Persons with Visual Impairments and their Educational Needs in India:
Use of Special Devices and Assistive Technologies

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In many societies around the globe, people with visual impairments comprise some of the most socially excluded groups. Though disability studies in education have recently been formally recognized, it started when the educators have resisted and spoken against the hegemony of special education, institutionalization, sheltered workshops, and social exclusion. Disability studies in education also depend on the social theories which influence the conceptualization of disability to a large extent. Now, scholars in the humanities also have been influential. Today, educators around the globe are coming up with new ways of thinking about disability and educational research, policy, and practice.

Since India’s independence, the policy makers treat physically disabled persons as the recipients of the state sponsored welfare schemes. Though, one cannot completely neglect the benefits of these schemes, mere welfare schemes are inadequate to facilitate the visually disabled to perform major roles as the able individuals. Therefore, the role of the state components such as the legislature, executive, and the judiciary system becomes extremely important in transforming the societal attitude towards persons with disabilities. Within this broader framework, the paper aims to look at the concept of visual impairment in general and the Indian understanding of the concept in particular, followed by their educational needs and various implications. The central theme of the paper is to look at the significance of assistive technologies for the education of persons with vision impairments. In this context, some of the constitutional provisions and legislative measures have also been analyzed. It also makes an attempt to analyse various types of assistive technologies and their usage for providing a quality education to such people.

Definition and Classification of Visual Impairment

The visually impaired is an umbrella term, used widely and understood in an educational context. This term is used to describe the group of persons whose vision is affected by impairments in seeing. The term refers to all the persons whose vision disadvantage has resulted from impairment as well as disabilities. In case of persons who are completely without

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vision or who have light perception only, it is desirable to use the term “blind”. In all other cases of visual defects the term “visually impaired” should preferably be used. For the persons whose visual acuity falls between 6/18 and 6/60 in the better eye after the best possible correction, the term “low vision” should be used. In context of vision defects, a variety of terms viz. totally blind, stone blind, blind, partially blind, legally blind, economically blind, visually limited, low vision, partially sighted, visually handicapped, visually impaired etc. are being used [RamaKrishna T. 2009, Armstrong 2009, http://www.pls.org.uk/ngen_public/default.asp?id=60].

Understanding of visual impairment in India

The most common definition and classification of disability used by the Government of India for all purposes was determined with the enactment of the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995 (section 2). Disability has been classified into seven classes on the basis of medical definition. These classes include people with blindness, low-vision, leprosy (cured), hearing impairment, locomotor disablement, mental retardation and mental illness. Out of the coverage of each of the aforesaid seven groups, the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995 has given the following respective definitions to blindness and low-vision:

- **Blindness** refers to a condition where a person suffers from any of the following conditions namely:
  - Total absence of sight; or
  - Visual acuity not exceeding 6/60 or 20/200 (Snellen test) in the better eye with correcting lenses; or
  - Limitation of the field of vision subtending an angle of 200 or worse.

- **Person with low-vision** means a person with impairment of visual functioning, even after treatment or standard refractive correction but who uses, or is potentially capable of using, vision for the planning or execution of a task with appropriate assistive device.

Thus, blindness in India has been classified broadly under two categories: i.e., total blindness and low-vision. If we analyze the above mentioned definitions of the concept ‘visual impairment’ we can clearly find some practical problems. Though low vision and no-vision have been defined separately, they broadly come under the category of visually impaired. A totally visually impaired individual is quite different from a person having low vision.
Educational Needs and Implementation

As per the Constitution of India, education is as one of our fundamental rights. In our country, we earlier had the concept of special education for the disabled sector including students with visual impairments. However in the mid 1970s the integrated system of education has come into existence. Besides this, many non-governmental organizations with the help of the state administration are imparting traditional vocational education to the disabled. Now due to technology friendliness, the focus is being given on distance mode as the means to educate these sections of people by providing them all sort of accessibility. The government has formulated a few policies and legislations regarding the education of people with disabilities.

In an ideal system of inclusive education, the general education itself should make the education of disabled children as its integral part. This implies that the general classroom teachers should be equipped with skills to address the educational needs of children with disabilities with minimum or no assistance of specialist resource teachers. This calls for strengthening the pre-service general teacher preparation programme with the inclusion of adequate component of the education of disabled children in the curriculum. Therefore, inclusive education means creating effective classrooms where the educational needs of all children are addressed irrespective of ability or disability. Most people feel that educating a child with disability in general school is inclusion but it can be treated as total inclusion only when the general classroom teachers take most of the responsibilities for the education of these children. If the disabled child’s needs are taken care of, only by a specialist teacher in the general school, it is not total inclusion {Mukhopadhyay, S. and Mani, M.N.G. 1999, Ramakrishna T. 2009}. Access involves much more than providing ramps. Access is also the key element of inclusion, which involves much more than placement in a particular setting. The relationship of access and inclusion may not be obvious to individuals who are not familiar with the educational and social impact of a vision loss. Placing a student with a visual impairment in a regular classroom does not necessarily provide access and the student is not necessarily taken into consideration. A student with a visual impairment, who does not have access to social and physical information because of visual impairment, is not included, regardless of the physical setting. Students with visual impairments will not be included unless their unique educational needs for access are addressed by specially trained personnel in appropriate environments and unless these students are provided with equal access to core and specialized curricula through appropriate specialized books, materials and equipments {Petty, R.E. 2012}. 
It is important to remember that educational goals for students with visual impairments are essentially the same as those for all students. The goals are: effective communication, social competence, employability, and personal independence. In order to accomplish these goals, however, students with visual impairments require specific interventions and modifications of their educational programs. An appropriate assessment of these unique educational needs in all areas related to the disability and instruction adapted to meet these needs is essential to ensure suitable educational programming [Ramakrishna T. 2009].

**Legislative measures**

In order to provide quality education to the disabled, the Government of India has formulated and enacted a number of policies and programmes. The Government of India had numerous objectives to uplift the condition of the disabled people, which are reflected in different five year plans. In the last decade, academicians, social activists, and policy makers have realized the need for integrating disabled persons into the mainstream society. Due to their coordinated efforts, the "Persons with Disabilities (Equal Opportunities, Protection of Rights & Full Participation) Act" was introduced in Parliament in 1995 and it was a significant landmark in empowering persons with disabilities, including the visually disabled ones. This act for the first time treated the rights of persons with disabilities as the Human rights. The act establishes responsibility on the society to make relevant adjustments, so as to help the visually disabled to overcome various practical, psychological and social hurdles created by their disability. The act places disabled people at par with other citizens of India with respect to education, vocational training and employment. Thus, for a change, the state treated the "persons with disabilities" as active participants in various social activities rather than the recipients of mere welfare schemes. Due to these developments, the disabled are viewed as individuals with a wide range of abilities and each one of them willing and capable to utilize his/her potential and talents.

**National Policy for Persons with Disabilities-(2006)**

The constitution of India ensures equality, freedom, justice and dignity of all individuals implicitly and mandates an inclusive society for all including persons with disabilities. The national policy for persons with disabilities recognizes that persons with disabilities are valuable human resources for the country and seeks to create an environment that provides them equal opportunities, protection of their rights and full participation in the society. Some of the focused areas in this policy are:
• Development of assistive devices
• Education for persons with disabilities
• Assurance of barrier-free environment
• Promotion of research

Some of the measures discussed in the policy statement for the promotion of education of the persons with various disabilities are reproduced below:-

1) Medium and method of teaching will be suitably adapted to the requirements of most disability conditions.

2) Technical/ supplementary/ specialized system of teaching/learning will be made available within the school or at a common center easily accessible to a cluster of schools.

3) Teaching/learning tools and aids such as educational toys, Braille/talking books, appropriate software etc. will be made available. Incentives will be given to expand facilities for setting up of general libraries, e-libraries, Braille-libraries and talking books libraries, resource rooms etc.

4) Sign language, Alternative and Augmentative Communications (AAC) and other modes as a viable medium in inter personal communication will be recognized, standardized and popularized.

In the era of knowledge society, computers play very important role. Efforts will be made so that every child with disability gets suitably exposed to the use of computers.


**UN Convention on the Rights of Persons with Disabilities**

United Nations organization has come up with comprehensive and integral international convention to promote and protect the rights and dignity of persons with disabilities in December 2006. By recalling the principles proclaimed in the United Nations charter which recognizes the inherent dignity and worth and the equal and inalienable rights of all members of the human family as the foundation of freedom, justice, peace in the world, this convention on the rights of persons with disabilities recognizes that disability is an evolving concept and it results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with others. It also recognizes the
importance of accessibility to physical, social, economic and cultural environments, to health and education and to information and communication, in enabling persons with disabilities to fully enjoy all human rights and fundamental freedoms.

India had adapted the same UN convention on the rights of persons with disabilities in October 2007. The issue of education has been dealt separately in article 24 of the convention in detail. Some of the features are as follows:

1. In realizing this right, States Parties shall ensure that:

(a) Persons with disabilities are not excluded from the general education system on the basis of disability, and that children with disabilities are not excluded from free and compulsory primary education, or from secondary education, on the basis of disability;

(b) Persons with disabilities can access an inclusive, quality and free primary education and secondary education on an equal basis with others in the communities in which they live;

(c) Reasonable accommodation of the individual’s requirements is provided;

(d) Persons with disabilities receive the support required, within the general education system, to facilitate their effective education;

(e) Effective individualized support measures are provided in environments that maximize academic and social development, consistent with the goal of full inclusion.

2. States Parties shall ensure that persons with disabilities are able to access general tertiary education, vocational training, adult education and lifelong learning without discrimination and on an equal basis with others. To this end, States Parties shall ensure that reasonable accommodation is provided to persons with disabilities. (*Source: UN convention document on the rights of persons with disabilities*)

Despite all these attempts of the government to develop the overall condition of the disabled persons in general and their educational level in particular, their achievement in educational level is not satisfactory. A study conducted by the National Centre for Promotion of Employment for Disabled People (NCPEDP) available at http://www.ncpedp.org/eductn/ed-resrch.htm disclosed shocking facts of discrimination against those with disabilities. A survey of 89 schools across the country found that a mere 0.5 percent of the total number of students were those with disabilities, though the
Persons with Disabilities Act recommended a reservation of three percent seats in institutions funded by the government. Eighteen of the schools surveyed acknowledged that they did not admit students with disabilities. Twenty percent of the schools polled were not aware of the 1995 Disability Act at all. While girls comprised 41.6 percent of the total student population, among children with disabilities, the percentage of girls was only 33. While Education comes under the Ministry of Human Resource Development in India, education for those with disabilities comes under the Ministry of Social Justice and Empowerment. Education of People with Disabilities is still considered an act of charity. The disabled persons do not need sympathy. But the least they can ask for is sensitivity. Education for them has been a struggle for sure. Until recently, disabled people were not given any special attention in higher education. Till today most of the educational institutions are not even made physically accessible. In addition to that the study contents, reading materials, use of assistive technology, and individual need based support is lacking.

A study from NCPEDP 2004 available at http://www.ncpedp.org/eductn/ed-resrch.htm shows that only 0.1% (1635) of disabled persons has been enrolled in higher educational institutions. In many parts of the world including India, this is still the case where institutions of higher education purport to provide equal access and reasonable accommodations, disabled students still face discriminatory policies and practices. In addition, too little is available about inclusive pedagogy and policy in higher education.

People with disabilities are precluded from accessing or benefiting from mainstream educational, vocational training, employment and self-employment and income generation programmes on account of physical, communication, transportation and attitudinal barriers. Many of the educational institutions are situated in the urban areas. The illiterate rural masses do not have access to them. The administration has failed to create awareness among the rural people to send their disabled family members to educational institutions. At the same time, most of the institutions to a large extent lack the necessary infrastructural development, assistive technological support and more importantly well trained teachers. Though society is moving towards the age of information technology, in India we do not have sufficient institutions to bring the disabled population to the mainstream for competing with their counterparts.

**Use of assistive technologies**

In all educational institutions including special institutions generally, students with special needs come with a number of questions. For example, what sort of technological
tools can help them in getting education like their counter parts? Such questions vary
from person to person depending upon his/her needs. Hence, it becomes necessary on
the part of teachers and manufacturers to know the specific needs of these people and
the concepts like assistive technology, universal design and accessibility. In this section,
an attempt has been made to discuss the above mentioned concepts with particular
reference to the use of assistive technologies and various methods and techniques to
adapt them in teaching-learning process. Some assistive technologies and their specific
use for students with vision impairments have also been discussed. People with
disabilities or / and special needs according to their own requirements need some
structural changes or some extra tools to be added to the conventional or traditional
technological tools with the main devices for better accessibility. This kind of technology
assists such people to get their work done. Any device that is used to enhance a person’s
working ability is called a special device or assistive technology. In other words,
assistive technology means alternative or adaptive specialized hardware and software,
including input and output devices designed for users with various disabilities
(Ramakrishna T. 2009, Petty, R.E. 2012 ) defines assistive technology as ‘Software or
hardware that has been specifically designed to assist people with disabilities in carrying
out daily activities’. These technologies help the students with learning and physical
disabilities to actively participate in inclusive teaching and learning tasks such as
writing, reading and for doing mathematics.

To a large extent, assistive technologies are found useful in creating new abilities for
children and adults with disabilities including sensory, cognitive, learning and physical
disabilities. This allows these students to independently complete their assignments,
examinations and other academic activities. Some examples of assistive technologies are:
touch control devices, alternative keyboards and mouse, speech-to-text word recognition
tools, Word prediction programs, word processors, grammar checkers, scanners,
compact disc recording (CD-R and CD-RW) drives and spell checkers ( Petty, 2012 ).

New innovations and growth in technology is making it less and less excusable to ignore
the needs of those who are disabled. Researchers are developing sophisticated hardware
and software which help even the most severely handicapped individuals to do their
work successfully in the mainstream society. The demand for assistive technologies is
increasing significantly, because now more disabled students are studying in normal
educational settings. Assistive technologies are highly essential for helping students with
various disabilities to succeed in their studies. These also can enable disabled students to
socially interact with their non-disabled peers. The similarity between assistive and
conventional technologies revolves round the common aspects. In this context, all
activities involve three things: input, processing and output. Input refers to how one gives information to a product. Processing is related to the electronics that operate on or process, according to the information one provides. Output means what the device does and produces with the information provided. The ways in which assistive technologies are different from conventional technologies involve these same three aspects. Individuals with disabilities who use these technologies usually select a combination of conventional and assistive technologies. They rely on the conventional ones especially when universal access features are part of the product’s design. The distinction between assistive and conventional technologies is becoming less clear because now the concept of universal design is being incorporated into conventional technology. Both assistive and conventional fields are broadening and converging. What is a necessity for some is a convenience for all. For example, touch screens can be used as alternatives to the mouse for people with disabilities. But at the same time, these are the convenience for others which are generally used in ATM machines and at airports. Similarly, voice recognition system which allows controlling a computer through verbal commands can be used by people who cannot use a keyboard to provide input. Today, as the demand from the community of assistive technology users is increasing for universal access, manufacturers have been responding accordingly. The assistive and conventional technologies are blending and a new generation of products with easy accessibility features are emerging [Armstrong 2009].

**Special devices and Technologies**

It is very difficult to classify or label the varying degrees of visual acuity. Most of the students with visual impairments need some type of technologies for effective learning while pursuing their studies. The students who are visually impaired but have some useful vision mostly rely on large-print materials, specialized magnification lenses or on the electronic enlargement technologies for better accessibility. The people with no vision, who traditionally had to depend on tape recordings or on Braille print, now have many options of other devices and technologies which make them independent for example, descriptive video services. This technology provides a detailed verbal description of visual elements. These services are useful in helping blind or low vision students to use educational video programs efficiently. Another significant development in the field of computer technology is the innovation of synthetic and digital speech synthesizers. These are the output technologies which assist the students with communication disorders and visual impairments. These text-to-speech applications are also known as screen readers. With the use of these screen readers, visually impaired students can read the text found on the screen aloud. The screen reading technologies
also facilitate to read the text repeatedly and in reviewing or editing the written text. Thus these technologies provide an equal platform and opportunities to visually impaired students to participate efficiently like their peer groups in all academic activities [Petty, R.E. 2012].

Another useful computer based technology in this regard is optical character recognition. It helps in scanning and reading the text aloud. Students with visual impairments can have access to all types of print materials by the use of this scanning technology. Because they can scan the materials and read the text with the help of screen reading technologies individually, now this software is available with most computers and scanners. The only drawback of this technology is that, it cannot read handwritten materials accurately. At the same time, advances in computer technologies have made Braille more useful. A number of software applications have been developed which combine Braille with computer technology. For example, in Braille note takers there is facility to store Braille characters and read text aloud. These technologies have been found useful to assist students with visual impairments in their studies. Though Braille displays have already been developed those technologies are still not widely used because of high cost and lack of awareness among the users.

**Computer screen magnification:** In most of the computers available today, magnification of the screens is possible by the use of special software. The user can select a portion of the screen and then enlarge that section up to 16 times of the original size. This magnification technology helps the low vision students to use the screen easily. With the magnification, they can see the particular portion of the screen better and larger than before. This facility gives them the opportunity to use the computer and other such technologies according to their needs.

**Descriptive video services:** As we have already discussed, this technology gives a narrative verbal description of the visual elements displayed on the screen. These may be background, costumes, physical descriptions of the characters and facial expressions. In some of the advanced countries, the television sets are being manufactured with this facility. If anyone needs that facility, then he/she has to switch on the option on the television set. The user can automatically hear the description of all the visual elements [Petty, R.E. 2012]. The descriptive video services technology helps the blind students by providing them access to information, video programs and movies which are part of our culture. It provides them opportunities for better socialization and knowledge building.
**Screen readers:** Screen readers are generally a type of software. These are also known as text-to-speech applications. A screen reading software analyzes the characters, words and sentences and converts them into synthetic or digital speech. Today, text-to-speech software have become in built technology in many software packages, including many word processing and educational software programs. While using the screen reading software, the users can adjust the volume, pitch and speed of reading. They can even choose a male or a female voice according to their choice. With the use of synthetic speech, the computer reads text passages, analyzes the phonetic structure of words and attempts to reconstruct the words by putting together a string of synthetic phonemes. But sometimes, the computer fails to read the wrongly put text where the students face difficulty in understanding the message. In addition to this, digital speech has been used in many of the technologies for the same purpose. Digital speech is composed of actual recordings of human voice. It is much easier to understand but, requires a large amount of storage because each word that the computer may come across must be prerecorded. For that reason, the use of digital speech is often not feasible in teaching. If some technology with sufficient storing of electronic information with low cost becomes available, then digital speech can be used more to assist students with communication disorders and visual impairments.

JAWS is a best example of screen reading software used widely by the visually impaired students to read the text appearing on the screen. It is easily operated by keyboard commands. This software has both the options of Braille display and a synthetic voice.

**Optical character recognition:** This technology helps blind students to scan the books or other print materials and read them by using synthetic or digital speech. The first optical character recognition technology was introduced in 1976 for the visually impaired people, when Ray Kurzweil invented the Kurzweil Reader. It was large in size but, was considered a remarkable achievement for the blind people. It could not be widely used in the teaching/learning process because of its high cost and large size. Today, many small and portable scanning devices with OCR technology are available which can be used effectively by the visually impaired students for scanning and reading the text.

**Braille Scanning Software - OBR (Optical Braille Recognition):** Optical Braille Recognition (OBR) is a Windows software program that allows to ‘read’ single and double sided Braille documents on a standard A4 scanner. It scans the Braille document, analyzes the dot pattern, and translates it into normal text that it presents on the computer screen.
Independent Text Reading: The blind and low vision students today are dependent on voluntarily readers and are able to barely manage to study their textbooks but due to acute shortage of human readers these days, the problems have multiplied. However, with the use of Text Reading machines, like the K1000 OCR reading software, which using a PC and scanner convert any printed text into sound and magnify the text for low vision on a Standard TV/monitor, or even provide support for reading, writing and studying for dyslexic [learning disabled] they can simply borrow any book from the library and read the same independently and Prisma print magnifier connected to a 21 inch TV or monitor for low vision.

**Audio devices:** Along with Braille materials and computers, visually impaired persons prefer to use audio materials in their studies. They use various cassette players and other recording machines for different purposes; to record the lectures, books and study materials and to submit their assignments in audio formats. Now-a-days, talking books are available in different formats which can be listened with some sophisticated audio devices. Generally the audio cassettes and CDs are used for preparing talking books for people with visual impairment. In the advancement of technology, this process of preparing talking books becomes easier day by day.

The traditional audio guides and CDs are arranged in a linear sequence of tracks. These are designed either to play in a complete sequence from beginning to end, but usually they play a single track at a time, then wait for the user to select another track. The tracks are usually identified, for example by number, at the information posts located beside each artifact. The user can enter the number and listen to the appropriate audio. But now-a-days the DAISY format plays a great role as an advanced audio device in the field of education. The DAISY format is similar, but introduces a more sophisticated level of navigation. Instead of a simple series of tracks, the content is arranged in a series of chapters, each containing a number of sections, which can also contain sub-sections. Audio information can be synchronized with the transcript. However, the DAISY format was originally designed to be held on a CD-ROM, but is by no means limited to this medium. As memory becomes cheaper, and more capacious but physically smaller, DAISY content no longer has to be held on CD-ROM but can also be held on hard-drive memory. Hence an increasing number of blind people now have their own DAISY format players, which give them access to entering and reading text.

In today’s world, the blind learners use various digital sound recorders for their study purpose. These digital sound recorders can help the visually impaired persons to record the lectures. These are portable devices and very easy to operate. Digital sound recorders have made the learning process of the people with visual impairments easier. So, these
are very helpful to the visually impaired persons who don’t know Braille. Besides, the blind people also use various other audio devices in their learning process.

**Braille translators and displays:**

Braille translators and displays are designed specially for the blind users who depend on Braille script. With the new assistive devices, it has become easier to read and write Braille. Today, the computers and other educational devices have been equipped with Braille displays. It has become possible to read the text and all other instant messages in Braille by the use of some specialized software or devices.

Braille display is a tactile device consisting of a row of special 'soft' cells. It is a device, typically attachable to a computer keyboard, which allows a blind person to read the contents of a display one text line at a time in the form of a line of Braille characters. When used in conjunction with a Braille keyboard, the Braille display makes it possible for a person to operate a computer, read the display, send and receive e-mail, and browse the Web.

A refreshable Braille display or Braille terminal is an electro-mechanical device for displaying Braille characters, usually by means of raising dots through holes in a flat surface. Blind computer users who cannot use a normal computer monitor use it to read text output. Speech synthesizers are also commonly used for the same task, and a blind user may switch between the two systems or use both at the same time depending on circumstances.

**Braille embosser:** A Braille embosser is a printer, necessarily an impact printer that renders text as Braille. Utilizing special translation software, a print document can be embossed with relative ease, making Braille production much more efficient and cost-effective. Today, thousands of books and magazines of different languages of the world are embossed in Braille and are made available for the blind readers in a cheaper rate. So the revolution in the Braille printing society not only fulfilled the desires of the blind learners but also enabled them to get the knowledge of the whole world.

Formally, the Braille embossers used to produce materials in Braille which were too big and quite manual. Hence it was taking a lot of time for the production of Braille books and other materials. But the development of technology, today, has reduced the time for preparing books and material in Braille. Now-a-days, by utilizing computer technology, it has become easier to emboss more and more books and materials in Braille within a short period of time. Today, different types of Braille embossers are used for producing Braille books and materials. Even these devices are very easy to operate. We can print
the text in Braille on both sides of the papers like other normal printers. Now, these devices are available with different varieties.

**Braille Note-takers:** Braille note-takers are small assistive devices specially designed for the blind students. These devices are primarily used to take notes in Braille. The note-takers have the same six keys as found on a traditional Braille writer. However, in most of the note-takers, the users can review what they have already written. These devices have translating software which translates the Braille into normal text. The stored documents can be accessed with the use of word processors or by the screen reader software. To get a hard copy of those documents, the students can connect the note-takers with the printers for text output. Similarly, Braille displays and Braille printers can be attached with note-takers to get Braille output. Devices like the Braille note-takers that combine Braille with computer technology have made Braille much more useful and easily accessible.

Two decades ago, it was a very difficult task for a blind learner to take notes in the class while the teacher was teaching. A traditional note taker, which consumes a lot of time to take notes, was used by the visual impaired persons to take notes in the class. So the learners could not take full notes of a class. But the growth of technology has reduced this problem to a great extent. By utilizing computer technology, the advanced note taker helps the blind learners to take note speedily in the classroom. It not only helps to take class notes but is also is useful to take notes in seminars and conferences (Armstrong 2009, Ramakrishna T. 2009, Petty, R.E. 2012). It not only fulfills the educational needs but also enhances the working ability of the visual impaired persons in their day–to–day life.

**Use of assistive technologies in teaching-learning process**

Educators must be careful in the selection of appropriate tools and should encourage using such products and methods that allow the students to do their work efficiently. While designing the curriculum, they should take care of the special needs and should think about various assistive devices which can help them to pursue the courses and programmes smoothly. The important thing is to let the disabled learners know that they are welcomed. No one can anticipate everyone’s needs, but one can let them know that he/she is willing and prepared to work with such people for accommodating them to the best of their ability. It may take time to learn and adapt the new programs and some of the special devices. But we need to start somewhere. So let people know that the doors of the technology are open to everyone in the community. Responsible bodies should not wait until a disabled person applies to do a course or tries to use a service; rather they
should think about what reasonable adjustments they could make beforehand. They should anticipate the requirements of disabled students and should make the necessary adjustments for giving them better accessibility.

With the help of assistive technologies education can be made more open and accessible for people with special needs. These technologies help to enhance the lives of people with certain limitations in all aspects, but its use in the field of education is more desirable. These technologies can be applied as the major support service providers in all teaching/learning processes. These can be used in all aspects of education according to the institutional or individual requirements. For example, the institutions can apply the universal design principles along with the help of special technologies in all instructional activities, from preparing the study materials till the assessment of the learners. Similarly the students can take assistance, from the time they take admission in a course till they appear in the exams at the end.

**Interactive radio counseling and teleconferencing:** Today, emergence of satellite technologies has broadened the scope of education by making it more accessible. Satellites have been used in various sectors like defence, meteorology, research and science. India has launched a special satellite for educational purposes. Now, most educational institutions are taking advantage of it. Satellite technology can be used at its best to educate the students with special needs. Many special devices have been manufactured to serve the needs of such groups based on satellite technology. Through teleconferencing or video conferencing many of the above mentioned needs can be fulfilled. For example, if some assistive tools such as, the pictures, graphics, various sounds, sign language interpretations, and power point presentations along with the lectures can be used, and these will be of more use. Similarly radio can be used successfully in teaching-learning process. Through interactive radio programmes, these students can be given special counseling and necessary information time to time. Various educational programmes can be prepared and broadcast through radio or television to enhance their study skills [Armstrong, 2009, Petty 2012].

**Provision of Study Materials**

People with reduced sight or with low vision often find the conventional print materials indistinct, dim and very difficult to read. Central damage to the retina prevents some students from seeing small print clearly and reduces their ability to move their eyes in the ways needed for reading. Text can be made more legible for these readers by the use of large print materials. Therefore, attention should be paid on the following:
• E-text materials which are friendly to screen reading software and speech synthesizers (for people with total visual impairments).

• Large print/with large font size materials compatible with screen magnifiers (for low vision people).

• Should be available in Braille, Daisy book format or talking book format (in MP3 and audio) (for the learners with visual impairments and others with a different interest in audio materials)

• E-text should be supplemented with audio-visuals wherever necessary with the help of multimedia technologies.

• The visuals should be further supplemented with captioning (open or close and live speech) and pictures should be with DVS (Descriptive Video Services) (for learners with hearing, vision impairments and for people with various learning disabilities).

**Use of internet and web accessibility**

In this age of technology, there is no need to going out to collect study materials or attend a conventional educational institution for getting quality education. This could happen because of internet and World Wide Web (or, the web) accessibility. Along with this, Internet facility has minimized the limitations of education. To a large extent, it helps to make education more accessible for all including the people with vision impairments. The Web is fully capable of delivering a variety of multimedia and interactive instructional resources including audio and video services. But, due to some constraints the students with visual impairments are unable to access graphic images, text formatted in complex ways, Java applets and video clips. In addition, documents created by using Adobe Portable Document Format (PDF) are difficult to read with screen readers and refreshable Braille displays. Thus, if materials are provided on a website in PDF format, an alternative version should also be available in plain text or HTML format. Of course, this is only feasible for textual information and would not apply to materials, or portions of materials, that are inherently graphic in nature such as pictures, graphs and maps.

With some adjustments or changes, the websites can be made more accessible for the students with certain physical limitations. A strong effort is being made world over to give more accessibility. For example: http://www.access-board.gov/news/508update.htm is a webpage, in which an effort has been made to give some standards and principles for creating accessible websites. Under Section 508, the criteria, rules, procedures and
definitions of web accessibility have been discussed in detail. These principles are binding only in USA; still such techniques can be used for designing more disable friendly websites. The World Wide Web Consortium (http://www.w3.org/) is developing accessible assistive technologies which include specifications, guidelines, software and various tools to make the web more accessible, particularly for the people with various disabilities. Some of the guidelines given by them are as follows:

- Provide access to images, pictures, diagrams and charts for users who are blind or visually impaired through text or other formats with equivalents.
- Provide access to data in tables, all type of graphs and maps to visually impaired users.
- Provide access to textbooks and other reading materials.
- Provide verbal descriptions of moving visual information in both auditory and text form.
- Ensure that text and graphics are perceivable and understandable when viewed without color.
- Ensure that moving, blinking, scrolling, or auto-updating objects or pages may be paused or frozen.
- Ensure that pages using newer HTML features (i.e. style sheets, forms, tables) will transform gracefully into an accessible form.
- Use features that enable activation of page elements via input devices other than a pointing device (e.g., via keyboard, voice, etc.).
- Only use technologies defined in a W3C specification and use them in an accessible manner. Where not possible, provide an accessible alternative page.
- Use interim accessibility solutions so that assistive technologies and older browsers will operate correctly.
- Provide mechanisms that facilitate navigation within your site.

With a little effort, the above mentioned guidelines can be followed to develop websites with more accessibility. The students with vision impairments can comfortably use the WebPages according to their needs.
**During assessment**

Examination and assessment policies, practice and procedures should provide disabled students the same opportunities as their peers, to demonstrate the achievement of their learning. Institutions should consider and implement certain procedures for alternative assessment and should make proper examination arrangements when and where ever necessary. As assessment is a key shaper of the student’s future, the educational institutions should help them by suggesting appropriate technologies. For disabled students, it is essential that they should be assessed in such a manner, that they will not be under any disadvantage. It is advisable to examine such issues related to disabilities at the design stage of a course or a programme.

The students with various physical limitations including vision impairments should be allowed to submit the assignments in large print, in Braille, on Audio cassettes or in normal print. With the help of assistive computer technologies these students can do Computer Marked Assignments (CMA) s along with all other computer assignments. Now it is very much possible to provide question papers and assignments in Braille and other formats. Earlier, some students used to take the help of scribes to write their exams. But today they can use the computers and audio or video devices to appear in their exams. Now they are in a position to write online examinations and can perform all the duties what others can do. Therefore, the institutions should apply these sophisticated technologies in the assessment of such students {Armstrong 2009, Ramakrishna T. 2009}.

**Conclusion**

The persons with visual impairments continue to struggle to gain education in contemporary areas relevant to the market place and their disability. Technological progress has much to contribute to this state of affairs, with highly inaccessible computerization of many online educational courses. Educational institutions have been slow to ensure accessibility of learning materials and environments for these people. Studies show that assistive technologies significantly help disabled students in general and visually impaired in particular to excel in inclusive teaching and learning. These technologies comprise a number of products which include a wide variety of software applications, input devices and hardware which allow visually impaired students to perform difficult tasks independently. But ultimately, the educational institutions (colleges or universities) must provide facilities to ALL students based on the individual needs in support of their willingness to learn. Inadequate teacher training, lack of awareness, infrastructural deficiency and high cost are some of the major problems in
the use of technology. But with willingness, appropriate effort and positive outlook these shortcomings can be overcome. All teachers need training for using assistive technologies and special products effectively to address the needs of the students with various disabilities including visually impaired. Thus, it is important to become familiar with the issues surrounding the use of technologies for all individuals who are involved in policy decisions, teacher training and in the funding of educational technologies. By working together, Parents, teachers, administrators and students with disabilities and their non-disabled friends can help to create technology friendly environments in which all students have opportunities to learn.
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