PAPER

Digital and Mobile Applications for Autism Inclusion

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ABSTRACT

The purpose of this research analysis is to identify the contribution of online applications to the integration of autistic individuals in typical educational contexts. The difficulties faced by both autistic people and teachers are analyzed. These difficulties are calls to improve the technology that has been introduced into the daily life of children and adults with autism. As people are becoming familiar with technology by a very young age, inexpensive applications can be used through devices such as mobiles/tablets. These applications have the power to strengthen areas in which autistic individuals fall behind. The research articles we have studied present data over the last decade, and their results are applicable to a large portion of the autistic population. Data highlighted in current analysis may be useful for improving web applications targeting autistic individuals and their families.

KEYWORDS

autism spectrum disorder, web applications, mobile applications, inclusion, integration, autism, assistive technology, ASD, AAC

1   INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication, difficulty in speaking, and repetitive and unusual sensory-motor behaviors. Community inclusion for people with autism, in an ideal world, means full inclusion in every aspect of community life. There are many levels of inclusion and many methods to help autistic people. The deficits and difficulties of people with ASD are improved with the help of mobile devices and the use of technology. Mobile devices and the technologies they use are affordable and provide sufficient processing power and memory to support screening activities and improve the lives of individuals with ASD and their caregivers [3]. In the context of supporting these individuals, the social integration of individuals in educational contexts is also achieved. This paper presents a package of information and communications technology (ICT) and mobile assistive and cognitive rehabilitation applications to support the inclusion of people with ASD [22]. Research results showed that children with ASD who used apps improved their social responsiveness in the school environment [1, 19].

2 APPROACHES TO AUTISM

Because of the diversity of autism in the way children learn, teaching should approach different aspects of pedagogy, such as lesson design and delivery style. General teaching principles often need to be replaced by programs of individualized strategies and tactics [10–12]. On the other hand, teachers should not deviate from the basic principles of education. Independent critical thinking should be a fundamental educational goal to help persons with real difficulties take responsibility for their actions [45]. This will happen depending on the level of each child, which may vary widely. Any approach should be be guided by the purpose of achieving success in terms of the educational objective. Emotional regulation and how to achieve it are important skills that teachers should possess. More specifically, the child's way of learning should determine the chosen approach in this regard.

3 STRATEGIES TO FACILITATE THE EDUCATIONAL INCLUSION OF STUDENTS WITH ASD

It can be challenging and may require special help to successfully integrate students with ASD into the general education classroom. Inclusion-promoting individual and systemic interventions are discussed here, along with current developments in autism intervention research [8]. We look at organizational/systemic approaches to reducing issues and enhancing social and academic results for adolescents with ASD, including response to intervention and positive behavior support at school [20, 23]. These models can be used with additional customizable techniques, which are presented [14]. Prior to presenting intervention options that have been empirically proven to be effective for including students with autism in regular classes, research trends in inclusive settings for children with ASD will be discussed. More recently, efforts have been made to alter how schools support and engage children by concentrating on the entire school system or environment [9, 15].

4 FUTURE EDUCATIONAL DIRECTIONS

The education system is faced with huge obstacles, as the number of pupils with ASD rises. For desirable social outcomes, it is crucial to include autistic pupils [46]. It should be easier to successfully include pupils with ASD if research concentrates on the effects of standardized models, systemic transformation, and the application of particular tactics. The practice of inclusion is based mostly on unaffected peers rather than teachers, who are typically active in monitoring academic progress, as shown in a study of 16 high-functioning autistic children (HFA) enrolled in American public schools [26, 27]. Peers use both positive and negative inclusion methods when it comes to children with autism. This is accomplished by using ethnographic observations and videos of common classroom and playground activities. The study demonstrates a variety of repetitions in negative integration, such as rejection and scorn, in high-functioning autistic youngsters. Sometimes when something happens, like when you forget something or immediately react in a certain way, and emotionally charged tales of horrific school events afterwards told to family members. This suggests that HFA children may be aware of and distressed by other people's negative attitudes and actions, despite symptomatic difficulties in discerning others' intentions and feelings. HFA children's social world in American public schools looks

like this. Inclusion practices are primarily based on unaffected peers rather than teachers, who are frequently engaged in monitoring academic progress and recording transgressions across a range of students, according to ethnographic observations and video recordings of daily activities in the classroom and playground. However, peers in the classroom might not be well-informed or perhaps unaware of the basics of autism and how to deal with the peculiarities of kids who have it. Due to their handicap, children with autism are more likely to experience social isolation [26, 27]. People with autism, for instance, struggle to form friendships, follow directions, come up with discussion topics, empathize, comprehend concepts that are not literal, and play imaginatively. The lack of comprehension of their peers about this condition drives autistic youngsters more towards exclusion.

A federal strategy known as inclusion encourages the inclusion of students with impairments in regular classrooms [16]. The revolutionary 1975 Education for All Handicapped Act stipulated that all students with disabilities must receive a free and suitable public education in the least restrictive and most inclusive environment [54]. This law, which was modified in 1997 to become the Individuals with Disabilities Education Act (IDEA), guarantees special-needs children—including those with autism—the right to attend school alongside peers without disabilities. Children with autism are believed to benefit enormously from connection with peers who are typically developing their formal and linguistic skills, but just placing children with disabilities in inclusive educational settings is not enough to encourage successful socializing. Instead, mechanisms created by recipients to enhance engagement and understanding must address both the social impairments of HFA children as well as the lack of knowledge of typical peers.

The research on inclusion is pedagogically focused, outlining and assessing academic initiatives to improve the completion of activities designed by autistic children. As an alternative, it contrasts inclusion as a legal strategy and a pedagogical program [2] as opposed to inclusion as a collection of activities in which students and teachers rely on little to no understanding about the disabilities of the children affected in the classroom.

The introduction of IDEA and other regulations has led to an increase in the degree of variation among pupils in a classroom. As a result, students may meet peers who have severe physical, mental, or emotional problems for the first time and interact socially. Even though any child can experience social exclusion from their peers, institutionally identified "special needs" children are more likely to experience it.

In a study of the dynamics of the family, institution, and environment that influence the social standing of high-functioning autistic children in public school settings, it was found that when these kids display unusual or unexpected behaviors, the lack of peer relatedness with peers with disabilities may be exacerbated.

Children with autism who are high-functioning occasionally behave abnormally. For instance, they tend to avoid eye contact and hesitate to enter social groups. They speak, but their linguistic choices are not always acceptable.

Autistic children have trouble understanding social expectations surrounding relationships, activities, and environments as well as determining the intentions and emotions of those who speak to them [47–50]. Children with autism, for instance, frequently make harsh comments, ask inappropriate inquiries such as "How are you?" to strangers, reject attempts to steer the conversation elsewhere, and focus on eccentric subjects [51].

"Negative integration" and "positive integration" are discussed in a study that examines the interacting dynamics of two different types of integration. Positive and negative inclusion are differentiated based on how other people act and behave toward the impacted students in their classroom, not on how well the students'

efforts actually succeeded. Negative inclusion is when other people neglect to try to include a child with special needs in an ongoing focal activity. Negative inclusion includes both blatant retrogression and incidents of neglect, where a child with special needs is left out through omission. Positive inclusion, on the other hand, is described as the actions taken by others to include a child with a disability, regardless of the results. When inclusion may be possible, members of the school community make an attempt to interact with autistic children. They could, for instance, work to resolve their conflicts or gently correct anomalous behavior.

According to experimental investigations, high-functioning autistic children may not fully comprehend their peers' unfavorable reactions [52]. Children with HFA, as opposed to comparable regular children, appear less able to perceive emotions in lab settings [53]. Their own speech frequently has peculiar rhythm, intensity, tone, and stress [55, 56]. Teenagers also struggle to distinguish between social feelings such as pride and embarrassment, as well as to relate these and other emotions to interactive texts [57, 59]. Children with autism were able to recognize teasing, but according to [58] discovered that they were less aware of the environmental cues that initiate teasing and the use of teasing to affect the social conduct of others. Children with autism who are high-functioning exhibit a variety of reactions to ridicule, disdain, oblivion, or rejection. These responses might be anything from forgetfulness and inactivity to overt attempts to demonstrate to classmates that they are capable of acting in the same way as everyone else, to emotionally heated accounts of embarrassing school situations to parents later in the day.

4.1 Practices for privacy and inclusion

As a first step in understanding both negative and positive integration, we examine the institutional elements that have an impact on integration practices. These requirements include the teacher's awareness of the disorder, acceptable demands placed on the teacher during school hours, and the choice of whether to keep the diagnosis of the autistic child private or to disclose it to administrators and the child's peers. The wellness of autistic students in the classroom is significantly impacted by these circumstances. How much information about a child's handicap is disclosed by instructors and students in the US state of California depends on the policies of the school district and the parents of the affected child.

4.2 Negative inclusion

Our investigation into how to include high-functioning autistic children focuses on the school community's role in integrating afflicted children into the school's social life. A child with special needs may not be included in an ongoing social activity by people in the social setting or may be unable to be included. In situations where members make no attempt to attract such a child, negative inclusion is offered. Here, we focus on two forms of negative inclusion: (1) negligence and (2) direct rejection.

4.3 Negligence

Every inclusion classroom experiences a sort of neglect when classmates occasionally ignore or don't pay attention to a child with special needs. The social and

cognitive challenges that HFA children face are partially hidden, and their teachers and peers may not be ready to identify and address these challenges, which contributes to the neglect. When a child with HFA is neglected by others, this can lead to situations in which the child becomes socially isolated [21].

HFA children's proficiency in many areas makes admission into conventional classes possible despite mild symptoms of autism. However, the attenuated symptom presentations of these children mean that those around them might not immediately notice how difficult it is for them to participate in school activities. The children we witnessed frequently retreated into themselves without drawing attention, as classmates and teachers simply carried on partaking in individual classroom work, class discussion, group activity, or casual chatting in this context. Sometimes, kids with HFA would stay away from others for a long time and not talk or play with them. Other kids at school would often ignore this and not pay attention to it, even though it is a common thing for kids with autism to do.

It is important to remember that withdrawal is typically an autistic child's attempt to cope with an overly stimulating environment and may serve as a method of recovering balance. The children in our study, however, often demonstrated their acute inner anguish when they were overloaded by closing their eyes, covering their ears, nodding off at their desks, or retiring from their immediate social surroundings into a quiet place. These kinds of acute withdrawal episodes do not fall within our definition of neglect, as others have typically considered such behavior.

4.4 Rejection and contempt

Beyond passive neglect, some HFA children experienced verbal rejection and open mockery from their peers for their peculiar habits.

4.5 Positive inclusion

In positive-inclusion social interactions, a child with disabilities is included as a participant in the main activity and/or as a member of a social group [18]. Positive inclusion in this study occurred when HFA students interacted amicably with members of the school community. Peers might, for instance, demonstrate or describe what to do, gently rebuke the HFA child when he behaved badly, acknowledge but downplay specific symptom occurrences, encourage the child for positive ideas, and/or become friends with him.

5 ASSISTIVE TECHNOLOGY FOR AUTISTIC PEOPLE

Technology occupies an important part of people's daily lives. It is important to make it clear that technology has the means to support and improve the daily lives of autistic people, their educators, and their relatives.

Technological tools develop social and organizational skills. There are low-tech technology, mid-tech technology, and high-tech technology tools. Low-tech technologies are composed of simple programs and equipment that may promote independence and deter rebellious conduct [4]. Preparing pupils for high-tech assistive technologies is the ultimate purpose of low- and medium-tech teaching tools. Organizational, social, communication, and academic abilities are developed using

video modeling and applications in mid-tech technology [7], which consists of electrical devices such as screen magnifiers, audiobooks, custom music players, voice enhancement, translation software, and custom keyboards.

High-tech technology tools include video, audio, and educational software with graphic animations that increase the attention and focus of the individual. The main advantage of these devices is their ease of use. Computers, tablets, cellphones, electric wheelchairs, adaptive equipment, portable word processors, sophisticated voice output devices, notification systems, and many more electronic gadgets are among them. In particular, videos can make it easier to recognize facial expressions, body language, and voice. As a result, speech- or voice-output communication devices can help children express themselves and get around the difficulty of spoken communication. A major improvement in engagement, expression, and communication is anticipated, thanks to modern technologies including virtual reality, 3D animation, collaborative virtual environments, 3D avatars, and web apps [6].

6 MOBILE APPLICATIONS EMPOWER THE AUTISTIC COMMUNITY

Web applications are now being used by autistic persons to transform their smartphones and tablets into assistive technology. Simple household items can unexpectedly transform into cutting-edge technology that helps autistic individuals learn both inside and outside of the classroom, improves social skills, and facilitates communication.

The following 13 types of web applications were created with the input of autistic people to help those with autism improve their daily lives. Below are the goals achieved by users while using them.

6.1 Proloquy4Text

AssistiveWare's Proloquo4Text is a text-based communication tool that speaks the words you write. The program is split across a single screen and was created with non-verbal users in mind, making it simple for them to customize the main screen to meet their unique needs. For quick, on-the-spot communication, the software offers word and sentence prediction in 15 different languages. Users are able to choose their own voice, giving them control over both their content and delivery.

6.2 Assistive express

A text-based communication tool called Assistive Express makes it simple for people to express themselves verbally and offers text-to-speech functionality. The word-prediction function in the software helps users respond more quickly, and it also lets users save frequently used words for quick access. English, German, Italian, and Spanish are the available languages.

6.3 Proloquo2Go

Assistive Ware developed Proloquo2Go, a sign-assisted communication tool, for persons who have trouble speaking. The program may be modified to better suit users' particular needs because of its three different vocabulary levels and movable visual grids. By utilizing technology, users are able to swiftly and simply

communicate by turning text into speech. They can also include words they commonly use, such the names of their loved ones and local places.

6.4   Keeble

Keeble is an accessible keyboard designed to swap out any application's regular on-screen keyboard for a more user-friendly one for people with motor coordination issues. Because there are so many customizable keyboards available, users can choose the one that best meets their needs.

6.5   Avaz FreeSpeech

The Avaz FreeSpeech application allows users to drag and rearrange image tiles from a visual grid and rearrange them into phrases. The tiles are then translated into speech by the image language software. Through a series of training modules, the application assists users with language barriers in constructing grammatically sound and complete phrases [13].

6.6   Children with Autism

This application lets users keep track of their scheduled activities and was created with the autistic population in mind. Users can anticipate and plan changes to their daily activities with the aid of the scheduler. It can give people step-by-step guidance for everyday tasks to increase their independence [4].

6.7   Choiceworks

Choiceworks gives users the option to sequentially rank their jobs/tasks and indicate which have been completed and which need to be performed, which helps users manage their daily routine. Users are supported by the app in difficult circumstances. Choiceworks is particularly helpful when users are waiting for a job/task, because it gives them options to pass the time.

6.8   Miracle Mode

The purpose of this program is to help users regain their composure. Miracle Mode attempts to address a portion of this issue by using the lights, sounds, and colors that users need to see in front of them in order to the various patterns and analog screen configurations to help users find calm in emotionally overwhelming situations. For an autistic person, the world can frequently become overwhelming and confusing.

6.9   FlummoxVision

This is an app unlike any other, which aims to create a quirky, live comedy where specialists try to solve the hardest scientific riddle of them all: other people's ideas, according to the developers and the group of scientists that came up with the concept.

The app allows kids to watch episodes and interact with the characters in "Discuss Mode" to help them develop their social and emotional skills.

6.10 Injini

Children with cognitive, verbal, and movement challenges can benefit from the learning game Injini. The growth of fine-motor and language skills, cause-and-effect comprehension, spatial layout recognition, memory enhancement, and visual processing are all aided by games created with autistic children's needs in mind. To encourage children to try again anytime they want to without reinforcing their sense of failure, all of the games in the app follow a "no penalty" approach, which means that incorrect responses are not penalized in the game.

6.11 Pictello

A creative program called Pictello was developed to let users make their own photo albums and picture books. Each website has audio enhancements so visitors can record their voices. When used by autistic persons in new or stressful situations, such as going to the hospital or visiting locations they have never been before, the app is very helpful.

6.12 Emergency Chat

For emergency scenarios where communication is crucial but speaking might not be possible, the Emergency Chat App was developed. The pre-written splash text on the home screen explains that the user cannot speak but wishes to use the program to communicate. According to the app's developers, it was made for autistic people whose speech centers are still not working.

6.13 Autism Apps

An extensive list of applications used by persons with ASD is available on the website Autism Apps. Users can easily find the apps in a categorization of apps as well as the vast information made available for each app. For example the following path could encourage autistic people to find the most useful application according to their need, https://apollobehavior.com/best-autism-apps/.

7 CONCLUSION

We underline the importance of all the digital technologies in the education domain that are addressing autism inclusion. Many have proven successful in facilitating and improving assessment, intervention, and educational procedures via mobile devices to bring educational activities everywhere [28–29]. Various ICT applications have become core supporters of education [30–31]. At the same time, games have transformed education into a very friendly and enjoyable interaction [32]. Additionally, the enhancement and combination of ICTs with theories

and models of metacognition, mindfulness, meditation, and emotional intelligence cultivation [33–44], have accelerated and improved special-education practices and results, especially in the domain of autism inclusion.

There are numerous approaches that encourage the inclusion of autistic pupils in regular school settings [55, 56]. If necessary and suitable assistance is offered, even students with severe autism can participate [57, 59]. Numerous interventions— from early procedures to delayed contingencies, from self-management programs to peer-mediated tactics—have been used in studies. Standardized methods of personalized intervention, such as Prevent – Teach – Reinforce (PTR), give teachers a defined procedure for creating and putting into practice particular tactics to improve problematic behavior and encourage inclusion [24, 25]. When taken together, these studies offer a useful supply of intervention alternatives that are likely to help any student who needs support in the classroom improve [17].

More investigation is still required in the typical environments and situations that pupils encounter during the course of the school day. There are not many studies that have been done in classrooms with teachers acting as the change agent for ordinary everyday activities and routines. This prevents that the techniques that are being used for situations like classroom withdrawal are not universal. Additionally, it is critical that researchers include a wider range of ASD children, including those who face different behavioral and intellectual difficulties. To ascertain whether the interventions are practical and beneficial for students of all ages and grades, the age range must be expanded from predominantly elementary-school students to middle- and high-school students [5]. It is evident that in order to properly promote the inclusion of students with ASD, standardized models, such as an autistic inclusion model, are required. Such a model ought to be affordable, workable, and capable of being broadly disseminated. Future research must also keep assessing system-change interventions and the potential effects of individual efforts.

The inclusion of children with ASD in standard educational classes is hindered by their difficulties in social-adaptive behaviors, characteristics that can be significantly improved by technology through online applications and by achieving a strengthening of the social response of individuals in the school environment.

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