Understanding the Educational Landscape of Children with Autism in Bangladesh

Anurata Prabha Hridi[1(✉)], Shameem Ahmed[2], Ifti Azad Abeer[3], Anik Saha[3], Anik Sinha[3], Mohammad Sorowar Hossain[4], Nova Ahmed[3,4], and Moushumi Sharmin[2]

[1] Clemson University, Clemson, USA
ahridi@g.clemson.edu
[2] Western Washington University, Bellingham, USA
{ahmeds,sharmim}@wwu.edu
[3] North South University, Dhaka, Bangladesh
{ifti.azad,aniksaha,anik.sinha,
nova.ahmed}@northsouth.edu
[4] Biomedical Research Foundation, Dhaka, Bangladesh
sorowar.hossain@brfbd.org

Abstract. Early childhood education and teachers providing them play an imperative role in the development of children with autism, which motivated us to examine the current educational practices, teachers' experiences, needs, and expectations in Bangladesh. Findings from our qualitative study with teachers (N = 20) from four schools specializing in autism reveal that despite not having the required training for these kids they join the profession and even after getting a meager salary they continue to teach them. We also found that their relationship with the parents is complex, resulting from lack of effective communication about student progress. We propose a set of guidelines to design ICT tools which are a first step in addressing how to improve the educational experience of the teachers and their students by leveraging existing ICT tools. We believe our findings will open avenues for future researchers and guide them in envisioning robust technology to aid the existing educational process.

Keywords: Autism · Special education · Autism in Bangladesh · ICT

1 Introduction

Autism Spectrum Disorder (ASD) has become a global issue recently and Bangladesh is no exception. In 2012 it was estimated that globally 17 out of 10,000 children had ASD with an additional 62 out of 10,000 experiencing pervasive developmental disorder [13]. In Bangladesh, the prevalence of ASD is unknown; however, a pilot study conducted in 2013 estimated the prevalence rate as 0.15% [16].

Bangladesh is a developing country with a population of over 160 million. Being a less privileged country in terms of facilities - be it healthcare or technological, it has

A. P. Hridi and S. Ahmed—Contributed equally to this work.

A. Sundqvist et al. (Eds.): iConference 2020, LNCS 12051, pp. 1–15, 2020.
https://doi.org/10.1007/978-3-030-43687-2_35

undergone multiple phases of evolutions over the years. Until recently, ASD has not been considered as a problem, let alone an area requiring resource allocation. To reduce the negativity and stigmatization and to better support the needs of children with neurodevelopmental disorders including ASD, the government of Bangladesh has taken some initiatives which include but are not limited to raising awareness, establishing child development centers, facilities for neurodevelopment and ASD care, and introducing information on these challenges in academic materials. Consequently, the number of special schools focused on educating children with autism has increased, particularly in the urban areas [17].

Previously, two studies were conducted to understand the educational scenario at autism schools in Bangladesh [6, 7]. These studies highlighted the necessity of special schools for children with autism. Recently, Faisal et al. examined the perceptions of teachers of both special and mainstream schools regarding the inclusion of children with autism in the mainstream educational programs [8]. These prior studies offered important insights about autism schools in Bangladesh and the scope of integration of children with autism into mainstream schools. However, the current process of educating children with autism and challenges in improving the educational process is still unexplored.

Our primary objective is to understand the current context of ASD in educational settings in Bangladesh through the lenses of the special school teachers. We conducted in-depth face-to-face interviews with 20 teachers from four autism schools to understand the challenges and needs of special school teachers in helping children with autism in Bangladesh. There could be many ways to address these challenges and needs; however, as researchers of ICT (Information and Communication Technology), we chose to examine how the use of ICT can support these teachers in their role as educators. Our secondary objective is to explore what types of ICT tools will be the most effective for assisting them.

Therefore, this paper makes the following contributions:

(a) We report findings from our interviews with special education teachers in Bangladesh, which provide a deeper understanding of current practices, challenges faced and the needs of educators in helping children with autism.
(b) We propose ICT-based design guidelines (e.g., building a digital daily routine for each kid, creating an app to track developments of the kids so that parents can see as well) to address existing problems experienced by the educators.

2 Related Work

Prior research primarily focused on how technology can benefit children with autism in addressing many challenges faced during their everyday lives. For instance, in 2018, researchers analyzed 149 peer-reviewed research articles that discussed the use of smart technology for children with autism [12]. Here, we focus on research relevant in the context of educational settings of children with autism in Bangladesh.

2.1 Prevalence of Autism in Bangladesh

Bangladesh is relatively new in the realm of research on ASD. Rahman reported the number of individuals with autism in the USA is 1 in 150 and extrapolated it to be 1.5 million out of 165 million people in Bangladesh [1]. Hossain et al. conducted a systematic review of epidemiological studies of ASD in eight South Asian countries (Bangladesh, India, Pakistan, Nepal, Sri Lanka, Bhutan, Maldives, and Afghanistan) to identify gaps in existing knowledge about case definition, screening devices, and criteria [2]. In this corpus, six articles focused on identifying the prevalence of ASD in Bangladesh, India, and Sri Lanka, which reported a prevalence of 3%, 0.90% and 1.07% in Bangladesh (only Dhaka), India, and Sri Lanka respectively. The authors aimed to offer an understanding of the scale of the prevalence of ASD in Bangladesh and tried to identify the causes for such prevalence.

2.2 Autism-Related Technology in the Context of Bangladesh

The scarcity of information regarding ASD in Bangladesh makes it difficult to detect and diagnose ASD in toddlers and children properly. Bardhan et al. proposed an automated ASD screening device for developing countries like Bangladesh, where advanced treatment options were unavailable [3]. They proposed a smartphone-based app, Autism Barta, which represents M-CHAT (Modified Checklist for Autism in Toddlers) questions in a pictorial format to determine if a toddler is on the spectrum [5]. Mamun et al. proposed a cloud-based screening framework to automate the diagnosis of ASD where an application consisting of screening questionnaires with relevant pictorial representation (e.g., pictures, animation, and video) was utilized [4]. Muslima et al. focused on validating a Rapid Neurodevelopmental Assessment (RNDA) tool to determine neurodevelopmental impairments (NDIs) in children in Bangladesh [18–20]. Khan et al. conducted a similar experiment with toddlers and reported that RNDA could be used effectively in a clinical setting [20]. Ahmed et al. proposed a strategy for primary screening of autism by utilizing the well-established vaccination platform to avoid infrastructure and deployment cost where parents and caregivers would answer the autism-screening questionnaire during the vaccination schedule [11]. If a positive screening is found, parents can seek further help from specialized personnel. This process may reduce the burden on the limited number of experts and parents and caregivers to conduct and participate in the initial screening respectively.

This thread of research focused on designing tools and techniques for early diagnosis of autism in developing countries where professional expertise is sparse. In contrast, we focus on identifying challenges in the educational setting in Bangladesh and how to design technological solutions to address these challenges. Ehsan et al. stated infrastructural and cultural challenges (e.g., Bangladeshi people are still new to mobile technology and their overall poor socioeconomic condition denotes their attitude towards children with autism) for designing mobile assistive technologies for ASD in Bangladesh [27] which partially resonate with our thoughts as we investigate the challenges faced by the teachers for now, not the caregivers at home.

2.3 Autism in Educational Settings in Bangladesh

Majumdar conducted an in-depth study to identify the needs of children with ASD after they were enrolled in autism schools [6]. By collecting data from teachers, parents, and the school environment, the authors identified parameters that hindered the educational advancement of children with ASD and suggested to prioritize personal needs while developing an educational plan for children with autism.

Akanda identified factors that made teaching at special schools difficult and challenging in Bangladesh while reiterating the necessity of special schooling for children with autism [7]. A notable difference with our research and [7] is that we aim to identify factors that would make the educational process effective for the teachers and the students instead of focusing on improving the experience of schools and teachers. Through a cross-sectional quantitative study, Faisal et al. reported that teachers of children with autism are more optimistic than teachers at mainstream schools about the idea of inclusive programs at mainstream schools [8]. They reported that teachers in special schools considered that children with mild autism who are verbal and non-aggressive could be taught in mainstream schools. Teacher groups from autism schools and mainstream schools agreed that limiting the environmental noise and distraction will facilitate a smooth transition of children with autism into the mainstream. Our findings are well-aligned with findings reported in [8], which contradicts Akanda's suggestion that mainstream schools were mostly unsuitable for children with autism. Our work also extends this thread of research by uncovering challenges in the educational setting that could be addressed by utilizing ICT-based solutions.

3 Research Methodology

3.1 User Recruitment

After receiving permission from the ethical board of WWU, the study-initiating institution, we recruited study participants using convenience sampling. First, we contacted the corresponding authorities of multiple autism schools in Bangladesh to grant us access to their teaching staff. Upon receiving written permission from four schools, we recruited 20 participants (m = 3, f = 17) who are working as teachers in one of these four schools. This gender disparity is reflective of the male and female educator ratio in autism schools in Bangladesh, which is also reported by other researchers [6]. The distribution of the participants is as follows: first school (N = 6), second school (N = 3), third school (N = 5), and fourth school (N = 6). All these four schools are in Dhaka. We opted not to disclose the names of the schools and participants' affiliation to limit any consequences on our participants who shared sensitive information about the educational practices and processes utilized in their schools.

3.2 User Profile

The minimum, maximum, and average ages of our participants are 20, 50, and 32.7 years respectively. Before starting their job at the corresponding schools, only three participants changed their jobs. In terms of the highest educational degree earned, all

participants had at least a high school (12th grade) degree. The distribution of advanced degrees is: Master's degree (N = 10), Bachelor's degree (N = 7), Diploma (N = 1), High school degree (N = 1), and did not disclose (N = 1). The minimum, maximum, and average number of years of job experience were 0.25, 14, and 6.1 years respectively.

3.3 Semi-structured Interviews

We conducted semi-structured interviews to understand current educational practices, challenges faced by educators and their needs in autism schools in Bangladesh. During the study, we used a questionnaire to guide our discussion. All interviews were conducted in Bengali, the official language of Bangladesh, and the native language of both the participants and the interviewers. The study dates and times were scheduled via telephone and the study was conducted at the schools of the participants where they were employed. Interviews were audio-recorded and lasted up to 66 min.

Our interviews were designed and conducted based on contextual inquiry methodology [15], which helped us to observe the teachers in their own environment and the resources they have access to. During the study, we asked our participants a series of questions, which focused on (1) participant's demographic information, (2) training and previous knowledge about autism, (3) process of adaptation in autism schools, (4) experience with ICT in the education process, and (5) suggestions to design ICT solutions to address their challenges. The questionnaire consisted of 29 questions. We allowed tangents from participants to get a clear picture of their overall experience. Each participant had the right to skip a question and/or stop participating in the study at any time. Participant 4 skipped a question when she was asked about her age and participant 7 did not disclose her highest educational degree.

3.4 Post-fieldwork Analysis

After transcribing the interview audio recordings, we imported these transcriptions into Atlas.ti software [14]. We then carefully read the transcripts and identified 35 initial codes (e.g., motivation, professional experience, teaching method, challenges, current responsibility, training, private tuition, and electronic devices). After refining these codes in an iterative fashion and reviewing those with team members, we agreed on 51 codes. We then grouped the similar codes together to identify high-level themes.

4 Findings

We report findings emerging from the high-level themes we discussed in the research methodology section. Although some of these are commonly known in autism-related studies globally (e.g., kids' non-responsiveness for quite a long time at a stretch when social interaction is initiated [24], their adherence to regime hence strict obedience to plans, etc.), we report these and also novel findings to provide a holistic view of the current educational practices, teachers' experiences, needs, and expectations in the context of Bangladesh. All quotes are translated from Bengali to English and include

information about the participants' gender and years of experience, which may influence their opinion about teaching, challenges faced, and needs.

4.1 Structure of a Typical Autism School in Bangladesh

A Typical Day: Structure is Key. Children with autism prefer to follow a routine and teachers in most of the schools try to maintain the same routine whenever possible. Majumdar stated about the preference to structure [6] which resembles our observation that educators consider this structured activity an integral part of their teaching process:

> *Typically, the day starts with an assembly followed by 'My Choice' class where the kids select a toy of their choice. Since they hardly know how to play with such objects meaningfully, we teach them how to do so. For example, we show them a toy car and how it works. (P9, f, 3 months)*
> *We have a daily lesson plan which we follow every day. I think this is a very effective process. Having a fixed plan makes it easier for us to teach them that they can understand easily too. (P20, f, 6 years)*

Segregation Between Special and Mainstream Schools. Three out of four schools we visited offered no opportunity to children with autism to interact with neurotypical children, which reflects the existing segregation of special schools and mainstream schools in Bangladesh:

> *Mainstream schools do not want to take them [as students]. (P6, m, 4 months)*

Educators have varying opinions regarding enrollment of children with autism in mainstream schools:

> *Let them [autistic and neurotypical children] mingle and play together. They should interact no matter what. (P3, f, 4 years)*
> *The [autistic] child must hold a minimum IQ, so that effort can be put to bring them into the mainstream. (P12, m, 12+ years)*

IEP-Based Teaching: To Modify or Not to Modify. All four schools use the IEP (Individualized Education Program)-based teaching method [10], where a small set of targets is set for the students based on their deficiencies in different cognitive and behavioral areas. The fourth school follows JSS Behavioral Services [9] along with IEP. When a child gets enrolled, teachers build an IEP based on a thorough assessment of the child and try to help the student reach his/her target:

> *We have a health educator who prepares a report which diagnoses whether the child has autism or not. A customized plan is formed in the presence of teachers, physicians, and coordinators. (P1, f, 8 years)*
> *While working with IEP, we try to teach them step-by-step. We focus on the things they lack. (P13, f, 10 years)*

When asked about deviation from the designed IEP, most teachers (N = 13) commented that such adjustment is beneficial for children with autism:

> *We [teachers] have full rights to bend the procedures stated in the IEP so that learning becomes more fruitful and meaningful for the child. (P11, f, 11 years)*

Few participants (N = 4) advocated for the non-modified version of the IEP while rest was agnostic in terms of deviation. Strong belief on the effectiveness of IEP was mentioned as a rationale behind it:

(IEP is based on) Research to find out the exact way to drive the children towards better communication, social and cognitive skills. (P10, f, 14 years)

4.2 Teaching Journey: Not a Straight Path

Most teachers associated with special schools at some point in their career faced a dilemma regarding continuing their profession due to the demanding physical and mental workload and lack of enough monetary benefits.

Professional Commitment: A Mixed Review. Educators participating in our study lacked special education training or professional experience related to autism when they started their jobs whereas in the US it is mandatory to have a bachelor's in special education to get into this profession [26]. Out of 20, only four participants were aware of autism before joining the schools. Remaining 16 participants had little to no prior knowledge about autism:

Earlier I had no idea about autism. After joining here, I came to know about that. (P11, f, 11 years)

Lack of related background caused difficulty for most educators early in their careers. It is a common phenomenon among them since most of the people in Bangladesh are unfamiliar with autism. After getting more aware of autism and working with children with autism, they became more empathetic towards them:

I was emotionally devastated when I first joined here. I found that I must be very patient, hardworking, affectionate, and dedicated. I wanted to leave immediately. However, I completed seven years so far and over the years have learned a lot about these kids. I hope to learn more. It makes me happy. (P4, f, 6+ years)

When asked about motivations behind embracing this profession despite their lack of training and knowledge, attachment to children and having extended family members in the spectrum were provided as reasons (N = 3 in both cases), while others simply chose this profession as they needed a job.

From Zero Experience to Full-Fledged Training. After getting involved in the profession, our participants received formal training on autism to better prepare themselves for teaching roles from several Bangladeshi organizations including Bangladesh Protibondhi Foundation, Centre for the Rehabilitation of the Paralyzed (CRP) and Society for the Welfare of Children with autism, etc. Some teachers (N = 3) received training from multiple organizations. School authorities arranged their enrolment in training sessions and these included specific intervention techniques (e.g., ABA: Applied Behavior Analysis and PECS: Picture Exchange Communication System), life-skill training (e.g., self-help training, toilet training, challenging behavioral training, and cognitive skill development training):

We were assigned under an experienced special teacher and we had to follow him/her to get a hold of everything that we needed to learn about the children. (P6, m, 4 months)

The training contents were straightforward, combined theoretical and hands-on experience, and were considered useful by the teachers:

We were taught about the structured and disciplined routine we had to follow for each child. From assembly to academics, physical exercise to other therapies - we were given all sorts of exposure. (P8, f, 11 months)
Those training sessions were very helpful and effective for us. (P16, f, 7 years)

Although teachers valued these training sessions and spoke highly of them, they could not apply theoretical knowledge all the time and needed improvisation to handle new or different situations:

Theoretical knowledge does not always help. (P1, f, 8 years)
Training materials vary from school to school. Hence, we need to improvise [the training materials]. (P3, f, 4 years)

Insufficient Fund Affects Teachers' Financial Satisfaction and Overall Educational Experience. The percentage of male teachers in autism schools in Bangladesh is significantly low, which resulted in a similar disparity (17f:3m) among our participants. However, there is a high demand for male teachers as female teachers lack the physical strength to manage relatively older, restless kids:

For little children, any mother figure is the best caregiver. However, as they grow up, it is not possible for a female teacher to handle all the activities of a hyperactive child. (P12, m, 12+ years)

Despite this demand, since this job alone does not provide enough money to cover even the basic needs of a small family in Bangladesh, males are not showing interest in these positions:

When the school wants to hire male teachers, salary should be thought over because it's a challenging job! It requires a lot of patience and a fellow feeling. (P12, m, 12+ years)

Financial inadequacy also impacts the experience of the students:

We can neither ensure any separate rooms to calm down those who get extremely restless nor afford to take the children out by a car for some time as the school has no transportation facilities. (P12, m, 12+ years)
They [children with autism] should be given a field to play. Unfortunately, we do not have that yet. (P4, f, 6 years)

Teachers' Role Outside of the Classroom. Some teachers (N = 4) have paid positions (through the parents) as 'in-home private tutors' for the children with autism to teach them the same materials they covered at school. Teachers feel that these additional appointments create a stronger bond with the kids and improve their relationship with the parents:

Sometimes parents make a request to give time to their children if they are busy. What we do is teach them the same things at home. As a result, there is a synchronization between home and school and no time is wasted [to acclimatize with the child] since the same teacher is dealing with the child. (P1, f, 8 years)
Yes, I go for tuition. I feel more connected to the child and his/her family in this way. The parents also recognize us as an integral part of their child's life. (P12, m, 12+ years)

4.3 Relationship Between Teachers and Parents: It's Complicated

Teachers considered educating a child with autism as a joint responsibility where parents and teachers should play equally important roles:

Neither teachers nor parents can handle them [children with autism] alone. (P20, f, 6 years)
It [development of children with autism] demands teamwork from the teachers and the parents. (P11, f, 11 years)

Our findings suggest that the relationship between teachers and parents/caregivers is a complex one. After working with children with autism, teachers became more empathetic towards parents:

They [parents] share their pain with us. (P13, f, 10 years)
I do feel for them. I face only a part of the hassle. I cannot even imagine what they go through. (P9, f, 3 months)

However, many educators (N = 6) believe that parents are not committed to the success of their children with autism and do not spend enough time and energy on them compared to their other neurotypical children. Many teachers (N = 12) showed skepticism towards parents' contribution and blamed the parents for lack of patience and lack of dedication towards their children with autism:

Parents do not provide as much effort as we do. Otherwise, there could be some good outcomes. Perhaps they have another neurotypical child. The effort behind that [neurotypical] child affects their concentration about the autistic child. (P1, f, 8 years)

Some teachers (N = 6) considered parents responsible for the slow or lack of progress of children with autism:

We prepare a routine for the [autistic] children which they should follow both in school and at home. The parents do not understand that. As a result, even if we are moving the development process forward, the process is going backward because of them. (P4, f, 6 years)
Parents do not follow the structure or the IEP designed for their children at home. They do not put an effort to help the children complete the homework. This hinders the overall progress. (P11, f, 11 years)

Schools often organize training sessions for parents aiming to expose the techniques that would enable them to take better and structured care of their children. Such sessions also help parents to recognize teachers' efforts towards educating their children. However, according to teachers, many parents are reluctant to join these sessions or discontinue after attending a couple of sessions due to additional time requirements, other responsibilities, etc. This lack of effort to manage time for the children with autism led the teachers to believe that parents are not committed to the betterment of their children with autism.

5 Discussions

Financial need is one of the major reasons why teachers took up this job. The nature of this job (teaching is socially considered as a respected profession for women in Bangladesh) and the urge to become economically solvent inspired many women to engage in this profession. However, in contrast to the workload, the salary is not enough to run even a small family in Bangladesh. In the patriarchal society of Bangladesh, this job alone is insufficient for males to maintain their families. This also contributed to the uneven ratio of female and male teachers in this area.

Before starting their career in autism schools, most of the teachers lacked educational and professional training in special education, and most of the teachers had no awareness or experience with children with autism. This lack of awareness led to suboptimal experience for the educators and may have influenced the quality of education and care received by the students. Currently, there is a scarcity of training resources for educators and many schools address this inadequacy by creating their own training programs. However, teaching children with autism introduces unique challenges that require special training, empathy, and skills that may be difficult to acquire from these makeshift training programs.

Teachers empathized with parents' 'difficult' situations but also held them responsible for 'not caring enough' or 'not being there' for their children. In developed countries, educators and parents communicate regularly at IEP meetings regarding students' progress and concerns. However, in Bangladesh, these meetings are not the norm. There is a communication gap between teachers and parents about their respective roles in a student's development. Among the papers we reviewed, none of them mentioned a systematic progress report of the students. Many teachers also work as home-tutors for their students, which is uncommon in other countries. Since home-tuition for the conventional education system is vastly popular in Bangladesh, this practice is also accepted without much controversy. However, as there is no systematic monitoring system, it is unclear whether this tutoring makes a positive impact on the children's lives.

Mainstream schools in Bangladesh do not have educational or training programs for children with autism. Research signifies the benefit of an inclusive classroom environment, which is reflected by programs such as AIM (Access and Inclusion Model) utilized in the US among other developed countries [25]. Educators in Bangladesh also commented on the potential benefit of such inclusive programs where children with autism will have access to the same opportunities as neurotypical students and have an opportunity to learn firsthand from their peers. This segregation may contribute to the limited awareness of autism in Bangladesh.

Exposing children with autism to real-life situations (going to grocery stores, using public transportation, playing in a park) is challenging in Bangladesh due to lack of funds available for field trips, lack of manpower in maintaining the security and safety of the children outside the classroom environment, and lack of social awareness from the general population, which may lead to unwanted situations. Creating awareness about autism may bring a positive social change where people may become more accepting of children with autism.

6 Design Implications

The total number of mobile phone users and Internet subscribers in Bangladesh are 152.5 million and 88.7 million respectively [22]. When teachers were asked about their perception and interest in using ICT tools (e.g., mobile phones, Internet, digital games, etc.) in an academic setting, they showed a keen interest in using ICT-based tools to enhance the feasibility of their teaching methods. According to them, students' interaction with ICT tools seem natural and effortless (e.g., listening to songs on YouTube, playing games using tablets):

> *They can operate everything on their own! Perhaps I myself won't be able to do that. (P12, m, 12+ years)*

Our participants highlighted possibilities of independence for kids with autism through a technology-based career. They reported that these children are interested in technology and can learn skills that can prepare themselves for the job market:

> *Autistic children can be independent by learning technology-based works – how to operate photocopy machines, perform computer-related jobs, and design websites. (P9, f, 3 months)*

While our participants mostly considered the inclusion of ICT as teaching tools as positive, a few of them were a bit cautious and wanted to restrict the use of ICT tools. Participant P15 was concerned about kids' natural attraction towards these tools, which might result in attention deficit and distract them from socialization or meaningful learning activities.

Considering the pervasive nature of ICT among mass people in Bangladesh and our participants' keen interest in using ICT as teaching tools, we suggest some ICT-based solutions to support teachers in their role inside and outside the classroom. Our recommendations stem from our observations of the schools we visited, analysis of the interviews we conducted, and our prior experience working in the domain of autism and technology.

6.1 Technology-Aided Synergistic Platform for Learning: Bridging Communication-Gap Between Teachers and Parents/Caregivers

Student learning can be enhanced through a synergistic approach by educators and parents where they follow the same processes in a synchronized manner using the same resource. Educators expressed a need for such platforms that will enable children to learn the same things in different contexts (school vs. home), which will support repeated exposure, thus enhancing cognitive abilities:

> *There could be some visual materials that can be used at home too in the absence of us [teachers]. (P6, m, 4 months)*

This will also ensure that children are following the same process for a specific task - limiting confusion and reducing the performance gap at school and at home, a common concern expressed by teachers. With technological support, concepts and materials introduced at schools can be shared seamlessly without worrying about limitation of access and portability with parents, who can use them to reinforce the

learning process outside school. Moreover, communicating 'processes utilized' in school without technological aid (video) may be difficult as written or verbal narration may fail to capture the nuances of such processes. Technology can also be used to capture the activities students are doing at school with their teachers and at home with their parents/caregivers. For example, in the US, many elementary schools are currently using Seesaw [23], a free web and mobile-based platform for teachers, students and parents to actively engage in the education process. Such a shared platform will help to bridge the gap between educators and parents, as they would have access to the activities performed and the resulting outcome.

6.2 Creation of Visually Enhanced Educational Materials and Daily Routine

Children with autism learn better when information is presented visually. Besides, many children with autism are non-verbal and/or experience challenges in expressing themselves. Educators commented on the advantage of using mobile applications where audio along with visuals can help children to imitate the 'correct behavior' (e.g., the correct pronunciation of words) and images can offer a solution where children can touch or point to materials, activities, or even emotions to indicate their needs or feelings:

> *There can be something where children can touch – it can be a picture or a scene to express what they are asking for. (P6, m, 4 months)*

While such applications are widely available in the Google Play and Apple app store, they do not provide culturally relevant or accessible content, which limits their applicability as a teaching tool in Bangladesh. For example, most available apps for children with autism include images of LEGO, strawberry, and hamsters which unlike the developed countries are unfamiliar in Bangladesh due to their unavailability. Besides, such applications use English as the primary language - a barrier for Bengali-speaking children. Members of this research team have created the first mobile application in Bengali to make it accessible and culturally relevant [21], which received positive feedback from parents of children with autism. Figure 1 shows four interfaces of the prototype of the app.

We also found that teachers create a structured plan for the students that they must follow and keep track of their success and/or failure in these tasks which is critical for the kids' progress. The current approach of creating it lacks efficiency and cannot be reused as educators create and update it manually for each student as they follow the steps. Simplifying the process of creating a daily planner and updating them as students go through their day were considered a huge help. As the set of activities is limited and has well-defined structures, creating an application that would enable selection of a specific activity, visualize associated steps, and let educators select the appropriate status of a student's performance, should not present many technological challenges. Such applications can also facilitate adding new activities and removal of unwanted ones. From a technological point of view, this idea is not novel, however, such a tool has the potential to alleviate a lot of burden from the busy day of an educator.

Fig. 1. Culturally relevant information presented in an interactive mobile application as a teaching tool [21].

6.3 Digitalization to Create Accessible, Context-Aware Educational Contents

While showing children the physical objects used in schools may help recognition, it does not teach them how to utilize this knowledge in real life. Exposing children to real-life scenarios where such concepts are used can be very beneficial but also very expensive in terms of resources needed. Technology can offer a viable solution where real-life scenarios are captured and shared with the students to help them understand what they can do with this new knowledge. For example, showing a note of taka (the Bangladeshi currency) does not convey the concept of money and how it can be used to purchase things. Augmenting 'role-play' scenarios with interactive digital content to show students how 'taka' can be used in different situations, may offer a better understanding.

7 Limitations and Future Work

Our research goal was to gain a deeper understanding of the current educational process of children with autism in Bangladesh. As a first step, we conducted contextual inquiry inspired qualitative study with special education teachers. While we focused on

educators only, our findings reveal that family members and caregivers play a critical part in the education process and it is essential to learn their perspective to get a holistic picture of the educational process. Moreover, existing research suggests that parents' socio-economic conditions and educational background may influence the educational facility of their children. Currently, we are designing a study to understand their role and experiences regarding their children's education. Although for the current study we did not collect data about the socio-economic strata of the parents, we can speculate that the parents were moderately tech-savvy (since mobile and internet penetration is very high in Bangladesh, especially in Dhaka) and affluent (autism schools are expensive compared to the regular schools in Bangladesh [17]). Moreover, the four schools where we conducted our study are in Dhaka. Although most of the autism schools in Bangladesh are in Dhaka [17], selecting autism schools from other cities or rural areas of Bangladesh may have resulted in different insights. In fact, many training institutes (e.g., CRP, IPNA) are still Dhaka-based and it is difficult for the teachers to have access to such resources outside Dhaka and get properly trained. Besides, another observation from the teachers' part was that parents must be motivated so that the feasibility of such a synergistic tool is achieved at the highest level. We look forward to this in our next ongoing study. By promising to address this, we hope to bring a positive change for these kids and their learning process here.

8 Conclusion

Like many other countries worldwide Bangladesh is experiencing an increase in the number of children diagnosed with autism. Early intervention through specialized education and training is imperative for the proper development of children with autism. Recognizing the immense importance of early childhood education and teachers' role in shaping the lives of children with autism, we focused on understanding current educational practices and teachers' experiences, needs, and expectations. Our findings being the novelty of this study reveal that ICT tools can be used to address many of the issues. Among others, technology to create accessible and contextual educational materials, a shared communication platform for parents and teachers, and applications to create interactive activity planners and progress tracker may aid the education process.

References

1. Rahman, M.M.: Autism spectrum disorders. J. Bangladesh Coll. Phys. Surg. **28**(3), 143–144 (2010)
2. Hossain, M.D., et al.: Autism spectrum disorders (ASD) in South Asia: a systematic review. BMC Psychiatry **17**(1), 281 (2017)
3. Bardhan, S., et al.: Autism Barta—a smart device based automated autism screening tool for Bangladesh. In: 5th International Conference on Informatics, Electronics and Vision (ICIEV), pp. 602–607. IEEE (2016)

4. Al Mamun, K.A., et al.: Smart autism—a mobile, interactive and integrated framework for screening and confirmation of autism. In: 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 5989–5992. IEEE (2016)
5. M-CHAT. http://mchatscreen.com/. Accessed 16 Sept 2019
6. Majumdar, A.: Exploring the state of educational and care giving services for autistic children in Dhaka city: a case study of two schools. Diss. BRAC University (2011)
7. Akanda, M.D.: Writing a thesis on teaching challenges at autism schools-teachers perception. Diss. BRAC University (2010)
8. Faisal, R.A., Hossain, S.: Teachers' perspectives on the mainstreaming of autistic students in Bangladesh. Teacher's World **42**, 25–36 (2015). ISSN 0040-0521
9. JSS Behavioral Services. http://newsite.jssbehavioral.com/. Accessed 16 Sept 2019
10. Individualized Education Plan (IEP). https://www.understood.org/en/school-learning/special-services/ieps/understanding-individualized-education-programs. Accessed 16 Sept 2019
11. Ahmed, N., et al.: Managing autism spectrum disorder in developing countries by utilizing existing resources: a perspective from Bangladesh. Autism **23**(3), 801–803 (2019)
12. Sharmin, M., et al.: From research to practice: informing the design of autism support smart technology. In: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (2018)
13. Elsabbagh, M., et al.: Global prevalence of autism and other pervasive developmental disorders. Autism Res. **5**(3), 160–179 (2012)
14. ATLAS.ti: The Qualitative Data Analysis & Research Software. https://atlasti.com/. Accessed 16 Sept 2019
15. Holtzblatt, K., Jones, S.: Contextual inquiry: a participatory technique for system design. In: Schuler, D., Namioka, A. (eds.) Participatory Design: Principles and Practices, pp. 177–210. Lawrence Erlbaum Associates (2017)
16. Global Autism Movement and Bangladesh. http://cri.org.bd/2014/09/03/global-autism-movement-and-bangladesh/. Accessed 16 Sept 2019
17. Autism School and Resource Center in Bangladesh. https://www.autismwing.com/autism-school-and-resource-center-in-bangladesh/. Accessed 16 Sept 2019
18. Muslima, H., et al.: Validation of a rapid neurodevelopmental assessment tool for 10-to 16-year-old young adolescents in Bangladesh. Child Care Health Dev. **42**(5), 658–665 (2016)
19. Khan, N.Z., et al.: Validation of rapid neurodevelopmental assessment for 2-to 5-year-old children in Bangladesh. Pediatrics **131**(2), e486–e494 (2013)
20. Khan, N.Z., et al.: Validation of rapid neurodevelopmental assessment instrument for under-two-year-old children in Bangladesh. Pediatrics **125**(4), e755–e762 (2010)
21. Abeer, I.A., et al.: Reinforcement based learning through communicative Android app for autism personnel. In: Proceedings of the 20th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct, pp. 132–138 (2018)
22. Bangladesh Telecommunication and Regulatory Commission Data Statistics. http://www.btrc.gov.bd/data-statistics. Accessed 16 Sept 2019
23. Seesaw. https://web.seesaw.me/. Accessed 16 Sept 2019
24. McConnell, S.R.: Interventions to facilitate social interaction for young children with autism: review of available research and recommendations for educational intervention and future research. J. Autism Dev. Disord. **32**(5), 351–372 (2002)
25. AIM program. http://aim.gov.ie. Accessed 16 Sept 2019
26. Requirements of special education teacher. https://www.alleducationschools.com/teaching-careers/special-education-teacher/. Accessed 16 Sept 2019
27. Ehsan, U., et al.: Confronting autism in urban Bangladesh: unpacking infrastructural and cultural challenges. EAI Endorsed Trans. Pervasive Health Technol. **4**(14), e5 (2018)