

# Development of a Therapeutic Mobile Application for Indian Autistic Children



C.S.Kanimozhiselvi, K.S.Kalaivani, S.Poonguzhali, D.Jayaprakash

**Abstract**— Autism is a serious, incurable mental disorder that hampers one's ability to interact and communicate. This disorder may be present as early as 18 months of age and can diagnose from early childhood. In recent times, one in every 68 children diagnosed with Autism Spectrum Disorder (ASD). Early diagnosis, social acceptance of kids suffering from this disorder and clearing misconceptions about the same is extremely important for social welfare. As of now, intervention is not of good quality in India and needs an institution building and professionalization to create real impact. Hence, it is necessary to provide autism intervention and therapies in school as well as in home to students from the age group of 2 to 16. Hence, there is a necessity to develop a mobile app, which will help the parents and teachers to train the autistic children. This mobile app will act as a therapeutic app and can offer help to caregivers in performing therapy and increase the time a child is engaged to therapy at reasonable cost.

**Keywords** : Autism Diagnosis, Communicative Skills, Mobile Application, Therapy

## I. INTRODUCTION

Autism Spectrum Disorder (ASD) is the pervasive developmental disorder with impairment in social communication and interactions along with restricted repetitive behaviors. ASD identified at the early years of life of children will affect all the areas of learning and development of the child. It leads to clinically significant impairment in social, occupational and other important areas of development.

Children with autism have the difficulty in social interaction, one of the noteworthy problems for children on the autism spectrum. The level of disorder classified as mild, moderate and severe in the DSM-V. Even the child with mild disorder may have major social communication problems. In

some situations, the autism children may lack the basic social skills. They often fails to make eye contact, raise and respond questions, or act in response appropriately with 'please' and 'thank you' with others. These basic skills are necessary to enhance the social relationships.

In few situations, they have the basic communication skills intact, however, have the difficulties in understanding other's feelings and react appropriately. These issues arise due to their inability to understand other's perspective; which can be predicted by normal people as what is going on through others body language. In general, most of the autistic children cannot interact with society without other's support and proper training.

The best way to improve the conditions of the autistic children is to approach a trained therapist at an earlier stage. The early intervention will lead to improvement of children with autism disorder. However, the accessibility and availability of standard therapeutic intervention found to be difficult, time consuming and costly for the people living in villages and remote areas of India like low socioeconomic countries. Most of the time, the families with autistic children are unable to access the therapy as early and within the required period. Hence, most of the autistic population remains as it is with their own disadvantages and difficulties. Nowadays, the computer and mobile technology plays an increasing vital role in medical field as well as other common day-to-day activities. Indian population is the highest consumer of computer and mobile technology among worldwide population. If a mobile-application built for therapeutic intervention of autistic disorders, the accessibility to the people will be increase. The proposed therapeutic mobile app can act as home based frequent and convenient access therapeutic aid for the parents and caregivers. The objective of this work is to develop a mobile application that can help to diagnose and prescribe the appropriate training module for a particular category of ASD child as per their level of need for assistance like Mild, Moderate and Severe. The efficacy of the tool can be tested and compared with the available tools in the field. The therapeutic mobile app may be helpful for the parents and teachers, can reduce the work force utility, caregiver's financial expense and burden of time expenditure on the therapy.

## II. LITERATURE REVIEW

Autism Spectrum Disorder (ASD) children have impairments in verbal and non-verbal communication; which plays a crucial role in making relationship with their families and others around them [2].

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## Development of a Therapeutic Mobile Application for Indian Autistic Children

According to the sources, around half of the children diagnosed with ASD are with strong visual spatial skills and often with reduced or no speaking ability [1], [2], [13]. Research says that the persons with ASD reacted better for visual communication media than audio-based communication [3], [5], [6]. Computer and mobile-based devices can act as good audio-visual aids, being capable of storing stills and moving visuals, which can be accessed frequently and faster. Hence, the use of computers and mobile technology to ASD children seems like a perfect match. Computers are emotionally and socially neutral and this addresses the anxiety that children with ASD typically experience when trying to communicate with other people in person or in unpredictable social environments [3].

ASD children often over-react or under-react to certain stimuli and totally ignore other cues in their surroundings. Due to this, children have difficulty in learning and understanding the social aspects of the cues. Applied Behavioral Analysis (ABA) is the evidence-based psychotherapeutic method used to improve the autistic difficulties. The Pivotal Response Training (PRT) is the ABA technique, which can improve the learning ability of the autistic children in the natural environment [4]. Using PRT, we can teach the everyday skills, teachers can incorporate the technique with the aid of parents as a co-therapist, along with the normal mode of teaching and improve the learning and communicative conversing ability of the children [16]. The computer games based on PRT techniques will focus on verifying whether individualized cues could be used to improve non-verbal communication among autism children with severe speech impairments.

Nowadays the ASD children diagnosed with computer-assisted tools [4]. These modern tools for intervention have become a vital part to treat children with disorders and help them to learn how to socialize with others in the society [7]. Children very often use mobile phones and computers for gaming. Keeping this in mind, many computer games have been developed to address the interest and necessity of autism children, since the games happen to be an attractive tool for intervention of children with special needs [8], [12]. The application of serious games is as a complementary element to traditional face-to-face psychotherapy [19]. Specialized games have been developed over the recent years and there are many researchers contributing to the development of educational and therapeutic games for the aid of special children. Now-a-days, computer and mobile devices have evolved from tough keyboards and mouse into smart touch screen and virtual computing techniques.

The “cMotion” is the virtual computing game that helps autistic children with emotional recognition, logical analysis and problem solving [9]. The ‘ALTRIRAS’ is the role-play gaming application for ASD children to teach basic emotions: joy, sadness, anger and surprise, essential for the understanding of other more complex emotions [17]. The ‘LIFEisGAME’, help the ASD child to recognize and express emotions through experiential learning with facial expressions [20]. The “picaa” learning application working on iOS platform, being user friendly to the parents and children deliver the multiple cues of PRT [10]. The “Go Go Games” is the PRT based software with various themes of child friendly games that offers multiple cues of behavioral

intervention targeting “pivotal” skills [16]. The “TouchStory” software presents the linear sequences of t-stories with touch screen, aimed to improve the understanding and narrative capacity of the autistic child [11]. The autistic population mostly tends to be visual learners than auditory learners. The serious therapeutic computer games and applications with visual strategies tend to have high effects on the autistic population [13], [15]. The ‘ADDIE’ based android maze game help the ASD child to improve the concentration and cognitive skills [18]. The substantial improvement noted on a randomized controlled trial on a therapeutic iPad app targeting basic social communication skills [21]. The digital technology has an important advantage while comparing traditional methods, that it can be easily adapted to accommodate different learning styles and the individual's current knowledge than face-to-face learning. The repetitions of learning materials, the quantity and level of difficulty, all can be adjusted automatically based on the learner's response. The app-based learning extends the learning environment, not only learn at school; can learn at home. The educational apps can provide a seamless transition from school to home, promoting greater learning, critically important for ASD intervention programs, where repeated exposure is required [22].

### III. PROPOSED WORK

Autistic children are easily distracted by extraneous stimuli like light and sounds, have difficulty to make and maintain eye contact for sustained attention to learn anything, they do not know how to express their feelings, needs, and do not understand others' perspective too. Therefore, here is the problem in reciprocal social relationship. They are different and odd to the society; they have no friends, less number of close relatives, often be depressed and with temper tantrums. They have unwanted repetitive behaviors, poor language development and problem in communication both in verbal and non-verbal form. The educational and vocational training always be difficult for the autistic child. On the other hand, most of the ASD children are attracted and obsessed with visual spatial stimuli; computer and mobile screen with these features can be used as an advantageous therapeutic aid and convert the negativity as positive. By providing theme-based colorful moving lively images, we can teach the desired skill. Storing and retrieving utility of these gadgets can be useful for the repeated trials at any number of times. It can save the teacher's time and parent's expenses at therapy. Nowadays, the use of mobile phones for the healthcare industry is increasing. Therefore, this work supports the use of mobile technology as an alternative mechanism for teaching the required skills for autistic children.

#### A. Design and development

The mobile application proposed to design with two interfaces. The first one designed to diagnose the disorder by the Clinician with Childhood Autism Rating Scale (CARS) based diagnostic tool [14]. It can be used as an administration, scoring and interpretation manual for the assessment of autism child. The interface has 14 items with likert scale scoring. The items listed as follows:

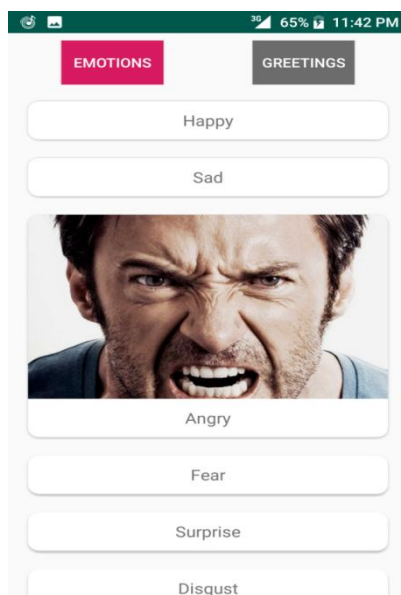


1. Verbal skills
2. Listening skills
3. Social skills
4. Nonverbal skills
5. Imitation
6. Objects Use and interests
7. Emotional Response
8. Visual response and interests
9. Body movements and use
10. Level of activity
11. Taste, Smell, Touch and pain senses.
12. Adaptation to Change
13. Fear and Nervousness
14. ASD features with intellectual and functional language skills.

Clinician observes the child for the above features and enters a score from zero to four for each item. The app grades the child's autistic features based on the scores and displays a assumed grade like mild moderate and severe for a particular child. The deficient skills of the child identified and the app suggests the appropriate training module to improve the particular deficit skills. The app itself can monitor the child's level of improvement through the therapy sessions.

The second interface designed as therapeutic application for the autistic children. It developed with three modules, the first one "Me and Others" developed with features to improve the emotional skills of the child like, how to recognize other's emotions and express emotions appropriate to the situation. The second module "What I need" designed to improve the communicative skills of a child. It helps the child to choose and ask the desired items like food, drinks water etc. The third module "Happy Learning" will improve the child's verbal communication, object use skills, and intend to make the child learn the desired skills. In addition, the app can help the clinician as well as parents to monitor and evaluate the child's progress and performance. The application developed in both Tamil and English language for the convenience of native population.

The three modules of interface as follows,



**Fig. 1. Example image of available emotions in the mobile app.**

## RESULTS:

### 1. 'Me and Others'

The children with ASD have problem in social communication and usually fails to know how to express the emotions and feelings like how to greet others, how to react with other's emotions. Therefore, they often remains aloof, failed to make friendship with peers, have difficulty in interacting with family members and deprived of social contribution. Understanding the feelings of the autistic child is always tough to the parents and teachers handling them. This module will help the children to improve their emotional expressions and responses by giving lively images and audios. It encourages the children to smile, greet, do and talk. This will improve the social interactions and communicative skills of an ASD child. Fig.1 shows the snapshot of various types of emotions and greetings available in the mobile app.

### 2. 'What I Need'

The autistic child always has lesser expressions even for their essential needs. The parents and caregivers are handling them in everyday life being in a critical situation of not knowing what they need at a time, even the basic requirements like food and drinks, natural calls etc. This module allows the child to choose and express what they need at a time, from the screen contains colorful lively images and pictures of eatables, drinks, clothing, bedtime, story time etc. This module also helps the child to learn and express themselves in the socially acceptable ways of communication. The module will act as an expressive device and improve the socio-communicative skills of the autistic child. Fig. 2 shows the sample images of drinks and eatables that the children can choose.

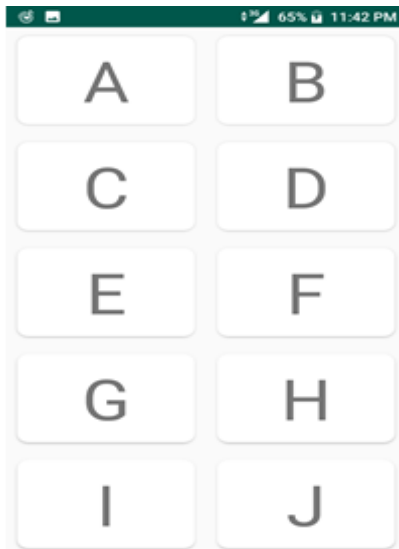


**Fig 2. Sample images of drinks and eatables to choose**

### 3. 'Happy Learning'

'Teaching essential literacy skills like language, mathematical and vocational skills to the autistic children is vital for the well being of the autistic population. However, it is often tough due to their "stimulus over selectivity", [16]

The Tendency to attracted and distracted with particular environmental cue in an extreme degree. They have poor concentration on the learning tasks, often preoccupied with their own world of thoughts. The module developed with the attractive, lively, colorful pictures of daily needs, numbers, alphabets, fruits, vegetables, animals etc. It will help the ASD child learn at ease with the retell and recall options until the correct responses. The module helps the child to improve the verbal, numerical skills, object utility and communication skills. Fig 3. Shows the sample of Alphabetical learning.



**Fig.3 Sample images that create a learning environment**

#### IV. CONCLUSION

Children with Autism Spectrum Disorder (ASD) said to have qualitative impairments in verbal and non-verbal communication skills that severely affects their relationship with their families and others around them. The institution based intervention programs often seem time consuming, expensive, and logistically difficult. As a result, many families in low socioeconomic background are simply unable to access these programs. Until now, very little research on using technology to assist the ASD children to learn, communicate and improve their quality of life. This mobile application will act as a diagnostic and therapeutic app and can assist the professionals, parents and caregivers for delivering therapy in ease; and reduce the time and financial expenditure for the therapy. By using this mobile application, we can improve the verbal, non-verbal and social communication skills of the autistic child and learning by repeated exposure. Parents can use it on their own convenient time and reduce the burden of the special teachers handling autistic children. The application has an advantage of bilingual options in native language Tamil as well as English.

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