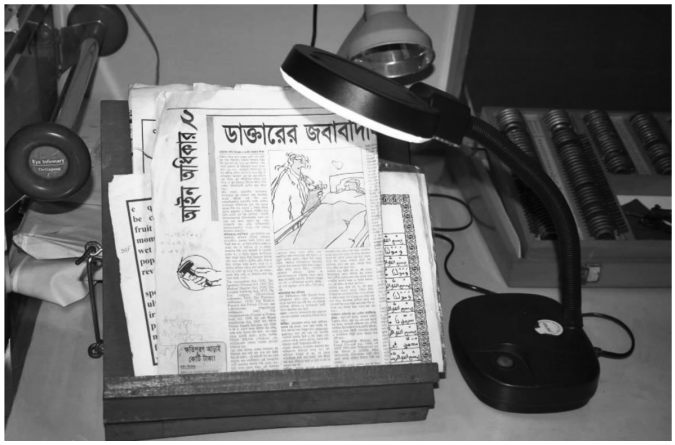
Non-optical devices are low vision aids that do not use magnifying lenses to improve visual function. They can improve the other visual aid's function or can even replace

optical aids. They enhance visual function by:

- Lighting control
- Enhanced contrast
- Reduction of glare
- Improving physical comfort

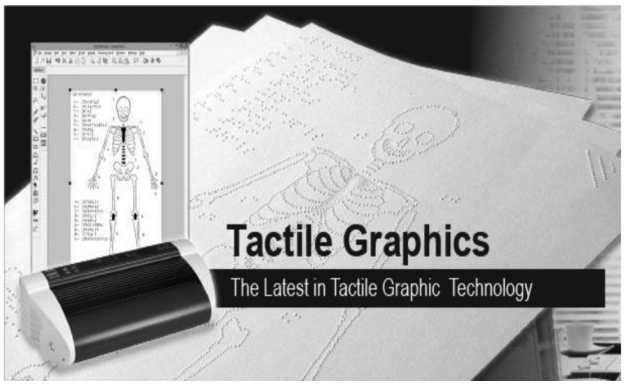
Low vision non-optical devices can include a number of adaptations, such as reading stands, supplemental lighting, absorptive sunglasses, typoscopes, and tactile locator dots. They are often recommended as part of a low vision examination, and can be used in combination with magnifiers and other low vision optical devices that can help with reading and a variety of tasks. Few non-optical low vision devices are listed below:

- Adjustable Reading Stand
- Typoscope
- Bold Pen
- Reading Lamp
- Absorptive Glasses
- Writing Guide



4.6.3 Projection Devices

Projection devices include Close Circuit Television (CCTV) and other projection based magnifier system. CCTV consists of a monitor and a camera that projects the enlarged image on the screen. Advantages are higher reading speed and greater working distance when compared to other aids. The larger working distance makes it easy to use for writing, drawing, or painting. It provides additional visual field, brightness, contrast, and polarity control, making it the choice for



diseases with low contrast and glare. It may allow magnification of 2 to 60 times with several features including black and white or color, and fixed-focus or autofocus, allowing objects to be seen at various distances.

4.7. Technology for developing Tactile Diagrams

Tactile graphics, including tactile pictures, tactile diagrams, tactile maps, and tactile graphs, are images that use raised surfaces so that a visually impaired person can feel them. They are used to convey non-textual information such as maps, paintings, graphs and diagrams.

Tactile graphics can be seen as a subset of accessible images. Images can be made accessible to the visually impaired in various ways, such as verbal description, sound, or haptic (tactual) feedback. One of the most common uses for tactile graphics is the production of tactile maps.

The types and forms of tactile maps began with the oldest and most rudimentary or a mixed media format. This tactile map is produced by simply attaching objects to a substrate to represent different items or symbols. More recent tactile maps are produced by computers through different means such as an ink-jet printers.

4.7.1 Thermoform and Swell Paper technology

- **Thermoform Technology**

Thermoform is one of the most common methods of producing tactile maps. This process is also known as vacuum forming. Thermoform maps or plans are created from a process where a sheet of plastic is heated and vacuumed on top of a model or master. The master can be made from many substances, although certain materials are more durable than others. Since this process involves creating a mould, it is somewhat time consuming.

- Swell paper Technology

Swell paper has a special coating of heat-reactive chemicals. Microcapsules of alcohol implanted in the paper fracture when exposed to heat and make the surface of the paper

inflate. Placing black ink on the paper prior to a heat process provides control over the raised surface areas. This type of map is not as robust as the Thermoform map, but can be produced with less effort and expense.

4.7.2 Software for developing tactile diagrams

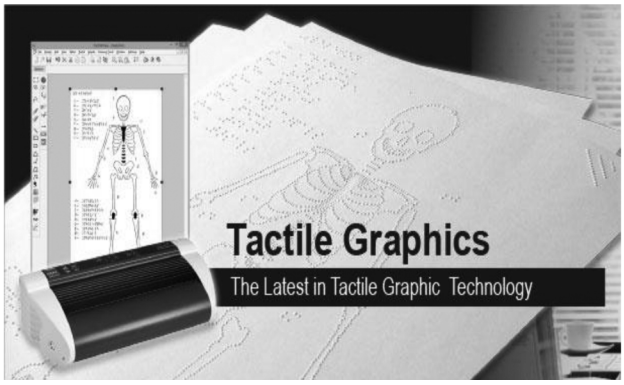
Drawings produced by computers can turn into raised lined (embossed) graphics for the visually impaired. The effective software applications for computer generated tactile graphics should contain scalable vector graphic components; e.g.- lines, shapes, freeform drawing tools, arrows, patterns, shapes fill, and line weight etc. Softwares that contain these components are the best tools to use when producing computer generated tactile graphics. Drawing that look like a picture are called bitmaps.

Third-party software containing mainly scalable vector graphic tools. Corel Draw, Adobe Illustrator, and Microsoft Office (Word and PowerPoint) are the examples of these kind of software. With the help of this application software one can produce tactile graphic illustrations for science, maths and geography. These drawing applications may not have scalable vector graphic drawing components, however, they can be used to produce tactile graphics if a swell (encapsulated) paper device is doing the embossing. Few dedicated tactile graphics production software are as follows:

- TactileView - Tactile Graphics

  The TactileView Software is a tactile graphics tool from house of Index embosser. TactileView's Design Software

- Import complex graphics
- Create tactile street maps
- Draw custom graphics
- Add audio tags to tactile diagrams
- Web catalog
- Image and text combination



- In addition compatible with learning environment it is able to create subject wise support; Math - Charts and graphs; Science - Diagrams for anatomy, geology, and other visual subjects; and Art & Mobility - tactile maps for mobility, raised art & drawings.

4.8 Let us sum up

Learning Mathematics has been always being found crucial for learners with visual impairment. The Taylor Frame or, Taylor Mathematical Slate is a device used to teach Mathematics to blind students, Developed by William Taylor. The main purpose of this device is to aid in the teaching and working of problems of long division, multiplication of large numbers, subtraction, and addition. Abacus is a device used by visually impaired children for doing basic Mathematical calculations. Abacus is rectangular in shape. Abacuses with varied columns are used in different countries. Measuring tape is designed to indicate measurements by touch. There are several Mathematics learning software packages available for strengthening of Mathematical concepts among students with visual impairment including Scientific Notebook, Graph-It PC, etc.

Science materials may include measuring devices, charts, reading materials, and equipment. Following are few important science related assistive technologies to facilitate the learning science concepts among students with visual impairment. The tactile demonstration thermometer allows students to independently read, set, and compare temperatures. It usually includes both Fahrenheit and Celsius scales presented in both large print and Braille. Talking calculator is a very useful device for various calculation by students with visual disabilities. A talking calculator is an inexpensive and invaluable device for students with disabilities struggling with maths at school. A talking calculator can verify the accuracy of keys pressed and give feedback to the user while making calculations. Talking calculators look and function like common calculators.

The special education teacher may also need to provide models (ex., a model of a volcano, historical objects, etc.), depending on the topics of social sciences. It is important that students first receive instruction in reading maps and other materials such as pie charts, bar graphs, and timelines. The use of maps is an important skill for all children to learn. For students who have visual impairments, learning to read a map is an important step towards independence, as well as a way to participate more fully in the regular geography and social studies curriculum. Auditory maps could be a wonderful tool to get comprehension of geographical concepts among persons with visual impairment. With the introduction of the Global Positioning System (GPS), the power to quickly and accurately determine one¡¦s place on earth) is available to anyone. It does not require any training.

There are several low vision assistive technologies available to support use of remaining vision. These assistive technologies could be grouped into optical aids (using lens or

magnifier for magnification); non-optical aids (using environment control to make better lightening condition) and projective aids (using magnification based on projective devices). Tactile graphics, including tactile pictures, tactile diagrams, tactile maps, and tactile graphs, are images that use raised surfaces so that a visually impaired person can feel them. They are used to convey non-textual information such as maps, paintings, graphs and diagrams.

4.9 Check your progress

1) The Taylor Frame or, Taylor Mathematical Slate is developed by:

   a. Robert Taylor

   b. William Taylor

   c. James Taylor

   d. Taylor Keith

2) The area of upper abacus and lower abacus is in proportion:

   a. 2/3 and 1/3

   b. 3/2 and 3/1

   c. 1/3 and 2/3

   d. 3/1 and 3/2

3) Spur wheels is

   a. serrated wheel revolving in a plated metal handle

   b. used for making continuous embossed lines

   c. create embossed line on the reverse side of the paper d. all of the above

4) Geo-board is meant for learning:

   a. Geometrical calculations

   b. Geography

   c. Geostationary satellite

   d. Geometrical shapes

5) A talking calculator:

   a. can verify the accuracy of keys pressed

b. give feedback to the user while making calculations

c. Both

d. None of the above

e. Can show Movies

f. Can play Games

6) Students with visual impairment should be provided with models that they could :

a. Touch

b. Explore

c. Examine

d. All of the above

7) In the geography and social studies classes, teaching should be stimulated by using

a. tactile maps

b. tactile graphics

c. tactile chart

d. all of the above

8) Audio or tactile map aims to

a. Spatial cognition

b. Self-actualization

c. Conditioning

d. As a Stimulus

9) Which one is not an optical aid for children with low vision:

a. Stand Magnifier

b. Telescope

c. Handheld Magnifier

d. Typoscope

10) Production process of thermoform is also known as :

a. Sterlization

b. Chromonisation

c. Random buffering

d. Vacuum forming

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UNIT - 5 ❑ Computer-Aided Learning

Structure

5.1 Introduction

Technology in the form of adaptive and assistive devices, plays a crucial role in the education of the visually impaired. This course brings into sharp focus the need and importance of such technologies both for the practicing teachers and the visually impaired learners. While highlighting the significance of addressing the users point of view/feedback and involving mainstream professionals in developing required technologies, the course also dwells upon on how best students with visual impairment get access to the printed text/material. The course also acquaints the student-teachers with various devices for making the teaching-learning process for important school subjects meaningful, exciting and rewarding for all concerned. The educational needs of children with low vision and related technological perspectives are addressed, too, along with critical contributions of computer-aided learning and interventions.

5.2 Objectives:

In this unit we will explore the need, importance and components of computer-based teaching-learning processes. When you will complete this unit, you will be able to:

- Sensitize about use of social media, teleconferencing and other tools in education of children with visual impairment.
- Demonstrate understanding of computer-based teaching- learning processes.
- Explain importance and components of social media, tele-conferencing and other tools of distance education for computer aided learning among students with visual impairment.
- Illustrate how e-classroom could be useful for the children with visual impairment.
- Understand the role of computer mediated learning among the children with visual impairment.

5.3 Computer Aided Learning: Concept & Need

It is widely accepted that the integration of modern Information and Communication Technologies (ICT) into the teaching learning process has great potential. In fact, it

could be the most important way by which schools and institution can meet students¡¦ educational aspirations within reasonable time and resources. The use of computers in schools is basically vision as a teaching and learning aid besides to develop computer literacy amongst the children. Computer aided learning will help us to make the present teaching learning process joyful, interesting and easy to understand through audio-visual aids. Teachers resourced with multimedia contents to explain topics better are being widely appreciated by students. Overall it helps to improve quality of education in long term.

Computer Aided Learning is an integrative technology, which describes an educational environment where a computer programme is used to assist the user in learning a particular subject. It refers to an overall integrated approach of instructional methods. Computer aided learning is a device as well as a learning strategy to make teaching more interesting, joyful and sustainable. Any use of computers to aid or support the education or training of people may be considered under computer aided learning. Computer aided learning can test attainment at any point, provide faster or slower routes through the material for people of different aptitudes, and can also maintain a progress record for the instructor.

5.4 Social Media

Social media are forms of electronic communication (such as websites for social networking and microblogging) through which users create online communities to share information, ideas, personal messages, and other content (such as text, pictures and videos). Social media has gained credibility over the years as a trusted source of information and platform where individuals or organizations can interact with other individuals. Social media infuses today's society with millions of us engrossed, some would argue to the point of unhealthy addiction, in the latest happenings via apps such as Facebook and Twitter.

The use of social media in education provides students with the ability to get more useful information, to connect with learning groups and other educational systems that make education convenient. Social network tools afford students and institutions with

multiple opportunities to improve learning methods. Students can benefit from online tutorials and resources that are shared through social networks. There is valuable knowledge to be gained through social media such as analytics and insights on various topics or issues for study purposes. Social media is also a medium where students can establish beneficial connections for their careers.

5.4.1 Advantage of using social media in Education

1) Connecting with experts:

The great thing about using social media is that you soon learn who the experts are in particular fields and subjects. When you start following these experts you learn more and gain useful content from them, this empowers you to produce great results. Social media has the ability to broaden your perspective on various subjects and gives illuminating, instant content that is new. You have the opportunity of engaging experts to get answers on topics that you may need help in. Many institutions communicate with students via YouTube and Facebook.

2) Connect with Students:

Learning colleges have the ability to connect with students through social media networks such as Facebook, Google Plus groups, and YouTube. These channels can be used to communicate campus news, make announcements and provide students with useful information. This builds engagement between the College and students which help tackle many student issues through the group interactions.

3) Institutions Resource Sharing:

Institutions can share supportive and positive posts that reach all students that are connected to the networks and pages. You can initiate hashtags on social media to engage students and online

discussions that are helpful. Video is a prominent tool in social media trends that are effective and you can use it to share useful videos that inspire students and help them in their course subjects. Through social mediums such as YouTube, Facebook or Instagram live video the engagements between students and the institution can be sustained. It is advisable to be selective about which social platforms to use for the best practice.

4) It helps in Research process:

Social media offers audience and subject monitoring tools that are useful and it is one of the best platforms to extract data. You can find out how the majority people feel about a particular topic or how experts perceive and advice on specific issues. This can help students compile and produce useful content for research. Whether students are working on an assignment,working on a project or trying to gain more insight on a subject, some of the best information and results can be extracted from social media.

5) Educational Tool:

Today's students arrive at school, fluent in Web and social networking technologies. Teachers can make use of this knowledge to enhance opportunities to learn. With social media, teachers can promote cooperation and discussion, create meaningful conversation, exchange ideas, and boost student interaction.

6) Enhance Student Engagement:

Social media is an effective way to increase student involvement and build better interaction skills. Learners who hardly ever raise a hand in class may feel more comfortable on Facebook, Twitter, or YouTube. Social media systems enable instructors to identify ''back channels'' that promote conversation and surface ideas that students are too shy or nervous to speak out in class.

7) Improve Communication among Students and Teachers:

Facebook and Twitter can improve interaction among learners and teachers. Teachers can respond to student's, questions via a Facebook page or Twitter feed, post homework assignments and lesson plans, send messages and updates, schedule or announce upcoming events, and share interesting Web sites and multimedia content. Students can

use Twitter to get help from teachers or other students. A great way for teachers to give participation points in addition to in class participation is by having students tweet about something that was discussed in class.

8) Preparing Students for Successful Employment:

Students entering the workforce can use social networking sites to network and find employment. With various social media, older students or alumnus can establish a professional connection with other students. Students could make web presence, post a resume, research a target company or school, and connect with other job seekers and employers. Career centres and alumni associations are using different social media (eg. Facebook & Twitter) to broadcast job openings and internships. Students could follow businesses or professional organizations on social media to stay updated on new opportunities and important developments in their field.

9) Social Media as a Tool to Develop Students s' Voices:

One of the major benefits of using social media with students is teaching them to communicate openly, honestly, and, above all, kindly with their peers. The perceived privacy or anonymity of being online is especially freeing for boys, who may otherwise feel it is uncool to engage in class discussions or to show their emotions. Therefore, it is imperative to use this teachable moment to promote empathetic communication.

10) Work More Effectively:

Social media allows you to change the paradigm from teacher as expert to group as expert. Rather than asking around between classes or sending and tracking emails to multiple people who may know answers, you can ask a global community via social media.

5.4.2 Disadvantage of using social media in Education

Any school and classroom need to have solid guidelines in place before you introduce technology. This keeps everyone safe and ensures your students only harness the power of social media for good. Some challenges are also associated with the use of social media, which can affect children with visual impairment and others significantly. Following are few major disadvantages of using social media in education:

a) Social Media can be a Distraction:

A common issue among teachers is that social media is distracting in the classroom. These teachers maintain that resources like Facebook and Twitter divert students' attention away from what's happening in class and can disrupt the learning process. With the possibility that the use of social media tools can be an invitation for students to play truant, teachers should make sure they won't be abused.

b) Cyberbullying:

While social networking sites provide a way for students and teachers to link up, they can be a tool for harmful behaviour- even at school. Teachers who use social media as part of their teaching should be wary of possible risks and plan to intervene on minor

incidents before they become more serious.

c) Discouraging Face-to-Face Communication:

Some educators are worried that while real-time digital stream may create a safe situation for students who are uncomfortable expressing themselves, learners are missing valuable lessons in real-life social skills. Students may find themselves at a disadvantage during university admission or job interviews when they need to command attention and deliver a coherent message. At public events and in personal relationships, they need to be able to effectively express themselves and connect with others.

Ultimately, while the debate continues over what role social media should play in the classroom, no one can argue the influence that social networking has on today's students. The new generation is tech-savvy generation and they conduct much of their life through social media including sharing of emotions and achievements. They are already using various social networking sites (viz. YouTube, Facebook, Twitter etc.) as tools for learning and collaboration. They expect that their education will follow suit. With this in mind, it seems practical and sensible for today's institutions to get on the social media and explore ways to successfully integrate these tools into the learning of students with visual disabilities.

5.4.3 Few Social Media Sites used in Education

We do have several social media platforms to connect and interact with educational purposes. Followings are few important social media platforms (other than popular Twitter and Facebook) through students and teachers could connect and interact with each other:

a) Twiducate:

The Twiducate platform is a free resource for educators. Objective of Twiducate is to create a medium for teachers and students to continue their learning outside the classroom. It is easily accessible and allows teachers to create a class community online using a class code rather than an email address. It also allows teachers to have total control over who is a member and what gets posted.

b) Blackboard:

This is a popular course management system as well as academic social media for

school community. It allows multi stage restricted permission to access, create and edit the content. The decision to use Blackboard is usually made at the top tier. Blackboard is an incredibly powerful, safe and comprehensive platform. It is not a free application. Rather, it is a very expensive platform. Again, it also lacks flexibility at higher extent.

c) Wikispaces Classroom:

Wikispaces Classroom is a free social writing platform for education. It is easy to create a classroom workspace where a teacher and students can communicate and work on writing projects alone or in teams. Various assessment tools allow teachers to measure student contribution and engagement in real-time. Wikispaces Classroom works great on modern browsers, tablets, and phones. Wikispaces Classroom is free for teachers and students. Over ten million registered teachers and students are available on the platform. Teacher can assign, collaborate on, discuss and assess projects all within the site. It can even handle multimedia.

d) Edmodo:

Edmodo is an excellent and free classroom management system. It includes news feeds, assessment tools, communication capabilities and security features. It connects teachers students and others for educational purposes.

e) Skype:

It is the one site that can bring the outside world right into your classroom. You can host authors, visit science labs or talk to resource persons from across the globe. It allows two way tele-conferencing among resource persons and students.

f) Academia.edu:

Academia.edu is a social networking website for academics. The platform can be used

to share papers, monitor their impact, and follow the research in a particular field. It was launched in September 2008. The platform website allows its users to create a profile, upload their research or academic works, select areas of interests and then the user can browse the networks of people with similar interests. As of January 2017, there were 47 million users from around the world.

g) Researchgate:

ResearchGate is a social networking site for scientists and researchers to share research papers, ask and answer questions, and find collaborators. It is believed to be the largest academic social network in terms of active users. People that wish to use the site need to have an email address at a recognized institution or to be manually confirmed as a published researcher in order to sign up for an account. Members of the site each have a user profile and can upload research output including papers, data, chapters, negative results, patents, research proposals, methods, presentations, and software source code. Users may also follow the activities of other users and engage in discussions with them. Users are also able to block interactions with other users.

5.5. Creation of Blogs

A blog or, weblog is a discussion or informational website published on the World Wide Web consisting of discrete, often informal diary-style text entries. These text entries or multimedia entries are known as posts. Posts are typically displayed in reverse chronological order, so that the most recent post appears first, at the top of the web page.

5.5.1 Blog: Concept & Classification

The emergence and growth of blogs in the late 1990s coincided with the advent of web publishing tools that facilitated the posting of content by non-technical users who did not have much experience with HTML or computer programming.

Previously, a knowledge of such technologies as HTML and File Transfer Protocol had been required to publish content on the Web. Having a blog and making posts on blog

could be termed as blogging. Blogging can be seen as a form of social networking service. Indeed, bloggers do not only produce content to post on their blogs, but also often build social relations with their readers and other bloggers. Many blogs provide commentary on a particular subject or topic, ranging from politics to sports or education. A typical blog combines text, digital images, and links to other blogs, web pages, and other media related to its topic. The ability of readers to leave publicly viewable comments, and interact with other commenters, is an important contribution to the popularity of many blogs. However, blog owners or authors often moderate and filter online comments to remove hate speech or other offensive content. In education, blogs can be used as instructional resources. These blogs are referred to as edublogs. There are different types of blogs, differing not only in the type of content, but also in the way that content is delivered or written:

- **Personal blogs:**

  The personal blog is an ongoing online diary or commentary written by an individual, rather than a corporation or organization. While the vast majority of personal blogs attract very few readers, other than the blogger's immediate family and friends, a small number of personal blogs have become popular, to the point that they have attracted lucrative advertising sponsorship. A tiny number of personal bloggers have become famous, both in the online community and in the real world.

- **Collaborative blogs**

  A type of weblog in which posts are written and published by more than one author. The majority of high-profile collaborative blogs are based around a single uniting theme, such as politics, technology or advocacy. In recent years, the blogosphere has seen the emergence and growing popularity of more collaborative efforts, often set up by already established bloggers wishing to pool time and resources, both to reduce the pressure of maintaining a popular website and to attract a larger readership.

- **Microblogging**

  Microblogging is the practice of posting small pieces of digital content¡Xwhich could be text, pictures, links, short videos, or other media on the Internet. Microblogging offers a portable communication mode that feels organic and spontaneous to many users. Examples of these include Twitter, Facebook, Tumblr etc.

- **Corporate or organizational blogs**

  Blog is generally personal or private in most cases. But, it can be for business or not-for-profit organization or government purposes. Corporate or organizational Blogs used internally, and only available to employees via an Intranet are called corporate blogs. Companies use internal corporate blogs to enhance the communication, culture and employee engagement in a corporation.

5.5.2 Blogging Platforms

There are several blogging platforms. Followings are some important blogging platforms (other than Facebook and Twitter) where user can create their blog and post text, picture, videos etc. accordingly for educational purpose:

1) Word Press:

Word Press is a Downloadable blogging (and website management) software, as well as of of the most popular blogging platform. Currently 25 percent of the entire web blogs are powered by Word Press. The software you get from WordPress.org is a downloadable package, which you then have to upload/install on a web server you already manage. WordPress is very easy to use and need not any specific training for using it. Only having basic computer skills are enough for use blog managed by WordPress. Once, blog is being created, using this blogging platform on a daily basis to publish your posts is very straightforward and easier. There are more than enough free themes in the official directory at WordPress.org.

2) Google Blogger

Blogger is one of the oldest blogging platforms and owned by Google. The separate login account is not needed for creating a blog on blogger. One need to sign

up with his/her standard Google account, similarly to WordPress.com. Blogger takes care of all the technical heavy lifting, allowing you to just focus on creating content. Blogger platform is free but, personalized web domain and hoisting may lead to additional payment. When one creates blog on blogger, individual gets a subdomain like example.blogspot.com. You can change your custom domain too. Basic computer skills are enough to start blogging under Blogger.

3) Tumblr

A trendy micro blogging hosted platform with a social network aspect. Tumblr is a great blogging platform optimized specifically for bloggers who want to publish short-form content, such as micro-blogs, quotes, images, videos, and animated pictures. Tumblr is also a community of users, ready to promote and comment on each other's work. Tumblr hosts your blog for no additional cost. No specific skills are required to start and run a Tumblr blog. The interface is user-friendly Tumblr blogs are easy to set up and easy to run afterwards.

4) Medium

A publishing platform for your blog posts, stories and articles. Medium has grown in popularity a lot during the last couple of years (more than a million people have joined Medium). In short, it¡¦s a community of writers and bloggers, all using the same looking site design to share their opinions and stories on various topics.

- **Wix:**

Wix is very easy to use when it comes to launching a new website. However, you do need to go through a couple of additional steps to add the blog module. Nothing too difficult but still. Overall, Wix provides a step-by-step wizard to get through the whole process. More than 500 designs available. There's a number of essential site management features built-in.

5.5.3 Creation of Blog

Each platform does have certain specification and a certain path to create a blog on that. It is very difficult to discuss creation of blog on each and every blogging platforms. We are taking Google Blogger as an example to create a blog and use the same. Following are the steps to create a bog with help of Google Blogger:

To set up a blog of your own

- Go to https://www.blogger.com/start and Click the orange ''Create a Blog'' button.
- Fill out the registration information, click that you accept the terms of service, then click ''continue.''
- Fill in the information on the next screen, officially opening a Google account, then click ''continue.''
- Give your blog a name (remember–it should suit your chosen character!) and choose a unique URL address. Check the availability on the URL you have chosen, and once you find an available one, click ''continue.''
- Now comes the fun part: scroll through the available templates and select one you think would appeal to your character. Click ''continue.''
- Congratulations! You should see the ''Your blog has been created'' screen. Click ''start blogging now.''

To make a post

- The most recent posts will always appear at the top of your blog.
- Sign in to your blog at https://www.blogger.com/start2 with the e-mail and password you gave during set-up.
- Now you will see your dashboard page, with many options for what to do. Click the blue bubble that reads ''New Post.''
- Type in a title for your post- this will show up above the text in your blog - then enter whatever text you wish in the box. You may also add images, videos, or links (see below). The menu across the top will allow you to alter the font, size, and color of your text, should you wish to do so. Keep your graphic design interesting, but remember that the text of your posts is more important than changing each letter into a rainbow of color. Try to make design decisions you believe your character would make.
- Click ''Publish Post.'' You will now be able to choose to ''View Blog,'' ''Edit Post,¡¨ or ''Create a New Post.'' Select an option.

To add an image to a post

- Save an image to your desktop. If it is not an image you took, be sure to write down the source information and include that in a Sources Cited section on your blog. continued Blog Creation Steps (continued)
- On the ‘‘New Post’’ page run your mouse across the menu of option icons just above the text box. Click on the little blue box with the mountain in it that reads ‘‘Add Image’’ when your mouse crosses it.
- In the new box, click ‘‘Browse’’ and then choose the picture file from your desktop. Choose to place image in the left, center, or right of the screen. Choose to make image small, medium, or large. You may format and add up to five images at a time.
- Click ‘‘I accept the terms of service’’ and then ‘‘Upload Image.’’ Your images should soon appear in your post.

To add a video to a post

- Save a video file to your desktop. If it is not a video you took, be sure to write down the source information and include that in a Sources Cited section on your blog.
- On the ‘‘New Post’’ page run your mouse across the menu of option icons just above the text box. Click on the little film strip that reads ‘‘Add Video’’ when your mouse crosses it. Choose the file from your desktop, give the video a title, accept the terms of service, and then click ‘‘Upload Video.’’

To add a link to a post

- Copy the desired URL from your web browser.
- Copy the link into your post, and then highlight it again with the mouse.
- Run your mouse across the menu of option icons just above the text box. Click on the one with a green circle that reads ‘‘Add Link’’ when your mouse crosses it. Paste or retype your link into the box and click OK.
- Your text should change color and become a link.

To edit or delete a post

- From your main blog page (you can always access this page by choosing ‘‘View Blog’’), choose ‘‘New Post.’’ On the new post page, just above the main box, choose the link ‘‘Edit Posts.’’

- This will take you to a page showing all past posts. You may click the box for any post and then choose ‘‘Edit’’ on the far left. This will take you back into the page as if you are still continued. Blog Creation Steps (continued) working on the post for the first time. You can make any changes you wish and then click ‘‘Publish Post.’’ The new post will replace the old one.
- If you prefer to erase the post altogether, simply click ‘‘Delete’’ on the far right of the ‘‘Edit’’ page for the chosen post.

To add a group of links, text, survey, or image to the sidebar

- From your main blog page (you can always access this page by choosing ‘‘View Blog¡¨), choose ‘‘Customize’’ in the upper right corner.
- From the ‘‘Customize’’ page, you can add any number of page elements. On the upper right, choose ‘‘Add a Gadget.’’
- Scroll through your gadget options, selecting the one you wish from: ‘‘Poll,’’ ‘‘Link List,’’ ‘‘Picture,’’ or ‘‘Text.’’ You can also try adding other gadgets’ Xexperiment!
- Follow the instructions for the gadget you choose and then click ‘‘Save’’ to put the gadget into your sidebar. This will return you to the layout page.
- Back on the layout page, you can click ‘‘Preview’’ to see what your new gadget looks like, or you can click ‘‘Save’’ to make it part of your blog.
- You can always delete gadgets from the layout page, simply by clicking ‘‘Edit’’ in the gadget’s box, and then choosing ‘‘Remove.’’
- You may also rearrange your page elements in this page by clicking and dragging any element to a new location.

To add a footer image or quotation

- From your main blog page (you can always access this page by choosing ‘‘View Blog’’), choose ‘‘Customize’’ in the upper right corner.
- From the ‘‘Customize’’ page, you can add any number of page elements. On the bottom of the page choose ‘‘Add a Gadget.¡¨ You may now add a picture or text across the bottom just like you did in the sidebar in the previous menu.

5.6. Tele-Conferencing

From the points of view of the teaching functions, interactivity and user friendliness, tele-conferencing emerges as an appropriate technology for reaching varied clientele groups in diverse settings. Teleconferencing means meeting through a telecommunications medium. It is a generic term for linking people between two or more locations by electronics. This technology is famous in open and distance learning modalities. With the advancement of communication technologies and reduction of costs, various organizations are also opting this technology in their education and training programmes.

5.6.1 Teleconferencing: Concept and Scope

The word *'tele'* means distance. The word 'conference' means consultations, discussions. Through teleconferencing two or more locations situated at a distance are connected so that they can hear or both see and hear each other. It allows the distant sites to interact with each other and with the teaching end through phone, fax, and e-mail. The interactions occur in real time. This means that the learners/participants and the resource persons are present at the same time in different locations and are able to communicate with each other. There are three following essential features of teleconferencing:

- Learners/participants present at particular time and in dispersed places
- Resource persons present at the same time at the teaching end or different teaching ends.
- Interactions between:
- Learner–resource persons/AV materials at the teaching end(s).
- Learner–learner at the learner center
- Learner–facilitator/materials/activities at the learner center
- Learner–learner at/between other learner centers

- Resource person–resource person.

Tele-conferencing (especially video-conferencing) increases efficiency and results in a more profitable use of limited resources. It is a very personal medium for human issues where face-to-face communications are necessary. When you can see and hear the person you are talking to on a television monitor, they respond as though you were in the same room together. Videoconferencing maximizes efficiency because it provides a way to meet with several groups in different locations, at the same time. The communication in teleconferencing is both vertical and horizontal, and the emphasis is on interaction at all levels. Meaningful interaction in real time is the strength of teleconferencing, and this sets it apart from other technologies used in education. The one-way limitation of educational broadcasting is overcome through the technology configuration. Stimulating responses to visuals, situations, dialogue, discussion, sharing, active experimentation, project work, etc. encourage interactivity. Some of other features of tele-conferencing are as follows:

- Move Information, Not People or physical things.
- Electronic delivery is more efficient than physically moving people to a site, whether it is a faculty member or administrator.
- Save Time: Content presented by one or many sources is received in many places simultaneously and instantly. Travel is reduced resulting in more productive time.
- Lower Costs: Costs (travel, meals, lodging) are reduced by keeping employees in the office, speeding up product development cycles, improving performance through frequent meetings with timely information.
- Accessible: Through any origination site in the world.
- Larger Audiences: More people can attend. The larger the audience, the lower cost per person.
- Adaptable: Useful for business, associations, hospitals, and institutions to discuss, inform, train, educate or present.
- Flexible: With a remote receive or transmit truck, a transmit or receive site can be located anywhere.

- Security: Signals can be encrypted (scrambled) when it is necessary. Encryption prevents outside viewers.
- Unity: Provides a shared sense of identity. People feel more a part of the group...more often. Individuals or groups at multiple locations can be linked frequently.
- Timely: For time-critical information, sites can be linked quickly. An audio or point-to-point teleconference can be convened in three minutes.
- Interactive: Dynamic; requires the user's active participation. It enhances personal communication. When used well for learning, the interactivity will enhance the learning and the teaching experience.
- Concretization of experience
- Reflective observation

Teleconferencing could have different technical configurations and applications. It includes use of telephone for audio conferencing, graphics in addition to audio for audio-graphic conferencing, television and/or computer for video conferencing. Following are different types of Teleconferencing:

- **Audio Teleconferencing:** Sometimes, it is called as Voice-only conference or, conference calling. Interactively links people in remote locations via telephone lines. Audio bridges tie all lines together. Meetings can be conducted via audio conference. Preplanning is necessary which includes naming a chair, setting an agenda, and providing printed materials to participants ahead of time so that they can be reviewed. Distance learning can be conducted by audio conference.
- **Audiographics Teleconferencing:** Uses narrowband telecommunications channels to transmit visual information such as graphics, alpha-numerics, documents, and video pictures as an adjunct to voice communication. Other terms are desk-top computer conferencing and enhanced audio. Devices include electronic tablets/ boards, freeze-frame video terminals, integrated graphics systems, Fax, remote-access microfiche and slide projectors, optical graphic scanners, and voice/data terminals.
- **Computer Teleconferencing:** Uses telephone lines to connect two or more computers and modems. Anything that can be done on a computer can be sent over the lines. It can be synchronous or asynchronous. An example of an asychronous mode is electronic mail. Using electronic mail (E-Mail), memos, reports, updates,

newsletters can be sent to anyone on the local area network (LAN) or wide area network (WAN). Items generated on computer which are normally printed and then sent by facsimile can be sent by E-Mail. Computer conferencing is an emerging area for distance education. Some institutions offer credit programmes completely by computer. Through computers, faculty, students and administrators have easy access to one another as well as access to database resources provided through libraries.

- **Video Teleconferencing:** Combines audio and video to provide voice communications and video images. Can be one-way video/two-way audio, or two-way video/two-way audio. It can display anything that can be captured by a TV camera. In two-way audio/video systems, a common application is to show people which creates a social presence that resembles face-to-face meetings and classes and enables participants to see the facial expressions of participants at remote sites. Video conferencing is an effective way to use one teacher who teaches to a number of sites. It is very cost effective for classes which may have a small number of students enrolled at each site. Rural areas benefit particularly from classes provided through video conferencing when they work with a larger institution.

5.6.2 Advantages of Teleconferencing

- It provides learning to large groups, which are geographically dispersed.
- For organizations, delivery costs are reduced with resultant cost benefit in terms of time, travelling and spread of resources over large groups
- It makes the best use of the available resources by expanding them learning opportunity and taking the resources to the learners.
- It overcomes time or scheduling problems for the learners who can assemble at a learning centre for a limited period only because of their full time or part time work, and family and community commitments.

- It can be designed to meet local specific requirements of training in terms of content, language and conditions.

- There is greater appeal, motivation and retention of information as a variety of teaching methodologies are used.
- By using animation, graphics and other techniques, teleconferencing is good at showing processes for demonstrations and experiments, thereby concretizing learning.
- By conveying sights, sounds, and the spirit of the subject, it provides a more rounded view of an issue.
- It provides uniformity of training, which is interactive. On the basis of feedback, instructors can make appropriate shifts in the teaching strategies to meet learner needs.
- The element of interactivity in teleconferencing is encouraged through dialogue and by stimulating responses to situations and visuals. The opportunity of dialogue allows the learners to discuss, question, and challenge issues. Stimulating the learners to respond to situations and visuals leads to higher processes of learning. As the learners become familiar with the technology and its practices, their communication and learning skills are enhanced.
- Interactivity gives a sense of participation and an active environment for learning.
- The learners may feel themselves to be a part of the ¡¥real-life¡¦ learning situation, and though located on different sites they feel they are connected. Relationships are established as in a group situation.
- For the field functionaries in remote rural areas, it reduces the sense of isolation, encourages sharing of concerns and ideas, and helps solve their problems.

5.6.3 Limitations of Teleconferencing

Teleconferencing has its limitations, but these can be overcome to a great extent by corrective measures and using appropriate content, planning, organization and management.

- If the number of centers is increased, time for interactivity for each center is correspondingly reduced.
- Since teleconferencing demands real time interaction, the learners are required to be present at particular times and places. Otherwise it will not work. It may be difficult for learners to do so because of logistics problems and other regional reasons resulting in poor attendance at the sessions.

- Evaluation of learning could be a challenge in tele-conferencing.
- Teleconferencing to be effective for any type and purpose would require planning, teaching strategy, development of content and materials, presentation techniques and evaluation.

5.7 Distance Learning and ICT

Technology is not limited to the use of machines, and the aim is to apply the scientific knowledge in order to obtain a practical result. The humankind has created science and technologies, from the wheel to the computer, and the changes were significant in their relations between the human beings and the nature, overcoming the traditional learning and teaching process. We cannot simply use a resource. It is important that all the pedagogical action is previously prepared, using structured objectives and allowing students to keep in touch with new and different contents. By doing it, learners are stimulated to build new relations with themes previously acquired. The teaching work makes use of a pool of technological assets, aiming the learning appropriation according to the mediation of the educator, with diversified resources and from different methodological procedures. Technology becomes the mediation for Distance Education and the technology serves as a vehicle through which the course is conducted.

5.7.1 Distance Learning

In conventional system of education teaching-learning takes place in classrooms, where the students and teachers meet regularly at fixed timings. Distance education was an educational mode supplementary, complementary and alternative to conventional/ traditional system of education, depending on the situation it was practised. Today it has evolved into an independent system of education. The growth of communication technologies and the cognitive sciences which are flexible enough to use the technologies for pedagogic purposes have key roles in distance education.

The term open and distance learning and its definition are

relatively new in the field of education, having gained prominence only in the past 20 years. The language and terms used to describe distance learning activities can still be confusing, and geographical differences in usage. There is no one definition of open and distance learning. Rather, there are many approaches to defining the term. Most definitions, however, pay attention to the following characteristics:

- separation of teacher and learner in time or place, or in both time and place;
- use of mixed-media courseware, including print, radio and television broadcasts, video and audio cassettes, computer-based learning and telecommunications. Courseware tends to be pre-tested and validated before use;
- two-way communication allows learners and tutors to interact as distinguished from the passive receipt of broadcast signals.
- Communication can be synchronous or asynchronous;
- possibility of face-to-face meetings for tutorials, learner¡Vlearner interaction, library study and laboratory or practice sessions; and
- institutional accreditation.

5.7.2 ICT and Distance Education

Distance education is an educational innovation to meet the ever increasing and diversified educational needs and demands of the society which are sequel to changing social, economic, and other conditions on one hand and technological developments on the other. Information and communication technology has widened the scope of educational technology and enhanced the efficiency of educational communication coupled with accuracy and speed of feedback. As a result of this, it has become possible to offer a variety of educational programmes to different sections or groups of people through various media of communication.

Distance Education follows the evolution of the communication technologies, which gives support to this kind of education. In this context, the teacher may understand that technology contributions as a pedagogical resource will occur continuously. Then, he/she needs to act according to this possibility, planning his/her practices and organizing the pedagogical actions as a mediation for this learning process, trying to

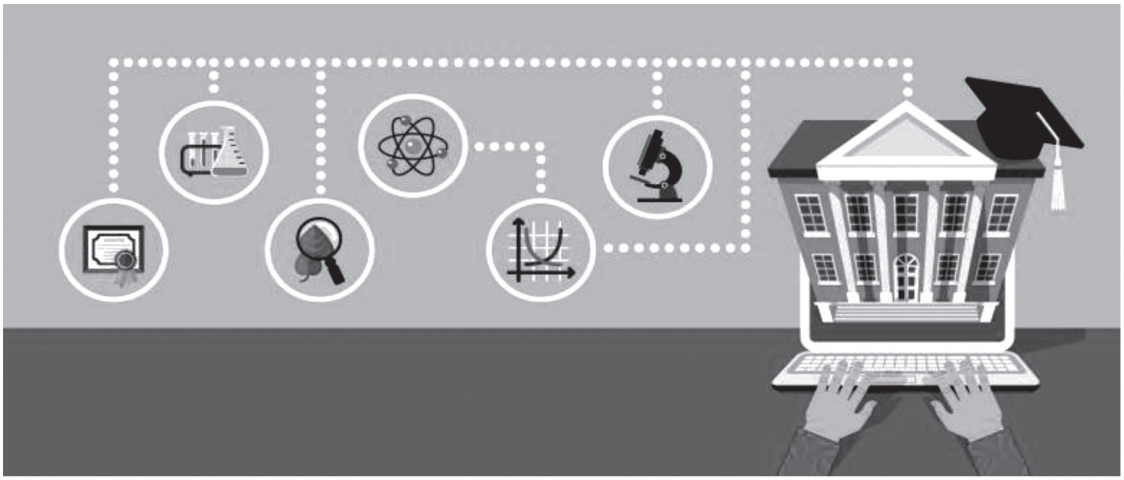
overcome expectations and, consequently, the appropriation of knowledge. The development of new technologies, which has instigated a revolution in our society and in people¡¦s jobs, has permitted other possibilities for teaching and learning process. It has also provided the development of new alternatives for the Distance Education modality, combining the familiar educational resources with the tools of the Information and Communications Technologies (ICTs). These directions point to the renovation of teaching by formulating a wider conception of the educational process in order to meet the demand of the society. In doing so, the ICTs can be used by the higher education institutes aiming to adequate and make their contents available, then giving rise to a greater flexibility of access to the distance courses.

5.8. e-Classroom: Concept and adaptations for children with visual impairment

Teaching without chalk and blackboard made possible through technology that serves as fundamental structural changes as integral to achieving significant improvements in productivity. It used to support both teaching and learning, technology infuses classrooms with digital learning tools, such as computers and hand held devices. Student engagement and motivation; and accelerates learning. Technology also has the power to transform teaching by ushering in a new model of connected teaching. This model links teachers to their students and to professional content, resources, and systems to help them improve their own instruction and personalized learning.

5.8.1 e-Classroom: Concept

E-classroom as part of our educational technology eliminates the barrier to quickly access new information and it bridges the gap between the rich and the poor and urban



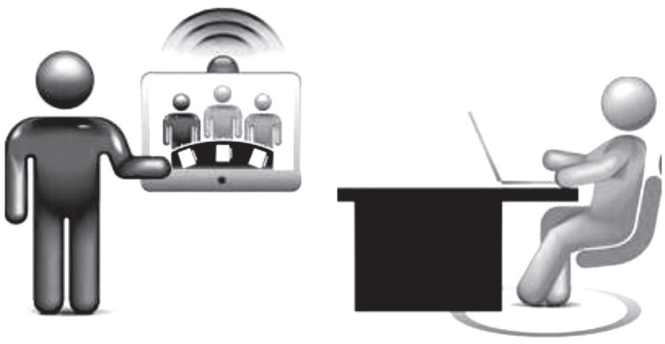
to remote areas to quest for quality learning. This type of learning creates opportunities to teachers and pupils/students to use the educational resources and other technologies that can increase educational productivity by accelerating the rate of learning reducing costs associated with instructional materials and better utilizing teacher¡¦s time. E-classroom has also the potential to improve educational productivity by accelerating the rate of learning, taking advantage of learning time outside of school hours, reducing the cost of instructional materials, and utilizing teacher¡¦s time. It also helps to develop the mindset of the students towards positive thinking and quest for more learning towards excellence. These can be particularly useful in rural areas where online learning can help teachers and learners accessible to information and to overcome distance. Digital resources like electronic grade books, digital portfolios, learning games, is a powerful tools to help teachers create more engaging and interactive teaching ways of learning on teacher and student performance, are a few ways that technology can be utilized to transform learning.

5.8.2 Objectives of the E-Classroom

There are a number of pedagogical methods and models of instruction. Rather the goals of the electronic classroom focus on the support of a wide range of instructional and classroom activities. The high level goals of the electronic classroom are as follows:

- To provide a more interactive learning experience than is generally possible in the traditional classroom.
- To provide interactive and hypermedia technologies during classroom interaction.
- To increase student-to-student and student-to-teacher interaction and collaboration.
- To provide students with an integrated learning environment with access to hypermedia databases, telecommunications, and simulations.

One primary theme running through these objectives is interactivity, to involve the student actively in the learning process. The other primary theme is to enrich the educational environment. Hypermedia provides a way to bring text, graphics, audio, and video together;



telecommunications opens up a window to the world; and simulations provide dynamic, graphic models of abstract systems and theories.

These technological objectives, however, should in no way obscure or take precedence over higher educational objectives. A good lecture devoid of technology may be necessary to engage students in a theme. Face-to-face, unmediated interaction may be necessary to drive a point home. Only when it proves beneficial should the instruction turn to the electronic media.

The narrow view of the electronic classroom is that it is a room with computers and multimedia displays. The broader view is that it is an electronic environment that supports the many processes of classroom education. But to provide such an environment the classroom must have some combination of the following elements:

- A computer workstation for the instructor.
- A multimedia system capable of presenting a variety of types of information (e.g., text, graphics, animation, audio, and video).
- A database of educational materials within the classroom.
- A computer workstation for each student
- A local area network that allows communication among all of the workstations, and the viewing and sharing of screen images.
- A system that provides storage, sharing, and transfer of documents.
- A telecommunication system to link the classroom to external educational resources.

5.8.3 e-Classroom: Adaptations for Visually Impaired

The Internet and internet based learning are tremendously important, including the lives of people who are blind or visually impaired. The world-wide-web makes daily life a lot easier for most of us but there are also people who cannot fully take advantage of the benefits of the web such as blind people. Not every e-classroom platform is optimally designed for use by individuals with visual impairments. When an e-classroom is built without regard to proper web design, they become inaccessible by people with vision loss who use access technology. Fortunately, things are changing and blind people can use the web just like everyone else although web accessibility for blind people is far from ideal.

Everyone could be benefited by accessible e-classroom. The same good techniques that

make platform accessible to those of us who use access technology benefit users of other devices as well. For example, people with slower Internet connections and those using devices such as cell phones or tablets that have smaller screens. Since the web and computers are primarily a visual media, blind people obviously cannot use it without specially designed technology. They typically use web browsers which are specially designed for blind people or the so-called screen readers - software programmes which work by speaking the text. Some, however, also use the refreshable Braille display which, like its name suggests, converts textual information into Braille characters. In addition to enabling blind people to understand the content on a particular website, screen readers can also ‘‘detect’’ text that is highlighted or differently coloured, read pre-selected text on demand, ‘‘determine’’ the location of the cursor, etc. by which they make the web fully accessible to blind people but only under condition that the websites they are accessing are designed with the use of codes that can be ‘‘read’’ by screen readers.

Despite the ethical standards, not all website and web based platforms are fully accessible for blind or visually impaired people. This is partly related to the fact that blind people form a small percentage of disabled web users and partly due to misconception that making proper adjustments to improve web accessibility is complicated and expensive. But it is not complicated nor expensive. It is important to mention that web accessibility for blind people does not affect the attractiveness or usability of the website for non-disabled people in any way. And proper adjustments that make a website accessible for all users regardless of their disabilities are not expensive nor complicated.

5.9 Let us sum up

Computer Aided Learning is an integrative technology, which describes an educational environment where a computer programme is used to assist the user in learning a particular subject. It refers to an overall integrated approach of instructional methods.

Computer aided learning is a device as well as a learning strategy to make teaching more interesting joyful and sustainable. Social media are forms of electronic communication (such as websites for social networking and microblogging) through which users create online communities to share information, ideas, personal messages, and other content (such as text, pictures and videos) Social media has gained credibility over the years as a trusted source of information and platform where individuals or organizations can interact with other individuals. Social media infuses today¡¦s society with millions of us engrossed, some would argue to the point of unhealthy addiction, in the latest happenings via apps such as Facebook and Twitter. The use of social media in education provides students with the ability to get more useful information, to connect with learning groups and other educational systems that make education convenient. Social network tools afford students and institutions with multiple opportunities to improve learning methods. A blog or, weblog is a discussion or informational website published on the World Wide Web consisting of discrete, often informal diary-style text entries. These text entries or multimedia entries are known as posts. Posts are typically displayed in reverse chronological order, so that the most recent post appears first, at the top of the web page.

The emergence and growth of blogs in the late 1990s coincided with the advent of web publishing tools that facilitated the posting of content by non-technical users who did not have much experience with HTML or computer programming. Blogging can be seen as a form of social networking service. Indeed, bloggers do not only produce content to post on their blogs, but also often build social relations with their readers and other bloggers. Many blogs provide commentary on a particular subject or topic, ranging from politics to sports or education. A typical blog combines text, digital images, and links to other blogs, web pages, and other media related to its topic. The ability of readers to leave publicly viewable comments, and interact with other commenters, is an important contribution to the popularity of many blogs. However, blog owners or authors often moderate and filter online comments to remove hate speech or other offensive content. In education, blogs can be used as instructional resources. These blogs are referred to as edublogs. Through teleconferencing two or more locations situated at a distance are connected so that they can hear or both see and hear each other. It allows the distant sites to interact with each other and with the teaching end through phone, fax, and e-mail. The interactions occur in real time. This means that the learners/ participants and the resource persons are present at the same time in different locations and are able to communicate with each other. Tele-conferencing (especially video-

conferencing) increases efficiency and results in a more profitable use of limited resources. It is a very personal medium for human issues where face-to-face communications are necessary. When you can see and hear the person you are talking to on a television monitor, they respond as though you were in the same room together. Videoconferencing maximizes efficiency because it provides a way to meet with several groups in different locations, at the same time.

The communication in teleconferencing is both vertical and horizontal, and the emphasis is on interaction at all levels. Meaningful interaction in real time is the strength of teleconferencing, and this sets it apart from other technologies used in education. The one-way limitation of educational broadcasting is overcome through the technology configuration. Stimulating responses to visuals, situations, dialogue, discussion, sharing, active experimentation, project work, etc. encourage interactivity. E-classroom as part of our educational technology eliminate the barrier to quickly access new information in the field of research and it bridges the gap between the rich and the poor and urban to remote areas to quest for quality learning. This type of learning creates opportunities to teachers and pupils/students to use the educational resources and other technologies that can increase educational productivity by accelerating the rate of learning reducing costs associated with instructional materials and better utilizing teacher's time. E-classroom has also the potential to improve educational productivity by accelerating the rate of learning, taking advantage of learning time outside of school hours, reducing the cost of instructional materials, and utilizing teacher's time.

5.10 Check your progress

1) Computer aided learning is to make teaching more:

   a. interesting

   b. joyful

   c. sustainable

   d. all of the above

2) Computer aided learning is a _____to make teaching more interesting:

   a. device

   b. learning strategy

c. Both

d. None

3) Social media are forms of

a. electronic communication

b. face to face meeting

c. Personal meeting

d. Sharing papers

4) Major disadvantages of using social media in education:

a. It may create distraction

b. Cyberbullying

c. Discouraging Face-to-Face Communication

d. All of the above

5) Wikispaces Classroom is a free social writing platform for

a. Education

b. Industry

c. Movies

d. Games

6) In blogs posts are typically in

a. reverse chronological order

b. chronological order

c. random order

d. increasing post size

7) Essential features of teaching through teleconferencing:

a. Learners present at particular time at dispersed places

b. Resource persons present at the same time at the teaching end

c. Interactions between them (a & b)

d. All of the above

8) In e-classroom technology contributions are as :

a. learning barrier

b. content facilitator

c. pedagogical resource

d. readiness

9) e-learning creates opportunities to teachers and pupils to

a. Use the educational resources

b. Use other technologies that can increase educational productivity

c. Accelerating the rate of learning

d. Reducing costs associated with instructional materials.

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