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Voices from Academia

Assistive Technology/Augmentative & Alternative Communication Implementation: School to Home during COVID-19

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ABSTRACT

This explanatory sequential mixed-methods study sought to describe the implementation process of AT/AAC from school to home during the COVID-19 pandemic, including the extent to which AT/AAC was used, how AT/AAC was used, and what, if any, support the school systems provided. A researcher-designed survey was completed by 104 special educators and 45 parents. Seventeen follow-up interviews were conducted with educators and parent participants. Results of the study demonstrated the importance of clear communication, explicit expectations and procedures for AT/AAC use, and collaboration among stakeholders if AT/AAC implementation is to be as effective as possible.

Keywords: assistive technology (AT), augmentative alternative communication (AAC), COVID-19, virtual learning, special education

ASSISTIVE TECHNOLOGY/AUGMENTATIVE AND ALTERNATIVE COMMUNICATION IMPLEMENTATION: SCHOOL TO HOME DURING COVID-19

The emergence of COVID-19 led to many challenges and opportunities for educators and parents. One of those challenges was the need for educators to pivot from face-to-face (F2F) classes to virtual delivery models. This has been especially challenging for parents, teachers, and therapists responsible for the education of students with disabilities. In order to understand the timeline of our study, it is important to recognize that the pivot from F2F to virtual or hybrid learning occurred in three distinct windows of time.

1. Pre-COVID: Traditional teaching and learning during the 2019–2020 academic year. This ended in March of 2020.
2. Emergency remote teaching (ERT). Preliminary findings of current research (Courduff et al., 2021) suggest that a majority of states across the nation announced the abrupt closure of schools and pivoted to virtual learning in mid-March of 2020. What was to be a three-week break from school lasted through the end of the academic year, May/June 2020. Teachers were provided with very little information, less guidance, and few resources (Bozkurt & Sharma, 2020; Fournier et al., 2020).
3. Transition to virtual teaching and learning supported by online learning pedagogy. This started in August/September of the 2020–21 academic year. Although schools and districts provided more resources and opportunities for professional development, this varied from district to district and state to state (Marshall et al., 2020). No federal guidelines were provided and information from state leadership varied (Marshall et al., 2020). Our research team has divided the 2020–2021 academic year into two distinct halves:
    a. August–December 2020: Preparing/Implementing Assistive Technology/Augmentative & Alternative Communication (AT/AAC) remote learning
    b. January–May/June 2021: Implementing/Evaluating AT/AAC remote learning

Target Audience and Relevance

In this study, we focused on the state of AT/AAC implementation from January through May of 2021. The results of this study are relevant to parents, special educators, support therapists, general education teachers, and all others who work to support students with disabilities.

***Author note: The research team uses the terms special education teachers and special educators interchangeably. Additionally, these terms encompass all those who work with students with disabilities, including, but not limited to, speech-language pathologists (SLP), occupational therapists (OT), assistive technology consultants (ATC), physical therapists (PT), applied behavior analysts (ABA), board certified behavior analysts (BCBA), and others.*

Purpose of the Present Study

Schools and districts across the United States transitioned to virtual learning during COVID-19. For

special educators, the pivot to emergency remote teaching (ERT) intensified an already complex system (Hodges et al., 2020; Sakarneh, 2021). The problem of practice addressed in this study is that researchers and practitioners possess a limited understanding of the processes that districts, schools, and special educators used to implement assistive technology (AT) and augmentative and alternative communication (AAC) tools during the pivot from face-to-face (F2F) instruction to virtual instruction during the COVID-19 pandemic. An emergence of research is beginning to appear in the literature, but the main focus of existing studies regarding AT/AAC has been on tools that have been used by educators in F2F instruction prior to the pivot to virtual learning (Edyburn, 2020). Some scholars have addressed the obstacles faced by educators during the transition to ERT. For example, Ferri et al. (2020) identified three key obstacles in remote teaching, including technological, pedagogical, and social challenges. Additionally, some research has focused on applicable tips for online teachers and strategies for organizing online classrooms (Schuck & Lambert, 2020). However, there is a paucity of literature regarding the process through which special educators, including therapists, paraprofessionals, and parents, were able to implement AT/AAC tools at home via virtual learning. There is limited literature on the specific processes schools and districts used to support accessible, fully online learning for special educators and the students they teach (Boot et al., 2017 Edyburn, 2014; Edyburn, 2020). There is no literature on the efficacy of using AT/AAC during virtual learning that occurred due to the COVID-19 pandemic. Therefore, this study seeks to fill this gap in the existing empirical literature.

The purpose of the study was to investigate special education teachers' and parents' experiences with the use of assistive technology (AT), including augmentative and alternative communication (AAC), in Pre-K–12 virtual settings during the COVID-19 pandemic. We sought to describe the implementation process of AT/AAC from school to home, including the extent to which AT/AAC was used, how AT/AAC was used, and what, if any, support the school systems provided.

METHODS

Design

The explanatory sequential mixed-method design allowed for examining quantitative and qualitative data over time and across participants. We utilized the UTAUT survey to gain an understanding of the technological aspects of participants' experiences in the transition and support of AT and AAC from school to home. Further, we utilized interviews to understand participants' experiences through their personal stories of AT/AAC transition and support from school to home. This study was intentionally designed to answer the proposed research questions and assess study objectives (Creswell & Plano Clark, 2018). The utilization of the mixed-methods design also enabled triangulation of data collection and analysis results (Creswell & Plano Clark, 2018).

The Universal Theory of Acceptance and Use of Technology (UTAUT) is based on the premise that performance expectancy, effort expectancy, social influence, and facilitating conditions contribute to developing an intention to use and actual use of AT in learning situations (Admiraal et al., 2017; Venkatesh et al., 2003). The theory guides this explanatory sequential mixed-methods study that examines teachers' and parents' perspectives regarding the use of AT/AAC in PreK–12 virtual settings

during the COVID-19 pandemic. A descriptive study design was used to investigate the extent to which AT/AAC was used, how AT/AAC was used, and what support, if any, the school systems provided to teachers and students who used AT/AAC. A comparison study sought to ascertain the differences between teachers' and parents' perceptions of the actual use, performance expectancy, effort expectancy, social influence, and facilitating conditions associated with incorporating AT/AAC in learning situations during the COVID-19 pandemic.

Participants and Setting

The study sample was garnered using convenience sampling and snowball sampling (Creswell & Guetterman, 2019). Upon gaining approval from the institutional review board, we posted an invitation to participate in a Qualtrics survey on professional educational organization discussion forums, such as the International Society for Technology in Education (ISTE, n.d.) and the Quality Indicators for Assistive Technology (QIAT, n.d.) online forums, and social media groups, such as educational Facebook groups and Twitter feeds, for four weeks in the Spring 2021 semester. We also invited participants attending special education technology training in Tennessee to participate, accounting for the large portion of the sample from Tennessee and Mississippi. Participants were invited to provide their names and email addresses for a follow-up interview. Otherwise, names were not collected on the survey. Once the survey was closed, the data were downloaded from the Qualtrics survey system and exported into the Statistical Package for Social Sciences (SPSS) for analysis.

Procedures

Parents and teachers completed an online survey, which consisted of a researcher-created, self-report instrument to measure demographics, actual use, and theoretical constructs. Survey data were analyzed using descriptive and analysis of variance (ANOVA) analyses.

Following the survey, a semi-structured interview protocol was developed by the researchers to conduct individual interviews with select parents and teachers. Interview data were then analyzed using case study analysis methods (Yin, 2014) to identify: 1) how, if at all, learning situations during the COVID-19 pandemic influenced the use of AT/AAC; 2) how school-to-home communication and support affected the process of learning with AT/AAC at home during COVID-19; and 3) how the various constructs of the UTAUT facilitated or hindered incorporation of AT/AAC in learning situations during the COVID-19 pandemic. Interview transcripts were individually coded by the research team for preliminary codes. The research team then met and compared codes, finalizing a list of codes to be sent to interviewees for feedback and member checking. Codes were then triangulated with quantitative data and researcher memos in order to ensure accuracy of data reporting.

The sampling frame consisted of 104 special education teachers after deleting 15 incomplete survey responses. The majority of participants were White (n = 67, 64.4%) women (n = 91, 87.7%) between the ages of 30–39 (n = 51, 49.0%) and 40–49 (n = 30, 28.9%). Thirteen (12.5%) of the teacher participants identified as men. Twenty-five (24%) participants identified as Black, seven (6.7%) as Asian, four (3.8%) as Hispanic, and one Other. Almost half of the teacher participants (n = 48, 46.2%) were early career educators, reporting 1–5 years of experience in their teaching role. Twenty-two teachers (21.2%) reported

6–10 years of experience, 12 teachers (11.5%) reported 11–15 years of experience, 20 (19.2%) reported 16–20 years of experience, and only two participants (1.9%) reported more than 20 years of teaching experience. The majority of the sample (*n* = 91; 87.5%) were special education teachers, while 10.6% (*n* = 11) of the educator sample were Speech Language Pathologists (SLPs) and two participants selected "Other" to describe their educator roles. The participants reported being located in states across the United States, with the majority of participants (*n* = 62, 59.6%) being from Tennessee. No data were collected on languages spoken in the home. However, the survey and interviews were conducted in English only. Additional descriptive statistics for the school settings of the teacher participants are reported in Table 1.

Table 1: Descriptive Statistics of School Settings for Special Education Teacher and Parent Samples

		Teachers	
School Setting		***Percent (%)***	***Frequency***
School Level	High School	8.7%	9
	Pre-K, Elementary	66.3%	69
	Pre-K, Elementary, Middle School	3.8%	4
	Pre-K, Elementary, Middle School, High School	20.2%	21
	Pre-K, Elementary, Middle School, High School, Transitional Adult	1.0%	1
School Location	Rural	27.9%	29
	Suburban	26.0%	27
	Urban	46.2%	48
School Learning Approach (During COVID-19)	Hybrid learning: A combination of in-person and virtual	11.5%	12
	Virtual learning: 100% of the learning delivered online	88.5%	92
		Parents	
School Setting		***Percent (%)***	***Frequency***
School Level	Pre-K	8.9%	4
	Elementary School	44.4%	20
	Middle School	26.7%	12
	High School	15.6%	7
	Transitional Adult	4.4%	2
School Location	Rural	40.0%	18
	Suburban	42.2%	19
	Urban	17.8%	8
School Learning Approach (During COVID-19)	Hybrid learning: A combination of in-person and virtual	0.0%	0
	Virtual learning: 100% of the learning delivered online	100%	45

The sampling frame also consisted of parents. Forty-five parents responded to the survey after deleting 7 incomplete survey responses. The majority of parents identified as White (*n* = 28, 62.2%) women (*n* =

35, 77.8%) between the ages of 40–49 (*n* = 26, 57.8%). Ten (22.2%) of the parent participants identified as men. Eleven (24.4%) participants identified as Black, two (4.4%) as Asian, and four (8.9%) as Hispanic. Most participants (*n* = 30, 66.7%) reported having one child in their household with a special education classification. The participants reported being located in states across the United States, with the majority of participants being from Mississippi (*n* = 12, 26.7%), Pennsylvania (*n* = 12, 26.7%), and Tennessee (*n* = 13, 28.9%). Additional descriptive statistics for the school settings of the parent participants are reported in Table 1.

Nine special educators and eight parents agreed to participate in optional interviews. The interviews were conducted in a password-protected online meeting room, then transcribed and coded using case study analysis methods (Yin, 2014). Interview questions were derived from researcher-selected components of the UTAUT and from the research-based Survey of Assistive Technology User's Needs in Massachusetts (https://www.massmatch.org/documents/ATSurvey-1107.pdf; see Appendix A).

Instrumentation

The quantitative portion of this study focused on understanding the use of AT/AAC in Pre-K–12 virtual settings during the COVID-19 pandemic from both teacher and parent perspectives. As no instrument had been previously developed to measure the constructs of UTAUT as they were specifically related to AT/AAC during this unique historical event, we designed the What Have We Learned: The School to Home Assistive Technology Use Survey [teacher and parent version] to ascertain teachers' and parents' perceptions and experiences. Table 2 outlines the constructs of UTAUT and how they were adapted for this study. The instrument that was used for the study may be obtained by contacting the corresponding author.

Table 2: UTAUT Constructs and Definitions

Construct	Definition
Actual Use	The teacher/parent's and student/child's use of AT/AAC for learning in a virtual setting during the COVID-19 pandemic
Facilitating Conditions	The belief in the availability of the necessary organizational and technical infrastructure, including training, information, and provision of tools, for enabling the use of AT/AAC for virtual learning settings during the COVID-19 pandemic
Social Influence	The importance accorded to the expectations and opinions of others (e.g., teacher, parent, child/student) regarding his/her use of the AT/AAC with the child/student for virtual learning during the COVID-19 pandemic
Performance Expectancy	The belief regarding the learning benefits that the children/student drew from using AT/AAC in virtual learning settings during the COVID-19 pandemic, which includes the parent/teacher's perceptions of how the AT/AAC supported them in facilitating the child/student's learning
Effort Expectancy [Student]	The belief regarding the child's ease of using AT/AAC for virtual learning settings during the COVID-19 pandemic
Effort Expectancy [Teacher/Parent]	The belief regarding the teacher/parent's ease of learning to use, training the child/student to use, and also using AT/AAC for virtual learning settings during the COVID-19 pandemic

The instrument was developed following a thorough review of the empirical literature examining assistive technology (AT) and augmentative and alternative communication (AAC) (Edyburn, 2020). Theoretical literature related to UTAUT (Venkatesh & Davis, 2000; Venkatesh et al., 2003), Fishbein and Ajzen's (2010) Theory of Planned Behavior and Theory of Reasoned Action, and Davis's (1989) Technology Acceptance Model also informed the instrument development. The teacher version consisted of 47 items, and the parent version consisted of 36 items. The Cronbach's alpha coefficients for each subscale on the teacher version of the survey demonstrate that the instrument has good reliability (i.e., facilitating conditions = .84 [8 items], social influence = .98 [3 items], performance expectancy = .96 [6 items], teacher's effort expectancy = .87 [3 items], student's effort expectancy = .98 [3 items], and actual use = .98 [23 items; student/teacher use [6 items] = .96, teachers' use for instruction, facilitation and design = .97, teacher's use to promote an inclusive environment = .94) (Cohen, 1977). Similarly, the Cronbach's alpha coefficients for each subscale on the parent version of the survey demonstrate good reliability (i.e., facilitating conditions = .82 [9 items], social influence = .98 [3 items], performance expectancy = .91 [6 items], parents' effort expectancy = .85 [3 items], child/students' effort expectancy = .99 [3 items], and actual use = .97 [6 items] (Cohen, 1977). Additional questions about demographics, classifications of students, and experience with AT/AAC were also asked.

DATA ANALYSIS

Quantitative survey data were analyzed using descriptive and correlation analyses, including frequencies, means, standard deviations, medians, bivariate correlations, and a multiple regression. Qualitative data in the form of recorded interviews were individually coded by each team member. We met twice a month to discuss preliminary codes, then cross coded for significant statements. Then, we met to discuss combining the statements into themes. Finally, we developed descriptions of experiences based on what participants said happened, and how it happened. We condensed the descriptions into the essence of participant experiences.

RESULTS

Special education teachers and parents were asked to describe their experiences with AT/AAC when COVID-19 required changes in students' learning situation, namely when working in a hybrid or virtual environment. Teachers and parents were also asked to rate their experiences with AT/AAC when COVID-19 required changes in students' learning situations. Agreement with statements was measured on a 7-point Likert-type scale (i.e., 1 = not important at all, 7 = extremely important; 1 = extremely negative, 7 = extremely positive; 1 = none, 7 = a lot). Table 4 provides the results; percentages are reported. Both teachers and parents rated assistive technology (AT) and/or Augmentative Alternative Communication (AAC) as extremely important or very important (teachers = 100%, parents = 100%) to students' ability to complete learning tasks successfully during the pandemic [COVID-19]. Teachers' ratings were mainly favorable concerning the overall experience, particularly when looking at their rating with the overall experience as being somewhat positive (78.8%), even though the majority reported that they were provided with no school-sponsored training (55.8%) or only some school-sponsored training (43.3%).

“There was no mandatory training for us, just mandatory standards on what is expected. However, even though they can come into your classroom at any time, there is nothing that’s truly monitoring what’s going on with regards to the approach like adequate use of technology” (T2).

Moreover, teachers reported no or little to some (44.3%) support from the school. “We were kind of on an island...as we had to pivot to figure out how we were going to be teaching virtually and teaching with AAC device on” (T1). Participants felt that significant school-sponsored training and support were a priority for administration. 51.9% of teachers (*n* = 54) reported that their students had previously used all AT/AAC tools in school or at home before the pandemic. Only two teachers noted that their students used new hardware (e.g., laptop, mobile device, screen covers, Braille keyboards, etc.). However, 46.2% of teachers (*n* = 48) did note that their students used new software or subscriptions (e.g., websites, software, closed captioning, signing, apps). Teachers may have also been self-directed and sought their own needed resources to compensate for training and support that were not provided by the school. “There was no systematic support...I had to do a lot of research on how to navigate through this on my own because we hadn’t had the connection with the speech teacher” (T1). “I’m in person, five days a week; however, tech personnel were only seeing him [my student] two days a week, and it was the other three days that I was on my own to just figure things out” (T1).

Parents expressed more mixed experiences with the overall transition with AT/AAC during the COVID-19 pandemic. While the majority were extremely (48.9%, *n* = 22) or somewhat positive (28.9%, *n* = 13), 22.2% (*n* = 10) were somewhat negative. All parent respondents (100%) reported that their children used AT/AAC for a variety of purposes, including physical, social-emotional-behavioral, communication, and academic/cognitive needs, supporting the high importance placed on access to and use of these technologies. Interestingly, there seemed to be a disconnect between how teachers and parents perceived students’ familiarity with AT/AAC tools. One parent, who is also in the middle of her special education pre-service student teaching, explained, “I feel like I did all of it alone, unfortunately, but I do reach out to friends and colleagues. It’s very separate between them speaking to mom vs. co-worker or future educator, so there is that fine line with them. I only started doing research for everything that could have helped him [my son] this year” (P5).

A majority of the parents surveyed (80%, *n* = 36) reported that their child used new AT/AAC hardware for the first time during the pandemic as well as new software and subscriptions (53.3%, *n* = 24). Parents reported that training was provided through a variety of avenues, including in virtual classrooms (24.4%), virtual workshops (42.2%), and during already scheduled teaching or therapy sessions (28.9%). The majority of parents (51.1%) agreed with teachers that little AT/AAC tool support was provided by the school and reported that they often sought support from vendors (40%) or a specific point of contact within the school, likely their child’s teacher (28.9%). “She’s [assistive technology support person] not always accessible at the moments that we are struggling, or we pushed on something that now we’ve just wiped the device” (P2). This may indicate that parents had to seek out their own AT/AAC technical support and found it easier to gain information directly from vendors than to communicate with the school to address issues. “I did my own research and truthfully have been taking an AT class...I have downloaded speech-to-text and text-to-speech applications on his Chromebook” (P5; see Table 3).

Table 3: Teacher and Parent Perceptions and Expectations with AT/AAC

Item/ Scale	Teacher		Parent (*n*=45)	
	n	%	*n*	%
How would you rate your students' overall transition with AT/AAC when COVID-19 required changes in schooling?				
Somewhat negative	22	21.2	10	22.2
Somewhat positive	82	78.8	13	28.9
Extremely positive	0	0	22	48.9
How important was access to assistive technology (AT) and/or Augmentative Alternative Communication (AAC) regarding your students' ability to complete learning tasks successfully during the pandemic [COVID-19]?				
Extremely important	68	65.4	35	77.8
Very important	36	34.6	10	22.2
How would you describe the information and training you received from the school about the AT/AAC tools?				
None provided	58	55.8		
Some provided	45	43.3		
A lot provided	1	1.0		
How would you describe the AT/AAC tool support (e.g., help desk, tech support, support personnel for questions) you received from the school?				
None provided	57	54.8		
A little provided	1	1.0	23	51.1
Some provided	45	43.3		
A lot provided	1	1.0	22	48.9*

Parents and teachers also reported their perceptions of actual use, performance expectancy, effort expectancy, social influence, and facilitating conditions associated with incorporating AT/AAC in learning situations during the COVID-19 pandemic. One-way Welch's ANOVAs were conducted to determine if their perceptions across these areas were different. The Welch's ANOVA was selected given the unequal number of teachers and parents. Prior to conducting the ANOVAs, assumption testing was conducted. There were no extreme outliers, as assessed by boxplot; however, data was not normally distributed for either group across any of the variables, as assessed by Kilmagornov-Sminov tests ($p < .05$). One-way ANOVAs are, however, fairly robust when deviations from normality exist, even when the group sizes are not equal (Lix et al., 1996). This is especially the case as the sample size is not small and the groups are similarly positively skewed (Maxwell & Delaney, 2004; Sawilowsky & Blair, 1992). Normality violations in these cases do not usually affect Type I error. Therefore, we decided to conduct the ANOVAs rather than the nonparametric alternative, the Kruskal-Wallis H test. Homogeneity of variances, as assessed by Levene's test of homogeneity of variances, was not violated for most variables; it was violated for social influence and performance expectancy. Data for the means and standard deviations as well as each ANOVA are presented in Table 5. Parents and teachers differed in their perceptions across all of the variables. Effect sizes were moderate to large.

Parents reported significantly less favorably than teachers about facilitating conditions, reflecting that parents, on average, were less likely than teachers to believe that school systems' organizational and technical infrastructure, including training, information, and provision of tools, was set up to enable the use of a AT/AAC for virtual learning settings during the COVID-19 pandemic. "There was a lack of knowledge on how to use the AT. There was really no follow-through in virtual learning" (P5). "They didn't use the tool during the virtual learning time...so I can't really talk about this team too much because they weren't right there with her tool, but they saw me model it right...I modeled for them the whole time, but nobody did that, because everybody said, 'oh yeah she's not using the tool.' Everyone hindered the process because they didn't follow the plan...teachers were never taught how to use the tool [AAC]" (P2).

Parents were also significantly less favorable than teachers about the ease of using, training their child to use, and supporting their child's use of AT/AAC for virtual learning during the COVID-19 pandemic. However, parents compared to teachers were significantly more variable in all other areas, reporting favorably about the benefits and how easy their children found using AT/AAC in virtual learning settings during the COVID-19 pandemic. Parents reported their and their child's actual use of AT/AAC for learning in a virtual setting during the COVID-19 pandemic as higher than teachers, and parents recognized and attributed greater importance to the expectations they had placed on them by significant others (e.g., children and teachers) to assist their child with AT/AAC for learning. "He does really well this current year, because they provided the structure, they set up a Google Classroom, they loaned him the Apple MacBook and they had the MacBook completely set up with (I won't get the lingo right) his bar with all of his programs on it" (P1). This makes sense, given the more immediate nature of parents' ability to assist children with their use of AT/AAC in the home during virtual learning.

Table 4: Means, SDs, and ANOVAs for UTAUT Subscales

Item/Scale	**Teacher**		**Parent**		**Welch's *F***	***p***	***η*2**
	M	***SD***	***M***	***SD***		**-**	
Actual Use [All teacher items]	5.57	.86	-	-		-	
Actual Use [6 items]	5.76	.88	6.81	.36	61.044	>.001	.293
Facilitating Conditions	5.24	.86	3.34	.90	148.492	>.001	.503
Social Influence	5.60	.91	6.80	.76	60.094	>.001	.290
Performance Expectancy	5.63	.94	6.43	.61	27.416	>.001	.082
Effort Expectancy [Student/Child]	5.38	.97	6.20	.87	23.605	>.001	.138
Effort Expectancy [Teacher/Parent]	5.11	.89	4.52	.97	13.119	>.001	.157

There were 10 parent responses to the open-ended survey questions. Parents noted that they often had to train teachers and therapists on how to use tools and/or remind them that they needed to use the tools in virtual settings. This may explain why parents felt they were provided with training but not facilitated overall (see Table 4).

Additional Qualitative Results

Qualitative interview questions were designed to align with quantitative survey questions and to provide an opportunity for participants to add personal perspectives regarding AT/AAC implementation during the pandemic. Interestingly, several additional themes emerged in the qualitative analysis. This might be due to the semi-structured nature of the interview questions. Teachers and parents provided additional information and context that might not be revealed in a survey.

Daily/Weekly Organization and Follow-Through

Two parents described the home teaching and learning environment as extremely structured. P8 explained that a team approach is critical to successful learning with technology because "...not everyone knows everything about what's available." Her son flourished in virtual learning because of a deep commitment from everyone involved—parents, classroom teacher, SLP, vision and hearing specialists, AT, and OT. "They found ways of working with each other and with me...everyone (including family) knows what's being used and how to use it" (P8). P6 explained that "...it takes everyone. The ABA created a daily schedule that everyone—BCBA, SLP, OT, special education teacher—followed." High levels of collaboration were perceived as key to successful AT/AAC implementation.

Levels of Parent AT/AAC Implementation at Home

Teachers revealed that home conditions could either support or hinder the process of AT/AAC implementation. The range includes three levels: 1) Follow-through is challenging because parents don't believe that there is a need to use devices at home; 2) Follow-through is challenging because of a chaotic environment; 3) Follow-through is supported by families where at least one parent can be home to implement devices, are highly structured, and have high expectations for how their child should use the device for communication. "For some families, I have less expectation of follow-through, simply because there's so much going on at home that it's hard to keep to a schedule. There's a lot of noise, there's a lot of responsibility on kids to watch other kids. For those families, I really see my time with the kid as sort of our quiet time, one on one, to really focus on what we're focusing on" (T3). Other challenges included multiple disabilities in the home, no quiet place to learn, no reliable internet, multilingual families, and families in low socioeconomic or uneducated backgrounds.

P1 explained that she enrolled her son with CP in a dual language program. "What we believed was that he could do it, and if he could get through it, he would benefit in two ways; one would be the cognitive development, the learning of two languages, the other would be that if he only went as far as high school, he would have an added skill for employment" (P1).

Implementation must be consistent. “He has his device; he’s able to carry it everywhere. He goes, it goes with him; and if we don’t have a webcam because sometimes, he has days, where he’s like, I don't want to see it, we carry a laminated paper version of it” (P3).

Hidden Sense of Humor/Area of Talent

Students with severe communication challenges often take longer to respond to others using an AAC device. Teachers and parents explained that it takes a lot of time to get to know some students and to understand their wit and talent. The students are really smart technologically and artistically, and use kindness and humor when they use their voice [AAC]. T1 stated that her student,

> *...loves to tell knock-knock jokes and he will, purposefully, when I'm asking him a question. He's very, very smart in a lot of ways that I think most people don't give him credit for, and again, unless you’ve developed that relationship with somebody [the student]. But you’re not going to pick up on those things, you’re going to think that that’s a miss hit and it’s not. It’s his way of interacting with you, and unless you really know that, you’re not going to understand him” (T1).*

Additional comments revealed: This is possible when there is help in school and at home. AAC must be consistently implemented by everyone. “It works when all the players work together” (P7). “The right teacher makes a huge difference” (P8).

Just in Time Training

When asked about how he provides training on AAC devices, T3 stated that after a session with a student, he makes the task relatable at home. “I situate follow-up on tasks within a family’s day to day [routine], and I give them something bite-sized and doable to accomplish.” P8 said that this has been a great year for her son. “He is one of the kids who really excelled in remote learning this year.” She attributed part of her son’s success to the district’s “self-serve app” where students could access and download a wide variety of district-approved apps for learning. Her son was empowered by the ability to choose and use apps for learning, investigating, and creating. He is “...empowered to access the apps to create things important to him” (P8).

OUTCOMES AND BENEFITS

The results of this research provide insight into the experiences of special educators and parents as they navigated the challenges of remote learning during the COVID-19 pandemic. They also provide practical information for school districts to consider as they reflect on the ways in which their structures facilitated, or failed to facilitate, effective use of AT/AAC in pre-K–12 virtual settings during the COVID-19 pandemic. For this research, a total of 104 special educators and 45 parents responded to the survey and 17 teachers/parents were interviewed during April–June 2021. Their authentic voices and unique

perspectives identified areas where schools and school districts may improve the effective implementation of AT/AAC technologies for special education students and families. Specific outcomes and benefits are discussed below, followed by authors' recommendations for AT/AAC implementation strategies for the future.

DISCUSSION

Three research questions were established:

- What support structures did schools and districts implement to best provide assistance to students and parents for AT/AAC during remote learning January–May 2021?
- What were the barriers to effective AT/AAC implementation January–May 2021?
- Based on data, what recommendations can we make for improved implementation of AT/AAC in remote learning environments?

Two respondents expressed positive outcomes with AT/AAC implementation for the following reasons: 1) Parents, teachers, and therapists worked together to develop an organizational structure that was conducive to the student and all of those who supported them; 2) AT/AAC was implemented consistently at home and during virtual instruction; 3) resources and training were provided for all in a timely manner; and 4) stakeholders focused on student strengths rather than only on barriers and challenges. Additionally, survey results were generally positive or neutral with regard to the constructs of the UTAUT and teachers' and parents' experiences using AT/AAC for remote learning during the pandemic.

However, 16 of the 18 interviewees (teachers and parents) expressed ineffective and inefficient experiences with AT/AAC during the virtual classroom settings since COVID-19. They raised many issues that contributed to the ineffectiveness of students' learning situations. The three most serious issues that were identified by teachers were: 1) teaching; 2) relationships; and 3) system issues. The concerns related to teaching were identified as critical and 48% of concerns were expressed in this category. For example, teachers expressed that there was a lack of timely training/workshops provided, the training was developed for general education teachers, or it was hard to obtain relevant technologies, materials, and information. The relationship issues included special education teachers not feeling supported by school administrators (districts), parents, or general education teachers.

Parents shared concerns that were a bit different. Forty percent of the concerns parents shared were about system issues. For example, ineffective virtual classroom settings, ineffective systems for evaluating AT/AAC implementation, and hiring unqualified teachers or teachers new to the profession. Lack of supervising systems was addressed as a major cause of the ineffectiveness of virtual learning. In addition, parents also addressed relationship issues (such as ineffective communication between teachers and students/families) and personal issues (such as educating themselves, finding appropriate resources, understanding their rights under IDEA, etc.).

Both teachers and parents expressed that their experiences with AT/AAC during the pandemic were chaotic because there were no clear rules, policies, and procedures regarding the structure of special

education virtual classes with AT/AAC. In addition, both groups agreed that the collaborative work between teachers and parents has the potential to increase students' success in education.

Ironically, we found a cycle of blame among the three groups. Teachers blamed the ineffective education for their students mainly on parents (e.g., their lack of technological and content knowledge). Special education teachers blamed general education teachers for a lack of commitment to following the learning plans for students, and parents blamed teachers and school administrators. Blame was communicated as a negative or as a neutral concept. Some teachers and parents noted that although the system had challenges, it seemed that everyone was doing their best, given the circumstances.

In order to apply the results of this research to the special education setting effectively, we recommend the following three guidelines, which would improve the facilitating conditions for AT/AAC use.

First, when a school (or school district) initiates an assistive technology-related project, the big picture regarding shared goals, action plans, and timelines should be communicated clearly and thoroughly, and shared with all stakeholders (e.g., school administrators, special and general education teachers, parents/guardians/families, students). One critical aspect of this is to provide detailed daily procedures and routines for the student, the family, and the educational stakeholders. Ongoing communication is essential among all stakeholders during the project through regular checkup meetings and formative feedback sessions.

Second, setting expectations thoroughly and defining roles clearly could increase the likelihood of success of the project. We heard many voices of teachers and parents together in which unclear rules, lack of accountability systems, vague roles between teachers vs. parents/families, general vs. special education teachers, administrator/staff vs. teachers, caused unnecessary stress and burden. Further, expectations and roles must be identified and implemented by all stakeholders. The expectations should be created under the assumption that some home situations are complex, and streamlined implementation might prove more difficult than it appears from the teachers' perspectives.

Finally, providing necessary training programs, workshops, required resources, and information would be another recommendation for implementing the project successfully and effectively. Ongoing communication from home to school and from school to home regarding needed training and regular support is the key factor for the success of AT/AAC projects. As one SLP stated, "… give them bite-size training—give them what they need in the moment and there will be buy-in" (T3).

Limitations

While these study results have valuable implications for the implementation of AT/AAC and the support of special education students during a pandemic, this study is not without limitations. First, while the survey instrument was developed using both empirical and theoretical literature and demonstrated strong reliability, it was created by the authors and had not been validated prior to its use in this study. Further validation of the instrument with a larger sample of participants would further strengthen the results of the present study. Additionally, the participant sample was regionally weighted, with a majority of the

teacher and parent survey participants residing in the southeastern United States. It is possible that a more geographically diverse sample may have yielded different results. Additionally, the teacher sample was made up predominantly of White women. While this is representative of the persistently problematic lack of diversity in the general K–12 teaching population (NCES, 2019), a more diverse teacher sample should be sought in future studies. The use of a self-report survey can also yield over-positive results (Brenner & DeLamater, 2016). This should be taken into consideration when viewing our study results. Finally, we provided recommendations for strategies that practitioners might consider in order to improve the facilitating conditions for AT/AAC use. However, determining the actual effectiveness of these recommendations would require that some follow-up research be conducted to identify how, if at all, implementing these recommendations yields positive outcomes.

Implications for Future Research

There is still much to be done in the area of future research for AT/AAC service delivery. First, we need a more robust understanding of assistive technology service delivery procedures and systems at the district, school, and home levels. More research needs to be conducted on the relational aspects of service delivery, implementation, and support from both parent and teacher perspectives. Finally, more research needs to be done on how AT/AAC are perceived and used in the home in comparison to how AT/AAC are perceived and used at the school level.

CONCLUSION

In this study, we sought to investigate special education teachers' and parents' experiences with the use of assistive technology (AT), including augmentative and alternative communication (AAC) in Pre-K–12 virtual settings during the COVID-19 pandemic. Both quantitative and qualitative findings indicated that while special educators and parents/families found ways to provide the necessary support for special education students and their use of AT/AAC during remote learning, facilitating conditions were lacking. This created feelings of stress and confusion for those who felt the implementation of AT/AAC was chaotic. A key concern discussed by both special educators and parents was the need for clear, transparent communication among stakeholders. Education is communication. The comments below are from an interview with a special education teacher and a parent: "Things that weren't education, all you know we talked about educational, but it really is educational. It's communication...it is all about learning how to communicate—how to have a process of supporting what's the next step" (T4). "It is a team effort. It's a whole team. If somebody is lacking from one end, the bridge is going to fall. That's why everybody has to hold it up. if somebody is not putting their part, it's going to fail" (P1).

DECLARATIONS

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APPENDIX A

Interview Questions: Special Educators

- What support structures does your school implement to best provide assistance to students and parents for AT/AAC during remote learning January–May 2021?
- When implementing AT/AAC tools at home, what conditions helped the process?
- What conditions hindered the process?
- When implementing AT/AAC tools at home, what school personnel helped the process?
- If applicable, how did school personnel hinder the process?
- When implementing AT/AAC tools at home, how did the school level GenEd/SpEd team help the process?
- If applicable, how did the GenEd/SpEd team hinder the process?
- When implementing AT/AAC tools at home, what conditions facilitated usefulness of the AT/AAC tools?
- What conditions hindered the process?
- Overall, did the implementation process school to home help the student gain access to the tools necessary to be successful in reaching goals?
- What recommendations would you make for improved implementation of AT/AAC in remote learning environments?
- What lessons have you learned?
    - About yourself?
    - About your instruction?
    - About using AT/AAC tools in remote learning environments?

Interview Questions: Parents

- What support structures does the school implement to best provide assistance to you and your child for AT/AAC during remote learning January–May 2021?
- When implementing AT/AAC tools at home, what conditions helped the process?
- What conditions hindered the process?
- When implementing AT/AAC tools at home, what school personnel helped the process?
- If applicable, how did school personnel hinder the process?
- When implementing AT/AAC tools at home, how did the school level GenEd/SpEd team help the process?
- If applicable, how did the GenEd/SpEd team hinder the process?
- When implementing AT/AAC tools at home, what conditions facilitated usefulness of the AT/AAC tools?
- What conditions hindered the process?
- Overall, did the implementation process school to home help the student gain access to the tools necessary to be successful in reaching goals?

- What recommendations would you make for improved implementation of AT/AAC in remote learning environments?
- What recommendations would you make for improved implementation of AT/AAC in remote learning environments?
- What lessons have you learned?
    - About yourself?
    - About supporting your child's growth towards goals?
    - About using AT/AAC in your home?