

The Impact of Technology and assistive devices on educational experiences of students with Autism in Arizona.

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Abstract- This paper explores the impact of technology and assistive devices on the educational experiences of learners with autism in Arizona in United States of America, addressing a critical issue in contemporary education. The increasing prevalence of autism spectrum disorder (ASD) necessitates innovative educational strategies to support diverse learning needs. One significant challenge faced by learners with autism is the difficulty in communication and social interaction, which can hinder their academic performance and social integration. This paper employs the Capability Approach as a theoretical framework, emphasizing the importance of enhancing individual capabilities and opportunities for learners with autism. The conceptual framework of this study centers on the intersection of technology, assistive devices, and educational outcomes, positing that these tools can facilitate improved learning experiences. A qualitative methodology was employed, involving in-depth interviews with ten participants, including educators, parents, and specialists, to gather insights into the effectiveness of these technologies. One key finding indicates that the use of assistive devices significantly enhances communication skills among learners with autism, thereby fostering greater engagement in the classroom. The conclusion highlights the transformative potential of technology and assistive devices in education, advocating for their broader implementation to support learners with autism in Arizona. Key points include the necessity of tailored interventions, the role of technology in promoting inclusivity, and the importance of ongoing research to refine educational practices.

I. INTRODUCTION

Autism Spectrum Disorder (ASD) is such a diverse neurodevelopmental condition that presents enduring challenges in communication, social reciprocity, sensory integration and adaptive behaviour, Lord (2020). Within educational settings, these complexities often translate into substantial barriers that impede the full academic participation and social inclusion of learners on the autism spectrum (Lord et al., 2020). According to Ne'eman (2019), despite significant advancement in educational policy and disability rights, many students in mainstreams classrooms, particularly in the United States, continue to encounter systematic exclusion, instructional inflexibility and inadequate individualized support. Henceforth, these persistent gaps underscore the need for innovative, responsive and educational approaches.

Fundamentally, in Arizona, a state with increasing and continued rates of autism diagnoses and diversifying student populations, the deployment of technology and assistive devices has gained attention as a strategy to bridge pedagogical disparities. Schreibman et al (2015) contend that learners with ASD benefit significantly from technologically mediated instruction, which can mitigate communication deficits and facilitate differentiated learning. However, inconsistent access to assistive technologies and a lack of structured integration strategies have led to uneven implementation across school systems. Similarly, Lai et al. (2017) highlight that although many schools advocate for inclusive practices, their execution often remains superficial, lacking the technological and pedagogical depth required to support learners with complex needs.

Additionally, Guldberg et al (2019) critique the prevailing educational models for treating technology as supplementary rather than transformative, warning that learners with autism are routinely excluded from meaningful engagement due to a lack of adaptive tools and responsive teaching methods. To add, Odom et al (2021) expresses that while various assistive devices, which include text-to-speech software, alternative communication devices and sensory responsive tools hold considerable potential, however their efficacy is often undermined by insufficient teacher training, lack of administrative support and fragmented service delivery.

Notably, the above insights collectively expose a critical tension in the current educational landscape. This means that the availability of assistive technologies has outpaced the systematic capacity to implement them effectively. Therefore, this entails that there is a growing imperative to investigate and explore how such tools can be purposefully embedded into everyday instructional practice to empower learners with ASD, particularly within public education contexts such as those in Arizona.

More importantly, Cobb (2021) conducted a systematic review on the integration of digital platforms in autism education and observed that while these technologies enhance engagement and offer multisensory learning opportunities, their practical application is often hindered by educators limited technological fluency. He concluded his study by recommending the institutionalization of targeted professional development programs to ensure effective, sustainable integration of assistive technologies into individualized education plans (IEPs).

Furthermore, Parsons (2022) investigated the impact of AAC tools on classroom participation and found that such devices significantly increased verbal and non-verbal interaction among learners with ASD. However, he concluded that socio-economic inequities in resource allocation led to unequal access, perpetuating disparities in learning outcomes. He advocated for policy-level interventions to ensure equitable distribution of assistive technologies across school districts.

Moreover, Khowaja et al (2020) explored the use of virtual reality tools to foster social-emotional learning in autistic students. Their findings indicated substantial improvements in emotion recognition and situational awareness, yet they cautioned against overdependence on virtual platforms in lieu of human-centered instruction. They proposed a hybrid model that blends technology with direct interpersonal engagement.

In addition, Lindgren and Deutsch (2021) critiqued the lack of participatory design in the development of educational technologies for autistic learners. Their study found that many existing tools failed to resonate with users because they were created without the involvement of autistic individuals or their caregivers. The authors concluded that inclusive design methodologies are crucial to the development of effective, culturally responsive, and user-centered technologies. More so, Bouck and Long (2023) provided longitudinal evidence demonstrating that consistent use of assistive devices such as digital graphic organizers and speech-to-text tools resulted in improved academic performance in literacy and mathematics. However, they emphasized that these gains were highly contingent upon school culture, administrative buy-in, and the attitudes of classroom educators.

Consequently, while the aforementioned studies have significantly contributed to the discourse on technology and autism education, they predominantly examine individual tools or isolated classroom applications. Notably, absent in the literature is a comprehensive, context-specific analysis of how assistive technologies are being systematically implemented or underutilized within Arizona's public-school systems. Henceforth, this constitutes a critical knowledge gap.

Thus, the present study distinguishes itself by shifting the analytical lens from isolated effectiveness to systemic implementation, aiming to interrogate how technology and assistive devices can be deployed more holistically to enhance educational equity for learners with ASD. This study is unique in that it champions a rights-based, inclusive pedagogical model that positions assistive technologies not as

optional enhancements, but as essential enablers of academic participation, dignity, and agency.

In this regard, the central aim is to critically explore the challenges experienced by students with Autism Spectrum Disorder in Arizona's educational institutions and to evaluate how assistive technologies can be purposefully utilized to improve their academic welfare, functional independence, and social integration.

II. THEORETICAL FRAMEWORK

Capability Approach Theory

This study is anchored in the Capability Approach Theory, a normative framework which foregrounds the enhancement and the elevation of individual freedoms and the expansion of substantive opportunities or capabilities, as the ultimate goal of human development and social justice. It provides a powerful, critical and analytical lens, through which to examine how technology and assistive devices influence the educational experiences of learners with autism spectrum disorder in Arizona, United States of America. The Capability Approach was pioneered by Nobel Laureate Amartya Sen in the 1980s and later developed by philosopher Martha. Nussbaum. Establishing that, the quality of human life should be assessed in terms of individuals' actual freedom to achieve valuable functioning, that include acquiring knowledge, forming relationships and engaging meaningful in society.

Nussbaum (2021) further enriched the theory by articulating key central human capabilities that should be guaranteed to every person, in particular those with disabilities. More importantly, the capability approach rests on the assumption that human diversity is central, resources alone are insufficient and that freedom and agency are core values, of human development. This theory is particularly pertinent to the present study, which critically interrogates the impact of technology and assistive devices on the education of learners with autism, a group historically underserved and often excluded from full participation in the mainstream educational processes. As such, this study is of paramount importance since it seeks to evaluate the functional effectiveness of technological tools and to

farther explore whether such technology and innovations meaningfully enhance the learners' autonomy, communicative capacity and the sense of educational agency.

Fundamentally, this theory is relevant for this study because it critically addresses the core issues under scrutiny, which seeks to explore the extent to which educational technologies and assistive devices enable learners with autism to flourish intellectually, socially, and emotionally. Additionally, the capability approach redirects attention to how environments can be reshaped to unlock potential and promote dignity. This theoretical framework compels educators, policymakers, and technologists to consider the broader socio-cultural structures that may inhibit or facilitate capability realization. Thus, the Capability Approach underscores the interplay between personal characteristics, technological affordances, and contextual conversion factors. Ultimately, the Capability Approach contributes a deeply humanistic and justice-oriented foundation to this study.

III. RESEARCH METHODOLOGY

1.3.1 Research Paradigm

This study used the interpretivist research paradigm mainly due to the fact that interpretive ontology is "anti-foundationalist. It refuses to adopt any permanent, unvarying standards by which truth can be universally known" (Rehman & Alharthi, 2016). It stems from the ontological assumption that reality differs from one person to another. The ontological assumption of the constructivist research paradigm is that there are multiple subjective realities that people construct socially (Mertens, 2015) which means that there is no objectivity but rather subjectivity (Lincoln & Guba, 2018). Thus, the ontological approach of the research accepts that lived experiences should be treated seriously and that perspectives of the individual come from subjective experience and socially created realities (Terre Blanche, 2006)

1.3.2 Research approach

This study used the qualitative research approach. The qualitative research approach uses multiple methods of data collection (Silverman, 2020).

Qualitative research is centered on “developing explanations of social phenomena (MacMillan and Schumacher 2010)). It helps understanding of the social world in which people live and why things are the way they are” (Hancock & Windridge, 2007). Qualitative data can often be extended to people with characteristics like those in the study population, gaining a rich and complex understanding of a specific social context or phenomenon typically takes precedence over eliciting data that can be generalized to other geographical areas or populations” (Lincoln, 2018).

1.3.4 Sampling

The study involved ten participants who were selected through purposive sampling. This method was chosen to ensure that participants had relevant experiences related to the research questions, thereby enhancing the depth and richness of the data collected (Obilor 2023). The selection criteria included specific demographic characteristics and experiences that aligned with the research focus (Patton, 2020). These research questions include How can the use of technology and assistive devices improve the academic welfare of learners with Autism spectrum in the United States of America, How have the attitudes of stakeholders affected implementation of inclusive education for learners with Autism spectrum in America and How can policy and legislation influence the implementation of assistive devices and technology of inclusive education for learners with autism spectrum in schools in Arizona in United States of America?

1.3.5 Data Collection

Data were collected through semi-structured interviews, which allowed for flexibility in exploring participants' responses while maintaining a focus on the research questions (Walliman et al 2020). The interpretivist paradigm guided the choice of qualitative methods, emphasizing the importance of understanding participants' perspectives in their own contexts (Guba & Lincoln, 2019). Participants were interviewed three times over a period of six weeks. Each interview lasted approximately 60 minutes, allowing for in-depth exploration of the participants' experiences and perceptions. This iterative process

facilitated the emergence of themes and provided opportunities for clarification and elaboration on participants' responses.

1.3.6 Ethical Issues

Ethical considerations were paramount in this study. Informed consent was obtained from all participants, ensuring they understood the purpose of the research and their right to withdraw at any time without consequence. Confidentiality was maintained by anonymizing participants' identities and securely storing data (Shamao and Resnick, 2020). Additionally, the research adhered to ethical guidelines set forth by relevant institutional review boards. To enhance the validity and credibility of the findings, member checking was employed. Participants were provided with a summary of the findings and invited to provide feedback on the accuracy and resonance of the themes identified. This process not only validated the data but also enriched the analysis by incorporating participants' insights (Miemi & McMahon 2023).

1.3.7 Data Analysis

Data were analyzed using thematic analysis, which involved coding the interview transcripts to identify recurring themes and patterns (Braun & Clarke, 2016). This method allowed for a systematic examination of the data while remaining grounded in the participants' narratives (Braun and Clarke, 2021). The analysis was conducted iteratively, with initial codes being refined and grouped into broader themes.

IV. FINDINGS AND DISCUSSIONS

1.4 The significance of Technology and Assistive Devices

1.4.1 Increased engagement and attention

Participants noted that technology fosters interactive learning experiences, allowing learners to engage more actively with content. Assistive devices enable tailored educational experiences, accommodating individual learning styles and needs. The use of technology has been linked to increased motivation

among learners, as it often incorporates gamification and multimedia

"The tablets have transformed how my learners interact with lessons; they are more focused and eager to participate."

"Using apps tailored for autism has made it easier for my child to express themselves and stay engaged."

"I've seen a noticeable difference in attention spans when we incorporate technology into our lessons."

Participants' statements reflect a consensus that technology and assistive devices significantly enhance engagement and attention among learners with autism. The insights provided by participants highlight critical educational issues, such as the need for adaptive teaching methods and the importance of incorporating technology in special education curricula. Other scholars support the participants' views, emphasizing the positive impact of technology on engagement and learning outcomes for learners with autism (Baker et al., 2015). However, some researchers caution against over-reliance on technology, advocating for a balanced approach that combines traditional teaching methods with technological tools (Smith & Jones, 2018). This nuanced perspective suggests that while technology can enhance learning, it should not replace fundamental pedagogical strategies.

Theoretical Framing

Participants' experiences can be framed within the context of constructivist learning theories, which posit that learners construct knowledge through interaction with their environment (Piaget, 1970). The use of technology aligns with this theory by providing interactive and engaging platforms for learners to explore and understand concepts.

Communication skills

Technology has greatly improved communication skills for teachers and learners alike. By enabling easier and faster communication, technology has enhanced collaboration, critical thinking, and problem-solving skills among learners. Some participants had this to say

"Since we started using the communication app, my son has been able to express his needs more clearly."

"The speech-generating device has opened up a whole new world for my learners; they can now participate in class discussions."

"I've noticed that my daughter is more willing to engage with her peers since we introduced the tablet into her learning routine."

The participants' statements highlight the transformative role of technology in enhancing communication skills among learners with autism. The first statement underscores the ability of assistive devices to facilitate expression, while the second emphasizes increased participation in educational settings. The participants' experiences suggest that assistive technologies can address significant barriers to communication faced by learners with autism.

Other scholars support the participants' views, emphasizing the importance of tailored interventions that incorporate technology to meet the unique needs of learners with autism (Schlosser & Wendt, 2018). For instance, some researchers argue that while technology can enhance communication, it should be used as part of a comprehensive approach that includes social skills training and individualized support (Miller et al., 2014). Conversely, some critics caution against over-reliance on technology, advocating for a balanced approach that also emphasizes face-to-face interactions (Gena et al., 2020).

Theoretical Framing

The participants' statements align with the Social Model of Disability, which posits that societal barriers, rather than individual impairments, limit the participation of individuals with disabilities (Oliver, 2023). By utilizing technology, educators can help dismantle these barriers, facilitating better communication and social engagement for learners with autism.

1.4.2 The Impact of stakeholders Attitudes on the Implementation of Inclusive Education

Educators

Many educators emphasized the importance of inclusion, stating that it promotes social skills and peer relationships for learners with ASD. Some participants expressed concerns about their preparedness to meet the diverse needs of learners with ASD, indicating a lack of confidence in their ability to implement inclusive practices. A recurring theme was the necessity for ongoing training and resources to support educators in their inclusive efforts.

"Inclusion is essential; it helps learners with ASD learn from their peers."

"I often feel overwhelmed by the demands of including learners with ASD in my classroom."

"Without proper training, I don't think I can effectively support these learners."

The first quote reflects a positive attitude towards inclusion, suggesting that educators recognize the benefits of social interaction for learners with ASD. The second quote highlights the challenges educators face, indicating that negative attitudes may stem from feelings of inadequacy or lack of support. The participants' statements reveal a complex relationship between attitudes and the implementation of inclusive education. Positive attitudes can lead to successful inclusion, while negative attitudes may result in barriers to effective practice. This aligns with existing literature, which emphasizes the need for supportive environments and professional development to foster positive attitudes among educators (Forlin, 2019; Loreman et al., 2020).

Other scholars support the notion that educators' attitudes significantly impact inclusive practices. For instance, Avramidis and Norwich (2017) argue that teacher beliefs about inclusion directly influence their willingness to adapt their teaching strategies. Conversely, some researchers suggest that systemic factors, such as school policies and administrative support, play a more critical role than individual attitudes (Sharma et al., 2018). This divergence highlights the need for a multifaceted approach to understanding inclusive education.

Theoretical Framing

The participants' experiences can be framed within the social model of disability, which posits that societal attitudes and structures create barriers for individuals with disabilities. Educators' attitudes towards inclusion reflect broader societal beliefs about disability and inclusion, suggesting that changing these attitudes is essential for effective implementation.

Parents

Many parents expressed a strong belief in the benefits of inclusive education. One participant stated, "I believe that my child thrives in an environment where he can learn alongside his peers." Some parents voiced apprehensions about their child's acceptance in inclusive settings. A participant noted, "I worry that other kids won't understand my son's behavior and will isolate him." Parents emphasized the need for adequate resources to support inclusive practices. One participant remarked, "Without proper training for teachers, inclusion is just a buzzword."

The participants' statements reveal a complex interplay between support for inclusive education and concerns about its practical implementation. The first quote underscores a positive attitude that aligns with existing literature advocating for inclusive practices (Turnbull et al., 2015). The participants' perspectives relate to the theoretical framing of the social model of disability, which posits that societal attitudes and structures significantly influence the experiences of individuals with disabilities. This framing suggests that parental attitudes are not merely personal beliefs but are embedded within broader societal contexts that can either facilitate or hinder inclusive education.

V. CONCLUSION

Findings indicate that the use of assistive devices significantly enhances communication skills among learners with autism, thereby fostering greater engagement in the classroom. The management of autism spectrum is central to the implementation of technology and other critical assistive devices which can reduce the impact of the autistic conditions which can negatively impact the development of the children.

1.5.2 Implication of findings

Use of devices such as tablets, apps, and communication tools enables learners to access a variety of resources and customize their learning experience to meet their individual needs. Assistive devices empower learners with autism to navigate their environment and complete tasks on their own. Devices such as visual schedules, sensory tools, and communication devices can provide the necessary support for learners to succeed in the classroom

1.5.3 Contribution of findings

The finding adds value to the domain of inclusive education, especially in the area of technology in the education of learners with autism in schools. It is envisaged that the study may benefit teachers, learners with autism, researchers, policy makers and administrators. Teachers may have information on how to make better decisions when assisting children with autism in their classes. Such information will make the teachers more effective in the execution of their duties. This may also enable children with autism to develop their potential to the maximum.

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