

## Educational and Social Impact of Computing Devices for Children with Autism Spectrum Disorder (ASD)

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### ABSTRACT

The purpose of this study is to examine the perceptions of parents of children with autism spectrum disorder (ASD) about computing devices. Seven families with ASD children were interviewed about their children's use of computer devices and their impact on their academic and social behavior. Although parents raised concerns about internet addiction and cybersecurity, these devices were part of their children's daily routines and were used for educational and entertainment purposes. Occasionally, targeted activities such as video modeling have been used to address personal and social behaviors. However, the results suggested that parents were unprepared to help their children due to a lack of knowledge, community support, and resources.

### INTRODUCTION

The National Institute of Mental Health (2018) defines autism spectrum disorder, also known as pervasive developmental disorders (PDDs), as a neurological and developmental disequilibrium that can be detected early in childhood and persists throughout life. Children share common symptoms that affect behavior, interaction, communication, and learning processes (Benson, 2016; Bouck, & Savage, 2014; Quest, 2016; Schultz et al., 2011). According to 2021 estimates by the Autism and Developmental Disabilities Monitoring (ADDM) network, approximately 1 in 44 children in the United States has been identified with ASD (Maenner, 2021). With this alarming growth in the ASD student population, parents face numerous challenges on how to better meet the specific needs of their children.

Parental involvement in the implementation of intervention strategies to support children with autism has a history of at least three decades (Schopler & Reichler, 1971; Rogers, 1996). It is believed that the more skills parents master, the higher the chances for their children to learn and cope with different situations. McConachie, & Diggle (2007) conducted an extensive review of research that focused on interventions for children aged 1 to 6 years. Their review of the literature found very few studies that had adequate research design to properly evaluate the effectiveness of a parent-led early intervention. They concluded that parent training can successfully contribute to intervention in young children with ASD. However, the review emphasized the need for more rigorous research in this area (Park, 2021; Lee & Meadan, 2021; Morsa, et.al., 2022; Tripathi, et.al., 2022).

The use of multiple computing devices has become common practice in most homes and schools to address the diverse learning and communication challenges of students with special needs (Arslan, et al., 2022). Some needs can be met by mainstream devices like a laptop, while others might require accessories and other technologies customized specifically for each student. Many new applications have been developed in recent years to address the diverse needs of ASD children, particularly to accommodate common communication and behavioral challenges (Bennett & Goodall, 2022; Syriopoulou-Delli et. al, 2022; Liu, et.al, 2022). These communicative apps are believed to help reduce frustration levels and encourage desired actions. However, like any other type of technology, these tools have limitations and different benefits for each ASD child with a variety of needs (Dahiya, et.al, 2021; Kollias, et.al, 2021; Sani-Bozkurt & Bozkus-Genc, 2012). If parents are not well informed about what constitutes a good application, they end up using apps that were either suggested by other parents or downloaded randomly (Hammer, et al., 2021; Mertala, 2019). As a result, their children use iPads or smartphones for entertainment and gaming instead of using them for the intended educational purposes.

### THE STUDY

#### Purpose of the Study

The purpose of this study is to examine what parents of children with autism spectrum disorder (ASD) think about smart computing devices and the impact they have on their children's educational and social behavior. Seven families of children with ASD were recruited to participate in this study. Because each ASD case is unique, the goal of conducting in-depth interviews allows for an understanding of each family's experience. The interviews include shared stories, anecdotes, and specific details about the use of smart computing devices and how they impact their children's academic, personal, or social learning and behavior.

## **Design**

This study followed a narrative research approach to gather details about the lived experiences of seven families. The purpose of the narrative research design is to tell the stories of a few individuals to obtain rich information and a profound understanding of their experiences (Clark & Creswell, 2017). For this study, we followed a set of procedures to collect data in the form of field text and audio-recorded conversations to describe the experiences and the lived challenges of parents of ASD children. The data analysis followed an analytical process to retell or ‘restate’ the data by identifying common story elements using the interviewees’ own words.

## **Participants**

Our participants are seven parents or guardians of children diagnosed with autism spectrum disorders. These families are located in rural counties in the Southwest United States. Participants were recruited through a variety of methods and strategies, including verbal prompts at ASD support group meetings and from various platforms and online media, as well as through snowball sampling. Each family was offered a small stipend for their participation.

## **Procedures**

Seven families gave informed consent to participate in this study. The interviews were planned individually with each family. First, we met with each participant and walked them through the process, explaining the logistics of collecting data on their family members. The average interview length was about 45 minutes. The interview questions covered the educational and technical needs of parents of children with ASD and explored how technology and other new smart tools can support families. Each participating family was given a pseudonym and the interview data collected was stored anonymously. Recorded interviews were transcribed and converted from audio files into Word documents.

## **Analysis**

The interview questions were semi-structured. Participants were given time and freedom to elaborate on their answers, leading to a series of follow-up questions. The choice of the semi-structured interview format helped feed the qualitative data with well-detailed stories and examples. Initially, parents were asked to share general information about their children with ASD and if they could add specific details about their children's special needs. They later answered questions about computing devices that parents use to support their children's academic development. They had an opportunity to share their use of other tech tools besides computers or smartphones to support their children with ASD.

We followed a thematic data analysis process aimed at identifying thematic patterns emerging from the interview data. Thematic data analysis involves constantly moving back and forth between the entire dataset, the coded data extracts, and the analysis of the produced data. (Braun & Clarke, 2006, 2014). One of the advantages of thematic data analysis is that it is a flexible method when following an inductive approach that can be used for this type of exploratory data analysis where the themes depend on the data. Specifically, in our study, we followed both semantic and latent levels of themes as proposed by Braun & Clarke (2006). Semantic themes are “the explicit or surface meanings of the data and the analyst is not looking for anything beyond what a participant has said or what has been written” (p.84).

The data from the interview questions underwent a thematic analysis focused on how the computing devices are used and to what extent they support the children's educational and social behavior. Thematic analysis requires an iterative process of moving from raw data to a more structured and organized set of information that highlights the key themes in the data. The interview data analysis was first coded based on semantic topics. This analysis intended to identify the descriptive variables mentioned by the parents. In a second round, we created a second set of latent themes descended from the initial summative themes. This step involved looking for patterns or themes in the codes in all interviews and reviewing the themes. At this stage, we also looked more closely to not miss any underlying thoughts and assumptions from what the parents were saying. In a later step, researchers defined, named, and agreed on reliability issues after conducting a coding matrix cross-check. Finally, the research team prepared the collective analysis report.

## **FINDINGS**

### **Educational Impacts of Computing Devices**

Parents have considered computing technologies helpful and effective in supporting their children's educational needs. Most described their children as visual thinkers who are better with pictures and visual aids. They use images as their primary means of communication while words serve as their second language. Parents were aware that their children learn and communicate better when they look at pictures or words that help them visualize information. Additionally, one parent recommends that device usability should be “a visually appealing

device and apps that would not challenge them or add to their frustration”. Certainly, the use of smart and adaptable technologies could facilitate learning and make visual imagery more accessible and meaningful for children with ASD.

Communicating needs seemed to be a dominant factor and all parents were primarily concerned with how to build better communication opportunities for their autistic children. One parent found that using text messaging was the most beneficial way to establish some form of communication with their non-verbal adolescent. She found that texting was a positive communication tool that her son used to let those around him know about his needs. However, another parent who also uses texting to communicate with their son mentioned that typing isn't always easier “The verbal communication can definitely get confusing...we do a lot of talking but especially if it's something serious, then I choose when I do it and how I do it.” Two of our participants who have children with auditory sensitivity praised the flexibility of some devices to adjust to appropriate volume levels using an app like Noise Down, which automatically sets off an alarm when decibel levels get too high, or Too Noisy Pro, which notify users that the speaker volume is high.

Parents mentioned some benefits of computer devices that positively impacted their children's learning progress by reducing anxiety and frustration. Our participating parents noticed an improvement in their children's overall mood. In addition, frustration decreased for both their children and the parents themselves. Smart computing devices made everyday life easier and, above all, better communication. Improved fine motor skills were also mentioned as another benefit. Parents appreciated the precision of smart devices in assisting their children, especially those who struggle with fine motor skills, which make handwriting and drawing difficult. Parents also talked about the benefit of the voice input feature, which serves as auditory reinforcement for audiovisual learners, computer graphics help to visualize the words improving their reading skills. The joy of learning was also mentioned as an advantage. Using features like a keyboard, touchscreen, or speech-to-text app helped reduce the difficulties and frustrations traditionally associated with writing tasks, increasing individuals' enjoyment and motivation in learning. Pacing according to the learner's speed was also mentioned as another source of learning enjoyment, which is usually supplemented by playful visual aids.

Although our participants had different needs, backgrounds, and experiences, they all had a common reason why they would facilitate the use of computing devices with their children. Regardless of the varying nature and quality of educational use, all parents agreed that the primary purpose of making these devices available at home is to help their children catch up and learn at their own pace. Overall, many benefits can be gained from using computing devices and the parents can observe first-hand how these technologies improve their children's learning. Even if the educational gain is minimal, they think it worth it to invest in providing these devices to their children.

### **Social Impacts of Computing Devices**

The data revealed several themes that parents found helpful in improving their autistic children's social skills. Parents have appreciated the help these devices offer in improving their children's organizational skills and accomplishing some daily tasks. For example, one parent spoke about how computer devices helped her to work with her autistic child “So I've done a lot of social stories – you can find apps for social stories. There was an app that helped us potty-train him that was a rewards-based thing”. While video modeling has often been used to enhance children's daily routines such as showering and brushing, it has also been used to address educational and social behavior. A parent provided examples of how video modeling was used for educational and behavioral purposes “They've done it at school, at therapy, and we work on it at home. He was working on the ‘th’ sound and they emailed it to me and then I showed it on the computer himself which he really liked. And then... he tends to like to assimilate anything very quickly like if he sees himself. But at school recently they showed him something in the lunchroom that he didn't realize he had done and he was like ‘oh I guess, yeah...’ he was poking a kid or something or annoying him, not really realizing I think what he was doing, so they showed him the video of it and he was like ‘oh my gosh, I didn't realize I was doing that,’ so it's been good socially too, at school”. Another parent highly praised the effectiveness of video modeling “... probably the biggest thing that I've found it being useful for is we do a lot of video modeling, so like when he's working social skill or we're like not transitioning well, I'll try to video him doing it properly and he re-watches it and it assimilates really well. So we're doing a lot of that at [therapy center] but also at home we use it. So we've seen that really helping.”

Although parents highlighted a few concerns about their children's social vulnerability and their ability to read social situations and expressed frustration with the challenges of improving their children's social skills, the use of computing devices to support children in this area was limited. For example, one parent explained how the computing devices help his son's social interaction indirectly “He plays an educational math game (Prodigy) that

is like an online game where he can math battle other kids in his class, and that's the one that works him through the curriculum and so that's been good because he's accelerated his math skills but also he has something to talk about at school with his friends or other classmates. So that's been really good.” However, another parent spoke about their endless efforts to integrate their 18-year-old autistic child into mainstream society by finding employment opportunities for him to build social interaction. However, her child lacks the endurance to hold a job due to a health condition, preventing him from fully immersing himself in the workforce. Another parent mentioned the challenges in this area “Things just have to be more concrete and visual all the time so in order to make something click, that's why I keep a whiteboard in my kitchen to draw out, map out, social things that we're working through or whatever. I do a lot of drawing and pictures and social stories”.

## CONCLUSIONS

This study was conducted to investigate what parents of children with ASD think about the use of computing devices to support their children's educational, behavioral, and social needs. Overall, despite their limited knowledge of the effectiveness of technology use, parents were favoring the use of smart technology. Parents acknowledged the need and the benefits these devices bring to their kids' daily routine. Although parents raised concerns about technology addiction and cybersecurity, these devices are used for educational and entertainment purposes. However, parents do not have enough knowledge or the required expertise to assist their children while using these smart devices. Occasionally, targeted activities such as video modeling have been used to address personal and social behaviors.

The data indicated that, overall, parents lacked the theoretical foundations of what constitutes effective educational use, and what resources (e.g., educational links, websites, applications, gadgets, software, programs, etc.) are available to them to support their children's educational, personal, and social needs. It is worth noting that all participants except one parent expressed their lack of knowledge on how to effectively support their children with computing devices and set safety standards for their use. Even though parents provided few implemented strategies to control technology overuse, such as setting up time limits and verbal cues, they raised worries about their inability to detect potential malicious links, lack of professional support, and inability to find research-based platforms that would help them better support their children's growth. The results also showed that there is a lack of communication between school and parents. Sometimes parents are not well informed about what kind of technologies are being used with their children at school and how to maintain and expand that use at home. Interestingly, as an effective source of feedback or technological support, parents mentioned that ideas were occasionally provided by child therapists who guide parents in using specific applications or devices to maintain impact between therapy centers and the home.

This study was significant in that it provided a platform for parents with ASD children to share their thoughts and concerns. Overall, despite their limited knowledge of the effectiveness of technology use, parents had positive perception towards the use and impact of smart technology on their autistic children. Learning from the parents' experiences helped us understand their practices in using computer technology at home with their ASD children. Notwithstanding the sample size limitation, this study helped to show how parents explored the use of computer technologies to solve challenges related to the needs of ASD children. The result highlights the problem areas that professionals and policymakers should address to provide equal learning opportunities to enhance the educational, behavioral, and social skills of autistic individuals. Although the benefits of these devices were recognized, parents were underprepared to help their children due to a lack of knowledge, community support, and resources. There is a clear need to better educate parents to use technology effectively to support their children's learning and overall development. Therefore, the lack of research related to technology training for parents of ASD children is an area worthy of further research (Anupama, et.al., 2022; Dahiya, et.al., 2022; Pierson, et.al., 2021; Soares, et al., 2021). There is also a need for research to explore effective practices tailored towards the specific needs of parents of ASD children.

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