

Use of Computer Science & IT for Education of Visually Impaired persons

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Abstract: The paper is about to use and to implement the technology for visual impaired persons. Persons with visual impairment have the right to expect the same standard of services and equitable to access information and education as every other member of the society. Information Technology (IT) have opened a new door for disabled people. In India, more than 2.19 corer people are suffering from disability out of that 1.0 % are visual impaired. Technology can play an important role in lives of people with disability. New technology devices for disabled have raised the expectation that more people with disabilities can function more independently in their life for getting education and rehabilitation.

IndexTerms – Visual Impaired, Accessibility, Rehabilitation.

I. INTRODUCTION

With rapid growth and advancement in the technology coupled with opening of the Internet gateway, the plethora of information, data and personal communications stored on and transmitted by the computers have increased beyond everyone's imagination.

Computers were the advent of new information technology. Avowedly, information (Facts, Knowledge, data and news) Technology (Materials, Tools, System, and Techniques) is the key to economic growth. It is likely to bring about metamorphosis in society and may change the lives for better in a very short time. It will improve and enhance the quality of life for many people by making information more accessible and providing more information at low cost which will increase opportunities for all. The greatest gain will be to the educationally deprived class. Likewise special beneficiaries will be physically and mentally challenged person. Thus, it will empower the impoverished lot of physically and mentally challenged persons and make their lives more lively and worthwhile.

Emerging technologies are helping the disabled people not only to acquire physical independence but also to sharpen the requisite skills to become an important part of society and economy with pride and honor.

II. KEY CONCEPT OF DISABILITY

In this study we have used various concepts of disabilities. In India, the broad definition of different categories of the disabilities has been adopted in the Persons with Disabilities Act, 1995 as well as under the Rehabilitation Council of India Act 1992.

“Person with disability” means a person suffering from not less than forty percent (40%) of any disability certified by a medical authority .

A significant portion of our population (According to the Census 2001, there are 2.19 crore (21.9 million) people with disabilities in India who constitute 2.13% of the total population) has impairments which reduce their ability to effectively or safely works like normal people. These impairments may have been acquired at birth or through accident or disease. Note that much type of impairments which result in disabilities is associated with aging. This is especially significant, as the population as a whole is growing older. Although there is a tremendous variety of specific causes, as well as combinations and severity of disabilities. Table 1.1 shows disability data according to Census-2001.

Type of Disability	Population	Percentage(%)
In seeing	10,634,881	1.0
In speech	1,640,868	0.2
In hearing	1,261,722	0.1
In movements	6,105,477	0.6
In mental	2,263,821	0.2
Total disabled population	21,906,769	2.1

Table 1.1 Disability Data according to Census – 2001

The International Classification of Impairments, Disabilities and Handicaps (ICIDH) provides a conceptual framework for disability with three parts:

2.1. Impairment

Impairment is "any loss or abnormality of psychological, physiological, or anatomical structure or function". Impairments are disturbances at the level of the organ, which includes defects in or loss of a limb, organ or other body structure, as well as defects in or loss of a mental function. Examples of impairments include blindness, deafness, loss of sight in an eye, paralysis of a limb, amputation of a limb; mental retardation, partial sight, loss of speech, autism, cerebral palsy and learning difficulties.

2.2. Disability

Disability is a "restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being". It describes a functional limitation or activity restriction caused by impairment. Disabilities are descriptions of disturbances in function at the level of the person. Examples of disabilities include difficulty in vision, speech or hearing, learning, difficulty in moving or climbing stairs, difficulty in grasping, reaching, bathing, eating, and toileting etc.

2.3. Handicap

Handicap is a "disadvantage for a given individual, resulting from an impairment or disability that limits or prevents the fulfillment of a role that is normal (depending on age, sex and social and cultural factors) for that individual". The term is also a classification of "circumstances in which physically challenged people are likely to find themselves". Handicap describes the social and economic roles of impaired or disabled persons that place them at a disadvantage compared to other persons. These disadvantages are brought about through the interaction of the person with specific environments and cultures. Examples of handicaps include being bedridden or confined to home; being unable to use public transport; being socially isolated, being forced to remain illiterate.

III. TECHNOLOGY SUPPORT FOR VISUAL IMPAIRED

Usually technology is defined as a systematic development of methods, machines or process that help in the achievement of a given objective. "Assistive technology as any item, a piece of equipment or product system that is used to increase, to maintain or to improve the functional capabilities of the individuals with disabilities". Further, assistive technology can be broadly conceptualized as any technology with the potentiality to enhance the better performance of persons with disabilities. It includes both low technologies and high-tech devices and it incorporates technologies designed specifically for people with disabilities.

Advances in technology have always been technically better, faster and cheaper products which make life more convenient and organized. For people with disabilities, the promise is quite greater because, technology helps in turning their long cherished dreams into realities which may include a dream to play a game of chess with their friend, write a letter to their relatives or give a presentation in the annual corporate meeting without any assistance from other people. The ultimate ratio is independence and self-reliance achieved by the physically and mentally challenged people. It is all about making the less fortunate people free from bonds of reliance and taking charge of their lives. Technology is receiving the attention of families, advocates, legislators and professionals due to its potential for enhancing the lives of individuals with disabilities. From computers to communication devices in the world of technology offer many children and adolescents with disabilities the tools necessary to be more successful in school, at work and at achieving independence in daily living. Indeed, opportunities which were unimaginable then years ago are now becoming an available reality to some children with disabilities. With the assistance of new technology, the emerging technologies are raising new hopes in the life of physically and mentally challenged people.

Emerging technologies help the disabled people with substantial gain not only as physical independence but also as the requisite skills to become an important part of the society and economy. Till recent time, people with certain disabilities could not fully exploit the potential of PCs. For instance, if they are unable to use a keyboard or mouse they can't input information. But this has changed. Computer manufacturers and software developers are focusing on assistive and adaptive technologies. The traditional input devices such as keyboard and mouse require good dexterity and thus cause problems for most users with physical disabilities. Likewise, output tools such as standard screen displays are of little help to the visually impaired.

Nowadays, governments promote computer education among the disabled. Global IT giants including Microsoft, Sun, IBM and Apple are committed to advances in assistive technology. They are striving to make better IT products and software for the disabled. Microsoft has accessibility and disabilities sites which have exhaustive information technology and tools that can help the handicapped make their lives better. The Redmond Giant released the latest version of Accessibility of the technology software that developers use to make programs more accessible to people with special needs and use accessibility aid like screen reader. IBM is not far behind in its efforts. It facilitates homepage reader for spoken web access for the blind and visually impaired. The new talking browser orally communicates all the contents and information presented on the computer screen including graphics description, tables and columns. Digital Equipment Corporation, a leading player in text to speech technology, has special DEC talk software which lets developers create and employ application that speaks electronically to user. The software can transform ordinary text into natural sounding speech. Intel too has special products for difficulty press two key simultaneously, intelli-key allows the user to press the shift key followed by a letter key to type capital letter, two key in succession, not two keys at one time.

IV. FUNCTIONAL LIMITATIONS CAUSED BY VISUAL IMPAIRMENT

Since many people with visual impairments still have some visual capabilities, many of them can read with the assistance of magnifiers, bright lighting and glare reducers. Many such people with low vision are helped immensely by use of larger lettering, and high contrast coloring. Those with color blindness may have difficulty differentiating between certain color pairs. This generally doesn't pose much of a problem except in those instances when information is color coded or where color pairs are chosen which result in poor figure ground contrast. Key coping strategies for people with more severe visual impairments include

the use of Braille and large raised lettering. However, that Braille is preferred by only 10% of blind people. Raised lettering must be large and is therefore better for indicating simple labels than for extensive text. Due to all this visual impaired persons have lots of difficulty in getting education. In current era of technology, the trend of getting distance education and e-learning is growing fast. Even today all private, public and government sectors are using technology to produce and publish all information on web-sites. Due to that Visual Impaired persons cannot along with the rest of the society. They find themselves lacking something in there skill and ability.

V. SURVEY ANALYSIS

To know, the exact situation with respect to education level among disabled people survey method is used. For that information are collected from various institution of Gujarat. It is found form analysis of collected data that visual.

To know, the exact situation with respect to education level among disabled people survey method is used. For that information are collected from various institution of Gujarat. It is found form analysis of collected data that visual impaired persons and mentally retarded person are facing more difficulty in getting education as well as dropout ratio is also higher. The graphical representations of data are as shown below:

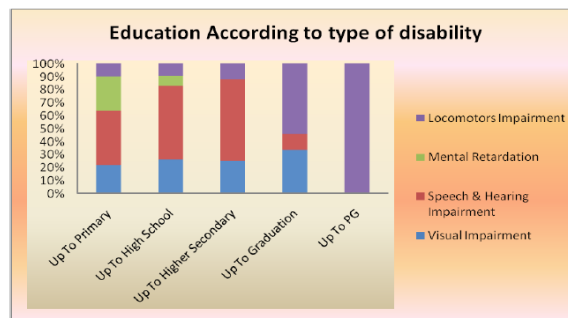


Figure1. Education according to type of Disability

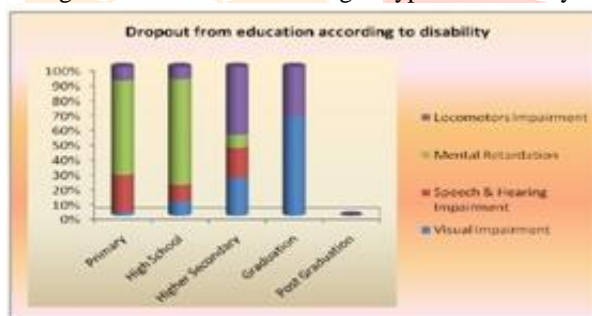


Figure2. Dropout from Education according to type of Disability

VI. ROLE OF TECHNOLOGY IN EDUCATION

Information Technology exerts a powerful influence over the lives of everyone, making life easier, more fulfilling, but sometimes more painful and frustrating. This statement is especially true for people with disabilities. The appropriate application of technologies to diminishing the limitations and extending the capabilities of disabled and handicapped persons is one of the prime social and economic goals of public policy.

Information Technology (IT) has opened up many opportunities for the disabled for learning, employment, travel, social interaction, accessing and exchanging information, participating in sports, arts, tourism, etc...

The Internet is a vast source of knowledge for mankind. Information Technology (IT) has connected people with disabilities around the world. Network operations for the disable in the region and around the world have come together. Computers, laptops, and cell phones are means of connecting people with disabilities. Deaf people can communicate via cell phone and the Internet. Students with disabilities can be integrated into school, since the use of computers is convenient for them. Software for visually challenged people has made communication between humans and machines friendly. Blind people can read the daily newspaper, exchange information, and learn via the Internet.

Information Technology (IT) opens up job opportunities for people with disabilities. Many people with disabilities who are learning IT and using computers have sought jobs, economic independence, and improvement in their life and position.

Education for visual impaired persons

Most of the students with visual impairments need some type of technologies for effective and easy learning. The students who are visually impaired but have some useful visions mostly depend on large print material. A special magnification tools can become more useful for them.

For students with vision impairments and low vision, the computer monitor, appearance, text and icon size, and resolution should all be modified to make text and images more legible and easier to see.

For students who have vision impairments and low vision, start by using the Make the computer easier to see page in the Ease of Access Center found in Windows 7 and Windows Vista.

Accessing e-learning material

In recent years e-learning/ distance learning has become a valuable tool for an increasing number of users. The benefit of this technology includes:

1. Remote learning for students.
2. Remote teaching for teachers living far from schools or universities and
3. Continuing education for adult.

Distance learning can be a valuable opportunity for the visual impaired and for other categories of disabled user, if suitable education methods and appropriate technologies are used. The resource material developed to provide e-learning should be accessible for visual impaired persons and persons with other disability. Interactive learning is quite difficult for visual impaired persons who are using screen reading software and voice synthesizers.

The design of e-learning material must consider three factors:

1. Usability
2. Accessibility
3. Educational effectiveness.

Particularly for blind student, it becomes useful if education materials are accessible and learning path can be defined properly for learners.

VII. ISSUES RELATED TO E-LEARNING MATERIAL

The following issues are kept in mind while generating e-learning material for visual impaired persons.

Content serialization: The screen reader reads the content sequentially. Blind user often have to stop the screen reading at the beginning, and they prefer to navigate by tab keys from link to link, or explore the content row by row.

Content and structure mixing: The important interface elements like images, links and windows object are read by screen reader as and when it appears in the code these elements prove to be very useful for making out the overall page structure for the blind users. However, as the real reading process requires a lot of cognitive effort this can overload the user. The table content organized by columns the screen reader announces the content of the page out of order and consequently, the information is confusing or misleading.

Lack of context: When the users navigate through the screen reader, they can access only small portion of the text and may not get the overall content of the page. Thus, it may be necessary to repeat the reading process again.

Lack of interface overview: Blind people cannot visualize over all structure of interface. So they can navigate for long time without finding the most relevant content. To solve this problem, it is necessary to arrange the HTML code appropriately.

Difficulty in understanding user interface: Links, content and button labels should be context independent and self explanatory.

Difficulty working with form control elements: The screen reader can handle the form elements by activating the modality (form mode on). If the forms are not labeled in correct manner, some unwanted effects may occur and user needs to restart the operation.

Difficulty to access video: A blind person is unable to access multimedia content such as video streaming, video conferencing and captioning.

Consequently, while designing an e-learning environment suitable for various users including those with disabilities, two main aspects should be kept in mind:

1. Accessibility and usability of the system, which provides content and activities for the participants, should be easy to use for all.
2. Accessibility and usability of contents, that is the texts, documents and interactive tools used for educational purposes should be created according to various usability.

This is very important for visual impaired persons who interact by screen reader, which interprets interface content sequentially.

VIII. PROPOSED DESIGN FOR E-LEARNING SYSTEM

To make e-learning system accessible and usable following guidelines, requirements and suggestions can become helpful to developers.

1. **User interface:** The visually impaired person does not recognize the overall structure of interface. Therefore it is important to design interface simple and sequential. Specifically it is possible to group and structure set of homogenous text and elements in order to give the user immediately the idea of the interface and allow them to move from one section to another.
2. **Sequence of content blocks:** Navigation of the container may become an obstacle to learning, so it is very important to place the most important element of the interface at the top of the content read by screen reader in order to access relevant content quickly.
3. **Proper instruction of most important events:** Audio feed back is very useful for blind user for some special events (for example success or failure of operation). It also required to add tone in some case, such as when the interactive forms element receive focus, when lesson is completed or new lesson is started etc.
4. **Simple keyboard interaction:** Interaction with system using keyboard is simplified if proper shortcuts and navigation keys are properly defined to access system.
5. **Multimedia content:** Inability to access multimedia content such as video streaming, video conferencing and other component. Supplementary content in audio presentation can include the exact text presented as well as the description of relevant graphical content.

IX. CONCLUSION

In recent years e-learning/ distance learning has become a valuable tool for an increasing number of users. Information Technology (IT) has opened up many opportunities for the disabled. Distance learning can be a valuable opportunity for the visual impaired and for other categories of disabled user, if suitable education methods and appropriate technologies are used. The resource material developed to provide e-learning should be accessible for visual impaired persons and persons with other disability.

REFERENCES

- [1] Marion A. Hersh and others: Assistive technology for visual impaired and blind people, Published by Springer.
- [2] Journal of Rehabilitation Council of India (Various Issues).
- [3] Beena Shah and D. Vekateswarlu: "Infotech : An Assistive Technology for the Disabled" University News (vol.40 Issue-APRIL-2020, Pages 1-4)
- [4] Accessible Technology in Computing -Examining Awareness, Use, and Future Potential Study: Commissioned by Microsoft Corporation and Conducted by Forrester Research, Inc., in 2004
- [5] Yvonne may Nolan : "Control and communication for physically disabled people, based on vestigial signals from the body" [Online]<http://ee.ucd.ie/rehab/Yvonne/thesis.pdf>
- [6] Teresa Chambel, Pedro Antunes, Carlos Duarte, Luis Carrico, Nuno Guimaraes : "Reflections on Teaching Human-Computer Interaction to Blind Students"
http://www.researchgate.net/publication/227325839_Reflections_on_Teaching_Human-Computer_Interaction_to_Blind_Students/file/d912f50656d001d611.pdf
- [7] Leni Chaudhuri : "Disability in India Issues and Concerns" [Online].
<http://www.apangutkarsh.com/pdf/disabilityinindia.pdf>
- [8] Norma J. Stumbo, Jay K. Martin and Brad N. Hadrick. : "Assistive technology: Impact on education, employment, and independence of individuals with physical disabilities" [Online]
<http://hmlcresearch.wikispaces.com/file/view/Assistive+Technology.pdf>