International Education Conference 2015
Learning Technologies in Education

Editors

Prof. Ahrar Husain
Prof. Ilyas Husain
Prof. Aejaz Masih
Prof. Harjeet K. Bhatia

Faculty of Education
Jamia Millia Islamia
(A Central University)
Jamia Nagar
New Delhi-110025, India

Information and Communication Technologies (ICTs) as a Catalyst for Learning for Differently Abled Learners

Ishrat Naaz

Research Scholar, Department of Teacher Training &
Non-Formal Education (IASE), Jamia Millia Islamia, New Delhi
E-mail: ishrat.naaz@yahoo.com

Abstract—*"For most people technology makes things easier, for persons with disabilities (differently abled learners), technology makes things possible" (Radabaugh, 1988, as cited in Ribeiro & Moreira, 2010). This statement creates a realisation about the importance of using technology for making things possible for differently abled learners. The potential of Information and Communications Technology in all forms of education has been well demonstrated. This paper examines how ICT acts as a catalyst for learning for differently abled learners. Different types of ICT tools assist the differently abled learners by providing them with learning opportunities, capabilities and also increase potential in different walks of life. ICT makes them capable by providing the ability to access knowledge with the help of suitable digital media. An illustrious example in this respect is that of Stephen Hawking, the world renowned astrophysicist, who cannot even move any of his limbs and hardly can utter some words, contributing significantly at the highest level to the world of knowledge and research. It became possible due to the ICT device developed for him to communicate his ideas to the world. Differently abled learners in India are often left out of mainstream schools due to a variety of reasons, primarily the lack of awareness amongst educational organizations and teachers, near absence of infrastructural resources and lack of training in this regard. It is believed that barely two per cent of the 70 million disabled persons have access to education in India. Researches have shown that the appropriate use of ICTs can catalyze the paradigmatic shift in both content and pedagogy that is at the heart of education reform in the 21st century. If designed and implemented properly, ICT-supported education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning. Studies have investigated how information and communications technologies (ICT) can influence the education of differently abled learners and have shown that this technology can play an important and useful role. This paper examines some ICT tools/applications for assisting different kind of differently abled learners such as ICT bases specialized vocational training to perform functions within abilities, specialized keyboards, such as Braille, Braille Printer, conversion of local language to Braille, screen readers, touch screens, eye tracking, talking word processors, screen magnifiers etc which are being used to improve quality support curricular changes and new learning experiences. The paper also talks about some innovations in the form of Assistive Technologies such as JAWS (Job Access with Speech), Sparsha, Window-Eyes, TOBII Eye Tracking System, I-Communicator, Head-Mouse Extreme, Math Daisy, Text Help System etc which have really helped those with physical disabilities. They have really helped to bridge the gap between learning and access of these individuals and that of those without disabilities. This paper also explores the benefits and limitations of ICT as a tool for learning for differently abled learners. The barriers of inadequate teacher training and high cost are problematic—significantly inhibiting the use of technology in*

classroom settings—but are not insurmountable. In the end, the paper concludes with some suggestions for its better usage as a tool which can work as a catalyst to improve learning for differently abled learners.

INTRODUCTION

The ICT stands for Information and Communication Technologies and is defined as a "Diverse set of technological tools and resources used to communicate, and to create, disseminate, store and manage information". These technologies include computers, the Internet, broad casting technologies (radio and television), and telephony.

ICT has become a very important part of the educational delivery and management processes. ICT in education is any educational technology that is applied in the educational process. It encompasses Hardware approach like use of machines and materials, Software approach like use of methodologies and strategies of teaching learning and Systems approach that uses the management technology that deals with the systematic organization of the hardware and the software. Different software packages for the use of ICT in different department of education; e.g. library software, administration software, software related to managing the entire teaching learning process. ICT is changing processes of teaching and learning by adding elements of vitality to learning environments including virtual environments for the purpose. New technologies make it possible for complicated collaborative activities of teaching and learning by dividing it in space and time, with seamless connectivity between them. Due to its capability to offer anytime and anywhere, access to remote learning resources, ICT is a potentially powerful tool for offering educational opportunities, both to previously underserved constituencies including differently abled learners as well as all others who for reasons of cost or because of time constraints are unable to register for on campus programs.

Today ICT is being used as a tool for improving the quality of life by improved efficiency and enhanced effectiveness. Different types of ICT tools assist the people with disabilities by providing them with learning opportunities, capabilities and also increase potential of the disabled in different walks of life. ICT makes them capable by providing the ability to access knowledge with the help of suitable digital media. ICT is playing very important role in communicating with peers, thereby promoting collaborative and social learning environment. ICT also helps disabled students in reading, writing, hearing and seeing process.

ICT is proving very effective in delivering learning to the disabled. An illustrious example in this respect is that of Stephen Hawking, the world renowned astrophysicist, who cannot even move any of his limbs and hardly can utter some words, contributing significantly at the highest level to the world of knowledge and research. It became possible due to the ICT device developed for him to communicate his ideas to the world.

Many studies over the last 30 years have shown that technology can play a significant role in any work with specific disadvantaged groups such as the blind and those with movement disabilities. It can do so in the provision of media to facilitate communication and education, but also in other learning. Studies have also investigated how information and communications technologies (ICTs) can influence the education of students with Learning Disability (LD) and have shown that this technology can play an important and useful role.

ICT is a particularly valuable tool for people with disabilities and can improve their quality of life, reduce social inclusion and increase participation. This is internationally recognised, as are some of the barriers–social, economic and political–that inaccessible information technology can create (WSIS, 2010). Balanskat *et al.* (2006) in their review of ICT impact in schools in Europe, highlight evidence of the impact ICT can have on motivation, engaging low achievers, supporting differentiation and improving behaviour. Blamire (2009) provides extensive evidence that ICT increases learner motivation, confidence and engagement. UNESCO, in a recent global report (UNESCO, 2013a) dedicated a chapter to using ICTs innovatively in education to improve affordability, accessibility and adaptability. Although the focus is primarily on access to information and knowledge, rather than education per se, it provides a useful analysis of the issues around emerging technologies and the challenge of ensuring that information and content is accessible to differently abled learners.

ROLE/ USES OF ICT FOR DIFFERENTLY ABLED LEARNERS

Research has shown that the appropriate use of ICTs can catalyze the paradigmatic shift in both content and pedagogy that is at the heart of education reform in the 21st century. If designed and implemented properly, ICT-supported education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning. The educational needs of people with disabilities are vastly diverse. On the one hand, they must, as their peers, get knowledge and skills required in the society in which they live. On the other, they have additional demands (often referred to as special educational needs) caused by functional limitations which affect learners' ability to access standard educational methods of instruction, therefore, prevent educational progress. In this context, ICT application is very important as it plays an essential role in providing high quality education for differently abled learners. ICTs have been introduced into the teaching-learning process in order to improve quality, support curricular changes and new learning experiences. In this way it is possible to meet the specific learning needs of different learner groups, including differently abled learners. Though specific applications of ICTs are extremely diverse and varied, they may be grouped into the following main categories:

- Compensation uses.
- Didactic uses.
- Communication uses

ICTs FOR COMPENSATION USES

That is the use of new technologies as a technical assistance that allows students with special needs to take active part in the process of interaction and communication, if a person has motor disability he may be helped to write, or to read if a person is with a visual deficiency. From this point of view ICTs develop the students' ability to control their environment, make choices about their experiences, support problem-solving, give access to information, thereby enhance communication with others both in the immediate environment and around the world. In other words, technology can recoup or substitute the lack of natural functions.

ICTs FOR DIDACTIC USES

ICTs used as a learning tool have prompted a new dimension of education and launched the transformation of the educational approaches. ICT application brings a variety of new teaching and assessment strategies for students with different educational needs. Here we must note that information technologies as a didactical tool are suitable for implementing the inclusive education. In order to enhance personal development, educational initiatives within the inclusive curriculum must aim at meeting unique needs, differences, and abilities of an individual; hence they must be fully supported to achieve these goals at an appropriate pace. Information technologies, thereupon, will become a valuable resource for inclusion.

ICTs FOR COMMUNICATION USES

Technologies can mediate communication with people having disabilities (often referred to as Alternative and Augmentative Communication). Assistive devices and software to meet the needs of students with definite communication difficulties are specific to every disability. We talk about the computer as a resource that eases and makes the communication possible, allowing a person with communicative disorders to exhibit his/her abilities in a more convenient way, or people with motor and communicative disorders to start communication, show the needs and make the demands. Furthermore, where teachers are in short supply (as in special education) distance teaching methods can help provide special services between geographically dispersed students and teachers.

DIFFICULTIES OF DIFFERENTLY ABLED LEARNERS IN USING ICT

Due to different kind of limitations, disabled people may not be able to use ICT applications and devices with ease, as it may be used by others. Some of the difficulties which are generally faced by different types of a disabled are:

- A physical impaired user may have difficulties in using input devices.
- A visual impaired user may have difficulties in seeing display devices.
- A hearing impaired user may have difficulties in hearing audio information.
- A person with learning/ cognitive disability may have problem in understanding system operations.

To solve above mentioned problems, assistive technologies are used. Assistive technologies usually refer to those products, devices or equipment's, which are used to increase or improve the functional capacities of individuals with disabilities. Some of the assistive technologies such as touch screen interface can be beneficial to those who have difficulty in using input devices such as a mouse or keyboard. When it is used in combination with software such as on-screen keyboards, or other assistive technology, they make computing facility more accessible to people who are having difficulty in using computers. ICT usually improves the efficiency and effectiveness of a common individual learner, but for a differently abled learner it represents more than this. ICT for them is a sort of extension of their physical body part and provides an opportunity to communicate, gain access to education services and become gainfully employed.

ICT TOOLS/ APPLICATIONS FOR DIFFERENTLY ABLED LEARNERS

All students need the skills and opportunity to participate in our increasingly information-focused society and economy. The ubiquitous role of the computer is accelerating electronic communication and expanding electronic interaction through desktop, laptop, tablet, and handheld computers. Digital alternatives and the advent of e-commerce, e-government, and e-learning services present opportunities for individuals with special needs to exploit and benefit from these resources through the use of assistive technologies.

Research supports the use of computer-assisted instruction (CAI) for differently abled learners as a supplement to traditional instruction (Christmann et al. 1997). One of the obvious benefits is that a computer allows such students to work at an individual pace. Several excellent science-based CAI software packages are available for such students. The development of such tools and applications presents new opportunities for these individuals to mainstream their activities and lifestyles, promoting their inclusive growth. An excellent example is Edmark's Virtual Lab Series, which gives these students the opportunity to explore light and electricity. Through computer simulation software, students can participate in lab activities that might otherwise be difficult, if not impossible. In addition, students who are unable to perform tasks that require the use of fine motor skills can use software that operates with single-switch technology. Single-switch technology allows students to trigger mouse "clicks" without applying pressure to mouse buttons.

Assistive Technology (AT) is basically; anything that makes a task easier to perform (including handheld text readers, sonar vision glasses for the blind, and keyboard aids) is considered assistive technology. Assistive technology also includes services for evaluation, design, customization, adaptation, maintenance, repair, therapy, training, or technical assistance (Sharp 2002). On a daily basis, all people use technology to function more fully in their lives. However, for people who have disabilities, it is sometimes impossible to function in a world designed for people without disabilities. Because disabilities differ among students, each student must be fitted with assistive technologies that are commensurate with their individual needs.

ALTERNATIVE KEYBOARDS (KEYBOARD EMULATORS)

Hardware that replaces or works in addition to a standard keyboard. They may be larger than standard keyboards, may have the keys configured differently, or may be set up for one-handed typing. Alternative keyboards must be positioned to meet the specific needs of any user.

AUGMENTATIVE/ ALTERNATIVE COMMUNICATION

Any communication methodology and code used to enhance or substitute communication for persons who are non-verbal or who have limited functional speech. Communication devices that support the use of AAC are also known as Voice Output Communication Aids (or VOCAs).

BRAILLE

The most widely used tactile substitution code for people with visual impairments. Each Braille character consists of a cell of either six or eight dots. Dots 7 and 8 can be used as a part of the character (mostly in European 8 dot Braille) or to show the position of the cursor in the text. They can be used for advanced mathematics work and computer coding too.

BRAILLE PRINTER

Hardware that prints documents in Braille on embossed paper through a Braille translation programme.

JOYSTICK

A device with four or five directional controls, joysticks can be used for mobility, to drive a wheelchair, or to access computers. Joysticks can be positioned for use with the hand, chin, foot, or head.

SCREEN READER

Software that supports the generation of speech or Braille to enable a visually impaired user to navigate the computer screen by having the text spoken out loud or reproduced on a Braille display.

SPEECH RECOGNITION/ VOICE RECOGNITION

Software and hardware (microphone) that allows a user to control the computer through spoken commands rather than by a keyboard/mouse.

SPEECH SYNTHESIZER

A device which presents artificial voices and uses either digitally stored vocabulary recorded by humans, or text-to-speech mechanisms that convert spelled text into spoken words.

SWITCH MOUNT

A device that allows a switch to be mounted in a variety of positions. A switch may be attached to a wheelchair and positioned to allow its easy activation. It may be positioned at the head, knee, chin, foot, elbow, or other site.

TRACKBALLS

A device that looks like an upside-down mouse, with a movable ball on top of a stationary base. The ball can be rotated with a pointing device or hand.

TOUCH SCREEN

A device placed on the computer monitor (or built in it) that allows direct selection or activation of the computer by a touch of the screen.

TOUCH-SENSITIVE KEYBOARD

A pressure-sensitive membrane that responds to a touch. It can be fitted with various overlays customized with letters, words, or pictures.

JAWS

JAWS (Job Access with Speech) is one of the most popular and effective soft ware's developed for the blind or visually impaired. The software enables visually challenged readers to read a computer screen with the help of a text-to-speech output or a refreshable Braille display. Such easy computer access for the blind would be unimaginable without JAWS.

SPARSHA

Sparsha is a toolset for the blind. Sparsha can translate the text on screen to Bharati Braille-a unified Braille script used to write English languages using cells containing six Braille dots. Apart from English, the languages supported by Sparsha include Hindi, Bengali, Assamese, Marathi, Gujarati, Oriya, Telugu and Kannada. Not only can it represent the text on screen in Braille, but it can also transliterate English into any of the above mentioned scripts. It has the facility to save the document, as well, so that it can be later printed using a Braille printer. Sparsha goes a step beyond being just a screen reader and also allows for reverse transliteration, so that Braille can be converted to text on screen. This has greatly reduced the communication gap between the visually impaired and other sighted people, making it far more seamless.

SANYOG

Since its inception in 2001, Sanyog-a project of the Indian Institute of Technology, Kharagpur-has impacted the lives of several speech impaired children, and enabled them to express themselves in creative ways. It is an Alternative and Augmented Communication tool that enables students with high motor disability use special access switches to represent their thoughts through icons and images. It then takes these images to form syntactically and semantically correct sentences in English, as well as in Indian languages such as Bengali and Hindi. Further, it also enables users to personalize icons to further represent their thoughts more accurately. The sentence thus formed can then be spoken out using the text to speech system made specifically for Sanyog.

AVAZ

AVAZ is the product which is India's first portable speech synthesizer and enables non-verbal persons to convey virtually any thought in their mind by providing them an 'artificial voice'. The principles of universal design are being followed by Inventions Labs so as to enable non-verbal persons with different kinds of disabilities to use the device. For example, the lack of motor control skills prevents persons with Cerebral Palsy, many of whom are non-verbal, from using traditional means of communication like writing or typing. AVAZ can easily be adapted for use by such persons with the help of commercially available access switches, many of which are compatible with the device.

LITERACY SOFTWARE

Literacy software solutions are also useful for those who have difficulties reading, writing and spelling or have Dyslexia. By harnessing the power of the inbuilt speech output facility, computer users can write, read, view and check text alongside a human sounding voice. High tech readers can be used by a visually impaired person to read any kind of printed material.

BENEFITS OF USING ICT IN IMPROVING CAPABILITIES OF DIFFERENTLY ABLED LEARNERS

A report by Fresh Minds Research into the Economic benefits of digital inclusion was published in May 2008 by UK Online Centres. The report said that ICT-assisted learning has been shown not only to stimulate learning but can also be demonstrably related to academic achievement. Some of the benefits of using ICTs in improving capabilities of differently abled learners have been dealt here:

- ICT is useful in improving a person's quality of life by enhancing effectiveness of teaching, developing life skills; complementing learning in special needs education, and exploring other related issues.

- ICT enables differently abled learners to gain access to the curriculum and supported learning, and provides a platform for disabled trainers to promote their skills.

- ICT is heralded as enabling PWDs to participate fully and to enhance the social and economic life of their communities. Combined with proper methodologies, it can offer individuals the capacity to compensate for physical or functional limitations.

- ICT is a significant force in terms of choice and opportunity for disabled students, and a significant means of bridging this gap.

- Computers can improve independent access for students to education (Moore and Taylor, 2000; Waddell, 2000)

- Students with special educational needs are able to accomplish tasks working at their own pace (ACE Centre Advisory Trust, 1999)

- Visually impaired students using the internet can access information alongside their sighted peers (Waddell, 2000)
- Students with profound and multiple learning difficulties can communicate more easily (Detheridge, 1997)
- Students using voice communication aids gain confidence and social credibility at school and in their communities (Worth, 2001)
- Increased ICT confidence amongst students motivates them to use the internet at home for school work and leisure interests (Waddell, 2000).
- ICT offers the old and young alike an opportunity to overcome social barriers to interaction and communication that can be caused by the lack of provision for impairments or lifelong limiting illness.
- ICT has also been identified as playing a significant role in offering severely disabled people an increased degree of independence in their everyday lives.
- ICT provides disabled persons with an improved quality of life and offers the possibility of accessing knowledge by adapting digital media to the nature of their disabilities.

LIMITATIONS IN USING ICT FOR DIFFERENTLY ABLED LEARNERS

The act of integrating ICT into teaching and learning process for differently abled learners is a complex process and one may encounter several limitations and difficulties. These limitations are given below:

- Lack of specialized disabled friendly teacher training.
- Limited flexibility in training options for people with disability.
- Limited availability of specialized disabled friendly hardware and software resources, due to business constrains.
- Lack of formal involvement of the government organizations and support structure for ICT for the disabled.
- Attitude barriers towards people with disability.
- Lack of appropriate disabled friendly policies and their implementation.
- Limitation of finances.

SUGGESTIONS FOR IMPROVEMENT IN USING ICTS FOR DIFFERENTLY ABLED LEARNERS

Below are some suggestions which, if taken care of, while planning, using, developing tools, applications and infrastructure for differently abled learners, will have impact in imparting assistive teaching and learning:

- Improvement of networking facilities to allow more effective co-operation between institutions and tele centres to assist all types of disabled people using online network.

- Creation of virtual environment for supporting different types of disabled learners

- Development of user-friendly multiple types of user interfaces for the same devise\application for facilitating different types of disables, to increase their ability to use the services

- Teachers/ resource persons should ensure that all (disabled) students have equal access to the same content and learning materials and experiences. Where possible this should involve the same learning technologies and other approaches as non-disabled students. They need to be aware of the need to ensure that disabled and other minority group students are fully included in the curriculum.

- Teachers/ resource persons should be aware of different approaches and the need for some differentiation of learning approaches to enable all students to maximise their learning outcomes. While there are advantages in all students using the same learning technologies, this will not always be feasible. They should also be aware of factors that may affect (disabled) learners, including their motivation, previous experience and confidence as a learner and disabled person, previous education and external demands.

- Teachers/ resource persons will require appropriate and regular training in order to keep up to date on available technologies and programs and the most effective ways to use them. Training is also required on accessibility issues, for instance to design accessible documents and web pages.

- Teachers/ resource persons should be aware of the advantages and disadvantages of different approaches to teaching and learning, as well as particular technologies. They should be able to combine the use of technology with more traditional approaches in appropriate ways in order to best support learning.

- Teachers/ resource persons should motivate students to increase their confidence and improve their self-perception of their learning abilities, as well as to use new technologies (in appropriate ways). They will also need to support learners in developing the new learning and other skills required to learn effectively with new technologies.

- Teachers/ resource persons should use organisational resources, such as centres supporting disabled students, and expertise in order to obtain information, advice and recommendations about teaching and supporting disabled students, including through the use of assistive and other learning technologies.

- Teachers/ resource persons should be open to using new technologies, combinations of new and traditional technologies in innovative ways. This could include the use of applications on mobile technologies and social networking. Online lists and communities, such as the ICT Accessibility in Higher Education Network, may be able to offer useful suggestions.

- Teachers/ resource persons should support cooperative learning, including discussing and negotiating different approaches to learning. They should provide meaningful and accurate feedback, encourage the meaningful use of existing knowledge and skills and also make learning enjoyable, while recognising that what is 'fun' for some students may be stressful for others.

CONCLUSION

The potential of Information and Communications Technology in all forms of education has been well demonstrated. This paper examined how ICT acts as a catalyst for the process of learning of differently abled learners. Different types of ICT tools assist the differently abled learners by providing them with learning opportunities, capabilities and also increase potential in different walks of life. ICT makes them capable by providing the ability to access knowledge with the help of suitable digital media.. In this context, ICT application is very important as it plays an essential role in providing high quality education for differently abled learners. ICTs have been introduced into the teaching-learning process in order to improve quality, support curricular changes and new learning experiences. In this way it is possible to meet the specific learning needs of different learner groups, including differently abled learners.

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