Chapter 2
Assistive Technology to Support Children With Autism Spectrum Disorder

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ABSTRACT

Assistive technology (AT) is defined as any device or technology ranging from low to high that helps to improve functional skills of individuals with cognitive, physical, or neurological disorders. These technologies are devised to improve the functional activities of persons. ATs focussing on cognitive disorders like dementia, autism spectrum disorders, etc. can be categorized as ATs for cognition (ATC) and augmentative and alternative communication (AAC). AAC interventions consist of tools that aid the challenges faced by individuals with speech impairment during communication. AACs used often are speech-generating devices (SGD), software programs, and communication apps for efficient production of speech. ATCs include social stories and video modeling strategies. The use of assistive technology in autism spectrum disorder (ASD) has great importance due to increased requirement for interventions in helping students. There are several lines of evidence showing the effectiveness of technology-assisted training in ASD patients.

1. AUTISM SPECTRUM DISORDER

The WHO defines Autism spectrum disorder (ASD) as a range of conditions characterized by some degree of impaired social behavior, communication and language, and a narrow range of interests and

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activities that are both unique to the individual and carried out repetitively. ASD symptoms also include impairment in motor skills. The characteristics of the Autism Spectrum Disorders patients can be divided into three categories:

- Social skills and behavioral impairments: Individuals with ASD face difficulties in making friends, interacting with people, maintaining eye contact, and reading body gestures and facial expressions. Instead of interacting with human beings, ASD patients prefer interacting with the surrounding objects.
- Communication impairments: The ASD patients also face problems in speech production and comprehension. They are also known to repeat a word or a phrase in a conversation. Some patients cannot produce speech at all or have limited speech.
- Repetitive movements and behaviors: The individuals, mostly children with ASD show inappropriate behaviors such as hand flapping, screaming, falling on the ground, and repeating sounds and phrases.

These characteristics are known as the 'Triad of impairments' together. The available epidemiological data suggests that approximately 1 in 54 children in the United States are diagnosed with an autism spectrum disorder (ASD), and ASD affects all racial, ethnic, and socioeconomic groups (Centres for Disease Control and Prevention [CDC], 2020). Furthermore, the prevalence of this spectrum of disorders has been increasing globally in the past 50 years; this may also be a result of increasing awareness among common citizens, improved diagnostic tools and a better understanding of the disorders with time. Although autism can occur in people with a high IQ, more than half the individuals with autism suffer from intellectual disability (defined as an IQ below 70) (Investigators, 2012).

Screening of autism spectrum disorders is a challenge because most of the diagnostic tools involve the detection of behavioral symptoms which include social interaction, aggression, attention deficits, gait patterns, and sensory processing, and the developmental traits of the subject which have to be carefully observed by an expert to reach at the conclusion (Wadhera et al., 2019). One major drawback of these diagnosis techniques is that they are not useful for early diagnosis. Another drawback is that the questionnaires are designed by the experts and the response of the children needs to be recorded and analyzed by the experts; this makes the process tedious and time-consuming (Wadhera & Kakkar, 2019). Some recent advancements in the diagnostic tools include:

Eye Tracker system: This system detects the gaze patterns and cognitive abilities of individuals and assists the analysis of eye movements using a deep learning system, which makes this process objective instead of subjective such as during the manual interpretation (Wadhera & Kakkar, 2019).

Multiple biometrics identification system: Biometrics is a pattern recognition system that distinguishes between individuals based on unique characteristics like fingerprints, gait, facial pattern, and iris pattern. Wadhera et al. had described that a combination of a biometrics system is useful in the early diagnosis of ASD by analyzing the morphology of the face and fingers (Wadhera et al., 2019).

Big-data-based system: Big Data is recently gaining more attention for the detection and treatment of ASD. It is an information hub with a large number of data points from different individuals suffering from ASD. These data points may consist of structured or unstructured data; structured data includes phenotypes, International Codes for Diseases (ICD) codes, etc. and unstructured data includes information about the environmental factors, clinical prescriptions, etc. The data is so huge that even the variations due to minute factors can be tracked (Wadhera & Kakkar, 2020).