Review of Assistive Technology for the Education of Students with visual Impairment: Opportunities and Challenges

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Abstract

The review article summarizes recent developments in education and inclusion of students with visual impairment in schools/educational institutions and how far has assistive technology been helpful in advancing the education of students with blindness in the mainstream classroom settings. This study focused key elements related to the use of AT in the education of students with blindness in schools of Delhi/NCR for their inclusion: Inclusive Education, History and status of technology use, Utilisation of Assistive technology in schools, barriers to the use of technology in educational institutions and provision of Assistive technology in the schools and role of training in adaptation of AT. It also delves into the challenges faced by students with visual impairment in accessing academic content and the assistive technology used by them. The study syntheses the findings of articles/research papers from 2002 to 2020 and attempts to compile various studies conducted in India and abroad and identify the areas which require attention on the part of the authorities to facilitate the education of students with visual impairment. The study will guide stakeholders such as teachers, school authorities, government and policy makers to take the necessary steps and lend support in making students with visual impairment consider themselves at par with their sighted peers in a mainstream classroom.

Key elements: Inclusive Education, Assistive Technology, Accessible, Mainstreaming, Training, Visual Impairment

Introduction

A student with Visual impairment encounters a number of challenges when he goes to school for learning and gaining education. There is a huge gap in availability of accessible educational material for him as compared to his sighted peers. There is also no or very less provision of Assistive technology which can facilitate his education. These two factors hamper his participation in the classroom. Assistive technology enables learning and facilitates the process of education. It has to be ensured that all necessary aids and appliances are made available to students with blindness so that they are able to fully participate in the classroom activities and get a sense of inclusion. Assistive technology has proved to be a boon as it supports and enables students with disabilities in being independent in various aspects of life, including education. The students are now able to take their notes, complete assignments and read books as that of other sighted students in the class. In short Assistive technology has led to inclusion and has made it possible for students with visual impairment to study in the same classroom with their sighted counterparts.
Inclusive Education

Ahmad, (2015) Inclusive education, locates and deals with all barriers that prove to be hindrance in quality participation of all the students in an educational setting. It aims to provide a ‘least restrictive environment’ (LRE) so that special children are able to attain quality education at par with their sighted peers. Inclusive interventions should not just be on the level of individuals but at the societal level where provisions should be made for special support services like universal designs to make infrastructure more accessible, change in attitude and perceptions of people regarding disability. Segregation of students into ‘disabled’ and ‘non-disabled’ students geographically and socially further leads to failure of the very term ‘Integration’ (Singh, n.d.). Singal, (2008) emphasized that among the major barriers of education are lack of governmental support, fragile legislation and policy framework, shortage of funds, lack of trained faculty and support staff and unavailability of necessary assistive technology. Smith et al., (2005) contends that assistive technology serves helps in overcoming the barriers in Inclusive education by ’aiding’ in the practice of teaching children in the same classroom; helping them to access the educational content in the most suitable way. Petty, (2012) advocates, technology is a great enabler in providing access for all learners.

As defined by IDEA, “Assistive technology is an umbrella term that includes assistive, adaptive, and rehabilitative devices for individuals with disabilities and includes ‘virtually anything that might be used to compensate for lack of certain abilities’, ranging from low-tech devices like crutches or to more advanced items like hearing aids and glasses, to high-tech devices such as computers with specialized software.”

Emergence of Inclusive education in India

According to Chauhan (1989), the first attempt in implementation of integrated education in India was made during 1960 by the Ministry of Education and the Royal Commonwealth Society for the Blind. This venture could not make much progress. Mrs. Rehmat Fazelbhoy, a pioneer of integrated education in India, launched integrated education during June, 1958 with the admission of two visually impaired students in the New Activity School, Mumbai. Taylor and Taylor (1970) also confirm this and report that during April, 1967 seven visually impaired children were enrolled here. Ras Mohun Halder, Principal of the Dadar School for the Blind and pioneer in the field of the education of the visually impaired.
impaired in India refers to integrated education in the regular school system in his 1943 publication “The Visually Handicapped in India.” He suggested establishing of a special class, in collaboration and co-ordination with a central sighted school, where these partially sighted children (not totally blind) children can congregate in a separate room provided with special equipment and under supervision of a properly qualified teacher. Halder (1943) reported that the first experiment of this nature was started in 1940 by the Dadar School for the Blind in cooperation with the Hume High School, Bombay. The Visnagar Project on the Itinerant Model of integration of the rural visually impaired children was initiated during 1981 with 11 children only. During 1990, there were 232 children enrolled in the regular rural schools. The Central Scheme of Integrated Education for the Disabled: was evolved by the Ministry of Social Justice & Empowerment during 1974. The Scheme has since been revised during 1987 in view of the National Policy of Education (1986). Ramakrishna Mission Vidyalaya, Coimbatore, established a major personnel preparation programme for promoting integrated education. Residential Schools- under this system of education, the visually impaired children are provided residential accommodation, meals and clothes and they attend special schools. One finds reference to the needs of providing special education in the Education Commission Report (1964-66) which recommends placement of children with disabilities, as far as possible in ordinary schools.

**History and Adaptation of Assistive Technology for Education**

Blackhurst (1997) asserts that, we should be concerned about the appropriateness of technology for individual students and through examination and effectiveness of the technology should be done before implementing them. The Individuals with Disabilities Education Act (IDEA) stresses on the importance of individualised approach while recommending AT to persons with disability. Bausch and Hasselbring (2004) found that legal provisions have been made for (AT) several years back. Bauder (1999) in his study found that the respondents had little or no awareness of assistive technology .It was also found that 54.7% of respondents had never gained assistive technology training. Malcolm MacLachlan et al (2018) concluded that there is a significant difference between the demand for and availability of AT. Lindeblad, et. al, (2016) asserted that teachers’ attitude towards assistive technology can determine the extent of us of assistive technology in the classroom. Rufus, et.al, (2015) states that Assistive technology makes the curriculum accessible for them and also impacts the quality of their learning.
experience. Anuar, Karim, Shattar, & Ali (2015) explained, assistive technology helps in rehabilitation and improves the functional capabilities of persons with disabilities. It can aid persons with blindness by enabling them to negotiate with their surroundings and ensures their safety while travelling too. Okolo and Diedrich, (2014) stated that respondents frequently make use of technology in their day to day lives, but rarely during the instruction of students with disabilities. For a widespread use of AT, there is a need for additional skills, along with access to technology and more funding. These are perceived as top barriers to propagation. Kumar & Raja, (2010) stated that the term ‘Assistive Technology’ is used to increase, maintain, or improve the functional capabilities of people with disabilities. It includes, a software program, or product system that. By making use of assistive technology in an inclusive classroom teachers can promote their independence in reading and writing. Boen, (2014) explained the use of technology has become part of our day to day lives. Shikden (2007) conducted research in North Central Nigeria to find out awareness level of the teachers and use of assistive technology by them while teaching children with special needs. The findings of the study were that (41%) teachers were not aware about Assistive technology. (69%) Teachers reported that they are not comfortable in using assistive technology. There was not sufficient provision for AT in majority of schools. Teachers also lacked training & competency and there was a shortage of devices. All these factors hindered them from using assistive technology effectively. Chukwuemeka & Dominic (2019) delved into factors like perception of the teachers that restrict the use of technology based assistive resources in special education schools of Nigeria. Findings showed that high-tech assistive devices are not being used regularly to teach students with disabilities. Khek, Lim and Zhong, (2006) described that Assistive Learning Technologies (ALT) has gained momentum in developing the technology literacy in education for supporting learner with disabilities in realizing their potential in the teaching-learning process. Chmiliar and Cheung (2007) reported that teachers are realising that there is a sudden rise in the educational needs and demands of students with special needs in inclusive classrooms, simultaneously there is a corresponding increase in the need for skill development opportunities for upcoming teachers in areas that will assist them to become more competent in meeting these needs. Teachers are seen to be lacking in skills and knowledge in the area of providing support for the use of assistive technology. This is largely due to gaps in preservice teacher training. Wolfe and Lee (2007) studied those digital technologies which offer alternative ways of accessing print materials for students with print-related disabilities. Alternative media, and assistive computer software like screen readers provide a means to access textual information. D'Andrea, (2011) discussed that focus on “multi-literacy” in the
classroom and emphasis on assistive technology can have great implications for both teachers and students. Poudel, (2016) defined that assistive technology (AT) has led to better academic progress and improved outcomes for students with disabilities post- school. It has been proved that the students who used AT in their life have a well-rounded support system. Among other factors were their prior skills and experience with AT as it was introduced at the right time in their lives. The academic performance of the students improved due to the use of AT and it also led to a boost in their overall sense of competence and self esteem. Lersilp, Putthinoi and Chakpitak (2016) stated that most students had access to assistive technologies and were using them frequently in special schools of Thailand.

Barriers to The Implementation of Assistive Technology in Schools

Comfort Atanga et al (2019) stated that assistive technology (AT) helps bridge the gap between students with and without disabilities. However, this calls for a need for teachers to become expert in the use of AT. Onivehu, Ohawuiru, and Oyeniran (2017), opined that the attitude, experience and quality of teachers determine the extent of use of assistive technologies in the classroom. Akpan and Beard (2013) found that despite enormous improvements in AT devices and services in American classrooms, the support needs of the students, parents and associated members continue to increase. More advanced and sophisticated assistive devices have been developed that can be used to redefine the capabilities of individuals with special needs.

Coleman (2011) discovered several unused assistive technology devices kept on shelves or stored in schools’ cabinets. He also emphasized the ineffective use of the AT devices by both teachers and students. Finding revealed that the use of high-tech assistive devices in the classroom will improve teaching and learning in inclusive as well as special schools. The findings coincides with the finding of Ajuwon and Chitiyo (2015) who states that the use of the necessary AT in special education schools in Nigeria will not only provide support to students with special needs but will also improve the overall atmosphere of the classroom. This finding is also in concurrence with the finding of Maraizu (2014) which concluded that most teachers do not make use of assistive technology regularly due to lack of assistive resources in schools.

Lenka and Lukas (2020) investigated barriers in using Information and Communication Technologies (ICTs) by the Czech secondary school teachers. The results indicated that there was a very low understanding of ICTs and they were being used by the teachers rather occasionally while teaching. Soderstrom and Ytterhus (2010) suggests that the use of assistive technology enhances the self-identity of persons with blindness and increases
their self-esteem. Senjam, foster and Bascaran (2020) conducted a study to identify the issues and challenges faced by students in using Assistive technology at special schools for the visually impaired in Delhi. Especially in developing countries students with blindness face many challenges in accessing assistive technology for their education. It should be the responsibility of school authorities to ensure assistive technology are made available in the school premises for their students and teachers in adequate quantity. Flanagan, Bouck and Richardson, (2013) examined teachers’ perceptions of assistive middle school special education. Results suggested that teachers found assistive technology to be instrumental in achieving goals of inclusive education, but seldom use it. However, the use of assistive technology is encouraged by the factors like success in previous tasks when performed using AT and the support which they got in learning through AT. Maraizu (2014) described the perception of the coordinators level of AT services within the school district. Result highlighted the shortage of A devices in school and this was a major hindrance in student learning.

**Provision of Adaptive and Assistive Technologies in Classroom or Libraries**

Ayiah et al (2017) concluded that access to general education curriculum and information for students with visual disabilities can be promoted to a great extent by using AT. The study focused on the availability of assistive technologies in school libraries for students with visual impairment so as to ensure immediate access to reference work related to their curricula. Recommendations were made to draft and disseminate new policies which stress on provisions, training and use of AT in educational institutions.

Gareema Sanaman (2014) identified the gaps in facilities available for persons with disabilities in the libraries of Delhi, NCR, India. The study depicts the lack of Assistive Technology facilities in National Capital Region libraries. It was found that there are no relevant researches and studies available in the libraries for the students. Manorama et al (2014) highlights the provision of AT in educational libraries of India, UK, the US and Canada. It studies the importance of assistive technologies for persons with special needs in general and for persons with blindness in particular. The study clearly pinpointed that the use and implementation of assistive technologies in India is still in its infancy while the libraries in developed countries, such as the United Kingdom, the United States, and Canada have highly adopted them and they are frequently in use. The study stressed that in order to meet the information needs of the students with visually impairment, it should be a mandate for the libraries to provide an
accessible environment with sufficient assistive technologies. Further, substantial efforts need to be made to understand how the students with visual impairment seek information and use these technologies to achieve their learning and academic goals. Koulikoudi (2008) emphasized the lack of AT in Greek Libraries. Green (2001) conducted research on "Assistive Technologies for Individuals with Print Disabilities in Academic Libraries".

Mates, (2010) stated that Assistive technology can range from a simple magnifying glass to a highly sophisticated computer. Separate workstations with computers installed with screen reading software and speech to text engines along with other useful equipment like scanners etc. can be set up in libraries which can facilitate persons with visual impairment to scan a book and read it.

**Importance of Training in Acceptance of Assistive Technology**

Davis, (2013) identified in his research that the special educators have little or no hands on experience on AT. His study points towards the need of formal and non-formal training for students with visual impairment to become contributors in the social change and this also necessitates enhancing the literature and training modules on use of assistive devices which are helpful in education. Alkahtani (2013) gathered information about assistive technology knowledge and skills among teachers. Results pointed towards inadequate knowledge and training of teachers teaching children with special needs. Provision of training to be inbuilt in the pre service and in service teacher training programs and knowledge regarding Universal design should also be imparted thoroughly so that they have adequate exposure and confidence in using AT when they join schools as teachers. Zhou, et. al. (2012) studied the teacher training programs of teachers who are soon going to teach students with special needs. It was recommended that there is a critical lack of course on AT in the training curricula and Universities should embed assistive technology competencies in their training modules. Second, studies related to steps taken by Universities to address AT needs are required to be undertaken. El-Rufai, (2011) asserted that a lack of proper training has emerged as one of the major reasons which leads to underutilisation and even abandonment of AT devices. Coleman (2011) reported that in a very few circumstance has it been observed that any workshop on operating high tech assistive technology has been organised by the educational institutions which is a major reason of teachers not using the same while teaching in the classroom.Lack
of resources and funds further aggravates the problem of integration of AT in the academic curricula.

Application of Assistive Technology for Visually Impaired Students

Kisanga and Dalton (2020) studies the effect of assistive technology devices in enhancing Inclusion and promoting participation of students with blindness in education institutions in Tanzania. They found that the students were well-aware of the technology available in the school but had no knowledge about other technologies that exist and can be useful in their education. It was also found that only a few AT devices were available in the school. They concluded that AT gives access to various educational material available worldwide and can impact the career and job prospects of the students. Komolafe (2020) stated that students with visual impairment make use of audio devices while learning social studies concepts. It was observed that there exists a positive correlation among the two independent variables (use of audio devices) on the dependent variables (Social Studies Learning outcome) of the students with visual impairment. Therefore, the use of audio devices i.e AT be encouraged in the Secondary Schools of Nigeria. Senjam (2019) stated that addressing disability needs a multidimensional approach, including the appropriate use of assistive technology (AT). The accomplishment of educational learning in students with visual challenge depends greatly on the use to AT. Maurya (2018) said that Assistive technology has the potential to handle most crucial problem of inclusive education and can facilitate inclusion to a great extent. Abner et al. (2002) concluded that although technologies like computer with screen readers teachers were available for the teachers but the teachers were not competent enough to train their students which impacted the adoption of technology. Members of the ‘Texas Action Committee for the Education of students with Visual Impairments’ (2016-2017) emphasized on providing critical resources and AT to schools and families to render support to children with blindness. It also ensured an appropriate individualized education program be planned for assisting these students. Willings (2016) noted that to achieve success in teaching learning situations of the classroom, the teacher should have the know-how of catering to the children’s individual needs including those of special students. Hallahan and Kauffman (2011) have documented the essence of audio and non-optical and other technological devices to improve learning outcome. They reiterated that the audio and non-optical assistive technological devices have opened up doors to formal education and employment. This is assumed to further integrate the students with visual impairment into the school system and ultimately improve learning outcomes.
Edward & Lewis (1998) explored the attempts of teacher to address the needs of AT and other necessary support of students with blindness. It was found that AT was being used in the institution. Braille embossers were used in large number (approx.) by 54.5% of the respondents, followed by magnification devices (47.3%), screen reading devices (36.4%), notetakers (24.5%) and OCRs (24.5%). Only 4 teachers (3.6%) trained students for using refreshable braille displays. Saleem & Sajjad (2016) in their research revealed that there were no provisions of maintaining adequate assistive technology at school for students with blindness. The students lacked awareness about latest assistive technology and how it can be utilised for satisfying their informational needs. Hussain, (2014) described that the most essential tools for students with visual impairment are assistive technology devices. They have an important role to play in students’ lives. Segers, (2015) stated that in order to browse net, use laptops and get access to print materials assistive technology must be used by students with blindness. However, AT is not readily available for them and their education is impacted. Wiazowski, (2009) stated that assistive technology assists students with blindness in all academic areas. Kelly (2008) undertook research on visually impaired and their use of assistive technology revealed those students are not using the technology properly. Cook and Hussey(2002), categorised assistive technology devices. They stated that “as the field advances, there will be new considerations that will further stretch our concepts and force new ways of categorizing and describing assistive technology.”

Summary

Inclusion of students with blindness and visual impairment depends upon the complex interplay of factors like attitude of students, parents and society at large. Assistive technology with a broad consensus has been found as a major contributor in facilitating Inclusive education, making students independent in reading and writing needs, boost their self-confidence and open a window to the world for students with visual impairment. However, this has been emphasised in majority of the studies that adoption of assistive technology depends to a great extent on the right training and support provided. Awareness about the latest inventions in the field, coupled with teacher’s readiness and competence to adopt the same in teaching-learning process gives great impetus to making educational content accessible for students with visual impairment and make them feel included in the classroom. School authorities also need to take care of the provisions made in the school to make assistive technology available in the school, maintain it.
and organise regular workshops for the teachers and special educators for understanding its use and importance. AT devices, such as laptops with screen readers, smartphones, tablets, scanners etc are most promising devices which can change and impact the lives of all students. Teachers of students with visual impairment are faced with multiple challenges of attending to the diverse learning needs of students in an inclusive classroom. Special education teachers have often been noticed to behave anxiously in the use of assistive technology in the classroom, especially where these devices are hi-tech and recently introduced. Lack of training and experience has emerged to be the most likely reason behind it. In addition to this lack of awareness about the latest technology in the field makes it even more difficult for the teachers to use them for the education of the students with special needs. Insufficiency of these resources, and poor motivation of teachers further add to this problem. Consequently, educationists have been tirelessly working to ensure that the diverse needs of these children are taken care of by various means. This involves the use of assistive technologies in planning instruction, real-time teaching and learning activities and evaluation process. There are established AT competencies for educators, and special educators must be insightful about selection and recommendation of AT to people as per their personalized needs. AT provide enormous opportunities to compensate for their functional loss and make the most out of their educational experiences simultaneously capitalizing on their strengths and abilities. AT has a potential to redefine the capabilities of students with special needs. There is high abandonment of AT due to lack of training and awareness of the teachers and the students. For students with disabilities, AT is a ray of hope and a means of empowerment, hope and encouragement. Denying them these options may amplify their special needs effects. All stakeholders viz. Educators, parents and school authorities must express their concerns with regards to the welfare of students and must strongly advocate for adequate provision and distribution of AT resources along with the requisite training and frame mandates for its utilisation in the classroom for transacting curriculum.

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