

"Inclusive Access for Differently Abled Children Through ICTs and Open Distance Learning"

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ABSTRACT

The majority of children and individuals with disabilities may find it easier to attend education, thanks to the development of open and distance learning, as well as flexible scheduling that allows for continuous learning. These groups might have access to resources from home, which is thought to be the least expensive, least restrictive, and safest setting. The current study attempts to address concerns and techniques related to education through Open and Distance Learning (ODL) systems in light of these and other considerations. Sustainable Development Goal 4 talks ensure inclusive, equitable and quality education for all. Therefore the role of ODL systems plays a major role in bringing a change. Many schools and universities have failed to keep up with the learning needs of this special group. Consequently, a large number of differently abled students are dropping out of these educational Institutes. Open Distance Learning provides education through an open learning system at the school stage as an alternative to the formal system. This system allows differently able to interact with digital learning resources in self-regulated learning. It facilitates meeting the needs of differently able and functional diverse children in order to increase their accessibility and e-inclusion capabilities in educational settings.

Keywords: *Inclusive education, Quality education, Differently Abled Children, Open Distance Learning, Sustainable Development Goals, Education for all.*

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INTRODUCTION

The field of distance education for differently-abled children has seen significant research developments in recent years. As technology continues to evolve, so too do the strategies and tools available to support inclusive education for students with various disabilities. **A Case study on Inclusive open Learning by Patel and Raman (2019) examined the** use of open and distance learning systems for differently-abled children in India, focusing on the integration of digital learning for children with hearing, visual, and physical impairments. The research aimed to evaluate how an open learning model can overcome barriers like geographic isolation, lack of access to special education resources, and limited social interaction. It found that multimedia resources improved understanding and engagement for students with hearing and visual impairments; Digital training helped students with physical disabilities operate computers, smartphones, and adaptive technologies.

Likewise, the study by **Bennett & Benda (2023)** focused on the impact of open learning platforms (OLPs) on children with learning disabilities, including dyslexia and ADHD. This research involved the development of an open learning platform that incorporated universal design principles to cater to various learning needs. They expounded on the Adaptive content, Customized learning pathways and self- paced learning for children with ADHD. Students with ADHD or dyslexia showed significant improvements in learning outcomes due to the self-paced nature of the platform. They could pause, rewind, and re-engage with content at their own speed, which helped them retain information better.

Sapp & al. conducted a study in *Distance Education* in 2022 to examine the opportunities and challenges of open and distance learning (ODL) for differently-abled children, particularly those with cognitive and sensory disabilities. The authors suggests that open learning systems, when designed inclusively, can significantly benefit students with special educational needs by providing flexible learning schedules, customized pace, and access to diverse resources.

The latest study conducted in 2024 by **Wong & Thomas** focused on integrating mental health and well-being resources within open learning environments for students with disabilities. The study concluded that Open learning platforms with integrated mental health support (e.g., coping strategies, stress management tools, and mindfulness exercises) helped improve the emotional well-being of students with disabilities, especially those with anxiety or depression.

Disability is a multifaceted concept that encompasses a wide range of physical, cognitive, sensory, and emotional impairments. It affects individuals' daily lives, societal participation, and access to opportunities. Disability rehabilitation is a crucial aspect of healthcare and social services aimed at helping individuals with disabilities achieve and maintain optimal physical, mental, and social functioning. A disability is any state of the body or mind that makes it more difficult for them to do certain activities that are limitation in activities of daily living and interact with the world around which is restricted participation.

As per the WHO (2019), Rehabilitation is defined as “a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment”. Rehabilitation helps individuals with disabilities regain independence, improve mobility, and engage in daily activities, thus enhancing their overall quality of life. It focuses on maximizing the functionality of individuals with disabilities by providing them with necessary therapies, assistive devices, and adaptive techniques tailored to their specific needs.

Rehabilitation plays a vital role in promoting social inclusion by enabling individuals with disabilities to participate fully in society, including education, employment, and community activities. It helps prevent or minimize secondary complications associated with disabilities, such as muscle atrophy, contractures, and pressure ulcers, by providing appropriate interventions and therapies. Through rehabilitation, individuals with disabilities are empowered to actively participate in their own care and decision-making processes, promoting a sense of autonomy and self-determination. Investing in rehabilitation services can lead to cost savings in the long run by reducing the need for more expensive medical interventions, hospitalizations, and long-term care services. Disability rehabilitation not only focuses on physical impairments but also addresses psychological and emotional well-being, helping individuals cope with the psychological impact of their disabilities and improving mental health outcomes (Raja 2016).

Rehabilitation efforts often involve advocating for accessibility and universal design principles, which benefit not only individuals with disabilities but also the broader community by creating more inclusive environments. Canton & Chapman (2016) laid emphasis on the support and resources under the rehabilitation services for caregivers and families of individuals with disabilities, as per them helping to cope with the challenges and responsibilities associated with caregiving. Access to rehabilitation services is recognized as a fundamental human right for individuals with disabilities under international conventions such as the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD). In a nutshell, disability rehabilitation is significant not only for the individual's well-being but also for promoting a more inclusive and equitable society where everyone has the opportunity to live life to the fullest extent possible.

I. METHODOLOGICAL PLAN

The methodological plan for the present paper adopts the Secondary research involving collection, synthesis, and analysis of existing data and information from the relevant data base including academic journals, ebooks, reports, government publications, and credible websites. This involved thorough searching of relevant databases- PubMed, Google Scholar, Scopus using keywords- disability, rehabilitation, ICT and assistive technologies. Two case studies of children with disabilities using assistive technologies are reviewed. The key findings and arguments were extracted from different studies. The information was organised and categorized based on subtopics. Finally the main findings were summarized and conclusions were drawn.

II. RESULT AND DISCUSSION

A. Integration of ICT and Assistive Technology into Rehabilitation practices

Integrating technology into rehabilitation practices offers numerous benefits and enhances the effectiveness of rehabilitation efforts in several ways. ICT and technology allow for the customization of rehabilitation programs to suit the specific needs and abilities of each individual. Sensors, wearables, and software applications can collect real-time data on a person's progress, enabling therapists to adjust treatment plans accordingly. Technology can overcome barriers to access by providing remote rehabilitation services. Tele-rehabilitation platforms enable patients to receive therapy sessions from the comfort of their homes, particularly beneficial for those in rural or underserved areas or individuals with mobility limitations. According to Batanero et al. (2018) disability rehabilitation through Information and Communication Technology (ICT) has shown significant advancements in recent years. Studies have highlighted the importance of ICT in improving the quality of life for persons with disabilities, especially in underserved areas.

Gamification and virtual reality (VR) technologies make rehabilitation exercises more engaging and enjoyable for patients. Interactive games and simulations can motivate individuals to adhere to their treatment plans and participate more actively in their rehabilitation process. Wearable devices and motion-tracking technologies provide real-time feedback on movement patterns and performance during rehabilitation exercises. This feedback helps patients and therapists track progress, identify areas for improvement and adjust techniques accordingly. As per the study by Barlott et al. (2019) the application of ICT in rehabilitation services is effective in addressing psychomotor deficits in children with disabilities, leading to the reconfiguration of planning in Rehabilitation Centers to offer hybrid care.

Automated rehabilitation systems and robotic devices can assist therapists in delivering repetitive tasks and exercises, permitting them to emphasize more complex aspects of treatment. This advances efficacy and reduces the need for extensive one-on-one therapist time, thus potentially lowering overall healthcare costs. Advanced technologies such as exoskeletons, prosthetics, and neuroprosthetic devices can restore lost or impaired function in individuals with disabilities. These gadgets improve mobility, dexterity, and independence by applying state-of-the-art engineering principles. Rehabilitation practitioners may use artificial intelligence (AI) and big data analytics to examine massive datasets for patterns, forecast patient outcomes, and customize therapy regimens based on unique patient traits and responses (Canton & Chapman 2016). Electronic health records (EHRs) and telemedicine platforms facilitate seamless communication and coordination among interdisciplinary rehab teams, ensuring continuity of care and promoting collaboration between therapists, physicians, and other healthcare providers. Integrating technology into rehabilitation practices fosters ongoing research and innovation in the field. Researchers can develop and test new technologies, rehabilitation protocols, and treatment modalities to continuously improve outcomes for individuals with disabilities. Additionally, the use of ICT in educational

rehabilitation practices has facilitated the inclusion of students with disabilities in regular academic programs, resulting in improved progress in various skills such as reading-writing, mathematical thinking, communication, and socialization (Amarilla et al. 2019)

Technology empowers individuals with disabilities to actively participate in their care journey and take charge of their rehabilitation process. Assistive devices and mobile applications enable users to perform everyday tasks more independently, enhancing their overall quality of life. The integration of ICT in disability rehabilitation not only enhances service accessibility but also contributes to better results and increased independence for individuals with disabilities. Internet of Things integration has also been investigated to improve rehabilitation management and resource allocation for these special people worldwide (Huang et al., 2022).

Henceforth, integrating technology into rehabilitation practices enhances the delivery, efficiency, and accessibility of rehabilitation services, eventually refining effects and quality of life for individuals with disabilities.

B. Technologies with reference to different Disabilities

The paper further discusses the multiple technologies for particular disabilities mentioned below-

(i) Technology for Persons with Intellectual Disability and Cerebral Palsy

The American Association on Intellectual and Developmental Disabilities (AAIDD) in 2019 identified a variety of technologies that help people with intellectual disabilities in their everyday life skills. Electronic planners, for instance, might serve as a helpful reminder of the numerous tasks they have to finish before the deadline. A child who is lonely may receive a talking doll or any other kind of toy. Through a video-based teaching approach, they can learn useful life skills like grocery shopping, writing checks, and using an ATM. Media Lab Asia and C-DAC developed a software tool called Punarjjani to assist educators in assessing the growth of pupils with intellectual disabilities. People with cerebral palsy can access multiple devices and mobility aids for enhancing their scholastic performance and staying on track with school programs, expressing feelings, thoughts and emotions, parents do not have to guess their child's needs and so on (Bryant and Lyon 2020).

(ii) Technology for Persons with Locomotor Disability

A person with physical disability arising from brain lesions sustained during the prenatal, neonatal, or newborn period of development is said to have comorbidity, a non-progressive condition. These people have numerous issues throughout their lives as a result of their mobility issues. Many people with co-morbidity have mild impairments, but some have severe issues that make it difficult for them to do even simple tasks. They will be able to overcome these issues and live as independently as possible with the assistance from technology. These days, electric wheelchairs are more

affordable than manual wheelchairs and may be found at affordable rates. They can be operated with the hand, foot, or both and have a shape similar to a button. These switches can be modified based on the individual's condition explained by Hillier, Westwood and Davies (2010).

For the children who need another means of communication, a few alternative and augmentative communication (AAC) devices have been developed for use in non-speech modes. While Sanyog, GupShup, pictorial communication software, Aditi, idraw, and voice output communication aid are developed in India, other countries develop dedicated communication devices, alpha talkers, walker talkers, digital augmentative communicators, Canon communicators, void, board maker software, and pictorial communication software. These devices facilitate effective communication between children with communication disorders and their families and caregivers (U.S. Department of Health and Human Services, 2017)

(iii) Technology for Persons with Hearing Disability

People with hearing disability are the ones who are incapable of receiving language through auditory channels, either with or without amplification, due to their hearing loss. With telecommunication equipment, persons can type and receive messages over the phone using a keyboard. Text messages and other types of messaging are frequently used on mobile phones for communication. Individual FM systems are used to educate people with hearing disability. There are assistive listening devices that use a distant microphone placed close to the source of sound to increase the sound-to-noise ratio for a single user. An amplifier in a hearing aid increases the sound's loudness to let the wearer listen to music with the least amount of distortion possible. The function of hearing aid is to produce a louder sound so that a person with hearing loss can recognize and utilize auditory signals (Roush and Pichora 2018). A hearing aid can be defined as an electronic device that amplifies sound to a certain extent and in a way that helps the person who is deaf to make the most of their residual hearing. A stenographer can record a meeting from a distance using computer-assisted remote transcribing. The capacity to add text to a visual display for ICT and Disability that facilitates the translation of spoken words into text is known as captioning. In numerous programs. There is the option for captioning on television, and live speech captioning is an additional method for making live programming accessible.

(iv) Technology for Persons with Visual Disability

U.S. The Department of Labor (2019) talked about The advancement of information and communication technology has significantly enhanced the educational opportunities and quality of life for individuals with visual disability. Thanks to advancements in technology, those with visual disability can now perceive the invisible world in amazing ways through nonvisual media. In this digital age, devices like smartphones, laptops, iPads, scanners, and the internet have allowed people to step outside of their comfort zones and interact with the outside world. They may now quickly and readily obtain information on any topic that was previously difficult for them to find in Braille or from other sources thanks to the internet. E-books, e-newspapers, and e-resources

have been a great help to them. These people can benefit from several technology solutions in their educational journey, including big print computers, Braille embossers, referable Braille displays, optical character recognition, e-books, audiobooks, closed circuit television, screen magnifiers, screen readers etc.

(v) Technology for persons with Autism

Technology is essential for aiding people with autism. Autism is a developmental condition that impairs three aspects of social interaction: verbal and nonverbal communication, recurrent interests or patterns of behavior. It is necessary to provide interventions to enhance the play, leisure, social contact, and verbal and nonverbal communication of children with autism in order to assist their holistic development. With the help of technology, they can become more participatory and more adaptive. With the help of devices like speak pads, language masters, audio recording, Sanyog, autism my voice communicator, first then visual timetables, my images talk, Pocatello, speech diaries, and so forth, they may interact with their environment

C. Challenges Faced by People with Disabilities in Accessing ICT and Assistive Technologies

Through facilitating communication, information access, and participation in numerous elements of society, assistive technologies and information and communication technologies (ICT) have the potential to greatly improve the lives of persons with disabilities. Still, despite technological developments, using and accessing these technologies presents a number of obstacles for people with impairments. Ahmadi and Nezami (2021) has pointed out obstacles that people with disabilities encounter while trying to use assistive technology and ICT are listed below.

- (i) **Physical Accessibility:** Physical accessibility elements are not taken into consideration in the design of many ICT platforms and gadgets. This covers obstacles like tiny buttons, touchscreens that need dexterous movement, and gadgets without connectors or interfaces that are inaccessible.
- (ii) **Digital Accessibility:** Accessibility elements are sometimes absent from websites, software programs, and digital information, which makes using them challenging or impossible for those with impairments. This covers problems including inaccessible multimedia content, inadequate color contrast for individuals with visual impairments, and a lack of keyboard navigation.
- (iii) **Cost and Affordability:** Many people with disabilities cannot afford assistive technology because they are too costly, especially in areas with poor healthcare coverage or limited resources. There may be substantial financial obstacles to access due to the high cost of specialist hardware and software.

- (iv) **Lack of Awareness and Training:** It's possible that a large number of disabled individuals are unaware of assistive technologies or their availability. In addition, people could not receive the assistance and training they need to learn how to use new technologies efficiently, which would prevent them from realizing all of their potential.
- (v) **Compatibility Issues:** Interoperability problems may arise when mainstream ICT hardware and software are incompatible with assistive technologies. Because of this, it may be difficult for people with disabilities to access vital digital services and content or to incorporate assistive devices into their daily life.
- (vi) **Limited Research and Development:** There is often limited investment in research and development of assistive technologies, particularly for less common disabilities or niche needs. As a result, there may be gaps in available solutions for certain types of disabilities or specific functional limitations.
- (vii) **Stigma and Social Perception:** People may be deterred from looking for or utilizing assistive technologies by societal hurdles resulting from negative views and prejudices regarding disabilities. Some people with disabilities may not be able to publicly embrace the use of technology to assist their needs because they fear being judged or embarrassed.
- (viii) **Availability in Non-English Languages:** The fact that many assistive technologies are produced mostly in English or other languages that are commonly spoken limits their usability for people who speak languages that have less resources or support for the development of assistive technology.

While ICT and assistive technologies have the potential to empower people with disabilities and enhance their independence, access barriers continue to pose significant challenges. Despite the benefits stated, multiple studies showed the lack of ICT facilities available (Johnson et al 2016). The facilities include the computers, the software, and the ICT courses are available differently able especially for persons with hearing disability. Zamir and Thomas (2019) in their study highlighted the challenge in using ICT was the professionally trained personnel who need to know not only software applications but also hardware procedures to operate the ICT. The teachers needed support when using ICT especially when dealing with technical problems when using ICT for teaching.

Addressing these challenges requires a concerted effort from technology developers, policymakers, educators, and advocacy organizations to promote accessibility, affordability, awareness, and inclusivity in the design and implementation of ICT and assistive technologies. By prioritizing the needs of people with disabilities, society can ensure that everyone has equal opportunities to fully participate in the digital age.

D. Case Studies

Case Study 1: Enhancing Independence through Technological Interventions

Background

Name: Sarah Thompson (name changed)

Age: 32

Disability type: Cerebral Palsy

Sarah Thompson was born with cerebral palsy, a condition that affects her muscle control and coordination. Despite facing physical challenges throughout her life, Sarah has always been determined to live independently and pursue her goals. However, everyday tasks such as communication, mobility, and accessing information presented significant obstacles for her.

Challenges Faced

Communication Barrier: Sarah's cerebral palsy affected her speech, making it difficult for others to understand her verbal communication.

Mobility Limitations: Sarah's motor impairment made it challenging for her to move around independently, requiring assistance for activities such as getting in and out of bed or using the restroom.

Limited Access to Information: Sarah faced difficulties accessing printed materials or using traditional computer interfaces due to her motor limitations.

Technological Interventions

Sarah's life changed when she was introduced to a range of assistive technologies tailored to her specific needs:

- **Augmentative and Alternative Communication (AAC) Device**

Sarah was provided with an AAC device equipped with a touchscreen and specialized software that allowed her to communicate using symbols, text-to-speech capabilities, and customizable phrases. This device enabled her to express herself more effectively and communicate with others independently.

- **Mobility Aid**

Sarah received a customized mobility aid that incorporated features such as powered wheels, joystick control, and obstacle detection sensors. This device allowed her to navigate her environment more easily, providing her with greater freedom and autonomy in her daily activities.

- **Accessible Technology**

Sarah was introduced to accessible technology solutions such as voice recognition software, screen readers, and alternative input devices tailored to her motor abilities. These tools enabled her to access information, use digital devices, and engage with online content more effectively, enhancing her independence and productivity.

Outcome

The technological interventions had a transformative impact on Sarah's life:

With her AAC device, Sarah gained the ability to communicate more fluently and express her thoughts, feelings, and needs more effectively. This enhanced her social interactions, improved her relationships, and boosted her confidence in various social and professional settings. The customized mobility aid provided Sarah with newfound freedom to move around her home, workplace, and community independently. She no longer had to rely on others for assistance with basic tasks, empowering her to live a more autonomous and fulfilling life. Accessible technology solutions enabled Sarah to overcome barriers to information and digital access, opening up a world of opportunities for learning, employment, and personal growth. She was able to pursue her academic interests, engage in online courses, and explore new hobbies with greater ease and confidence.

Sarah's story exemplifies the transformative power of technological interventions in enhancing the lives of people with disabilities. By leveraging assistive technologies tailored to her specific needs, Sarah was able to overcome communication barriers, enhance her mobility, and access information and opportunities previously out of reach. Her journey underscores the importance of personalized support, innovation, and inclusivity in empowering individuals with disabilities to lead independent, fulfilling lives in today's digital age.

Case Study 2: Description of EI app and its features for Children with Disabilities

Located in Tamil Nadu's Tenkasi District, Amar Seva Sangam Ayikudy (ASSA) is a non-profit, non-governmental organization (NGO) that supports and assists those with disabilities. ASSA has developed an early intervention program called Enabling Inclusion® (EI) that is family-centered and community-based because it firmly believes that digital technology may provide special solutions for closing the healthcare gap. Using ASSA's Enabling Inclusion® (EI®) software, the program teaches community rehabilitation workers (CRWs) to recognize children with developmental delays and offer early intervention in children's homes or neighboring centers with the assistance of a multidisciplinary team of rehabilitation specialists.

Through the EI® App, the EI® program seeks to guarantee last-mile delivery of early intervention and rehabilitation services to kids with impairments. Using the app, rehabilitation specialists can

create customized early intervention plans that direct care receivers (CRWs) and track and monitor the growth of the child and the outcomes for the caregiver. It has been demonstrated that the EI® approach enhances child development, reduces caregiver stress, and fosters caregiver empowerment.

The EI® app is intended for use in a range of contexts with kids and young adults aged 0 to 24. The software can be used by CRWs or rehab professionals to provide on-site assessments for developmental delays at community centers, preschools, schools, mobile clinics, and village health centers. In order to create goals and customized interventions that are shared with the family and the CRW via the app, rehab specialists (such as physiotherapists, occupational therapists, special educators, etc.) conducted additional assessments for those who were identified as having delayed development. During routine visits, CRWs then carry out the necessary interventions at the homes of families or in the community centers nearby.

Dashboard: The Dashboard gives each EI® app user a high-level overview of the program, including information about the number of children in their care, their specifics, such as disabilities, and a summary of their therapy, other task assignments, task completion rate, etc.

Screening: The EI® app's screening feature is made to be both quick and efficient. The app offers the Trivandrum Developmental Screening Chart and the UNICEF/Washington Group Child Functioning Module (CFM), two screening instruments that have been internationally verified.

Baseline Assessment: The team's CRWs conduct baseline general and environmental assessments on children who screen positively for developmental delays or impairments.

Assessments: Measures and instruments for standardizing and validating child development outcomes that support monitoring children's growth in a range of developmental domains (cognitive, physical, socioemotional), as well as family outcomes, are called evaluations.

Family-Centred Goals: Following an evaluation, the family and the kid work together to identify the child's unique requirements as the foundation for jointly developing goals.

Treatment/Intervention: Using drop-down and free text options, the rehab expert will create a customized treatment/intervention plan for the child within the app based on data from the baseline assessment, evaluation, and family-centered goals.

Calendar/GPS: An appointment schedule for therapy and other activities (screening, training, meetings, etc.) can be made in the EI® App based on the intervention plans.

E. Benefits of Information and Communication Technology (ICT)

The use of ICT has brought a huge change in the lives of people with disabilities due to the enabling effect of technology. Now, instead of limitations, we talk about the potential of people with

disabilities and they are seen as productive partners in all areas of society. Some of the benefits of ICT are the following:

- Promotion of equal opportunities
- Improved communication
- Movement and mobility is increased
- Participation in the community is enhanced
- Increased independence in various areas of life such as home, school, ICT and disability college, community, market and workplace, etc.
- Persons with disabilities become self-reliant
- The participation of disabled people in various activities at home, school and workplace is increased and the potential of disabled people is fully utilized.
- Technology helps them in learning through their preferred mode i.e. visual or auditory.
- The use of technology increases job opportunities for people with disabilities.

F. A Way Forward: Time for Action

In the last few years, there has been a revolution in the area of technology. Artificial intelligence has been a key for this sector, but when a technology is developed very few companies think about the accessibility of this technology to persons with disabilities. With its rapid succession of innovations, ICT today provides opportunities and makes life easier for many students with disabilities, who are now able to communicate with each other and learn, thanks to assistive technology (AT) and information and communications technology (ICT) tools. Although AT & ICT helps many students with disabilities to learn and interact, how, there are still some barriers that can prevent the differently able from taking advantage of these wonderful technologies. The following steps will help address this:

- Ensure that all students with disabilities have access to free appropriate public education that emphasizes special education and related services designed to meet their unique needs and prepare them for further education, employment and independent living. - Design and develop special-education programs and instructions to meet the unique needs of a student with a disability, at no cost to the child or the child's parents. This education is to be provided in a classroom, at home, in an institution or other setting.
- Establish training programs for differently able instructors and include personal training, classroom training, e-learning and online seminars according to needs and preferences.

- Collaborate with universities and research studies on innovation to expand the reach of AT solutions.

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