

Assistive Technology Outcomes and Benefits
Volume 14, Spring 2020, pp. 36-51
Copyright ATIA 2020 ISSN 1938-7261
Available online: www.atia.org/atob

The Development of an Assistive Technology Toolkit for Early Literacy Instruction

**Ruby Natale, PhD, PsyD, Christina Sudduth, MPH, Monica Dowling, PhD,
Sarah Messiah, PhD, MPH, Christina Nunez, MS, Michelle Schladant, PhD, ATP**

University of Miami Miller School of Medicine

Corresponding Author

Michelle Schladant, PhD, ATP

University of Miami Miller School of Medicine

1601 NW 12th Avenue, Room 3047

Miami, FL 33136

Phone: (305) 243-4466

Fax: (305) 243-5978

Email: mschladant@med.miami.edu

Abstract

Despite evidence supporting the use of assistive technology (AT) to improve early literacy outcomes, only a small percentage of preschool age children with disabilities utilize such devices and services. The goal of the Step Up AT to Promote Early Literacy Project is to develop an evidence-based training program to increase teacher and parent knowledge, confidence, and use of AT practices to promote inclusion and improve early literacy skills for this population. During years 1 and 2, a 6-month in-person and online training program was developed and implemented across 3 childcare centers serving children 3 to 5 years of age ($n = 56$), their primary caregivers ($n = 56$), and teachers and teacher aides ($n = 36$). This paper discusses how the program evolved over a period of two years to: a) better address the needs of children from Spanish-speaking and low-income families, b) incorporate a range of “low-tech” to “high-tech” AT options to serve a diverse population with various abilities, and c) enhance the utility of the toolkit for parents and teachers.

Keywords: early childhood, assistive technology, early literacy, professional development

Introduction

Early literacy is a national priority and critical to school success (National Institute for Literacy, 2009). Despite provisions for special education services mandated by the Individuals with Disabilities Education Act, the majority of young children with disabilities, particularly those from low socioeconomic backgrounds or who speak English as a second language, are delayed in early literacy skills compared to their typically developing peers (Burne, Knafelc, Melonis, & Heyn, 2011; Floyd, Smith Canter, & Judge, 2008; Teale, Hoffman, & Paciga, 2014). There is promising evidence that assistive technology (AT) can improve early literacy outcomes for young children with a range of disabilities (Dunst, Trivette, & Hamby, 2012; Satterfield, 2016). However, national reports have consistently documented that less than 10 percent of children ages 3 to 5 served under IDEA, Part B, received AT services in 2015 (U.S. Department of Education, 2015).

The National Institute for Early Education Research documented that 74% of preschool teachers serving children 3 to 5 years of age in Head Start programs held a bachelor's or advanced degree (Kaplan & Mead, 2017). The majority, however, are not trained in special education, and even less have had training in the use of AT (Baker, 2014; Beard, Bowden Carpenter & Johnston, 2011; Hemmingsson, Lidstrom, & Nygard, 2009). Increases in the numbers of children with complex communication needs, including autism spectrum disorders, Down syndrome, and cerebral palsy, who require AT, underscore the urgent need to develop effective research-based interventions to improve educators' ability to use AT (Light & McNaughton, 2012). In this case, AT may include a range of "low-tech" to "high-tech" tools and strategies, including visual supports, switches, communication devices and applications, adaptive books, writing tools, and more (Floyd et al., 2008; Simpson, McBride, Spencer, Lowdermilk, & Lynch, 2009).

While training has been minimal, even when teachers and parents had AT knowledge, it did not always translate into appropriate use of the technology (Baker, 2014; Burne et al., 2011; Neuman & Cunningham, 2009; Satterfield, 2016; Cardon, Wilcox, & Campbell, 2011). Promoting best AT practices for shared literacy experiences in early childhood programs and at home is critical (National Institute for Early Education Research [NIEER], 2006). Furthermore, training parents and teachers to be effective communication partners can lead to important social experiences that promote early literacy development (Light & McNaughton, 2012). AT provides additional support in both of these domains (Floyd et al., 2008).

There are many challenges in determining how to prepare early childhood teachers to support the needs of young children with disabilities with AT strategies (Friedman, Woods, & Salisbury, 2012; Nikolopoulou & Gialamas, 2015; Simpson et al., 2009; Smith & Smith, 2004). In particular, training for both the use of low-tech and high-tech AT options is required (Baker, 2014; Hill & Flores, 2014; Karlsson, Johnston, & Barker, 2017; Stanger, Mims, Wood, & Ahlgrim-Delzell, 2016). Short-term professional development (PD) activities, which are often the standard of practice, have limited effectiveness on changing teachers' practices in the classroom (Diamond & Powell, 2011; Dunst, Bruder, & Hamby, 2015; Parette & Stoner, 2008; Smith & Smith, 2004). Therefore, there is a strong need for innovative professional development opportunities, especially among teachers of children living in low-resource communities and for English

language learners. Students in these areas have shown to benefit the most from teacher quality, as well as collaboration between the home and school environments (McCray, Brownell, & Lignugaris, 2014; NIEER, 2006; NIEER, 2011).

Target Audience and Relevance

Step Up AT to Promote Early Literacy Project (Step Up AT) was a training program for teachers and parents of children with disabilities, 3 to 5 years of age. The team designed the program to increase the knowledge of evidenced-based AT practices, and promote the use of AT, for the inclusion and early literacy skills development of preschool children with disabilities. The program extended beyond traditional professional development practices by integrating (a) self-guided online learning modules for teachers and parents in English and Spanish, (b) access to AT devices and resources through a classroom toolkit and the Step Up AT Lending Library, and (c) training via coordinated coaching and workshops.

The team also designed the intervention to better equip teachers and parents to support English language learners in emergent literacy activities. Step Up AT was unique in that it was developed in a culturally and linguistically diverse community where the majority of the population was from a minority background, approximately 52% Latino from Caribbean, Central and Latin American descent and 23% Black from African American, Haitian or Caribbean descent, with 60% of the population speaking a language other than English in the home (United States Census Bureau, 2017). The project also emphasized the training of teachers and teacher aides in community-based Head Start and voluntary pre-kindergarten childcare centers with inclusion programs where few were trained in AT and special education. Most held the minimum requirement for a preschool teacher, a Child Development Associate credential (CDA).

The Step Up AT project was a collaboration between a University Center for Excellence in Developmental Disabilities Education, Research, and Service (UCEDD) and a statewide AT Act Program. Therefore, other stakeholders that might benefit from this work are funding and policy agencies that work with early learning or special education programs at the local, state, or national level. School districts with exceptional student education (ESE) divisions for pre-kindergarten, as well as organizations that are part of the statewide and national networks of AT, and intellectual and developmental disability services would find this work relevant to their priorities.

The purpose of this manuscript is to describe the development of the Step Up AT toolkit as well as lessons learned over the two years of piloting the professional development resource in a multi-lingual, low-income, low-resource population. The following will describe the major components of the comprehensive toolkit and the pedagogy used by the research team to inform design, delivery in the field, and adaptations between each implementation year.

Development of the Step Up AT Toolkit

The Step Up AT toolkit was comprised of online learning modules, a curated selection of assistive

technology (AT) for early literacy learning, and a coaching curriculum that was to be administered both in-person and via videoconferencing. An interdisciplinary team of psychology, special education, and AT professionals contributed to the development of the Step Up AT toolkit, building upon previous work in the field of early childhood special education and recommended practices as outlined by the Division of Early Childhood (DEC; Division of Early Childhood, 2014). The research team also included a partnership with the statewide AT agency to provide participants ongoing access to an AT lending library. The use of the device lending program increased opportunities for families to explore AT options and make informed decisions before investing in personal equipment (Wilcox, Dugan, Campbell, & Guimond, 2006). Finally, community and scientific advisory committees were adopted in order to gain feedback throughout program development.

Online Learning Modules

The conceptual framework for the training program was based on the DEC Recommended Practices (RPs) in Early Intervention and Early Childhood Special Education in the areas of environmental adaptations and instructional supports to support implementation of AT practices for children with disabilities (DEC, 2014). Specifically, the AT practices addressed how to: (1) incorporate the child's interest (Rogers & Dawson, 2010); (2) promote early literacy development through everyday activities (Rogers & Dawson, 2010); (3) use naturalistic strategies, such as modeling language, waiting for the child to initiate interaction, responding, expanding, and prompting when necessary (ECTA Center, 2018; Kaiser, Hancock, & Nietfeld, 2000); and (4) use a continuum of AT supports in the areas of classroom arrangement, shared reading, talking and listening, vision and hearing, and writing and drawing (Floyd et al., 2008; Milbourne & Campbell, 2007).

The curriculum was divided into six modules for teachers and four modules for parents and families, which were accessible by desktop computers, tablets, or mobile devices for ease of access. Table 1 demonstrates how each module aligned with DEC RPs to enhance each student's participation and engagement in early literacy activities. Module topics focused on developing teachers' knowledge and practices in (a) identifying each child's needs for AT to promote access to and participation in early literacy experiences (DEC RP E4), (b) modifying and adapting the child's environment to promote each child's access to and participation in early literacy experiences (DEC RP E3), and (c) planning for and providing AT supports and adaptations (DEC RP INS4; DEC, 2014). Each teacher module took approximately 20 minutes and included written information, videos, and interactive reinforcement activities.

The four corresponding parent modules mirrored the content of the teacher modules (see Table 1). They were shorter in length and took approximately 10 minutes to complete. The purpose of the parent modules was to encourage shared reading experiences between caregivers and the child at home, and to increase the likelihood of children integrating the use of AT tools and strategies across settings. See Table 2 for examples of early literacy activities using AT in the school and home. An emphasis was also placed on the developmentally appropriate use of technology and screen-time limits for this child population. To support the needs of dual language learners, the modules also highlighted the importance of continuing to build skills in a child's native (home) language.

Table 1: Step Up AT Teacher Online Learning Modules

Module	DEC RP	Components of Training Modules
1	E4	Overview of early literacy and how to consider and implement AT at school and home
2	E3	Effective classroom arrangement (engineering the classroom and environmental and visual supports)
3	INS4	Adapted books and other AT to promote shared reading
4	INS4	AT supports and strategies to support vision and hearing issues
5	INS4	AT supports to promote talking and listening
6	E4	AT supports for writing and drawing

These modules have a corresponding parent module.
(December 2014)

Table 2: Examples of Early Literacy Activities for School and Home

Module	Early Literacy Activities	AT for School or Home
1	Help children develop early literacy skills by talking, signing, playing, reading, and drawing.	AT is a tool to increase children's participation in early literacy activities. Considering AT starts with the child's interests, needs, and preferences.
2	Pair words in the book with actual objects.	Teacher pairs books about trains with a toy train during shared reading.
3	Expose children to books and make reading a special time.	Parent adapts the book <i>Hungry Caterpillar</i> with popsicle sticks so that a child with cerebral palsy can independently turn the pages in a book during a bedtime story.
4	Incorporate alphabet books and props in shared reading.	Teacher uses light colored magnetic letters on a dark surface such as a metal baking sheet to create color contrast as a visual support for a child with vision difficulties while reading <i>Chica Chica Boom Boom</i> alphabet book.
5	Read books with repeatable lines and phrases.	Parent records the story <i>Brown Bear</i> on a talking photo album while her child with autism presses the button on the talking photo album to read the repeatable line of the story.
6	Gather and organize ideas through drawing and scribbling.	A child with a fine motor delay creates an alphabet book by drawing his favorite animals using a slant board and a chubby crayon.

Maintaining cultural sensitivity was critical to the development of this project. Therefore, the team created all content and assessment tools concurrently in Spanish with culturally relevant materials fitted for the target population in the South Florida region of the United States (Kreuter, Lukwago, Bucholtz, Clark, & Sanders-Thompson, 2003). The Step Up AT team aligned the toolkit with the demands of the demographics of the region where the program was developed, and it reflected the growing population of Latino youth in the United States (Federal Interagency Forum on Child and Family Statistics, 2012). Cultural targeting strategies were utilized to create a program that would be linguistically and culturally congruent with the needs of participants (Kreuter et al., 2003). The team developed the online toolkit in English and Spanish, in an easy-to-read and accessible format to support parents and prepare teachers to adopt AT practices. The research team also sought feedback from community advisory councils, as well as parents and teachers from each implementation year to ensure that the materials were relevant to their needs.

Curating an AT Classroom Kit for Early Literacy

The foundation of the Step Up AT Project was the promotion of evidence-based AT tools that supported the early literacy development of preschool children with disabilities. The classroom kits incorporated a range of low-tech and high-tech devices such as adapted seating, visual supports, communication devices, tablets with literacy applications, materials for adapting books, and writing aids. The toolkit included low-tech AT options accessible for families with limited resources, and tools independent of electronic screens, given the “screen-time” concern for young children (NAEYC, 2012). Schools received an AT classroom kit with these select tools, listed in Table 3, and demonstration guides on how to use the AT devices in developmentally appropriate ways to support effective implementation (Dunst et al., 2012). The selected AT tools were also made available to teachers and parents through the Step Up AT Lending Library in partnership with the statewide AT services agency.

Table 3: Step Up AT Classroom Kit

AT Tool	Use
Smartphone and tablet applications	Applications supported the accessibility and development of behavior management, writing and drawing, communication, and early literacy skills (examples: ChoiceWorks®, Go Talk Now®, Starfall’s ABC®, Tell About This®, and more).
Switches	Allowed for devices, toys, and apps to be activated by a press of a button (examples: Perrerro® Switch, Jelly Bean Twist®, Koosh® Switch, and adapted bubble blower).
Communication software	Software and supplies to create visual supports and communication boards (examples: Boardmaker® Software, LessonPix® software, and laminator).
Communication devices	Devices with one, two, or nine voice outputs allowed for making choices, commenting, and requesting (examples: Big Mack® Switch, iTalk 2®, Go Talk 9®).
Book stand	Held and adjusted placement of reading material for more accessibility.
Pencil grips, chubby crayons, and fabric brushes	Allowed for easier grasp for children who struggle to hold traditional writing and drawing utensils.
Page fluffers	Physical objects, such as popsicle sticks, that were affixed and extend from pages to allow for easier turning.
Keyboard with extra large keys and a big trackball mouse	Adapted keyboard and mouse for those with mobility issues or visual impairments.
Cube chair	Provided further support for sitting than traditional chair.
Clock timer	Large visual support for timed tasks.

Expert Coaching to Implement the AT Toolkit

In addition to providing a platform for self-guided learning and access to AT tools, Step Up AT provided teachers direct coaching from bilingual (English and Spanish) special education professionals. This coaching facilitated intentional and systematic skill building in a naturalistic and supportive environment (Kaiser, et al., 2000). After having viewed each of the six online learning modules, teachers and teacher aides met with AT coaches as a classroom unit for face-to-face and virtual coaching sessions. During the sessions, the AT coach would introduce, model, practice, and reflect the AT early literacy strategies within the childcare center environment (Barkley, Cross, & Major, 2005; Rush & Shelden, 2011). The team tailored the coaching sessions to address participants’ needs and goals in the classroom as well as specific goals dictated in the children’s individualized education plans (IEP) (Rush & Shelden, 2011).

Implementation of the Step Up AT Toolkit

Step Up AT was a five-year project which included development (years 1 and 2), randomized control trial (years 3 and 4), and dissemination (year 5) phases. This article focuses on years 1 and 2 iterations of the toolkit, the lessons learned, and the adaptations made to prepare for the randomized control trial in years 3 and 4. In addition to creating the components of the Step Up AT toolkit, the research team determined the methods and desired outcomes to measure as part of the intervention's evaluation. The intention was to capture the impact of Step Up AT at the level of the individual child, the teacher-child and parent-child relationships, and the school and home environments using both quantitative and qualitative methods. The development phase of the Step Up AT Project afforded the interdisciplinary research team time to refine the implementation and evaluation methods required to create an evidence-based training program that translated AT strategies from theory into practice. Future publications will discuss a thorough explanation of the measurement tools and preliminary findings of the project.

Criteria for Participation

In the development phase (years 1 and 2), sites and participants met the following inclusion criteria. The schools (a) were required to have teachers that spoke English or Spanish; (b) served children between 35 and 60 months (i.e., three to five years old); who (c) had a current Individualized Education Program (IEP); and a (d) parent's or primary caregiver's consent for their child's participation, as well as a parent or caregiver willing to engage in the project.

There were no restrictions as to the specific type of disabilities children had to have in order to participate. The curriculum did not target students with particular disabilities because it was intentionally designed to support a broad range of abilities found in inclusive classrooms. In the first two years, the Step Up AT team implemented the intervention at inclusive Head Start and community-based voluntary pre-kindergarten (VPK) settings, and self-contained early childhood classrooms. The intention of the toolkit was to support teachers and families in various educational settings, including mainstreamed and more specialized programs given that AT has been found to benefit in all settings (Dunst et al., 2012; Satterfield, 2016).

The direct coaching component of the toolkit then addressed more individualized needs of the children in each participating classroom. By coaching to the specific needs of the students at that time, teachers were then able to practice implementing the various strategies across multiple cases. The goal was that the teachers would continuously integrate the AT strategies into their practices to meet the needs of future students with disabilities. To this point, the range of diagnosed disabilities included autism spectrum disorders, physical disabilities, developmental delays, chronic medical conditions, hearing impairments, intellectual disabilities, speech or language impairments, visual impairments, and dual sensory impairments. The majority of disabilities among students in years 1 and 2 were related to speech and language delays. The type and severity of the child's disability were self-reported by caregivers. Table 4 outlines the demographics of year 1 and 2 participants. In year 1, the children and teachers were distributed across 10 inclusion classrooms at one Head Start program, and in year 2, across six

classrooms, inclusion and self-contained, at two VPK centers.

Table 4: Step Up AT Participant Demographics

Role	Year 1 (N = 64)	Year 2 (N = 84)
Head Teacher	10	6
Teacher Aid	10	10
Child	22	34
Primary Caregiver	22	34
Childcare Centers	1	2
Classroom	10	6
Ethnicity	Year 1 – N (%)	Year 2 – N (%)
Hispanic	64 (100)	61 (73)
Non-Hispanic	0	23 (27)
Child Disability (self-reported)	Year 1 – N (%)	Year 2 – N (%)
Autism Spectrum Disorder	2 (9)	10 (29)
Developmental Delay	1 (5)	7 (21)
Speech and Language Delays	10 (86)	9 (26)
Other	0	8 (24)
Severity of Disability (self-reported)	Year 1 – N (%)	Year 2 – N (%)
Severe	9 (41)	2 (6)
Moderate	12 (54)	11 (32)
Mild	1 (5)	14 (41)
Not reported	0	7 (21)

Recruitment, Enrollment and Retention

The research team engaged in ongoing community networking with those organizations that address the needs of children with disabilities and community health disparities, in order to identify and recruit inclusion-based childcare centers. During both years of the development phase, the childcare center directors and support staff identified eligible students and brokered the initial contact with both teachers and parents. A letter was sent to parents in English and Spanish on behalf of the principal investigator informing them of their child's eligibility to participate. In addition, a flyer was created to summarize project eligibility criteria, benefits, and requirements detailed for teachers and primary caregivers.

Teachers and caregivers were invited to attend orientation meetings of the Step Up AT project. If caregivers could not attend, the research team set up individual appointments to complete the informed consent process and pre-assessment surveys, and to allow participants the opportunity to seek clarification, ask questions, or have the materials read to them if necessary. In order to accommodate caregiver schedules, the research team and AT coaches made appointments early in the morning and after working hours. Childcare and refreshments were provided during all program events to increase parent participation. The coaches also offered appointments at the school for parents with limited home internet access in order to facilitate their viewing of the online learning modules.

In addition to the professional development and training, parents and teachers were offered incentives for completing the program. Teachers received the AT classroom kits with iPads® to access the Step UP AT toolkit and had the opportunity to earn Continuing Education Credit Units (CEUs) for their participation.

Parents received a gift basket of adapted books, writing supports and other low-tech AT valued at fifty dollars for their participation in the parent workshop and the completion of any required assessments. Both teachers and caregivers had access to the Step Up AT Lending Library of AT resources.

Implementation – Year 1

Year 1 of Step Up AT began in January 2017, in the middle of an academic year when the grant cycle began. In year 2, the program spanned fall and spring semesters, and has since continued to be a full academic year training. Between January and May 2017, the following components of the Step Up AT toolkit were implemented at one Head Start early childhood center: (a) four teacher and four parent online learning modules, (b) access to the AT devices and resources through the classroom kit and Step Up AT Lending Library, (c) expert training for teachers via three coaching sessions per module, and (d) one workshop for teachers on how to use Boardmaker® Share to make visual supports and one parent AT orientation workshop.

During this year, Step Up AT had one AT Coach working with the Head Start center. Because it was an inclusion program, the eligible students were distributed across 10 classrooms where each classroom unit included approximately two participating students. This meant that the AT Coach worked with ten teacher-teacher aide dyads. Due to the short amount of time available to launch the program, only four of the six teacher learning modules were developed, and only three coaching sessions were provided per module, to introduce the AT strategy, to model, and then to practice the concept. The two remaining modules were developed over the course of the academic year to be implemented in year 2. Pre-assessment data was collected in December 2016, prior to implementation of the intervention. Post-assessment data was collected and focus groups were conducted with participants at the end of the school year in May 2017.

Outcomes and Benefits from Year 1

Lessons learned from the first iteration of the Step Up AT toolkit can be grouped into three main themes: (a) standardizing the curriculum to enhance learning among teachers, (b) adapting the program for greater parent engagement, and (c) improving logistics with the participating childcare centers. Focus group discussions, observations from the research and project team, and feedback from community and scientific advisory councils determined these main themes.

Standardizing curriculum. In advance of year 2, the coaching schema was updated with formalized coaching lesson plans, fidelity checks, a complementary teacher workbook and demonstration guides on how to use the AT. These were created in response to teachers who had requested additional structure in the content delivery. The lesson plans and workbooks ensured that the toolkit was implemented with fidelity across different classrooms, schools and academic years, even with additional AT coaches. These resources were available in print and on the Step Up AT website (www.StepUpAT.com) which participating teachers and parents could access with a username and password. In addition to the standardized curriculum, fidelity checks and adherence forms provided AT coaches a method to monitor the progress of teachers, teacher aides, and parents based on a quantifiable level of engagement and

participation. Furthermore, the project team incorporated an intensive workshop on how to use software, specifically Boardmaker®, to create visual supports, communication boards, and overlays for communication devices. Fidelity measures for coaches were also developed to ensure that the program was implemented as intended.

Strategies for parent engagement. This program targeted childcare centers located in underserved, low-resource communities. Barriers associated with underserved communities, although seen across all socioeconomic levels, may have interfered with overall parent participation (i.e. inflexible work schedules, transportation issues, childcare limitations, single parent households, etc.). Based on feedback and observation from year 1, the project team decided to modify the parent AT orientation workshop for year 2 to be more interactive and to facilitate hands-on practice with the AT tools and strategies. The 2-hour workshop was independent of an orientation on the program, and was offered twice per year, once in the fall and once in the spring, to accommodate schedules. Adding this workshop increased parent engagement from 14% to 41%, where parents watched at least one online module or attended one parent workshop.

To further encourage parent engagement, the project team created a “home-school connection” handout that fostered communication between teachers and parents related to the types of AT and how each child was utilizing AT in the classroom so that these practices could be translated to the home environment. Finally, AT coaches increased their use of free software to send group and individual text messages and made phone calls for more consistent communication with parents. It was determined that the parent requirements for participation needed to be more clearly presented during the consent and intake process at the onset of the program. These requirements included watching the 4 online modules, attending an orientation, attending the 2-hour AT workshop, reviewing the “home-school connection” forms, and completing all pre and post surveys for the program. Completing these requirements made parents or caregivers eligible for the Step Up AT gift basket previously described.

Improving program procedures. During the developmental phase of Step Up AT, the project team learned the necessity of ensuring that participating childcare centers have the appropriate technological resources—computers that function with software used in the AT toolkit, access to printers, and a strong wireless internet connection for an uninterrupted virtual learning experience. Furthermore, in the first year, one AT coach worked with ten classroom units; it was determined that this ratio was not feasible while implementing the full program in year 2, so fewer classrooms were enrolled with larger populations of children with disabilities.

Implementation – Year 2

During year 2 of the development phase, the Step Up AT team implemented the intervention from October 2017 through May 2018 at two VPK centers. The following components of the Step Up AT toolkit were implemented: (a) six teacher and four parent online learning modules; (b) teacher workbooks, AT demonstration guides, and access to the AT devices and resources through the classroom kit and Step Up AT Lending Library; (c) four coaching sessions per module; (d) one teacher and one parent Step Up

AT orientation; and (e) one Boardmaker® Share workshop for teachers and one 2-hour parent AT workshop.

In year 2, two AT coaches delivered the Step Up AT toolkit to six classroom units across two childcare centers. The team expanded the six teacher modules to be delivered across four weeks each, in order to offer four coaching sessions per module. The AT coach introduced a strategy and then modeled it, the teacher practiced the AT strategy, and then, one final coaching session allowed time to reflect and troubleshoot challenges teachers experienced in the integration of the AT tools and practices in the classroom. This last coaching session was established as a virtual session, utilizing the iPad® in the Step Up AT classroom kit and the teleconference software Zoom®. Pre-assessment data was collected prior to implementing the intervention in October 2017. Post-assessment data was collected and focus groups were conducted at the end of the school year in May 2018

Outcomes and Benefits from Year 2

Lessons learned from the second iteration of the Step Up AT toolkit are related to three main themes: (a) updates to the online learning system and modules, (b) adaptations to encourage further parent engagement, and (c) preparing the toolkit for dissemination so that the toolkit may reach a larger audience. Again, these were determined by focus group discussions, observations from the research and project team, and feedback from community and scientific advisory councils.

Updating the online learning system. After year 1, the community advisory council suggested that adjustments be made to the online learning modules so that they would meet accessibility criteria. Members provided insight regarding the need for high contrast colors and visuals, integrating alternative text to describe photos, as well as including voice narration throughout. These modifications were included in the 2018-19 iteration, year 3, of the online learning modules. The scientific advisory council suggested the Step Up AT team include demonstration videos to the website to further engage parents. It was also advised to create a list of Android® based applications that mirror the iOS® applications highlighted in the learning modules. These modifications were made in advance of year 3.

Strategies for parent engagement. The Step Up AT team learned that it was important to integrate the program into the already established offerings at each childcare center. During year 3 planning, if there were parent events or forms of communication already organized within the structure of the childcare center, Step Up AT looked to integrate program components with these institutional practices for long-term sustainability and adoption of practices. The team also began building partnerships with parent training and information centers who have a more established social media presence and relationships with families in the region. Parent engagement continued to increase, and in year 3, 52% of parents watched at least one module or attended one workshop.

In year 3, Step Up AT coaches started to track the fidelity of parent participation in each component of the program – attendance at workshops, completion of the online modules, interaction with the coach via email, text or the home-school connection form. Finally, the AT coaches created a plan to publish short

videos for parents on the online learning system to demonstrate the use of AT in the classroom. During focus groups, parents informed the team that due to busy schedules, shorter messages with electronic links to resources might be a better form of communication with families.

Preparing for dissemination. As the program evolved, the integration of virtual coaching sessions was utilized more frequently as a way to maintain the coaching dynamic while maximizing fiscal and personnel resources. After year 2, the scientific advisory council suggested adding demonstration videos or modules to serve as supplemental strategies for children with more profound disabilities. The idea was to expand the foundational video offerings, in order to leave more time for the AT coaches to provide targeted coaching in the classroom. Finally, booster sessions for previously participating centers were implemented to provide additional support as teachers continued to integrate AT strategies in the classroom.

Conclusion

Promoting inclusion and enhancing utilization of AT to support early literacy for preschoolers with disabilities should be an encouraged standard of practice in early childhood settings. Step Up AT provided extended training and coaching for teachers to learn and integrate AT best practices into daily classroom routines. This program utilized a multi-pronged approach to deliver professional development through virtual and in-person modalities. Specifically, it did this by providing teachers and caregivers a toolkit consisting of (a) online learning modules, (b) access to AT tools and resources, as well as (c) in-person and virtual coaching, while addressing the diverse language and cultural needs of South Florida.

During the development phase of the project, the interdisciplinary team implemented two iterations of the Step Up AT toolkit. A third iteration would be evaluated in a future wait-listed randomized-control study. Between years 1 and 2, and years 2 and 3, the project team worked to minimize barriers to parent and teacher participation by standardizing procedures, curriculum and fidelity measures, as well as modifying the delivery of workshops and coaching sessions. The accessibility features of the online modules and the use of virtual coaching were also improved. This development phase of Step Up AT allowed the team to formulate a well-designed professional development program that can be replicated for future evaluation and dissemination.

References

- Baker, F. S. (2014). Engaging in play through assistive technology: Closing gaps in research and practice for infants and toddlers with disabilities. In DaCosta, B. & Seok, S. *Assistive technology research, practice, and theory* (pp. 207-222). Hershey, PA: IGI Global.
- Barkley, E. F., Cross, K. P., & Major, C. H. (2005). *Collaborative learning techniques: A handbook for college faculty*. San Francisco: John Wiley & Sons.
- Beard, L. A., Bowden Carpenter, L. A., & Johnston, L. B. (2011). *Assistive technology: Access for all*

students (2nd ed.). Boston, MA: Pearson.

- Burne, B., Knafelc, V., Melonis, M., & Heyn, P. (2011). The use and application of assistive technology to promote literacy in early childhood: A systematic review. *Disability and Rehabilitation: Assistive Technology*, 6, 207-213. doi:10.3109/17483107.2010.522684
- Cardon, T. A., Wilcox, M. J., & Campbell, P. H. (2011). Caregiver perspectives about assistive technology use with their young children with autism spectrum disorders. *Infants & Young Children*, 24, 153-173. Retrieved from <https://www.learntechlib.org/p/50621/>
- Diamond, K. E., & Powell, D. R. (2011). An iterative approach to the development of a professional development intervention for Head Start teachers. *Journal of Early Intervention*, 33, 75-93. doi: 10.1177/1053815111400416
- Division for Early Childhood (DEC). (2014). *DEC recommended practices in early intervention/early childhood special education 2014*. Retrieved from <http://www.dec-sped.org/recommendedpractices> on March 31, 2016.
- Dunst, C. J., Bruder, M. B., & Hamby, D. W. (2015). Meta-synthesis of in-service professional development research: Features associated with positive educator and student outcomes. *Educational Research Reviews*, 10, 1731-1744. doi: 10.5897/ERR2015.2306.
- Dunst, C. J., Trivette, C. M., & Hamby, D. W. (2012). Assistive technology and the communication and literacy development of young children with disabilities. *Center for Early Literacy Learning*, 5(7), 1-13. Retrieved from http://www.earlyliteracylearning.org/cellreviews/cellreviews_v5_n7.pdf
- Early Childhood Technical Assistance (ECTA) Center. (2018). *Naturalistic instruction practices*. Retrieved from <http://ectacenter.org/decrp>.
- Federal Interagency Forum on Child and Family Statistics. (2012). *America's children in brief: Key national indicators of well-being*. Washington, DC: US Government Printing Office.
- Floyd, K. K., Smith Canter, L. L., & Judge, S. A. (2008). Assistive technology and emergent literacy for preschoolers: A literature review. *Assistive Technology Outcomes and Benefits*, 5(1), 92-102. Retrieved from <https://eric.ed.gov/?id=EJ884370>
- Friedman, M., Woods, J., & Salisbury, C. (2012). Caregiver coaching strategies for early intervention providers: Moving toward operational definitions. *Infants & Young Children*, 25, 62-82. doi: 10.1097/IYC.0b013e31823d8f12
- Hemmingsson, H., Lidstrom, H., & Nygard, L. (2009). Use of assistive technology devices in mainstream

schools: Students' perspective. *American Journal of Occupational Therapy*, 63, 463-472. Retrieved from <https://pdfs.semanticscholar.org/1e17/d9909229b7398632d05924707535875567af.pdf>

Hill, D. A., & Flores, M. M. (2014). Comparing the picture exchange communication system and the iPad™ for communication of students with autism spectrum disorder and developmental delay. *TechTrends*, 58(3), 45-53. doi: 10.1007/s11528-014-0751-8

Kaiser, A.P., Hancock, T. B., & Nietfeld, J. P. (2000). The effects of parent-implemented enhanced milieu teaching on the social communication of children who have autism. *Early Education and Development*, 11, 423-446. doi: 10.1207/s15566935eed1104_4

Kaplan, M., & Mead, S. (2017). The best teachers for our littlest learners: Lessons from Head Start's last decade. *Bellwether Education Partners*. Retrieved from https://bellwethereducation.org/sites/default/files/Bellwether_HeadStartWorkforce.pdf

Karlsson, P., Johnston, C., & Barker, K. (2017). Influences on students' assistive technology use at school: The views of classroom teachers, allied health professionals, students with cerebral palsy and their parents. *Disability and Rehabilitation Assistive Technology*, 1-9. doi: 10.1080/17483107.2017.1373307

Kreuter, M. W., Lukwago, S. N., Bucholtz, D. C., Clark, E. M., & Sanders-Thompson, V. (2003). Achieving cultural appropriateness in health promotion programs: Targeted and tailored approaches. *Health Education and Behavior*, 30, 133-146. doi: 10.1177/1090198102251021

Light, J., & McNaughton, D. (2012). Supporting the communication, language, and literacy development of children with complex communication needs: State of the science and future research priorities. *Assistive Technology*, 24(1), 34-44. doi: 10.1080/10400435.2011.648717

McCray, E. D., Brownell, M. T., & Lignugaris, B. (2014). *Handbook of research on special education teacher preparation*. New York, NY: Routledge.

Milbourne, S. A., & Campbell, P. H. (2007). *CARA's kit: Creating adaptations for routines and activities*. Child and Family Studies Research Programs, Thomas Jefferson University.

National Association for the Education of Young Children (NAEYC) & the Fred Rogers Center for Early Learning and Children's Media. (2012). Technology and interactive media as tools in early childhood programs serving children from birth through age 8. Retrieved from https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/topics/PS_technology_WEB.pdf

National Institute for Early Education Research (NIEER). (2006). Early literacy: Policy and practice in the

preschool years (Preschool Policy Brief, 10). New Brunswick, NJ: Strickland, D., & Riley-Ayers, S. Retrieved from <http://nieer.org/wp-content/uploads/2016/08/10.pdf>

National Institute for Early Education Research (NIEER). (2011). Degrees in context: Asking the right questions about preparing skilled and effective teachers of young children (Preschool Policy Brief, 22). New Brunswick, NJ: Whitebrook, M., & Ryan, S. Retrieved from <http://nieer.org/wp-content/uploads/2016/08/23-2.pdf>

National Institute for Literacy. (2009). Early beginnings: Early literacy knowledge and instruction. Washington, DC. Retrieved from <https://www.nichd.nih.gov/publications/pubs/documents/NELPEarlyBeginnings09.pdf>

Neuman, S. B., & Cunningham, L. (2009). The impact of professional development and coaching on early language and literacy instructional practices. *American Educational Research Journal*, 46, 532-566. doi: 10.3102/0002831208328088

Nikolopoulou, K., & Gialamas, V. (2015). ICT and play in preschool: Early childhood teachers' beliefs and confidence. *International Journal of Early Years Education*, 23, 409-425. doi: 10.1080/09669760.2015.1078727

Parette, H. P., & Stoner, J. B. (2008). Benefits of assistive technology user groups for early childhood education professionals. *Early Childhood Education Journal*, 35, 313-319. doi: 10.1007/s10643-007-0211-6

Rogers, S. J., & Dawson, G. (2010). *Early Start Denver model for young children with autism: Promoting language, learning, and engagement*. New York, NY: Guilford Press.

Rush, D., & Shelden, M. (2011). *The early childhood coaching handbook*. Baltimore, MD: Paul H. Brookes.

Satterfield, B. (2016). History of assistive technology outcomes in education. *Assistive Technology Outcomes and Benefits*, 10(1), 1-18. Retrieved from https://www.atia.org/wp-content/uploads/2016/11/ATOBN1V10_ART1.pdf

Simpson, C. G., McBride, R., Spencer, V. G., Lowdermilk, J., & Lynch, S. (2009). Assistive technology: Supporting learners in inclusive classrooms. *Kappa Delta Pi Record*, 45, 172-175.

Smith, S. B. & Smith, J. S. (2004). Technology integration solutions: Preservice student interns as mentors. *Assistive Technology Outcomes and Benefits*, 1(1), 42-56. Retrieved from <https://www.atia.org/wp-content/uploads/2015/10/ATOBV3N1.pdf>

Stanger, C., Mims, P., Wood, L., & Ahlgrim-Delzell, L. (2016). Supporting literacy achievement for

students with intellectual disability and autism through curricular programs that incorporate assistive technology. *Assistive Technology Outcomes and Benefits*, 10(1), 51-73. Retrieved from https://www.atia.org/wp-content/uploads/2016/11/ATOBN1V10_ART4.pdf

Teale, W. H., Hoffman, J., & Paciga, K. (2014). What do children need to succeed in early literacy—and beyond? In K. Goodman, R. Calfee, & Y. Goodman (Eds.), *Whose knowledge counts in government literacy policies? Why expertise matters* (pp. 179-186). New York: Routledge.

United States Census Bureau. (2017). QuickFacts: Miami-Dade County, Florida; Broward County, Florida; Florida. Retrieved from <https://www.census.gov/quickfacts/fact/table/miamidadecountyflorida,browardcountyflorida.fl#>

U.S. Department of Education. (2015). 37th Annual report to Congress on the implementation of the Individuals with Education Disabilities Act (Volume I). Washington D.C. Retrieved from <http://www2.ed.gov/about/reports/annual/osep/2015/parts-b-c/index.html#download>

Wilcox, M. J., Dugan, L. M., Campbell, P. H., & Guimond, A. (2006). Recommended practices and parent perspectives regarding AT use in early intervention. *Journal of Special Education Technology*, 12(4), 7-16.