

# HEALTH CARE: ROLE OF ICT IN AUTISM

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## ABSTRACT

Recently, Considerable advancement has been seen for educating the people with autism. Research has shown that people with autism reveals positive behavior while interacting with innovative information technologies as compared to therapies [5]. This review focuses on the possible use of ICT in the education and development of the people with autism and reducing their difficulties in communication [18]. A variety of different ICT applications for the treatment of autism including the use of interactive virtual environments, devices, computers, serious games and avatars will be discussed in this paper. ICT is a rapidly developing area of research to be used as a therapy for autism. Despite the fact that ICT has exciting positive results, most of the ICT proposals or implementations have limited use, performance and capabilities in actual conditions [6, 18]. Interactive devices, including robotics are being developed and used for the education and development of the people with autism. These devices teach and practice a skill, promote behaviors and provide feedback in specific environments. Development of interactive devices including robots having humanlike abilities and joint attention are the issues that are to be focused in the future research for assisting the people with autism [14].

## KEYWORDS

Technology, Autism Therapy, Joint Attention, Learning Disabilities.

## 1. INTRODUCTION

It has been proved that in the development of a child, social-emotional interactions play an important part [5, 18]. Communication is the key to develop the ability to identify, translate and create behaviors as well as it is the basis of social cognition. In social cognition, a child interprets verbal and non-verbal communication nodes like speech, gestures, facial expressions etc. [10]. It also helps a child to produce such nodes as social and emotional movements, expressions and gestures as well as synchronizing their behaviors with others and the ability of giving everyone a credit according to their state of mind [2].

There are two areas where disorders related to Autism are defined: (1) Permanent problem in social interaction and (2) Repetitive behavior, activities or interests [9, 10]. The main problem in autism is the difficulty in communication and interaction with others due to the lack of understanding or interpreting the expressions, gestures or movements [3]. Especially in children with autism it is observed that they prefer to play alone with their repetitive activities instead of playing with others. So it is big problem for them to keep interacting with human and the environment [6, 9]. Although it is a type of disorder in which positive development is poor but still considerable advancement has been observed in the development of such people with the help of various approaches [18].

## 2. ICT Applications

### 2.1 Use of Computers

The focus of ICT applications is to develop an interactive relationship between one user and one computer as well as to improve behavioral disorders related to autism. As computers provide predictability and consistency, so they are helping to motivate the children with autism as compared to humans. Computer is reliable for not sending social messages which create confusion [5]. From the research on students with autism, we concluded the increase in the following: (a) Focused and overall attention (b) Fine and

generalized skills and behaviors and decrease in the following (a) self-stimulatory behaviors (b) nervousness [3].

Assistive technology for autism can be used for improvement in daily activities. Hetzroni and Tannos conducted a research on five children and developed a program based on daily activities keeping the communication in main focus. This program showed improvement in learning as well as communicating that lesson in the classroom. ARC (Autism Research Centre) launched an educational emotion software, named Transporters. The Transporter is being used commercially for autism. It is a vehicle based on eight characters which attracts the children while moving due to its mechanical nature. Transporter containing faces of actors with emotions was developed to evaluate the ease in learning as compared to real world. Transporters resulted that this DVD is an effective way to teach the children to recognize emotion and can be generalized to new situations with new faces on the vehicles. Other who were not taught by Transporter resulted in less improvement [18].

## 2.2 Virtual Environments

Over the last decade, many software related to virtual environments have been produced for autism. VEs have the predictable interaction which minimizes the anxiety. The safe and close to nature scenarios of VEs as well as the animation and voice helps the children to take interest which minimizes the learning disabilities in a better way [11].

In past experiments, Autistic children have proved the successful learning of skills with the help of VE and also enjoyed the technology. Children, especially, are more interested in VE as virtual peers are animated characters with language enabled, computer generated, responding and life-long instead of other toys. Story telling scenario is the most researched area of this technology which gives company to a child [15]. In contribution to this research, a virtual café in which participants have to order a drink, sit and pay was programmed. This was a reality program to understand the social behaviors and examined on the children of teen-age. Different activities were taught and practiced including finding seat in both empty and crowded café and communicating with others in the cafe. It was concluded that more complex programs may provide children with more realistic interaction with social knowledge [17].

Another program in hic a virtual supermarket was created to make children think and play with touching the screen and interacting with objects. This increased the imagination and symbolic thinking of children and the outcome was more positive in sense of understanding and interacting. The multidimensional interaction with touch screen improved the participation of both learners and instructors with natural interaction between computer and child, instructor and child and computer and instructor as well [15].

A multi-user, multi-touch display, Diamond Touch Technology, can be used to engage the children in imaginative scenario where all the actions have real consequences in VE. This technology was further used for the improvement in positive social behaviors including eye contact in terms of both quality and quantity. This concluded that touch screens can be used to promote creativity and in future this can bring great advancements in learning of autistic children [17]. Although it is a reality that VE does not provide real touch of texture and feelings, sensing but still it is a promising improvement for development of disorders as this trains and motivates the child for the real-time interactions [15].

## 2.3 Interactive Environments

Recent researches have bring advances in this field of collaborative interactive environments through the control and monitoring of the behavior of the autistic child. This brings the skill of collaboration as well as a safe and enjoyable experience for the children because of no judgment issues in such interactions [18]. This is a notable thing and also proved that use of computers provide attractive environment for the purpose of education to an autistic child whereas real-time communication can lead them to problems. During the process of educating, different states of the behaviors of the child are measured with time in case of accomplishment of any goal and can lead to the factors involved in the progress of the child [2].

It becomes more complex and difficult task to educate a child with ASD in real-world interactive environments when the trainer has to think rapidly [1]. Many environments have been developed using pictures and sketches to entertain the child so far with the help of education platforms. Pictures and sketches are used to make the child distinguish the size, shape and color of the things as well as with the help of sound and voices. This type of environment also minimizes the monitoring of teacher due to their verbal and visual guidance [15].

## 2.4 Special Input Devices

Recent developments of ICT allow more attractive form of input after the research that people with ASD enjoy interacting with computers. That is why now most of the technologies use touch screen instead of mouse or joystick for input or feedback. In recent research, a multi-user touch was introduced that allows two or four user and detect their touch with the help of an antenna activated by all users one by one [17]. 3D environments, remote controlled environment and interfaces with big colored buttons increase the process of development in autistic people. With all such technologies, external devices are used to monitor and evaluate the internal and external state of the user. These external devices can be a wearable measurement device, a camera or a data glove. Video projectors are also an example of attractive virtual worlds that are being used by scientists for the educational purpose to be depicted on a wall [12, 13].

In history, TEACCH was the first program for educating the autistic children which have the principles like behavior changing and development of skill according to the personal need of the person. By recording the education process, these recordings can be further used to educate the other cases of ASD as well even by modifying the process according to the special needs of an individual. Apple, ipads, ipods and similar devices have been used to educate the individuals with ASD [18].

Studies were made on the following domains: (1) employment (2) academic and (3) leisure aimed to (a) deliver instructions and (b) teach to operate the devices. Half of the studies gave positive feedback as well as increase in their level of understanding and recognizing the objects. These studies proved that video modeling on ipads can be an effective technique to teach the students with ASD [16]. Personal Computers, mobile phones and MP3 Players are evaluated for the purpose of communication meditation of ASD. Research related to ipads for communication purpose and their comparison with communication system using picture cards was done by different authors. Similarly, the story telling video clips were used to increase the behavioral skills in the ASD individuals [17].

## 2.5 Serious Games

Serious games play an important role for the development of ASD as the instructor. Additionally, serious games playing improves the social skills and decision making of the participants [8]. Autistic people are found spending most of their time in games or cartoons and according to their parents, they are aware of cartoons more than people [15]. A game, named Jestimule was developed with heterogeneity to facilitate the children with ASD. Moreover, ICT was also used in a game to teach all kind of students the ability to recognize the emotions and all kind of situations effectively. With the help of this game, the participants improved their ability of facial and emotion recognition in different situations. Such kinds of results helped to improve these technologies for the use in future to train the autistic children [18, 12].

## 2.6 Telerehabilitation

The method of using telecommunication, operation and computing technologies for the purpose of educating, training or development of the autistic children by serving clinics, clients or systems for assisting them. Comparing the telerehabilitation with traditional approach resulted that telerehabilitation provides more effective ways in creating the supportive environment. In recent years, the biggest advancement have been seen in the field of telecommunication which is a backbone for the telerehabilitation [10].

In a comprehensive review report on the telerehabilitation and its models defined many health services that can be provided across distance which was named as telehealth. Three subcategories of telehealth are: (1) Telehealthcare (2) Telemedicine and (3) e-health/education [17]. The main focus was on the improved telerehabilitation with minimal cost, time and fastest access to the experts. Through this, various technologies involving geographic and economic problems were used for cost-effective health providence in home. This research also showed that telerehabilitation at home is as effective as the service providence in hospitals. These services can include cognitive rehabilitation with the help of internet or movement therapy with the help of using a computer/sensors for guiding through exercises [5, 6].

Most of the interesting or beneficial part of telerehabilitation is seen for the autistic people. Research is being done on this technology to provide assistance for the ASD at home by interacting with the therapists. Some barriers are being faced including the lack of specialists with long list of awaiting persons as well as the distance barrier [6]. Research is continue on telecommunication to provide health assistance to families at home by removing the distance barriers [1, 5].

By study, we have examined the telemedicine technology used to provide parental guide and teaching modality to support their children in social, communicative or play development. Guide was provided through a video conferencing program or coaching the parents through internet with the ability to see, hear and communicate as well with the specialists [5].

### 3. CONCLUSION

ICT research has explored many ways for the education, development and treatment of autistic people including the followings:

(1) Assistive technologies and their impact on daily life in cognitive impairment (2) improvement of social cognition through cognitive rehabilitation/meditation and (3) Cognitive computing to help in acquiring social and academic skills [1, 19]. Much of the things are still needed to be explored to have success from the perspective of practical treatment. Most of the ICT applications are limited in performance because of their unnatural interaction and use. Recent research reveals that use of computers, Avatars, serious games, telecommunication interactive and virtual environments generate a high degree impact of motivation and teach a person with ASD or learning disabilities specifically a person who is not willing to be social [6, 7].

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