

Digital Therapeutics as an Intervention Strategy to counter Behavioural Challenges in Students with Autism Spectrum Disorder at Secondary Level: A Review Study

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Abstract—autism spectrum disorder is a neurodevelopmental disorder, the onset of which generally occurs before the age of 3 years, majorly hindering the functions of the affective and social-communication domains. Individuals with Autism Spectrum Disorder generally have a difficult time adjusting to the daily transitions in one's routine life along with maintaining friendships and relationships due to their restricted patterns of behaviour which might be difficult for neurotypical people to understand and take into consideration. It becomes necessary to target these behavioural issues and counter them effectively with various solutions such as therapies, medications, mindfulness activities, etc. The purpose of this study is to understand the role of digital therapeutics to counter the behavioural challenges in persons with autism spectrum disorder as an effective intervention strategy. For the present study, review of relevant literature has been mentioned. Numerous research articles, journals and blogs have been reviewed to derive the research objective. After reviewing the aforementioned studies and perspectives of various researchers, it is clear that the use of digital therapeutics has worked effectively in reducing negative and problematic behaviours in persons with autism spectrum disorder and effective on people around the age group of early childhood to young adulthood depending on the intensity of the disorder. It is also imperative to note that the use of digital therapeutics as an intervention strategy not only aids children but also assists teacher in becoming better facilitators for providing an enriched classroom experience to all kinds of learners.

Index Terms—Autism Spectrum Disorder, Digital Therapeutics, Behaviour Modification, Children with Disabilities, Behavioural Intervention, and Game based intervention, etc.

I. INTRODUCTION

The advent of technological has paved way for researchers, educators and practitioners to explore and utilise countless components of the 21st century educational tools for creating a pool of teaching learning resources to address the requirements of the diverse learners in our classrooms that not only encourage the students to construct new knowledge but also assist students with exceptional needs to build their competence to stay on track with their neurotypical peers and achieve their full potential. Classroom teaching has undergone a 360-degree transformation from the traditional mode of teaching that involved lecture methods, passive learning, teacher centred methodologies, rigid curriculum, a 'one for all' approach for every student, to a comprehensive students centred learning system that is flexible and practicable for students with diverse learning needs, and is only progressing further. But that is not all, technology has reached its all-time prime with the innovation of 'Digital Therapy' something which is quite a new term a yet has secured a remarkable position in the field of medical and rehabilitation sciences.

To start with, let us first understand Digital Therapeutics (DTx) in manageable terms. Digital therapeutics is set of evidence-based practices that are powered by digital tools and software for the prevention, management and treatment of a medical inconvenience through patient-facing applications or digital platforms proven to benefit clinical practices. These are mostly implemented via advanced technological interventions that are based or dependent on tools such as Augmented Reality (AR), Artificial Intelligence (AI), Cloud computing, Big

data, Chatbot, Robotics, Quantum technologies such as used for developing vaccines during the Covid-19 pandemic, Simulation technologies, Telecom technologies, Social networking and use of Smart devices such as smart phones, smart watches, pulmonary senses, motion sensors, etc.

Self-Help Tools	Therapy Extenders	Virtual Care Platforms
		
Self-help tools that youth can use on their own	Therapy extenders that can support youth receiving therapy	Virtual care platforms provide access to therapists through technologies
Technology	Technology + Therapy	Therapy through Technology

(Source: Digital tools for Youth Mental Health, Frontiers for Young Minds, 2023)

Digital therapeutics has great quantity of advantages for various kinds of medical needs, for instance, Virtual Care platforms that are also referred to as tele-behavioural health, are helpful for connecting people to therapists for remote therapy sessions; this is a great initiative since many people do not feel comfortable face-to-face interactions with a therapist. 'Brightline' is one such application that is widely used and is a cost-free option.

There are numerous similar examples that state the significance and advantages of digital therapy tools and techniques which are becoming popular these days, and it's only obvious as to why they are so much in trend. Researchers and practitioners also applaud the application and implementation of these tools in medical practices for wide spectrum of utility.

II. REVIEW OF LITERATURE

Wu et al., (2023) conducted a bibliometric analysis on the global trends and hotspots in digital therapeutics of autism spectrum disorder. The purpose of this study was to objectively analyse the research status of digital therapeutics in ASD. For this study, a total of 509 articles about digital therapeutics for ASD from 2002 to October 2022 were analysed using Cite space. The major findings from this study suggested that the Journal for Autism and Developmental Disorders was the most cited journal for studies related to the relevant theme and variable like artificial intelligence, machine

learning, and virtual reality and eye-tracking were some of the research trends in DTx for ASD. The researchers concluded from the study that DTx is a rapidly developing research topic and gaining attention of researchers worldwide.

Edelson (2022) conducted a study for understanding challenging behaviours in individuals with autism spectrum disorder. The study aimed at describing an interdisciplinary model that expands the operant behavioural conditioning by taking medical co morbidities and interoceptive processing into consideration. The author reviewed a multi component interdisciplinary model to explain the presence or the lack of many challenging behaviours associated with autism spectrum disorder. The findings from the study suggested that frequent medical checkups should be done and clinicians should be aware that pain or discomfort sometimes might not be noticed or sensed by people with hypo-sensitivity. The author concluded that these underlying behavioural challenges should be consistently monitored otherwise it could persist into adulthood. Moreover, further researches should be made between the antecedents or stimulations and consequences, medical co morbidities, immediate environment conditions to design a comprehensive set of assessments and in developing effective treatment strategies to treat these challenging behaviours.

Choi et al., (2022) conducted a review-based study on the therapeutic effects of game based digital therapeutics on the mental health problems and the transfer of cognitive functions for children and adolescents. The purpose of this study was to review the effects of DTx to target mental health problems in children and adolescents y delivering treatments or preventive interventions via video games. The findings from the study suggested that game based DTx have the potential for therapeutic effects on mental health problems when used as a delivery tool for treatment or prevention interventions in both children and adolescents.

Lucio et al., (2022) conducted a review study on occupational therapy interventions using new technologies in children and adolescents with autism spectrum disorder. The study aimed at describing the use of new technologies for occupational therapy interventions in children and adolescents. The authors conducted a scientific review study following the standards of Cochrane Handbooks version and recommendations of the PRISMA extension for

scoping reviews, from which 20 studies were selected. The findings from the study revealed that there is a necessity of performing further studies with a larger sample size containing a control group along with a representative and a random sample with the use of validated assessment tools.

Laurie et al., (2022) conducted a study on the role of robotic toys in shaping play and joint engagement in children with autism. The study aimed at examining the interaction between digital devices and joint engagement for children with autism in a real-world setting and to explore the impact of tangible constraints in fostering social interaction. This experimental study observed children with autism aged 12-15 years while playing with a digital robotic toy and a non-digital toy simultaneously. The findings from the study revealed that children displayed increased levels of joint attention while sharing their toys with others whether digital or not with each child individually varying in the propensity to engage in social interactions.

Man-Yan et al., (2021) conducted a study on LSEAQ-S as a measure for adaptive behaviour for primary students with autism spectrum disorder. The study aimed at developing and examining and providing norms for the Learning, Social and Emotion Adaptation Questionnaire-Short form teacher report instrument. For this study the researchers utilized three samples of 2298, 2690 and 3305 students with ASD from 204 schools and 1869 students without ASD from 112 schools in Hong Kong. The finding forms the study showed that there were significant gender differences where girls with ASD were lagging behind as compared to their same gendered peers in skills than boys. Moreover, the results proved that this measure is capable of identifying challenging behaviours, difficulties and classroom needs, help monitor progress and also facilitate training and support targeting disruptive behaviours.

Pandina (2021) conducted a study on the role of digital medicine in autism spectrum disorder with the aim to review the assessment diagnosis with its outcome and digital therapeutics. The findings from the literary review suggested that caregivers and providers make use of mobile & web-based treatment tools such as robotics, virtual reality-based programs, gaming platforms to enhance engagement and skills of communication and social interaction. The author concluded from the study that appropriate construction

of such digital tools which are not limited to small scale pilot studies is required, with more focused research demonstrating the utility of digital approaches to aid assessment & diagnosis practices.

Vivanti et al., (2021) conducted a study on the early identification of autism spectrum disorders with the aim to address the outcomes of the early detection in children along with the tools that facilitate accurate and feasible identification and barriers and facilitators that assist in the successful implementation of early identification strategies. The author reviewed exclusively four studies and found that all these research papers emphasize the value of behavioural indicators that present the risk of autism in children. The author concluded from the study that numerous factors such as screening procedures and healthcare facilities jointly contribute to the success of early identification efforts.

Saleh et al., (2021) conducted a review study on the robot applications for autism spectrum disorder. For the present study, a total of 161 studies were selected with a total of 1671 participants in these studies. The findings from the study suggested social robots are considered promising to be utilized for rehabilitation for not only children with autism but also for children with other developmental disorders and delays. The authors concluded from the study that the use of robotics for rehabilitation of children with autism is helpful to augment their cognitive and social skills and recommend further study to assess the extent of its efficiency and effectiveness.

Dang et al., (2020) conducted a study on the role of digital therapeutics in the changing future of healthcare with the aim to provide a comprehensive overview of DTx regarding its functions and applications in healthcare and associated regulatory aspects. The findings from the study suggested that DTx has the potential to significantly benefit the primary care practice as it offers the physicians an option to provide treatment within flexible timings and locations, moreover physicians can make more informed and accurate clinical diagnosis and patient care decisions. The author concluded from this study that DTx provides practitioners the ability to develop personalized treatment plans and monitor and track the responses to the prescribed medical treatment plans.

DiPietro et al., (2019) conducted a study on the computer and robot assisted therapies to aid social and intellectual functioning of children with autism

spectrum disorder. The study aimed at identifying the types of IT platforms for computer & robot assisted therapies for children with ASD, the disciplines and professions studying and utilizing these therapies with the evaluation of their outcomes and the benefits of such therapies to children with autism. The authors reviewed a total of 18 studies that met their research criteria that demonstrated promising results in improving the management of autism in children. The authors recommended that more cost-effective high-quality researches with larger numbers of participants should be carried out.

Cai et al., (2018) conducted a study on the emotional regulation in Autism Spectrum

Disorder with the aim to suggest improved research on emotional regulation in autism, and to gain insight on the same and use that knowledge to design effective interventions for the wellbeing of people with autism. The findings from the study reported that individuals with autism presented ER difficulties along with a less adaptive pattern for ER strategy use. From this, the authors proposed new directions for investigating ER in people with autism and emphasized the importance of emotional self-awareness.

Saadatzi et al., (2018) conducted a study on virtual teacher and robot peer for individuals with autism spectrum disorder in a small group technology-assisted instruction. The study aimed at using a multiple-probe design to evaluate the effects of the instructional package on the acquisition and learning of sight words. For this experimental study, the researchers utilized a sample group of 3 students with autism and a humanoid robot emulating a peer that featured a virtual teacher instructing sight words via the use of social robotics and VR technology. The authors gathered from this study that the participants acquired, maintained and generalized the content taught with fewer errors.

Seok-Yun et al., (2017) conducted an experimental study on the social skills training for children with autism spectrum disorder. The study aimed at focusing on two main social skills which is eye contact and facial emotion regulation with the help of a self-designed robot system. The findings from the study revealed that the therapeutic robot facilitated the treatment intervention, and that the student's ability to play, their general behaviour and emotional symptoms were significantly impacted by the therapeutic intervention thus suggesting that robots are useful

mediators of social skills training for children with autism.

Sartorato et al., (2017) conducted a review-based study on improving the therapeutic outcomes in autism spectrum disorder to enhance social communication and sensory processing through the use of interactive robots. The study aimed to examine the range of socially interactive robots that have therapeutic effects and utility. The findings from the study revealed that social robots help in enhancing social skills and communication for children with autism and have shown to generate numerous social and behavioural benefits along with heightened engagement, increased attention and decreased social anxiety. The authors concluded from the study social robotics provide overall multisensory processing and audiovisual processing by allowing audiovisual cues to be experienced through a simplified version of human interaction, thus stating that they have the potential to strengthen the clinical utility for management of autism in children and adults.

III. OBJECTIVE OF THE STUDY

This purpose of this study is to understand the significant role of digital therapeutics in assisting teachers, parents, caregivers and other professionals working with children with autism spectrum disorder or a child with any other developmental delay, in effectively countering the behavioural challenges for secondary level students.

IV. METHODOLOGY OF THE STUDY

For the present study review of relevant literature has been mentioned. Numerous research articles, journals and blogs have been reviewed to derive the research objective.

V. DISCUSSION

Mr. Vijay Ravindran, the founder & CEO of Floreo, a company that is focused on bringing VR behavioural therapy for autism and other developmental disorders and delays, stated in a roundtable conference stated that, "The promise of virtual technologies is to increase access and to create pathways where there's more affordable care." If anything, good came out of the recent pandemic, it would be the increased trust

and reliance people have shown for digital platforms in any and every field, and with something as new and significant as digital therapeutics has become the need of the hour. With heightened ability to reach maximum population across national and international borders, it makes a worth accreditation which also support cost effective therapeutic strategies making it a more affordable option for every section of the community. Integration of digital tools and therapeutic interventions to treat behavioural challenges in children, adolescents and adults with autism spectrum disorder and is more efficient in tracking and monitoring progress than in person or manually, befitting the idea of a Right based service delivery model that suits the needs and is custom based according to the diverse needs of each individual.

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