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THE INFLUENCE OF ASSISTIVE TECHNOLOGY ON STUDENTS WITH DISABILITY: A REVIEW

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Abstract

The 21st century is known as century of Technology and the aim of technology is to improve the lives of human beings. Assistive Technology can be defined as equipment and software that are used to maintain or improve the functional capabilities of person with a disability. Technological innovation has dramatically altered the landscape of both preventive and therapeutic approaches to students with disability. Assistive Technology interventions measurably enhance students with learning disabilities immediate and long-term academicals performances. Assistive Technology play significant role in prevention and treatment of students with disability. Technical innovation has had a dramatic impact on a central arena of primary disability prevention: the reduction of serious, disabling injuries in children. In general, children with disabilities rely more heavily than other children on technical interventions, including medications, specialized medical and educational services, and a variety of assistive devices. Childhood disability cannot be fully understood without a clear appreciation for the power and machinery of technical innovation in the modern world. Technical progress in both preventive and therapeutic interventions is constantly reshaping the character and prevalence of students with disability and therefore its essential challenge to both the health and education communities. Computer technology has the potential to act as an equalizer by freeing many students from their disabilities in a way that allows them to achieve their true potential. The results reflected an improvement in student achievement as well as an increase in their attitudes about the use of the technology. Teacher's perceptions also are positive regarding the use of assistive technology to treat Disabled students. Assistive technologies can evoke both positive and negative sentiments from users. The number of students with disability is increase from 10% (1970s) to 15% (2010) in the technological world (WHO, 2010). Assistive devices and technologies can provide social and emotional benefits to users with disabilities. However, these benefits may be countered by negative side effects, such as stigmatization or feelings of helplessness and dependence on technology.

***Keywords**: Assistive Technology, Disability, Compute Technology, Prevention and Treatment of Disability*

Introduction:

The use of technology has been shown to be effective in a wide range of content areas (Ashton, 2005).Research says that use of Assistive Technology (AT) can contribute to strengthening students' skills in decoding, comprehension and reading with fluency (Higgins

& Raskind, 2000), word recognition, reading comprehension, spelling and reading strategies (Raskind & Higgins, 1999), spelling (MacArthur, Graham, Haynes, & DeLapaz, 1996), organizing, reading and synthesizing information (Anderson, Inman, Knox-Quinn, & Homey, 1996), proofreading (Raskind & Higgins, 1995) and writing (Raskind & Higgins, 1995). AT has proved effective in assisting LD students perform better and more accurately, gain knowledge and confidence, gain independence in performing tasks, achieve better.

Assistive Technology

Assistive Technology (AT)is defined by Raskind and Higgins (1998) as "any technology that enables an individual with a learning disability to compensate for specific deficits". AT covers a wide range of software which helps students read, writes, organize information and spell.

Assistive technology can be defined as: "equipment and software that are used to maintain or improve the functional capabilities of a person with a disability"

Assistive technologies they may need to use include:

- Technology that facilitates access to a standard PC,
- Technology that facilitates access to the Internet,
- Technology that facilitates access to and manipulation of written word,
- Technology that facilitates access to and manipulation of spoken word,
- Technology that helps to compensate for cognitive deficits.

Assistive technology includes hardware such as scanners, adapted keyboards or hearing aids and software such as speech recognition software or thought organisation software. Assistive technology is often associated with high-tech systems such as speech recognition software, but it can include low-tech solutions such as arm wrests or wrist guards.

Technological innovation is transforming the prevalence and functional impact of child disability, the scale of social disparities in child disability, and perhaps the essential meaning of disability in an increasingly technology-dominated world. In this article, Paul Wise investigates several specific facets of this transformation. He begins by showing how technological change influences the definition of disability, noting that all technology attempts to address some deficiency in human capacity or in the human condition.

Wise then looks at the impact of technology on childhood disabilities. Technical improvements in the physical environment, such as better housing, safer roads, and poison-prevention packaging, have significantly reduced childhood injury and disability. Other technological breakthroughs, such as those that identify genetic disorders that may lead to pregnancy termination, raise difficult moral and ethical issues. Technologies that identify potential health risks are also problematic in the absence of any efficient treatment.

Wise stresses the imbalance in the existing health care delivery system, which is geared toward treating childhood physical illnesses that are declining in prevalence at a time when mental and emotional conditions, many of which are not yet well understood, are on the rise. This mismatch, Wise says, poses complex challenges to caring for disabled children, particularly in providing them with highly coordinated and integrated systems of care.

Technology can also widen social disparities in health care for people, including children with disabilities. As Wise observes, efficacy—the ability of a technology to change health outcomes —is key to understanding the relationship of technology to social disparities. As technological innovation enhances efficacy, access to that technology becomes more important. Health outcomes may improve for those who can afford the technology, for example, but not for others. Hence, as efficacy grows, so too does the burden on society to provide access to technology equitably to all those in need. Without such access, technological innovation will likely expand disparities in child outcomes rather than reduce them.

Examples of assistive technology in use

Christopher has a visual impairment and finds standard computer kit onerous to use. He benefits from a larger monitor and some of the Windows high visibility background and text colour schemes, adjusting contrast and font size as appropriate. With the addition of text magnification and screen reading technology, as well as an OCR (optical character recognition) scanner with a facility for speaking written text, Christopher is producing the quality of work of which he is capable. Emily is a student who has ME (chronic fatigue syndrome) and struggles with tiredness and the associated lack of concentration. Although computers are available in her institution, demand outstrips supply and Emily finds it difficult to work ‘to order’, especially when there are people around waiting to use the equipment. Emily has used her DSA (Disabled Students Allowance) to buy her own PC, which she accesses with a small keyboard. Typing and proof reading work is minimised through the use of software modifications including an auto-correction facility and templates.

In addition, Emily can use a speech recognition package for ‘hands free’ computing. Finally, ‘Text help, Read and Write’ has been installed on her machine. This has a number of useful functions including word prediction and homophone checking, and will speak text audibly for proofing. Wald illustrates how speech recognition systems and other technologies can assist students with a hearing impairment. Keira is both dyslexic and dyspraxic, conditions that affect her ability to record information accurately and to control a mouse and keyboard effectively. She is now using an adaptive solution that meets her needs. This includes a small keyboard and trackerball, which she finds much easier to operate than a standard keyboard and mouse. A scanner with OCR and 'Texthelp Read and Write' enable her to listen to her work and hear text documents rather than having to read them. She also uses a 'brainstorming' package that allows her to enter her ideas and convert them into an action list – a major advantage for a student with a disability that impairs her ability to plan efficiently. Keira finds the auto-correction facility and templates useful features that can speed up the writing process by avoiding reentering often-used blocks of text and phrases. Another example of equipment which students find useful is a reader pen a light, hand-held version of a scanner which, when linked to other software, can provide an immediate spoken definition of a new word. Draffan provides a more in-depth overview of the types of assistive technology that dyslexic students might benefit from using. Beacham illustrates how the design of computer based learning materials for dyslexic students can be theory driven.

Gerry explained that there are seven main requirements of an ETA:

- Simple to use
- Easy to interpret mobility information
- Discreteness of mobility device
- Public understanding of mobility device detection of objects within a normal visual range (approximately 180 degrees)
- Assist in crowded places and
- Does not interfere with other senses

Benefits of AT

AT increases students' independence, builds their self-esteem and enhances their motivation to actively participate in academic study and improve their reading performance. It helps students develop independent work strategies and organizational skills. It endows students with life-long learning skills.

Disability:

According to Neal Half on and his colleagues, "A disability is an environmentally contextualized health-related limitation in a child's existing or emergent capacity to perform developmentally appropriate activities and participate, as desired, in society".

A careful examination of the relationship between disability and technology, however, raises important questions related to the definition and societal meaning of disability in the face of rapidly changing technological capabilities. First, a changing technological environment can dramatically alter the functional impact of any given disability. For example, the development of the telephone greatly enhanced communication in general society. At the same time, the central importance of aural communication in a telephone-dominated society made deafness an increasingly debilitating disability. Similarly, the emergence of a computer-dominated society and its text-based reliance on e-mail and cell phone texting has placed new burdens on the blind. Second, the dynamic interaction between disabilities and technology development underscores the rather arbitrary nature of disability definitions. Virtually all technologies attempt to address some deficiency in human capacity or in the human condition. Automobiles address human inability to move quickly over long distances; telephones address their inability to communicate with their voice over long distances; typewriters and their successors compensate for poor and slow penmanship. At some level, therefore, the definition of disability and the role of technology reflect both the prevalence of a lack of a particular capability and the social response to it. The interactions between disability and technology are, therefore, intensely dynamic and generally evade static categorization or definitions. Indeed, these interactions are undergoing such rapid evolution that they have generated a proliferation of philosophical challenges that have transcended the meaning of disability to seek the meaning of being human.

The 2004 reauthorization of the Individuals with Disabilities Education Act (IDEA) details the requirements and resources for special education services in the United States. The following categories of disability can qualify a student for special education services:

- Autism
- Orthopaedic impairment
- Deaf-blindness
- Other health impairment
- Deafness
- Specific learning disability
- Emotional disturbance
- Speech or language impairment
- Hearing impairment
- Traumatic brain injury
- Mental retardation
- Visual impairment
- Multiple disabilities

The IDEA requires Individualized Education Program (IEP) teams, which include parents, to review and recommend assistive technologies (ATs) and determine required accommodations for an individual student. This includes specialized technologies required for students with sensory or learning disabilities to access or produce printed materials, interact with classroom content, or communicate with their teachers and peers.

Many more students, however, could benefit from more deliberate use of new features built into today's technologies. Currently, the largest number of students receiving special education services is in the "specific learning disability" category. This growing student population experiences difficulty in oral expression, written expression, listening comprehension, basic reading skills, reading fluency skills, reading comprehension, mathematics calculation, or mathematics problem solving. For many students, these learning difficulties will remain lifelong challenges, but others will develop compensatory skill sets or successful coping strategies. Technology use can be a key factor for some students in turning a learning *disability* into a learning *difference*.

The 2002 reauthorization of the Elementary and Secondary Education Act—better known as No Child Left Behind (NCLB)—stresses ongoing assessment to identify and remediate the academic performance of underachievers and at-risk students before they fail and potentially become eligible for special education services. NCLB gave rise to a new paradigm for instructional practice embodied in the Response to Intervention (RTI) model. RTI programs utilize benchmark assessments to identify struggling students and then deliver tiered interventions designed to improve

How are the lives of people with disabilities affected?

The disabling barriers contribute to the disadvantages experienced by people with disabilities.

Poorer health outcomes

Increasing evidence suggests that people with disabilities experience poorer levels of health than the general population. Depending on the group and setting, persons with disabilities may experience greater vulnerability to preventable secondary conditions, co-morbidities, and age-related conditions. Some studies have also indicated that people with disabilities have higher rates of risky behaviours such as smoking, poor diet and physical inactivity. People with disabilities also have a higher risk of being exposed to violence.Unmet needs for rehabilitation services (including assistive devices) can result in poor outcomes for people with disabilities including deterioration in general health status, activity limitations, participation restrictions and reduced quality of life.

Lower educational achievements

Children with disabilities are less likely to start school than their peers without disabilities, and have lower rates of staying and being promoted in schools. Education completion gaps are found across all age groups in both low-income and high-income countries, with the pattern more pronounced in poorer countries. The difference between the percentage of disabled children and the percentage of non-disabled children attending primary school ranges from 10% in India to 60% in Indonesia. In secondary education the difference in attendance ranges from 15% in Cambodia to 58% in Indonesia (*24*). Even in countries with high primary school enrolment rates, such as those in eastern Europe, many children with disabilities do not attend school.

Less economic participation

People with disabilities are more likely to be unemployed and generally earn less even when employed. Global data from the *World Health Survey* show that employment rates are lower for disabled men (53%) and disabled women (20%) than for non-disabled men (65%) and women (30%). A recent study from the Organization for Economic Co-operation and Development (OECD) (*25*) showed that in 27 countries working-age persons with disabilities experienced significant labour market disadvantage and worse labour market outcomes than working-age persons without disabilities. On average, their employment rate, at 44%, was over half that for persons without disability (75%). The inactivity rate was about 2.5 times higher among persons without disability (49% and 20%, respectively).

Higher rates of poverty

People with disabilities thus experience higher rates of poverty than non-disabled people. On average, persons with disabilities and households with a disabled member experience higher rates of deprivations – including food insecurity, poor housing, lack of access to safe water and sanitation, and inadequate access to health care – and fewer assets than persons and households without a disability.People with disabilities may have extra costs for personal support or for medical care or assistive devices. Because of these higher costs, people with disabilities and their households are likely to be poorer than non-disabled people with similar income. Disabled people in low-income countries are 50% more likely to experience catastrophic health expenditure than non-disabled people

Increased dependency and restricted participation

Reliance on institutional solutions, lack of community living and inadequate services leave people with disabilities isolated and dependent on others. A survey of 1505 non-elderly adults with disability in the United States found that 42% reported having failed to move in or out of a bed or a chair because no one was are reported to be responsible for a lack of autonomy, segregation of people with disabilities from the wider community, and other human rights violations.

Most support comes from family members or social networks. But exclusive reliance on informal support can have adverse consequences for caregivers, including stress, isolation, and lost socioeconomic opportunities. These difficulties increase as family member's age. In the United States members of families of children with developmental disabilities work fewer hours than those in other families, are more likely to have left their employment, have more severe financial problems, and are less likely to take on a new job.

Negative attitudes towards disability can result in negative treatment of people with disabilities, for example:

- Children bullying other children with disabilities in schools
- Bus drivers failing to support access needs of passengers with disabilities
- Employers discriminating against people with disabilities
- Strangers mocking people with disabilities.

The Impact of Preventive and Therapeutic Technologies on Childhood Disabilities

Technological innovation has dramatically altered the landscape of both preventive and therapeutic approaches to childhood disability. Advanced preventive strategies reflect new capacities to reduce the occurrence of a disabling condition. The development of a broad array of new vaccines has helped prevent a variety of infectious diseases, such as meningitis, which in turn can result in serious disabling sequelae. Technologies have also played an important role in the early diagnosis of potentially disabling conditions, such as phenylketonuria and other genetic disorders; early diagnosis can permit the early implementation of preventive interventions, including dietary alteration. Rapid progress in therapeutic interventions has also in many instances reduced the impact of disability on daily functioning and social engagement.

Preventive Technologies

Technical innovation has had a dramatic impact on a central arena of primary disability prevention: the reduction of serious, disabling injuries in children. The importance of this preventive domain stems not only from the significant contribution that injuries make to disabling conditions in childhood but also from the strong evidence that injuries are highly preventable. Technical improvements in the physical environment of children, including housing, automobile travel, pedestrian and water safety, medication and poison packaging, and playground design, have led to significant reductions in injury-related mortality and disability in children.4 These examples also highlight the interactions between the legal environment, which has mandated safety improvements, and the development of technologies to meet these standards.

Therapeutic Technologies

In general, children with disabilities rely more heavily than other children on technical interventions, including medications, specialized medical and educational services, and a variety of assistive devices. The term "assistive technology device" was initially documented in federal legislation in the United States as part of the Technology-Related Assistance for Individuals with Disabilities Act of 1988. The proposed definition was "any item, piece of equipment or product system—whether acquired commercially, modified, or customized—that is used to increase, maintain, or improve functional capabilities of individuals with disabilities." Despite changes in the supporting legislation in 1994 and 1998, this definition has remained largely intact and in widespread use.

Analysis of various government reports and policy documents clearly suggests that international mandates and policy frameworks have provided a significant impetus to efforts undertaken at the national level. The UN General Assembly's declaration of 1981 as the International Year of Disabled Persons; proclamation of 1983-1992 as the Decade of the Disabled by UN; followed by the UNESCAP Decade of the Disabled Persons from 1993-2002; and subsequently the World Conference on Special Needs Education in Salamanca in June 1994, have all played an important role in bringing the spotlight on to people with disabilities, especially on education as a vehicle for integration and empowerment. Not surprisingly, many of these mandates have shaped new national legislations and policies. Here the following four legislations have had a significant impact on the government and the NGO sector, of these the first three are specific to people with disabilities:

- *Rehabilitation Council of India Act (1992):* states that CWSN will be taught by a trained teacher.
- *Persons with Disabilities Act (1995):* educational entitlement for all CWSN up to 18 years in an appropriate environment.
- *National Trust Act (1999):* provide services and support to severely disabled children.
- *The 86th Constitutional Amendment (2007):* free and compulsory education to children, up to 14 years.

These legal mandates have also helped shape the comprehensive National Action Plan for Inclusion in Education of the Children and Persons with Disabilities (MHRD, 2005), and the National Policy for Persons with Disabilities in 2006 (an MSJE initiative). While some have argued that India has one of the most progressive disability policy frameworks amongst the developing economies, I would note that there remains a huge challenge in operational sing this vision, which is in itself marked by contradictory and conflicting messages. Thus, there is a need to critically re-examine some of the assumptions that have underpinned these frameworks. For example, while the PWD Act makes an attempt at purporting a rights-based approach, the guidance in achieving the vision it offers is very weak, and there remain too many caveats. Additionally, the Act lacks any strong enforcement mechanisms.

Computer technology has also enhanced the development of sophisticated devices that can assist the two million students with more severe disabilities in overcoming a wide range of limitations that hinder classroom participation—from speech and hearing impairments to blindness and severe physical disabilities. However, many teachers are not adequately trained on how to use technology effectively in their classrooms, and the cost of the technology is a serious consideration for all schools. Thus, although computer technology has the potential to act as an equalizer by freeing many students from their disabilities, the barriers of inadequate training and cost must first be overcome before more widespread use can become a reality.

Technologies for Students with Mild Learning and Behavioural Disorders

Students with learning disabilities and emotional problems account for nearly 60% of all children receiving special services in schools today, and their numbers are rising each year. These students often have persistent Problems learning and behaving adappriately in school, problems that may become apparent only after teachers work with the students for weeks or months. Such students are likely to be given a broad label indicating only that their academic and social progress is unsatisfactory because of advisability, and their problems often persist despite a teacher’s efforts to meet their students ‘needs within the regular program. Most children with mild learning disabilities spend at least some portion of the school day in the regular classroom, even though many of these students find it difficult to keep up with their nondisabled peers and their teachers often find it difficult to spend significant amounts of time providing them with individual attention. Technology has proven to be an effective method of giving such students opportunities to engage in basic drill and practice, simulations, exploratory, or communication activities that are matched to their individual needs and abilities.

A teacher's ultimate goal is to help students develop skills and knowledge that can be used in real-world settings. Many computer-based applications—such as the Internet, communication technologies,

CD-ROM reference materials, and multimedia presentation tools—can provide students with opportunities to use their skills to engage in projects that address real-world problems.

Word Processing Software

The attributes of word processing that lead to its effectiveness as a learning tool for children with special needs are generally the same attributes that make it effective for children in general. For example, the ease of revising text, producing clean and readable text, and feeling a sense of authorship are frequently mentioned as attributes of word processors that lead to improved writing. Researchers have found that students are more willing to edit their work and to make necessary corrections on a word processor than on handwritten drafts. In addition, the word processor frees students from the more tedious duties related to the editing process, enabling them to spend more time on the content of their written products. These benefits are significant for the many students with mild learning disorders related to deficits in written language skills, who often need to spend a significant amount of time rewriting a passage to communicate an idea clearly.

Word Prediction Software

Word prediction software is another example of a computer-based technology that can help students communicates with written language more easily. This software, when used in conjunction with traditional word processing programs, reduces the number of keystrokes that are required to type words and provides assistance with spelling for students of various ability levels. For example, in one application, a list of words appears that begins with the letter a student presses on the computer keyboard. As additional letters are added to the sequence, the list is updated to limit the words to the sequence that has been entered.

Communication Technologies

Use of computers for communication and networking activities via the Internet can expand the learning environment beyond the walls of the classroom and allow students with disabilities, just like other students, to access and send information literally around the world. Yet improved access and delivery systems do not necessarily bring improved instruction. To the contrary, improved learning is dependent upon the quality of instruction and not on the medium through which it is delivered. Communication technologies become a powerful tool for learning only if they offer students opportunities to gather a wide variety of resources and information and then to exchange their thoughts and ideas with others in collaborative learning environments, networked through the Internet.

Hyperlinks

The concept of hyperlinks is not new—infact, speculation about such devices datesback more than 50 years.29 Text with hyperlinks,or “hypertext,” enables users to accesselectronically linked resources with the click

of a mouse, leaping through vast amounts of textual information in a non sequential manner. Hypertext is a web conceptually somewhat like a dictionary or an encyclopaedia with complex interdependencies among units of information that users can jump between in ways that are similar to the way the human mind thinks.30 Hyperlinks enable students to jump to electronic units of information with the speed and freedom of human thought, creating meaningful learning experiences through quick and easy links between new and previously learned information. Hyperlinks are helpful for all students, but they can be especially helpful for students with mild learning disabilities. If a student is reading a book and encounters a reference to another work that would enhance understanding of the content, for example, normally it would be necessary to turn to the bibliography to get the complete reference and then visit the library to track it down.

Alternative keyboards

There are a variety of alternative physical keyboards. For example, there are ergonomic keyboards for people who have hand and upper limb injuries, keyboards that present the keys in a different order (ABC rather than the conventional QWERTY), keyboards that use large keys and colour coding of the letters for people with cognitive and/or vision impairment and key guards that can be used to reduce the risk of the wrong key being activated. Also, the layout of some keyboards can be extensively customised to meet the specific needs of individual users.

Onscreen virtual keyboards

Some people are unable to type, perhaps due to impaired mobility, but still require the functionality provided by a keyboard. Specialist accessibility software can be used to display a virtual keyboard on the computer screen that allows users to enter data with a standard mouse, pointing device or joystick. Onscreen virtual keyboards can also help people who do not know how to type.

Alternative mouse systems

The standard mouse can be difficult for people with some disabilities to use. The user needs to be able to see the mouse cursor, and then move the cursor on the screen by moving the mouse across a flat surface in a precise way. The *trackball* and *touchpad* are probably the two most widely used alternatives to a standard mouse by people who are able to see the screen, but who have impaired upper-limb mobility.

A trackball is like an upside-down mouse, with the ball on the top and often with several buttons, much like an advanced multi-button mouse. With a trackball the actual device remains stationary and movement or rotation of the ball moves the cursor. Different sized balls can be used and people with significant fine motor skill problems often use a large ball. The ball is usually moved with the hand, but can also be operated with the foot, elbow or a stick held in the mouth.

A touchpad allows the user to move the cursor on the screen by moving a finger across the touchpad surface, as occurs with many laptop computers. Touchpads can be used by people who are unable to hold a device such as a standard mouse or who have very limited mobility, perhaps an ability to move just one or two fingers as may be the case when someone has motor neurone disease.

Some alternative keyboards can also function as a mouse through the use of Mousekeys. Both Windows and Apple operating systems for example, incorporate Mousekeys as an accessibility feature for people who have difficulty using a mouse. MouseKeys allows the user to control the movement of the mouse cursor with the numeric keypad.

Head wands

A Head wand is a simple device that is strapped the users head, and has a protruding stick that is used to type keys on a standard or modified keyboard. People with severely impaired limb mobility, but who are still able to move their head (for example, someone with cerebral palsy) are able to effectively use websites with head wands.

Head wands are often used in conjunction with the StickyKeys accessibility option that is available with both Windows and Apple systems. Keyboard functions that require the simultaneous pressing of two (or more) keys can be done with StickyKeys, since it enables the user to press a key and release it, and then press the other key or keys, and the software acts as though the keys are being pressed simultaneously.

Switches

People with very limited mobility maybe unable to use either a modified keyboard or mouse. A range of adaptive switches is available to help people in this situation use a computer and access the Web. Most switches consist of one (or a few) buttons, which can be activated by bodily movement. For example, a person who can only move their head maybe able to surf the Web by clicking a switch embedded in a headrest, while someone else might require a foot switch.

Other switches are touch free, relying instead on motion sensors, brain activation, or a suck and puff mechanism.

Switches are often combined with specialist software that extends the functionality of the device allowing more complex tasks to be undertaken. For example, auto-complete typing software can reduce the amount of typing required by looking at what the user starts to type and then presenting a range of choices that the user can select from to complete the word or phrase.

Voice (speech) recognition

Voice (or speech) recognition software allows a person to control a computer with their voice. With voice as the input device, speech can be used to open programs, write documents, save work, use the Web and write and send emails. There is a wide variation in the way people speak, so the voice recognition software needs to learn how to recognise the user's voice and the way they pronounce words. It can also remember commonly used phrases and words and use this information to make predications about what is to be input, thereby speeding up the process.

The accuracy of voice recognition has improved significantly in the last few years however, they still require the user to speak in a voice that is relatively easy to understand. People with disabilities that affect their ability to speak (for example cerebral palsy) may have difficulty using voice recognition as an input technology at this time.

Eye tracking

Eye tracking software allows people to use a computer with nothing more than eye movements. People with little or no control over the movement of their hands, and who also may not be able to speak, can use eye-tracking systems to operate a computer and access the Internet. Some eye tracking software can be combined with a virtual keyboard allowing the user to type by moving their eyes.

Eye tracking systems have the potential to bring very significant benefits to a relatively small number of people. However, at this stage they are very expensive and not widely used as an assistive technology.

Output Technologies

An output technology is a device that presents the data or information from a computer to the user. Most web users are familiar with commonly used output devices such as computer monitors and screens, speakers, printers and projectors. Mobile phones, PDAs, plotters and film recorders can also be used to output website content.A number of specialised assistive output technologies are available to enable people with disabilities to obtain information via the Web.

Screen readers and talking browsers

Screen readers and talking browsers interpret information that can be visually displayed on a computer screen and then present this information as audio output by synthetic speech and/or as tactile output by Braille display. Screen readers and talking browsers also interpret the input interactions made by the user, for example keyboard strokes, entering search requests and checking form radio buttons. These technologies are widely used by people with little or no vision. They are relatively difficult to learn and use and are usually controlled via a standard computer keyboard.

Screen readers don't read the screen. Working in conjunction with a web browser (usually Microsoft Internet Explorer) and an Application Programming Interface (eg. Microsoft Active Accessibility) screen readers use the source code of a web page to construct an alternative, accessible representation of the page and the functional components it contains. When a page is coded correctly, most screen readers are able to present (either through speech or Braille) the text on a web page, alternative descriptions for images and multimedia content, as well as identifying headings, lists items, links, frames, tables and form elements.

The most widely used screen readers in Australia are JAWS (available from Freedom Scientific) and Window-Eyes (GW-Micro). HAL and Supernova (Dolphin Computer Access) and LookOut (Choice Technology) are also used in Australia, but more widely used in other countries, particularly in Europe. Recent versions of the Windows and Apple operating systems have built-in screen readers, but the features are limited so they are not widely used by people who depend on a screen reader to access the Web.

Talking browsers are specialised Internet browsers that are able to present the content of a web page as speech in a similar way to a screen reader. IBM Home Page Reader is the most widely used talking browser. The Home Page Reader speaks web-based information as it is presented on the computer screen and allows the user to identify the different elements of the page such as headings and links. Users with low vision can use the Home Page Reader to magnify the screen and change font size and colour.

Braille display

A Braille display is a device that allows a blind person to read the contents of a computer display (or website) as a line of Braille characters. Braille display devices that are used with computers and the Web are often referred to as Refreshable Braille Displays, since the line of

Braille characters refreshes as the user moves from one line to the next.Refreshable Braille devices have a strip of rubberised material under which is a row of pins that can be made to rise and fall by electrical signals. The pins are presented in groups (arrays) of six or eight pins, which when activated form a Braille character, similar to the raised dots of Braille impressed on paper. There are usually 40, 65, or 80 arrays (characters) per line of text, depending on the size and cost of the device. Refreshable Braille displays generally include directional keys, which allow the user to navigate through a document.

When used in conjunction with a keyboard, the Refreshable Braille display enables a person to operate a computer, read text, send and receive e-mail, and browse the Web.

Refreshable Braille display devices are considerable more expensive than screen reading software to purchase and are less commonly used for accessing the Web when compared to screen readers. However, Braille is an essential communication medium for people with impaired vision and hearing.

Screen magnifiers

Screen magnifiers allow people with low vision to access information on a computer screen. The magnification software can increase the size of the information by a pre-determined amount. Most programs offer a maximum magnification of 16 times, but the most commonly used level of magnification appears to be 4 or 6 times magnified.

The screen magnifier increases the size of everything displayed on the screen, not just the text. Web pages that most people can view without scrolling require scrolling when viewed with a screen magnifier since only a section of the page will fit onto the computer screen. The mouse or keyboard is used to scroll vertically and horizontally as the users moves the area displayed in order to see all the content of the page.

Most screen magnification software has the flexibility to magnify the full screen or parts of the screen. These programs also often allow for inverted colours, enhanced pointer viewing and tracking options. Many screen magnifiers also contain screen reading software that can be used to speak the page content if the user wishes.

The most widely used screen magnifiers in Australia and elsewhere include, ZoomText Magnifier (developed by Ai Squared), MAGic Screen Magnifier (Freedom Scientific) and Luna and Supernova (Dolphin Computer Access).

Captions

All of the output technologies considered thus far are primarily concerned with improving the ability of people with impaired vision to access information presented with text or static images. The web however is increasingly becoming a multimedia environment containing video and audio material. Unfortunately, progress in improving the accessibility of this material is slow.

I am not sure if you can describe captioning as an output device, however it is a technique that will allow people with impaired hearing to read a description of audio content. Captions describing visual content can also be rendered by screen reading technologies thereby allowing people who can't see the content to access the information presented.

Joe Clark, one of the pioneers of captioning, provides a good overview of the issue and captioning techniques in his article, "Best Practices in Online Captioning".

Jared Smith from WebAIM presented a paper on the subject at the "Technology and Persons with Disabilities Conference 2004″, which also highlighted the need to provide captions for audio web content.

"On the Web, synchronized, equivalent captions should be provided any time audio content is presented. This obviously pertains to the use of audio and video that is played through multimedia players such as Quicktime, RealPlayer, or Windows Media Player, but can also pertain to such technologies as Flash, Shockwave, or Java when audio content is a part of the multimedia presentation."

Teachers of Students with Visual Impairments

While there was unequivocal recognition that AT was a facilitator to access information and to improve quality of life for students with visual impairments, findings indicate that there were significant gaps in AT knowledge and skill amongst the teachers. Where teachers claimed to be comfortable with low and medium technologies, such as talking calculators and hand-held magnifiers, many described themselves as "IT illiterate" when referring to high-tech AT devices such as screen readers and OCR (optical character readers) software. Still others had subjective interpretations to technology. Confusion between AT and ICT (information and communication technology) was noted when using the internet was construed to be using AT in teaching. Despite the gaps, there were individual advocates who championed the incorporation of AT to enhance communication and instruction.

By and large, students had limited skills, concepts and use of AT. Even amongst students who were exposed to AT, the extent of usage was at best basic. This was evident from the elementary keyboarding skills to the knowledge of using screen readers as a tool to access the computer. Where some children were familiar with the keyboard, others needed help to locate specific alphabets on the keyboard. Similarly, while some children had some knowledge in operating the screen reader using keystroke commands, others were unacquainted with the commands to execute even simple functions.

Internet of Things:

According to Cluster of European research projects on the Internet of Things 'Things' are active participants in business, information and social processes where they are enabled to interact and communicate among themselves and with the environment by exchanging data and information sensed about the environment, while reacting autonomously to the real/physical world events and influencing it by running processes that trigger actions and create services with or without direct human intervention. There are three IOT components which enables seamless ubicomp: (a) Hardware—made up of sensors, actuators and embedded communication hardware (b) Middleware—on demand storage and computing tools for data analytics and (c) Presentation—novel easy to understand visualization and interpretation tools which can be widely accessed on different platforms and which can be designed for different applications. Internet of Things can be realized in three paradigms—internet-oriented (middleware), things oriented (sensors) and semantic-oriented (knowledge). Although this type of delineation is required due to the interdisciplinary nature of the subject, the usefulness of IoT can be unleashed only in an application domain where the three paradigms intersect. If we had computers that knew everything there was to know about things—using data they gathered without any help from us -- we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best. We need to empower computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory.

Negative Effect:

These negative factors may impact assistive technology adoption, abandonment, and non-use. Users with disabilities might be reluctant to learn new assistive technologies with high learning curves, since they want to avoid perpetuating the idea that people with disabilities are less capable. Research on assistive device abandonment has found that the time that the disability is acquired also impacts the use of assistive technologies. Abandonment rates are much higher among people who acquired their disability later in life, and use is higher among people who accept their disability than those who do not.

The majority of research in the assistive technology community has focused on users of assistive technology – primarily of their use of technologies, but also on choices made in adopting or abandoning assistive devices. However, people with disabilities may have complex reasons for not using assistive technologies. Many papers cite the high costs of specialized devices as a barrier to use of assistive technologies for example, the JAWS screen reader license starts at $895 per user. However, some users may choose not to use assistive technologies for other reasons, and glossing over these reasons will make it harder to develop appropriate tools for users with disabilities in the future. By looking further into reasons for non-use, we can learn how to develop better technologies going forward, while understanding and respecting those who decide not to use assistive technologies.

Conclusion:

Assistive Technology can help students with learning disabilities bypass their disability and achieve the goals of life. The use of Assistive Technology has great potential for improving not only the reading level of the students but also in providing additional benefits, namely, confidence to grapple with the texts and a more positive self-esteem. Assistive Technology may have a significant impact on the work of teachers and administrators.Assistive technologies can evoke both positive and negative sentiments from users.

References:

Ashton , T.M. (2005). Students with learning disabilities using assistive technology in the inclusive classroom. In D. Edyburn, K. Higgins, & R. Boone (Eds.), Handbook of special education technology research and practice (pp. 229–238). Whitefish Bay, WI: Knowledge by Design.

Higgins, E. L., & Raskind, M. H. (2000). Speaking to read: The effects of continuous vs. discrete speech recognition systems on the reading and spelling of children with learning disabilities. Journal of Special Education Technology, 15(1), 19-30.

Raskind, M. H., & Higgins, E. (1995). Effects of speech synthesis on the proofreading efficiency of Postsecondary students with learning disabilities. Learning DisabilityQuarterly, 18, 141-158.

Raskind, M. H., Gerber, P. J., Goldberg, R. J., Higgins, E. L., & Herman, K. L. (1998). Longitudinal research in learning disabilities: Report on an international symposium. Journal of LearningDisabilities, 31, 266-277.

Anderson-Inman, L., Knox-Quinn, C., & Horney, M. A. (1996). Computer-based study strategies for students with learning disabilities: Individual differences associated with adoption level. Journalof Learning Disabilities, 29(5), 461-484.

Anderson-Inman, L., Knox-Quinn, C., & Szymanski, M. (1999). Computer-supported studying: Stories of successful transition to postsecondary education. Career Development for Exceptional Children,22(2), 185-212.

Neal Halfon and others, "The Changing Landscape of Disability in Childhood," Future of Children 22, no. 1 (2012).

Edyburn, D. L. (2004). 2003 in review: A synthesis of the special education technology literature. Journalof Special Education Technology, 19(4), 57–80.

Elkind, J., Cohen, C., & Murray, C. (1993). Using computerbased readers to improve readingcomprehension of students with dyslexia. Annals of Dyslexia, 43, 238-259.

Gordon, J. (1996). Tracks for learning: Metacognition and learning technologies. Australian Journal ofEducational Technology, 12 (1), 46-55. Available:http://www.ascilite.org.au/ajet/ajet12/gordon.html

Gotesman, E. & Goldfus, C. (2009). The Impact of Assistive Technologies on the Reading Outcomes of College Students with Disabilities. Proceedings of the Chais conference on instructional technologies research 2009: Learning in the technological era Y. Eshet-Alkalai, A. Caspi, S. Eden, N. Geri, Y. Yair (Eds.), Raanana: The Open University of Israel.