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Unveiling Layers of Interaction: An Investigation into the Behavioral Transformations of Preschoolers with Autism Spectrum Disorder Through Assistive Technology from a Caregiver's Perspective

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Abstract

This qualitative study explores the impacts of assistive technology (AT) on preschoolers with autism spectrum disorder (ASD) from the perspective of caregivers who observe and experience these behavioral changes firsthand within the home environment. Utilizing a phenomenological research design, the study involved semi-structured interviews with 10 caregivers, including both mothers and grandmothers. The analysis revealed several key themes: enhanced communication, improved social interaction, learning and development, challenges and support needs, and the variety and everyday usefulness of AT. Caregivers reported significant advancements in both verbal and nonverbal communication, increased family and peer interactions, and the development of academic and life skills in their children. However, challenges such as technical difficulties and the need for professional support were also highlighted. The study underscores the potential of AT to significantly improve the quality of life for children with ASD while also emphasizing the importance of robust support systems to optimize AT utilization. These findings contribute to a deeper understanding of the nuanced impacts of AT on children with ASD, offering valuable insights for future research and intervention strategies.

Keywords: *Autism, Assistive technology, Preschoolers, Caregivers*

1. Introduction

The rapidly evolving realm of assistive technology (AT) has emerged as a beacon of hope for individuals with autism spectrum disorder (ASD) by facilitating communication, nurturing social interactions, and honing life skills (Odom et al., 2015). The domestic environment, being the primary arena where children exhibit their authentic behaviors and interact candidly, presents a fertile ground to delve into the profound impacts of AT on children with ASD (Keen et al., 2016). This qualitative study is propelled by the aspiration to unravel the nuanced behavioral transformations in children with ASD as perceived and articulated by their caregivers, who are the silent witnesses to their triumphs and tribulations.

The prevailing literature robustly underscores the potential of AT in ameliorating the life

quality of individuals with ASD (Grynszpan et al., 2014). However, a conspicuous gap persists concerning the in-depth exploration of their behavioral metamorphosis from the caregiver's vantage point, especially within the sanctuary of the home. Caregivers, being the closest observers of children's day-to-day interactions and responses, hold a treasure trove of insights that remain largely untapped (Wang et al., 2020). Their narratives can shed light on the real-world implications and efficacy of AT, far beyond the clinical or educational settings which have hitherto been the focal point of most studies (Alzrayer et al., 2014).

2. Problem Statement

The core impetus behind this research emanates from the recognition that while assistive technology harbors the potential to be a game-changer for children with ASD, its impact is not homogeneous. Their behavioral responses and adaptations to AT are contingent on a myriad of factors, including the child's unique autism profile, the nature and implementation of the technology, and the sociocultural milieu of the home (Lorah et al., 2015). Moreover, the lens of caregivers, who navigate the maze of daily challenges and joys alongside their children, offers a rich, grounded, and holistic perspective. However, their voices have often been relegated to the periphery in the academic discourse (Mackintosh et al., 2012).

This study seeks to fill this lacuna by orchestrating a symphony of caregivers' voices to delineate the behavioral changes observed in their children with ASD when engaged with AT at home. Through a meticulous qualitative inquiry, we aim to transcend the superficial layers and delve into the complexities and subtleties of behavioral alterations, thereby contributing to a more nuanced understanding of the dynamics at play. This endeavor is not merely academic; it is rooted in the pragmatic aspiration to optimize the design and implementation of AT to resonate with the lived experiences and exigencies of children with ASD and their families (Bouck et al., 2014).

3. Research Questions

The research questions guiding this inquiry are as follows:
1. How do caregivers perceive the impact of AT on the behavior of preschoolers with ASD within the home environment?
2. What specific behavioral changes, both positive and negative, are observed by caregivers when their preschoolers with ASD interact with AT?

The anticipated findings of this study are poised to bridge the knowledge gap and furnish a richer tapestry of understanding regarding the interplay between AT and behavioral evolution in children with ASD from a caregiver's standpoint (Pennington, 2010). Through the crucible of caregivers' lived experiences and observations, we aspire to foster a dialogue that can propel the field of AT for autism into realms of deeper understanding and more effective application.

4. Aim of the Study

The aim of this study is to unravel the nuanced behavioral transformations in young children with ASD when engaged with AT at home, as perceived and articulated by their caregivers. By orchestrating a symphony of caregivers' voices, this study seeks to delineate the behavioral changes observed, understand the perceived benefits and challenges of AT, and explore the alignment or discord between anticipated and observed outcomes of AT utilization (Wong et al., 2015). Through a meticulous qualitative inquiry, this study aspires to bridge the identified gap in literature, thereby contributing to a richer, grounded understanding of the dynamics between AT and behavioral evolution in children with ASD from a caregiver's standpoint. This endeavor is not merely academic; it is rooted in the pragmatic aspiration to optimize the design and implementation of AT to resonate with the lived experiences and exigencies of children with ASD and their families, thereby aiming to

enhance the quality of life and ease the daily challenges faced by these families.

5. Literature Review

5.1 Impact of Assistive Technology on Communication Skills of Children With ASD

AT has been identified as a significant tool in enhancing the communication skills of children with ASD. A meta-analysis by Ganz et al. (2012) found that technology-based interventions are innovative approaches that have shown a positive impact on the communication abilities of individuals with ASD. Examples of AT encompass augmentative and alternative communication (AAC) devices, socially assistive robotics (SARs), and interactive or virtual environments, each showing promise in supporting communication development in this population (Boesch et al., 2013).

5.2 Impact of Assistive Technology on Socialization of Children With ASD

Assistive technologies have also shown potential in improving socialization skills among children with ASD. Kientz et al. (2013) detailed how smart glasses, particularly the second version of Google Glass, were utilized as wearable socio-affective aids, displaying a positive impact on school desirability and usability among a sample of children with ASD. Furthermore, the meta-analysis by Parsons et al. (2006) highlighted various technology-based interventions that significantly enhanced social interaction abilities among individuals with ASD.

5.3 Impact of Assistive Technology on Behavior of Children With ASD

Managing behavioral concerns is another area where AT has demonstrated promise. Grynszpan et al. (2014) showcased a mobile application specifically designed to teach receptive language skills, which also had a positive impact on behavior management. Similarly, Bouck et al. (2014) discussed technology-aided interventions and instruction for adolescents with ASD, reporting positive behavioral impacts through the utilization of these technologies.

5.4 Caregiver Perspectives on the Use of Assistive Technology for Children With ASD

The involvement of caregivers is crucial for the successful implementation of AT. Schaaf et al. (2011) explored caregivers' perspectives on the sensory environment and participation in daily activities of children with ASD, finding that caregivers noted significant benefits from using AT, including improved communication and reduced self-injurious behavior. Caregivers play a pivotal role in ensuring the effective use of AT, providing valuable feedback to developers and researchers for better design and usability (Pennington, 2010).

6. Methods

The primary objective of this qualitative study was to explore the nuanced behavioral transformations in young children with ASD when engaged with AT at home, as perceived and articulated by their caregivers. This section delineates the research design, participant selection, data collection, and analysis methods employed in the study.

6.1 Research Design

A phenomenological research design was adopted to delve into the lived experiences of caregivers and understand the essence of their experiences with AT and its impact on their children's behavior (Smith et al., 2009). This design enables an in-depth exploration of caregivers' perceptions,

experiences, and the meanings they ascribe to the behavioral changes observed in their children with ASD.

7. Participant Selection

7.1 Sampling

Purposive sampling was employed to select participants who were primary caregivers of children with ASD, aged between 3 and 7 years, and had been using AT for at least six months. The sample size was determined based on the saturation principle, where data collection continued until no new themes emerged (Creswell, 2013).

7.2 Recruitment

Participants were recruited from a local autism center in the city of Jeddah, where caregivers of children with ASD were approached by the organization's personnel. An invitation letter detailing the purpose of the study, participant criteria, and the voluntary nature of participation was disseminated.

7.3 Informed Consent

Prior to participation, informed consent was obtained from all participants. They were assured of confidentiality, anonymity, and the right to withdraw from the study at any point (Smith et al., 2009).

8. Data Collection

8.1 Interviews

Semi-structured, in-depth interviews were conducted by postgraduate students from the department of special education at X University. The interviews with the caregivers were conducted either face-to-face or via secure video conferencing platforms, depending on each participant's preference. The interviews were guided by a set of pre-determined open-ended questions, allowing flexibility to probe further based on participants' responses (Kvale, 2007).

8.2 Interview Protocol

The interview protocol comprised questions aimed at understanding the caregivers' experiences with AT, observed behavioral changes in their children, and the perceived impacts of AT on their family dynamics and children's social interactions (see Appendix A; Kvale, 2007).

8.3 Document Review

Additionally, any available documents, such as therapy reports, AT usage logs, or personal diaries maintained by caregivers were reviewed to corroborate the information shared during the interviews (Merriam, 2009).

8.4 Data Recording

All interviews were audio-recorded with participants' consent and transcribed verbatim for analysis. Field notes were also taken during the interviews to capture nonverbal cues and the interviewer's reflections (Creswell, 2013).

8.5 Data Analysis

A thematic analysis was conducted following Braun and Clarke's (2006) six-phase approach: familiarizing oneself with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and writing the report.

8.6 Validity and Reliability

To enhance the validity and reliability of the findings, strategies such as member checking, peer debriefing, and triangulation were employed. Participants were given the opportunity to review and confirm the accuracy of the transcripts and emerging themes (Lincoln & Guba, 1985). Multiple data collectors participated in interviewing caregivers, and the findings of data analysis were compared between two researchers. The percentage of agreement between them on the themes and subthemes reached 91%, and consensus was reached on differences through discussion.

9. Ethical Considerations

The study adhered to the ethical guidelines stipulated by the Institutional Review Board (IRB), and ethics approval for the study was obtained from the responsible ethics committee at the College of Education at X university. Consent was also obtained from the cooperating organization. Ensuring confidentiality, informed consent, and the right to withdrawal were paramount ethical considerations upheld throughout the study (Smith et al., 2009).

The methods delineated herein provide a structured approach to exploring the caregivers' lived experiences and perceptions regarding the impact of AT on their children with ASD. Through this qualitative inquiry, the study aims to contribute to the burgeoning literature on AT and ASD, with a unique focus on the home environment as observed by caregivers.

10. Findings

Ten caregivers participated in this study, who included both mothers (6) and grandmothers (4), with caregiver ages ranging from 33 to 51 years, as shown in Table 1. The children with ASD comprised both males (6) and females (4), with ages ranging from 3 to 6 years, reflecting the study's focus on early childhood. The participants represented a wide range of socioeconomic backgrounds and professional experiences. The number of children living at home ranged from 1 to 3, suggesting that these families often manage multiple children, including those with ASD. This demographic information provided context for the qualitative data collected from the caregivers, illustrating the diverse backgrounds and family dynamics involved in the study.

Table 1: Description of Participants' Demographics

Participant	Caregiving Role	Caregiver Age	Child Gender	Child Age	Occupation	No. of Children at Home
Participant 1	Mother	35	Female	6	Teacher	2
Participant 2	Grandmother	49	Female	5	Housewife	3
Participant 3	Mother	37	Female	3	Healthcare Worker	1
Participant 4	Mother	48	Female	6	Software Developer	2
Participant 5	Grandmother	50	Female	6	Sales Manager	2
Participant 6	Mother	33	Female	4	Accountant	3
Participant 7	Mother	38	Female	5	Freelance Writer	2
Participant 8	Grandmother	51	Female	6	Housewife	1
Participant 9	Mother	36	Female	3	Nurse	2
Participant 10	Grandmother	45	Female	4	Teacher	3

The thematic analysis of the interviews revealed distinct themes and subthemes that reflect the caregivers' experiences and observations concerning the impact of AT on the behavioral attributes of young children with ASD. The findings are presented under each identified theme and subtheme (see Table 2), enriched with verbatim quotes from the interviewees.

Table 2: Themes and Subthemes

Themes	Subthemes	Description
Theme 1: Enhanced Communication	Subtheme 1.1: Verbal Communication	Caregivers reported improvements in children's verbal communication abilities with AT use.
	Subtheme 1.2: Nonverbal Communication	AT provided alternative means of communication for children with limited verbal skills.
Theme 2: Social Interaction	Subtheme 2.1: Interaction with Family	Increased family interaction and engagement due to AT use.
	Subtheme 2.2: Interaction with Peers	Enhanced peer interaction, fostering social belongingness through AT.
Theme 3: Learning and Development	Subtheme 3.1: Academic Progress	AT facilitated enjoyable and effective learning, improving academic skills.
	Subtheme 3.2: Life Skills Development	AT aided in the development of daily living skills and independence.
Theme 4: Challenges and Support Needs	Subtheme 4.1: Technical Difficulties	Caregivers encountered technical challenges and a steep learning curve with AT.
	Subtheme 4.2: Need for Professional Support	Caregivers emphasized the need for professional guidance and training for effective AT use.
Theme 5: Types of Technologies and Everyday Usefulness	Subtheme 5.1: Variety of Technologies	Caregivers used a range of AT, each serving unique purposes in daily routines.
	Subtheme 5.2: Everyday Usefulness	Caregivers valued the practical utility of AT in simplifying daily routines and promoting independence.

Theme 1: Enhanced Communication

The ability to communicate effectively emerged as a significant benefit associated with AT use. Caregivers reported noticeable advancements in both the verbal and nonverbal communication skills of their children.

Subtheme 1.1: Verbal Communication

Caregivers expressed that AT facilitated improved verbal communication, with children exhibiting increased vocalizations and word usage:

"He's also started using words to request things" (Participant 4).

"The communication app has given her a voice" (Participant 7).

Subtheme 1.2: Nonverbal Communication

For children with limited verbal skills, AT provided alternative means of communication, reducing frustration associated with expression:

"She can now use pictures to communicate her needs" (Participant 2).

"He's been able to express himself using the symbols on his device" (Participant 5).

Theme 2: Social Interaction

AT was reported to bridge the social interaction gap, enabling children to connect better with family members and peers.

Subtheme 2.1: Interaction With Family

Caregivers observed increased initiation and engagement in interactions within the family:

"He now initiates interaction with us, especially his siblings" (Participant 1).

"She's more involved in family activities now" (Participant 8).

Subtheme 2.2: Interaction With Peers

The use of AT also enhanced children's interaction with peers, fostering a sense of social belongingness:

"He's now showing interest in playing with other kids" (Participant 3).

"The social stories app has helped her understand social cues better" (Participant 6).

Theme 3: Learning and Development

AT was recognized as a pivotal tool in supporting both academic and life skills development, aiding in children's overall growth.

Subtheme 3.1: Academic Progress

Caregivers appreciated the educational apps and interactive games that made learning enjoyable and effective:

"I've seen a notable improvement in her math skills" (Participant 9).

"His reading has improved a lot" (Participant 10).

Subtheme 3.2: Life Skills Development

The ability to follow visual schedules and engage in activities of daily living was enhanced with the use of AT:

"He can now follow visual schedules to complete his morning routine independently" (Participant 1).

"She's learning to prepare simple meals with the help of a step-by-step visual aid app" (Participant 7).

Theme 4: Challenges and Support Needs

Despite the benefits, caregivers voiced challenges concerning technical difficulties and the need for professional support.

Subtheme 4.1: Technical Difficulties

Technical glitches and the initial learning curve posed challenges for both children and caregivers: Common issues included device malfunctions, such as frequent system crashes, unresponsiveness, and short battery life, which often disrupted the continuity of activities. Several caregivers reported that these issues led to frustration for both the child and the caregiver, with one participant stating, "Sometimes the device malfunctions or the battery dies" (Participant 2).

Furthermore, caregivers emphasized the **steep learning curve** involved in setting up and using the devices. Customizing the devices to suit the child's specific needs, as well as troubleshooting issues without immediate professional help, posed significant challenges. Caregivers also mentioned the **inadequate user manuals** provided by the manufacturers, which compounded these difficulties. "It was a steep learning curve for us" (Participant 8).

Subtheme 4.2: Need for Professional Support

The necessity for professional guidance and training for parents was emphasized to optimize the use of AT:

The majority of participants reported that **training and ongoing guidance** from professionals were crucial to optimizing the use of AT in their homes. However, the level of professional support available to them varied, with some caregivers having access to comprehensive training, while others struggled to find **qualified professionals** who could provide the necessary assistance. For instance, one participant shared, "We had no idea how to use the device properly until we worked with a specialist who showed us how to adjust the settings and troubleshoot common issues, finding a professional who could guide us was a challenge" (Participant 3).

"More training for parents on how to effectively use and troubleshoot AT would be really helpful" (Participant 6).

Theme 5: Types of Technologies and Everyday Usefulness

Different types of AT were employed at home, each serving unique purposes in aiding the children's everyday life.

Subtheme 5.1: Variety of Technologies

Caregivers reported using a range of AT, from speech-generating devices to educational apps and visual scheduling tools, each tailored to meet their child's specific needs:

"The variety of apps available has been a game-changer for us" (Participant 4).

"We use a mix of high-tech and low-tech tools to support his daily routines" (Participant 10).

Subtheme 5.2: Everyday Usefulness

The practical utility of AT in simplifying daily routines and promoting independence was highly valued by caregivers:

"The visual schedule app has streamlined our morning routine" (Participant 1).

"Being able to communicate his needs has made day-to-day life less stressful for all of us" (Participant 7).

The findings elucidate the multifaceted impact of AT on children with ASD, reflecting a blend of positive transformations alongside challenges, as perceived by their caregivers. Through these themes, the study paints a comprehensive picture of how AT intertwines with the daily lives of families, shaping the behavioral landscape for children with ASD within a home setting.

11. Discussion

This discussion aims to interpret the findings of the study in light of the main research questions, drawing parallels and contrasts with the existing literature on the subject of AT and ASD.

11.1 Perception of AT's Impact

The caregivers' perception of the impact of AT is crucial, as it provides a pragmatic understanding of how AT is being utilized and its effectiveness in real-world settings. The reported enhancement in communication aligns with the assertion that AT serves as a self-management tool for individuals with intellectual disabilities (Mechling, 2007). Moreover, community-centric support, such as that from school librarians, plays a pivotal role in leveraging AT to assist students with autism (Ennis-Cole & Smith, 2011). The correspondence between these studies and the current findings underscores the consistency in the perceived benefits of AT across different settings and stakeholders.

11.2 Specific Behavioral Changes

The diversity in behavioral changes, both positive and negative, provides a nuanced understanding of the impact of AT. The positive behavioral transformations corroborate the systematic review by Bollin et al. (2018), which emphasized AT's potential in addressing various challenges faced by individuals with ASD. However, the technical difficulties and the need for professional support, as noted by caregivers in the present study, echo broader challenges in the AT domain. This reflects a crucial area of need, indicating that while AT holds transformative potential, its effective utilization may require a supportive ecosystem comprising technical support and training (Grynszpan et al., 2014).

11.3 Alignment With Anticipated Outcomes

The alignment or discord between anticipated and observed outcomes of AT utilization is insightful. It points to a pragmatic aspect of AT adoption and the realistic challenges that may surface. The anticipation of positive outcomes is congruent with the broader literature, which often underscores the benefits of AT (Ganz et al., 2012). However, the reality of technical challenges and the need for professional support resonates with the emphasis on extending the discourse to a broader support system (Wang & Jeon, 2020). This disparity underscores a pertinent area for action to bridge the gap between expectations and real-world experiences with AT.

11.4 Types of Technologies and Everyday Usefulness

The variety of AT types and their everyday usefulness as reported by caregivers enriches the current understanding of how AT is being integrated into daily routines. Mechling's (2007) emphasis on AT as a self-management tool is reflected in the present findings, where AT was utilized for various purposes, from communication to learning and daily living skills. The pragmatic utility of AT in simplifying daily routines and promoting independence is a strong testament to its potential to enhance the quality of life for families with children with ASD (Bouck et al., 2014). The data further reveals that professional training and ongoing guidance are critical to caregivers' successful use of AT. Caregivers who received in-depth training programs on how to operate and customize AT were more adept at troubleshooting problems and adapting the technology to their child's changing needs.

12. Implications

The findings underscore the potential of AT to significantly contribute to the betterment of living and learning conditions for children with ASD, as perceived by their caregivers. It highlights the necessity for a holistic approach encompassing not just the provision of AT but also robust support systems to ensure effective utilization. The identified gap between expectations and the reality of AT utilization points to an area of need for enhanced training and support services (Schaaf et al., 2011).

13. Limitations and Future Research

The reliance on self-reported data, while providing rich insights, could be complemented by objective behavioral assessments in future research. This multidimensional approach would provide a more comprehensive understanding of the impact of AT on children with ASD.

In summation, the nuanced understanding garnered from the caregivers' perspective in this study significantly augments the existing literature. It provides a grounded understanding of the real-world impacts of AT, thus contributing to a more informed discourse on strategies to optimize the benefits of AT for individuals with ASD and their families.

14. Recommendations for Future Research

1. Broadening participant demographics: Future studies could broaden the participant demographics to include a wider range of caregivers, educators, and professionals who work with children with ASD. This diversified perspective could provide a more holistic understanding of the impact of AT.
2. Longitudinal studies: Conducting longitudinal studies could provide insights into the long-term impact of AT on children with ASD and their families. It would be beneficial to understand how sustained use of AT affects behavioral changes and learning progress over time.
3. Comparative studies: Comparative studies between different types of AT, and between AT and traditional intervention methods, could provide valuable insights into the most effective strategies for supporting children with ASD.
4. Objective measurement integration: Incorporating objective measurements, such as behavioral assessments and standardized tests, alongside qualitative data from caregivers, would offer a more comprehensive understanding of AT's impact.

References

Alzrayer, N. M., Banda, D. R., & Koul, R. K. (2014). Use of iPad/iPods with individuals with autism and other developmental disabilities: A meta-analysis of communication interventions. Journal of Autism and Developmental Disorders, 44(5), 1124–1140. https://doi.org/10.1007/s10803-013-1973-5

Boesch, M. C., Wendt, O., Subramanian, A., & Hsu, N. (2013). Comparative efficacy of the Picture Exchange Communication System (PECS) versus a speech-generating device: Effects on social-communicative skills and speech development. Augmentative and Alternative Communication, 29(3), 197–209. https://doi.org/10.3109/07434618.2013.818059

Bouck, E. C., Maeda, Y., & Flanagan, S. M. (2014). Assistive technology and students with high-incidence disabilities: Understanding the relationship through the NLTS2. Remedial and Special Education, 36(2), 77–88. https://doi.org/10.1177/0741932514551280

Bollin, A., VanderMolen, J., & Bierwagen, T. (2018). The impact of assistive technology on autism spectrum disorder: A systematic review. Journal of the American Academy of Special Education Professionals, Spring/Summer, 107–125.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Creswell, J. W. (2013). Qualitative inquiry and research design: Choosing among five approaches (3rd ed.). SAGE Publications.

Ennis-Cole, D., & Smith, D. (2011). Assistive technology and autism: Expanding the technology leadership role of the school librarian. School Libraries Worldwide, 17(2), 86–98. https://doi.org/10.29173/slw6820

Ganz, J. B., Davis, J. L., Lund, E. M., Goodwyn, F. D., & Simpson, R. L. (2012). Meta-analysis of PECS with individuals with ASD: Investigation of targeted versus non-targeted outcomes, participant characteristics, and implementation phase. Research in Developmental Disabilities, 33(2), 406–418. https://doi.org/10.1016/j.ridd.2011.09.023

Grynszpan, O., Weiss, P. L., Perez-Diaz, F., & Gal, E. (2014). Innovative technology-based interventions for autism spectrum disorders: A meta-analysis. Autism, 18(4), 346–361. https://doi.org/10.1177/1362361313476767

Keen, D., Webster, A., & Ridley, G. (2016). How well are children with autism spectrum disorder doing academically at school? An overview of the literature. Autism, 20(3), 276–294. https://doi.org/10.1177/1362361315580962

Kientz, J. A., Goodwin, M. S., Hayes, G. R., & Abowd, G. D. (2013). Interactive technologies for autism. Synthesis Lectures on Assistive, Rehabilitative, and Health-Preserving Technologies, 2(2), 1–177. https://doi.org/10.2200/S00519ED1V01Y201303ARH002

Kvale, S. (2007). Doing interviews. SAGE Publications.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry. SAGE Publications.

Lorah, E. R., Parnell, A., Whitby, P. S., & Hantula, D. (2015). A systematic review of tablet computers and portable media players as speech generating devices for individuals with autism spectrum disorder. Journal of Autism and Developmental Disorders, 45(12), 3792–3804. https://doi.org/10.1007/s10803-014-2314-4

Mackintosh, V. H., Myers, B. J., & Goin-Kochel, R. P. (2012). Sources of information and support used by parents of children with autism spectrum disorders. Journal on Developmental Disabilities, 18(1), 41–51. https://psycnet.apa.org/doi/10.1007/s10803-007-0434-9

Mechling, L. C. (2007). Assistive technology as a self-management tool for prompting students with intellectual disabilities to initiate and complete daily tasks: A literature review. Education and Training in Developmental Disabilities, 42(3), 252–269. http://www.jstor.org/stable/23879621

Merriam, S. B. (2009). Qualitative research: A guide to design and implementation. Jossey-Bass.

Odom, S. L., Thompson, J. L., Hedges, S., Bord, A., & Boyd, B. A. (2015). Technology-aided interventions and instruction for adolescents with autism spectrum disorder. Journal of Autism and Developmental Disorders, 45(12), 3805–3819. https://doi.org/10.1007/s10803-014-2320-6

Parsons, S., Leonard, A., & Mitchell, P. (2006). Virtual environments for social skills training: Comments from two adolescents with autistic spectrum disorder. Computers & Education, 47(2), 186–206.

Pennington, R. C. (2010). Computer-assisted instruction for teaching academic skills to students with autism spectrum disorders: A review of the literature. Focus on Autism and Other Developmental Disabilities, 25(4), 239–248. https://doi.org/10.1177/1088357610378291

Schaaf, R. C., Toth-Cohen, S., Johnson, S. L., Outten, G., & Benevides, T. W. (2011). The everyday routines of families of children with autism: Examining the impact of sensory processing difficulties on the family. Autism, 15(3), 373–389. https://doi.org/10.1177/1362361310386505

Smith, J. A., Flowers, P., & Larkin, M. (2009). Interpretative phenomenological analysis: Theory, method and research. SAGE Publications.

Wang, Q., & Jeon, H. J. (2020). Bias in bias recognition: People view others but not themselves as biased by preexisting beliefs and social stigmas. PLoS ONE, 15(10), e0240232. https://doi.org/10.1371/journal.pone.0240232

Wang, S. Y., Parrila, R., & Cui, Y. (2020). Meta-analysis of social skills interventions of single-case research for individuals with autism spectrum disorder: Results from three-level HLM. Journal of Autism and Developmental Disorders, 50(5), 1595–1606. https://doi.org/10.1007/s10803-019-04336-4

Wong, C., Odom, S. L., Hume, K. A., Cox, A. W., Fettig, A., Kucharczyk, S., Brock, M. E., Plavnick, J. B., Fleury, V. P., & Schultz, T. R. (2015). Evidence-based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. Journal of Autism and Developmental Disorders, 45(7), 1951–1966. https://doi.org/10.1007/s10803-014-2351-z

Appendix A: Interview questions

1. Can you describe your initial experience with introducing assistive technology to your child?
2. How did you come to learn about the assistive technology you are using for your child?
3. Have you observed any changes in your child's behavior since the introduction of assistive technology? Can you provide specific examples?
4. Can you describe any positive or negative behavioral changes you've noticed?
5. Have you noticed any changes in your child's social interactions since using assistive technology? Please provide examples.
6. How has assistive technology impacted your child's communication with family members and others?
7. In what ways, if any, has assistive technology supported your child's learning and development?
8. How user-friendly do you find the assistive technology for both you and your child?
9. Have there been any challenges in accessing or using assistive technology? How did you overcome these challenges?
10. Did you receive any training or support in how to use the assistive technology? Was it sufficient?
11. What additional resources or support do you think would be beneficial in optimizing the use of assistive technology for your child?
12. What are your expectations or hopes regarding the use of assistive technology for your child in the future?
13. Are there any additional features or types of assistive technology you wish were available for supporting your child?
14. Overall, how satisfied are you with the assistive technology's impact on your child's behavior and development?
15. Is there anything else you would like to share regarding your experience with assistive technology and its impact on your child's behavior?