Innovations

Assistive Technology: Fostering Inclusive Paradigms in Childhood Development

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Abstract: *Global legislation about disability discussions has imbued in it the need for support and sustainability. For children, it is a particularly sensitive case as the importance of this support is instrumental to the 'No Child should be Left Behind' campaign. The research emphasizes the need to align environmental settings with the unique requirements of children with disabilities. Recognizing the ever-evolving nature of technology, the study advocates pilot programs and empirical testing to evaluate the effectiveness and adaptability of emerging Assistive Technology solutions. Such evidence-based approaches are essential for informing policy decisions and optimizing resource allocation. Thus far, there is no doubt that with Assistive Technology, family relationships are strengthened, friendships are engineered and maintained, education and healthcare are accessed with greater ease, play is made more pleasurable, quality of life is generally improved upon, and children get to flourish despite the presence of disability. However, Assistive Technology is not a magical solution to addressing the support that children with disabilities require for optimal development. Without a conducive environment or products that appeal to the users or professionals who are not well grounded in their respective fields of expertise, Assistive Technology will prove insufficient to meet existing needs.*

Keywords: *Assistive technology, inclusion, childhood development, environment, education, society*

Introduction

Over the years, pivotal efforts have been made to ensure that the marginalization of children with disabilities is ameliorated by incorporating them into mainstream settings. Before it was called inclusion, mainstreaming was the operational term. The gathering that has been most monumental in this move was the Salamanca Conference of 1994. To date, the Salamanca Statement on Inclusion in Education remains relevant and has come to be regarded as one of the Sustainable Development Goals (SDGs) initiated in 2015, seeing that over thirty years after

(Etchegoyen, 2023), there has been a rapid global move in the direction of the adoption of the inclusive model in education (Hoogerwerf et al., 2021). However, while many nations of the world have endorsed and pledged their commitments to support inclusion (Buchner et al., 2021) and the provision of Assistive Technology plays a crucial role in ensuring that no child is left behind, the reality is that gaps persist (Lersilp et al., 2015).

Assistive Technology often referred to as AT covers a wide range of products such as prostheses, eyeglasses, wheelchairs and extends to services like but not limited to occupational therapy and speech pathology and audiology, all meant to provide appropriate support for the management and enhancement of the living conditions of individuals with disabilities, facilitating independence, and an improved state of well-being (Botelho, 2021). Meanwhile, the New York State Education Department specifically rules out any surgically implanted medical device or corresponding replacement as part of Assistive Technology (NYCRR, 2017). Sadly, the vast majority of people, particularly children, in need of Assistive Technology do not know about it or are simply unable to access it (WHO & UNICEF, 2022). This poses a colossal obstacle on the path to inclusion, being that the estimated number of people with significant disabilities around the globe amounts to 1.3 billion, which is a whopping 16% of the world population (WHO, 2023). Of this 16%, the estimated population of children is nearly 240 million (UNICEF, 2023). The implication of the foregoing is that one in every ten children has one form of significant disability or the other and through history and geography, governments have chosen segregation, integration, and inclusion as standard approaches in engaging children with disabilities educationally, even though exclusion which is a more familiar experience for them remains disavowed especially in contemporary administrations (Jodl & Bian, 2023).

In a world where spaces are commonly conditioned to fit and meet the needs of majority groups, children with disabilities face intense difficulties in adapting to both intimate and larger settings and are, to that extent, likely to feel left out. Every child has the right to develop equally. Unfortunately, a ton of adverse effects such as illiteracy, poverty, delinquency, unemployment, aggression, loneliness and isolation become the eventualities of intentionally or unintentionally depriving children with disabilities of education (Mont, 2021). Thus, to fully propagate inclusion, strategic investments must be made in Assistive Technology for children with disabilities in the home, mainstream settings, classrooms and the community at large. This will enhance extant abilities while offering compensation or a total boycott of cohabiting challenges (Chambers, 2020). The New York State Education Department provides a checklist, although not exhaustive, that can guide student-specific considerations in facilitating inclusive spaces. This checklist includes suggestions for environments, tasks and Assistive Technology for support (NYCRR, 2017). Indeed, to ensure that no child is left behind and to ease the becoming of a well-rounded individual, Assistive

Technology must be introduced, reintroduced and improved upon in all areas of child development.

Inclusion and Development of Children with Disabilities

Many practitioners in the field of inclusion have hesitated to define the term, preferring rather to regard it as a journey or process as opposed to a destination or place (Graham, 2019). Nonetheless, within a relatively short period, the concept has established itself as the most promising method to effectively dismantle barriers before the Education for All (EFA) movement (Slee, 2018). Yet, as effective as it has proven to be both in theory and practice in climes where it has been adopted, like the United States, confusion persists concerning what it is and what it is not. A critical look will reveal that the possible reason inclusion proves difficult to explain arises from the indecision that survives at the demarcation between inclusive education and social inclusion (Hornby, 2011). But inclusion from a perspective angle means the acceptance of all children, undermining difference, paying keen attention to equality, participation and group solidarity to prevent rejection and stigmatization. Inclusion translates to a principle with which all people, despite interests, abilities, or state of being, are given room to participate in society (Karlsudd, 2017).

The United States has particularly hoisted the banner of inclusion high and instituted laws and policies specifically tailored towards ensuring equitable learning and care spaces both nationally and internationally (Kozlowski, 2022). Legislation such as the Americans with Disabilities Act (ADA) of 1990, the Individuals with Disabilities Education Act (IDEA) also of 1990, the Head Start Act of 2007, and even the Assistive Technology Act as amended in 2004 emphasize free, accessible and appropriate education for all children with or without disabilities in the same space (Kozlowski, 2022). To facilitate implementation, provisions such as the Child Care and Development Fund (CCDF) in collaboration with the U.S. Department of Health and Human Services & U.S. Department of Education, have been put in place to prioritize members with a long history of marginalization such as children with disabilities (Singer et al., 2012). The Head Start Act, as amended in 2007, goes as far as stipulating a 10% quota as a minimum of the population of children with disabilities expected to be admitted to a program-funded enrollment (Kozlowski, 2022). Despite all these, legislation acknowledges that inclusion is incomplete without support (Keim-Malpass, Letzkus, & Kennedy, 2015). Therefore, the perfect blend of peer-to-peer interaction greased by the appropriate individual support ensures inclusion not only at the stage of early childhood but all of life.

Evidently, inclusion works hand in hand with childhood development. A child who interacts freely with family members, peers, teachers and other caregivers will develop a sense of belonging to the society in which he or she exists and is likely to undergo a more wholesome development and escape the adverse outcomes that the

child who experiences exclusion is more than likely to encounter. This is especially buttressed by the stipulations of child rights in the Convention on the Rights of the Child (CRC) and the Convention on the Rights of People with Disabilities (CRPD). These policies can be fulfilled when appropriate support in the form of Assistive Technology is provided to enable children with disabilities seamless entrance and engagement in society (WHO & UNICEF, 2012). From all indications, Assistive Technology has the wherewithal to bridge existing gaps in the development of children with disabilities. If effectively implemented, significant enhancement in the learning experience, academic achievement and life skill development will be recorded (Kabariah&Adiyono, 2023). Thus, the opportunities that Assistive Technology provides must be leveraged to enhance the inclusion of children with disabilities across paradigms of development.

Diversity in Disabilities and Assistive Technology

Assistive Technology covers a wide range and is constantly undergoing evolution to satisfy users in need (Smith et al., 2023). Just as for disabilities, the world of Assistive Technology is diverse (Lorke& Stefanou, 2025). With various forms of disability from physical handicaps which cover chronic illness and mobility impairments to sensory impairments which is the umbrella term for visual and hearing conditions to cognitive dysfunctions like intellectual disabilities and learning disabilities to emotional conditions like depression (Nafukho et al., 2010), the demand for corresponding Assistive Technology is on the rise (Lancioni& Singh, 2014). The dichotomy exists where every disability fits into a different mould of Assistive technology. As special needs differ, so does Assistive Technology, and the fact that two children struggle with a disability of the same name does not mean they would require the same products and services for the intervention and management of their conditions.

According to Erdem (2017), the term Assistive Technology refers to the equipment, devices, apparatus, services, systems, processes and adaptations made to the environment that support and facilitate the functions used by persons with special education needs. Whether complex or adapted, Assistive Technology is any tool or device that maintains and improves the daily functioning of children with disabilities (Adebisi et al., 2015). The amended Assistive Technology Act of 2004, states that Assistive Technology is meant ‘to increase involvement in and reduce expenditures associated with programs and activities that facilitate communication, ensure independent functioning, enable early childhood development, support educational achievement, provide and enhance employment options and enable full participation in community living for individuals with disabilities (IWDs). Access to such devices can also reduce expenditure associated with early childhood intervention, education, rehabilitation and training, health care, employment,

residential living, independent living, recreation opportunities, and other aspects of daily living.' The foregoing statement highlights the institution and implementation of Assistive Technology as a means of catering to the needs of persons with disabilities right from childhood to adulthood while evaluating the short and long-term outcomes associated with effective use. Likewise, it highlights the economic benefits of Assistive Technology use.

Assistive Technology contains two main components, which are Assistive Technology devices/tools/products and Assistive Technology services (Lenker, 2012). Assistive Technology devices are further classified into low-tech, mid-tech and high-tech (Khasnabis et al., 2010). Assistive Technology services on the other hand are characterized by disciplinary multiplicity which usually involves the interventions of a host of professionals like therapists, special educators, rehabilitation engineers, and specialists for assessment, trial testing of devices, awareness creation and advocacy, caregiver and community support, device fitting, training and follow-up (Cook & Polgar, 2008).

The United States harbors diverse signifiers of belonging like class, ability, gender, religion, sex, race, sexual orientation, socio-economic status and so on,which ultimately means a range of factors must be put into consideration in the development and implementation of appropriate Assistive Technology for the diverse users. Failure to empathize translates to failure to adequately meet the needs of the population of children living with disabilities, which puts their lives both in the long and short run in jeopardy. To this extent, emphasis on interactions between producers and users and more research cannot be excessively emphasized.

Bridging the Gap: Upholding the Rights

In July 2014, the World Health Organization (WHO) established the Global Cooperation on Assistive Technology (GATE). The committee is charged with the responsibility of enhancing global access to Assistive Technology (Brandt et al., 2020). This is undoubtedly because though Assistive Technology plays a critical role in propagating participation (Desmond et al., 2018), many children with disabilities around the world continue to struggle with access to these resources or outright ignorance of their availability (Waterworth et al., 2022). This fog of ignorance encourages the already existing invisibility that often characterizes the world of disabilities and further disables the prospect of independence, inclusion and participation in society, which are intrinsic human needs and the backdrop upon which Assistive Technology is developed (Howard et al., 2020). But with initiatives like GATE and the stipulations in the CRC, CRPD, and the amended Assistive Technology Act of 2004, the horizon holds greater promise that the fight for inclusion for the large population of children with disabilities who presently experience exclusion will become a reality.

Children with disabilities do not automatically have their rights eroded due to their unique conditions. Essentially, policymakers, legislators, organizations, and human and disability rights activists have made colossal efforts to ensure that the rights of children, which extend to those with disabilities, are broadly publicized. At the moment, it is nearly impossible for any population to claim complete ignorance of the rights accorded to all children, whether or not they live with disabilities. Another standard that accentuates child rights laws with a spotlight on children with disabilities is the intersection between positive cultural perspectives and disabilities (Mosiiwa & Fazlioglu, 2017). Fundamentally, putting strategies and tools in place that are backed by law is instrumental to facilitating inclusion come what may (Schiariti, 2020). While refocusing attention and efforts on the concept and practice of inclusion, understanding Assistive Technology is the engine block of national and international efforts towards the advancement of the rights of children living with disabilities and provides a level playing field for all and sundry (Sabatello, 2013).

Meanwhile, to better advocate for the rights of this largely marginalized group, it is pertinent to review the level of awareness people, particularly caregivers in the form of parents, teachers, and health practitioners, including other support structures, have of Assistive Technology, its products, functions and related services. Indeed, Assistive Technology is becoming increasingly popular in the area of special needs. However, its adoption cannot be said to be at par with the needs evident in developing and emerging populations (Okonji &Ogwezzy, 2018). Several factors like awareness, perceptions and attitudes on the part of the family, educators, peers, society,and the government are contributors to this unsatisfactory status of Assistive Technology in such climes. The overall positive attitude towards Assistive Technology is inadequate to fuel an inclusive setting. This is because knowledge and institutional and professional support must work hand in hand with awareness for the implementation of Assistive Technology to succeed (Kundu, Bej & Dey, 2020). Much more than convenience, Assistive Technology must be regarded as a ticket for these children to access a better quality of life (Olatunji & Babalola, 2022).

Even though the CRC and CRPD have specific stipulations concerning the rights of children with disabilities, like the right to participate in society and the right to educational, health, and recreational access and preparation for employment, these conventions also acknowledge that realizing these rights is impossible without necessary support and accommodation. Inclusion would remain nothing but a matter of theory on paper if access to Assistive Technology is not improved (UNICEF & others, 2013). In essence, unavailability or inadequacy of Assistive Technology is a violation of child rights laws (Botelho, 2021). Simply put, the provision of accommodation and support needed towards the enhancement of the educational needs of children with disabilities cannot be extricated from the wide need of the

amended Assistive Technology Act of 2004, where the benefits of Assistive Technology are outlined extensively.

According to Mary Radabaugh (2014), 'For most people, technology makes things easier. For people with disabilities, technology makes things possible.' With the implementation of CRPD in the U.S.A., educational opportunities are created, and inclusion and participation among children of diverse backgrounds are actively brought into play, thereby making room for a truly wholesome society and what would ordinarily be regarded as impossible possible (WHO & UNICEF, 2015). The long-standing cooperation and collaboration between the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) has come a long way to include member states in the provision of Assistive and Accessible Technology at the most affordable rates, especially to children with disabilities. This way, the Education for All (EFA) movement is better accelerated. Despite the available evidence, research and studies continue to be carried out on issues that border on Assistive Technology and how it can be accessed. Of course, a good place to begin is the education of people across geographical and other societal borders on the numerous advantages of Assistive Technology not only to children with disabilities but also to those without. This way, a sense of cooperation and solidarity is engendered. Next is to emphasize the rights that accompany the use of Assistive Technology, especially where they are government funded. In all these, it is important to note that not much can be achieved without parental and community involvement. Disability notwithstanding, every child must feel a sense of visibility.

Unveiling the Hidden Challenges: Breaking Barriers

According to the Global Report on Assistive Technology, one in three people in the world over needs Assistive Technology, but only about one in ten has access to it (Senjam et al., 2023). Consequently, the inaccessibility of Assistive Technology amongst those with special needs is not exclusive to children but tends to take a greater toll on them. Even more alarming are other challenges that accompany disabilities and widen the exclusion gap, like race, colour, gender, religion, and social status, to mention a few (WHO & UNICEF, 2015). When children in need cannot access Assistive Technology, it ultimately reduces their control over their lives and their outcomes. Exclusion from activities at home, school, work environments and communities, as well as interaction with others, will leave them dependent and isolated with a reduced life expectancy (Fteiha et al., 2024).

The rapid evolution of Assistive Technology is also a contributor to the lack or inadequate awareness among those in charge of children with special needs, given that when making decisions concerning which Assistive Technology is appropriate for an individual, their environment, strengths, individual preferences, needs and learning styles are heavily influential (Floyd et al., 2020). The incessant flood of

information integrated into many Assistive Technology devices makes many caregivers overwhelmed and unable to keep up with the knowledge trend required on how best to administer support to beneficiaries (Floyd et al., 2020). Studies indicate that this lack of awareness poses a restriction to professional freedom to recommend appropriate devices even in situations of financial strength (Dwivedi, 2019).

The service aspect, which is the second component of Assistive Technology, poses another notable barrier. In many cases, the management of special needs requires a multidisciplinary approach, and the best way to facilitate this is by selecting an appropriate device specific to each individual's unique needs. Therefore, a team of specialized people who can properly and effectively decipher these needs, keeping the diversity of disabilities and the diversity of Assistive Technology in focus, is required (Floyd et al., 2020). For instance, a child who has shown signs of hearing loss noticeable by family members and possibly peers would require the services of a professional and experienced audiologist to subjectively and objectively ascertain the degree of hearing loss to know if the child would benefit from hearing aids. A speech therapist would also be involved to facilitate speech development in terms of habilitation or rehabilitation depending on the specifics of the child's condition, and an occupational therapist would need to keep track of the emotional health of both the child with the disability as well as family members.

Of course, one perk to employing multiple hands to attend to a child with special needs is how cost-intensive the exercise is, especially in middle- and low-income economies. However, such diagnostic and referral processes are not exclusive to children with hearing impairments. Other disabilities have corresponding processes through which they may be managed as in the case of the child with visual impairment who would require a set of glasses or contact lenses, the child with learning disabilities who would require learning aids in the form of gadgets and complementary software, the child with mobility struggles who would require prostheses or wheelchairs and so on (Boucher, 2018). The foregoing illustrations show how family members, school administrators, teachers and related service personnel, amongst others, are stakeholders who make up the team for the proper integration and intervention in including children with disabilities (Gierach, 2009). Hence, if teachers who are at the front are unwilling to learn the dynamics of Assistive Technology and its constant evolvement, access to inclusion for the development of the child is automatically hampered (Floyd et al., 2020). One notable case in which teachers were instrumental in the implementation of Assistive Technology to help a child with learning disabilities was that of Kolby Floyd-Norris, who went on to win the Yes! I Can Award in the year 2014 (Flloyd et al., 2020).

Notwithstanding, Assistive Technology cannot stand alone. Inappropriate staff training, negative attitudes, inadequate assessment and planning, time constraints,

insufficient funding, difficulties in procuring and managing equipment, stigma and unfavourable environmental conditions are all corresponding obstacles (Fteiha et al., 2024). Inherently, the environment plays the most extensive role in collaborating with Assistive Technology to influence inclusive paradigms for children with disabilities (Botelho, 2021). The physical, emotional, psychological, attitudinal, social and technological surroundings of the child cannot be ignored (Botelho, 2021). Since a part of the role that Assistive Technology plays is to humanize persons with disabilities, this effort becomes futile when despite the availability of a wheelchair the child with mobility disabilities still needs to be manually lifted where ramps are unavailable to enable wheelchair usage, likewise, hearing aids that become of no effect if the rechargeable batteries are unreachable costly and eyeglasses that cannot be worn in confidence due to social stigma (Widehammar et al., 2017). Without substantial barrier removal, children with disabilities will be unable to benefit from the game-changing solution of inclusion with which they can attain their full potential.

Ironically, physical growth also significantly hampers access to Assistive Technology. Since children are constantly changing, the likelihood that they outgrow recommended products is always imminent. This will lead to the abandonment of the products they can no longer use, which connotes several possibilities. Depending on the financial strength of the parents or available funding, the technology will either be replaced, or the child will have to live without it. This has the potential to put an obstacle between the child and educational opportunities, social interaction and participation on a larger scale.

Benefits of Assistive Technology in Early Childhood Development

Every child deserves a level playing field upon which they are provided with all the necessities to become all that they can be. When this happens, they can actively contribute to society, which in turn affords them a sense of accomplishment. In the area of special needs, there is continuous emphasis on early detection as a means of providing early intervention. When a child is with a disability even at the stage of Early Childhood, the ultimate aim of parents, teachers (if the child is of school age), caregivers and related service professionals is to provide necessary habilitation or rehabilitation to catch that child young and watch him or her grow into his or her fullest possible potential side by side those without disabilities. This is because the stage of Early Childhood is a critical one and the foundation of the rest of the individual's life. If children with disabilities must be effectively included, the world needs to start seeing things from a different point of view, which is an initiative the United States is already spearheading by legislation the government has put in place to accede to this. This effective angle of focus that grants children with special needs a ticket to limitlessly access society is Assistive Technology.

Across the paradigms of childhood development, Assistive Technology can be useful to children as it helps them grow with useful life skills like problem-solving in terms of cognition, motor, attention, communication, emotion, and behaviour (Thoreson, 2021). Assistive Technology helps them become well-rounded individuals who are not easily fazed by life's endless challenges. They develop healthy self-esteem, self-efficacy, and risk-taking behaviours, all essential to human survival. Even children with developmental delays are not left out of the benefits of Assistive Technology. It has the potential to help them catch up with peers and compensate for deficits (Parette & Stoner, 2008).

Through every stage of childhood, the benefits of Assistive Technology are inexhaustible. Above all, it affords the child participation and inclusion, disability notwithstanding. It affords children otherwise impossible ways to interact with their surroundings, communities, and society at large. To improve Assistive Technology and understand it better, research and studies are consistently ongoing to bring to pass the dream of many children with disabilities what it takes to function like their counterparts. Assistive Technology takes away the pressure and replaces it with otherwise impossible opportunities.

Recommendations for the Inclusion of Assistive Technology in Childhood Development

The diversity of disabilities and Assistive Technology should be taken into consideration for appropriate recommendations of devices and services that would be most effective to children with disabilities. Thus, when efficient assessment is carried out, the risk of abandonment of the recommended Assistive Technology will be reduced or eliminated. Assessment assists caregivers and related service professionals in understanding the specific needs of every child to set expectations. It also helps the special educator draw out a suitable Individualized Educational Plan (IEP), which dovetails into the delivery of befitting instruction. In the same vein, Assistive Technology devices that are undersized may be recycled to enable those who cannot afford them to have access to them as well. This also helps environmental preservation as it is a more effective method of disposal.

Consequent to the above, investments should be made into the proper training of those in charge of children with disabilities. The training has to be consistent and adaptable to the nonstop evolution of the technological terrain vis-à-vis childhood development, which is characterized by continuous change. Personnel must be trained with the consciousness that the success or failure of Assistive Technology in every case depends on their level of expertise. This makes professionals develop and take greater responsibility for the work they are charged with.

Furthermore, conditioning the environment is an important step to take in providing Assistive Technology to children with disabilities. Assistive Technology has greater

potential when efforts are invested in conditioning the environment to fit the unique needs of children with disabilities. Depending on how the environment is positioned, a child who relies on Assistive Technology will either develop a sense of belonging or feel left out and, by extension, dehumanized.

Pilot studies and trial tests should be religiously carried out before Assistive Technology is administered to the larger populace. These programs help stakeholders measure how effective the new product or service being provided is. Depending on the results, necessary adjustments and evidence can be presented to support further advocacy and attract investment (Kazi, 2024).

Conclusion

Comprehensive legislation has been put in place in the United States to facilitate and implement the inclusion of all children. The beauty of Assistive Technology is that it is not associated with the accomplishment of children with disabilities alone. Children without disabilities also get a hands-on opportunity to acknowledge experience and appreciate differences across various scopes. In practice, this is what inclusion truly means: the participation of every member in activities that bring fulfilment to the entire team. Children with disabilities can only reach their full potential when they feel part of a whole.

Still, in carving out a part for them in the whole, stakeholders and products manufacturers must be careful to ensure that they are not systematically left out. This is possible by making Assistive Technology a lot more subtle. Assistive Technology can make disabilities more visible and negatively influence societal attitudes, which can degenerate to stigma and hamper inclusion and growth.

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