frontiers | Frontiers in Education

ORIGINAL RESEARCH
published: 13 April 2022
doi: 10.3389/feduc.2022.806665

Augmentative and Alternative Communication in the Context of Dramatic Storytelling: A Single-Case Study of a Pre-schooler With a Cochlear Implant

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This single-case study of a pre-schooler with a cochlear implant aimed to integrate an Augmentative and alternative communication (AAC) intervention with dramatic storytelling activities to improve Jenny's receptive and expressive language ability and communication skills as a means to address her communication needs. The researcher developed a functional communication image-text vocabulary list of 50 items with five categories: people, social interactions, animals, colors, and frequently used verbs. The intervention was conducted during the regular school day in the corner of a regular classroom 3 days a week for 6 weeks. This study demonstrated that AAC developed during dramatic storytelling activities helped Jenny to improve the effectiveness of functional communication vocabulary learning and increase the frequency of oral language communication. Group dramatic storytelling provides opportunities for learning through peer imitation during naturally occurring activities as well as ones for intentional and systematic AAC instruction during activities.

Keywords: pre-school inclusion, dramatic storytelling, AAC, early intervention, communication

OPEN ACCESS

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Specialty section:
This article was submitted to Special Educational Needs, a section of the journal Frontiers in Education

Received: *01 November 2021*
Accepted: *01 March 2022*
Published: *13 April 2022*

Citation:
Wu J and Xie Y (2022) Augmentative and Alternative Communication in the Context of Dramatic Storytelling: A Single-Case Study of a Pre-schooler With a Cochlear Implant. Front. Educ. 7:806665. doi: 10.3389/feduc.2022.806665

INTRODUCTION

Augmentative and alternative communication (AAC) has been defined as "attempts to study and compensate for temporary or permanent impairments, activity limitations, and participation restrictions of persons with severe disorders of speech-language production and/or comprehension, including spoken and written modes of communication" (American Speech-Language-Hearing Association, 2005, p. 1). For children with communication disorders so severe that they cannot communicate through speech to meet all their communication needs, AAC has been an effective outlet for the fundamental human connection that all children need to thrive (Page and Quattlebaum, 2012). Portable communication devices have enabled users to purchase or customize applications according to their needs. Individuals who have needed pictorial or written supports to assist with language comprehension and/or emotional regulation also have used AAC (Mirenda, 2013). Low-tech strategies have been adopted for classroom use (Downey et al., 2004; Østvik et al., 2017). Additionally, young people have used AAC to adapt to internet and online social media. AAC also has been effectively implemented for emergent purposes in critical care settings (Frueh, 2013; Hynan et al., 2015; Handberg and Voss, 2017).

For many young children and adults with autism (Sigafoos and Drasow, 2001; Mirenda, 2003; Schlosser and Wendt, 2008) and intellectual disabilities (Jones, 2004), and adolescents with cerebral palsy (Saturno et al., 2015), AAC systems—such as no-tech manual signs, graphic symbols, and high-tech voice output communication aids—have been used to supplement existing speech or alter expressive communication.

The appropriateness of AAC supports for individuals with severe communication difficulties can be determined through an interdisciplinary assessment (Mirenda, 2013) that includes considerations of clinical and educational needs as well as the individual's financial situation. It is essential to assess the user's social, physical, and personal needs to determine the appropriate assistive technology (Pousada et al., 2011). Static boards with symbols have proven to be the most widely used devices. The complex health, motor, sensory, learning, and communication needs of children with cerebral palsy demand assessments from a multidisciplinary perspective (Clarke et al., 2016). Furthermore, family members' attitudes toward the use of AAC, as well as the parents' perceptions of the importance of communication, have been associated with AAC intervention effectiveness.

Studies have shown that parents' perceptions of the importance of communication were strongly associated with the development of receptive language in early intervention for children with cerebral palsy, and that expressive language demonstrated the strongest influence on AAC intervention decisions (Schladant, 2011; Smith and Hustad, 2015). Schlosser and Wendt (2008) conducted a systematic review of the effects of AAC intervention on speech production in children. They found that AAC intervention did not impede speech production. On the contrary, numerous studies have shown that AAC strategies improved the development of speech and increased speech production (Millar et al., 2006; Binger and Light, 2007; Schlosser and Wendt, 2008; Dada and Alant, 2009; Page and Quattlebaum, 2012; Nasfikur et al., 2017).

Most of the research on young children with severe communication disabilities has focused on AAC interventions with direct instruction. However, pre-schoolers—especially those enrolled in special education—have been shown to benefit from a combination of explicit instruction and naturalistic learning (Lonigan et al., 2011; Wolery and Hemmeter, 2011; Green et al., 2018). Activity-based interventions have provided opportunities for naturalistic learning.

This study focused on a variety of AAC interventions integrated with children's dramatic storytelling. Dramatic storytelling includes movement, improvisation, still images, role playing, emotional awareness, and many other elements. The integration of language learning and drama has proven successful among young children (Winston and Tandy, 2009, 2012). A dramatic storytelling group context provides opportunities for peer imitation (Barton and Ledford, 2018; Wu and Vomocilová, 2019; Wu et al., 2020) and learning as well as intentional and systematic AAC instruction within naturally occurring activities. Children with special needs also benefit in many ways from the multi-sensory information input that characterizes educational drama. The act of imitating dialogue, original speech, communication, and conversation are main activities utilized in AAC interventions. This study focused on the AAC interventions in the context of group dramatic storytelling for a pre-schooler with severe communication difficulties and a unilateral cochlear implant. Early intervention in special education has benefited substantially from the findings of studies using single-case research methods. The changes in a single individual identified through continuous assessments and evaluation may provide important insights (Wolery et al., 2011). The evidence-based practices that have emerged from single-case experimental methods have been recommended by the Division for Early Childhood [DEC (Odom and Strain, 2002; Sandall et al., 2005; Wolery et al., 2011)]. This study contributes to the existing literature on AAC in early interventions for children with severe communication disorders in inclusive classroom settings.

The purpose of this study was to use AAC to help Jenny master functional communication in two main areas: (1) identification of target functional image-text vocabulary, and (2) ability to express target functional image-text vocabulary using a communication pen called E-read. It has the function of recording, identifying, and reading. Another application called Listen and Talk (LAT) (2022) was also used for communication in the present study. The goal for both tasks was a rate of 80% correct. A second objective was the generalization of functional communication vocabulary.

RESEARCH METHODS

A 60-min assessment, the Mullen Scales of Early Learning (Mullen, 1995) for 5-year-old children, was administered to determine Jenny's receptive and expressive language age. A non-standardized scale also was used to assess her vocabulary preparation. The study included non-standardized assessment tools including a "functional vocabulary pre-test scale," "functional communication vocabulary scale," and an "observational record table for generalization." The functional vocabulary pre-test scale included basic frequently-used vocabulary, which was used for measuring Jenny's functional vocabulary. The functional communication vocabulary scale included additional words, which were used to measure her usage of functional communication vocabulary during the intervention. The researcher determined the communication content that Jenny had yet to master through conversations with her tutor and speech therapist. The researcher developed a vocabulary list of 50 items with five categories: people, social interaction, animals, colors, and frequently-used verbs. The vocabulary chosen was based on the story of *The Frog Prince* because Jenny's class was planning for a short drama production of that work.

The intervention was introduced after the baseline condition (Lane et al., 2007) was established. The impacts of the intervention were then assessed, and the intervention was again conducted. The intervention was conducted during the regular school day in the corner of a regular classroom three times a week (Monday, Wednesday, and Friday) for 6 weeks. One session contains three times, and took place each week. Each session lasted for 40 min, and all sessions were recorded on video. The first intervention began the second Monday following

the completion of the initial pre-tests. The researcher conducted 30 min of instruction on functional communication graphics for Jenny during each session. The remaining 10 min were spent on an assessment of learning outcomes. During the final week of the study, the entire class performed a dramatic telling of *The Frog Prince*. The integration of AAC instruction and drama activities permitted the researcher to make observations in distinct settings.

The researcher was accompanied by a speech therapist. Both the researcher and the speech therapist collected and recorded the data. The researcher measured the percentage of functional communication vocabulary that Jenny mastered. Once Jenny's improvements plateaued, a new intervention phase began. Interobserver reliability and visual analysis were derived from the data records and video recordings. During the generalization phase, the researcher used qualitative description, quantitative analysis from the video recording, and data from an in-depth interview of a focus group's participants to assess social validity. The participants included Jenny's tutor, parents, and speech therapist. The researcher conducted an in-depth interview that lasted for 2 h in the school's office. The interview included questions such as, "how would you describe Jenny's daily performance in classroom settings, family situations, and other public places?" The data collected was recorded and analyzed using key word coding.

Participant and Settings

Jenny was a 5-year-old girl with a severe hearing impairment. She received a unilateral cochlear implant when she was 2 years and 5 months old (see **Table 1**). The classroom setting was a familiar research teaching situation. This inclusive classroom setting included 35 children aged four to five with age-appropriate development, as well as one main tutor, one assistant teacher, and a nursing educator. She was there for 8 months. The researcher observed Jenny's communication behaviors in interactions with classmates and tutors prior to conducting the AAC intervention. Jenny could respond to her name as well as to verb- and noun-related single instructions in real life situations. She demonstrated a strong willingness to use her voice and to mimic a recorded voice. She also could pronounce single sounds or similar sounds, but with poor articulation. From her speech therapist's report, motor speech disorder was the reason for her difficult pronunciation. And Jenny needed more opportunities for successful communication to increase her motivation to initiate interactive communication with others. The tutor assigned all classmates to be her helper and communication partner. Her communication partner often tried to understand what she had said by guessing. However, her parents reported that she would become frustrated when people would guess what she wanted to say. Consequently, she would refrain from oral expression in her interactions with unfamiliar communication partners. Jenny frequently resorted to body movements and directed gaze to express her needs, as well as agreement and/or rejection. When she was in a bad mood, she would not interact with intimate family members and tutors in school. Jenny's family was able to understand her better than the peers and tutors in her class.

TABLE 1 | Participant description.

Name	Jenny
Child age in years	5
Ethnic origin	Chinese
Family income	US$22,000
Family size	5
Mother/father education	College graduate (both)
Home language	Mandarin Chinese
School language	Mandarin Chinese
Education setting	Inclusive kindergarten
Onset of hearing loss	From birth
Hearing loss degree	110 dB
Age of implantation	2 years and 5 months
CI implantation	Unilateral
CI frequency of use	Always
Receptive language[a]	3
Expressive language[a]	2

CI, Cochlear implant.
[a]*From Mullen scales of early learning (Mullen, 1995).*

Communication Aids

Augmentative and alternative communication provides a way for people with severe communication disorders to learn to communicate. Because Jenny could directly point to, click on, or press targeted graphics, direct selection was implemented throughout the intervention. The researcher employed E-read and an application LAT. Guangzhou Childhood Technology Co., Ltd. (2008) was used in the beginning of generalization. LAT permitted efficient communication throughout the other parts of the study. The researcher used LAT to design six communication layouts with the target 50 image-text functional communication graphics. The layout design was guided by the storytelling of *The Frog Prince* and related dramatic activities. The research took into consideration several principles for the layouts. Frequently used vocabulary was placed in the top row, from left to right. The graphics that were used less frequently had color labels (Thistle and Wilkinson, 2009) that corresponded to the categories of people, verbs, and social vocabulary. The researchers compiled 5×10 grids according to the communication content, and six layouts (see example in **Figure 1**) that contained a total of 50 functional communication vocabulary words. Colorful image-text graphics made the communication layouts attractive to Jenny. The classmates also were interested in communicating with Jenny; when they held conversations with her, they looked at her closely and even had the opportunity to click on some buttons.

For the first two layouts, graphics were placed vertically with two corresponding target words to help focus Jenny's attention. For the advanced communication intervention conducted later in the study, an E-read pen was used. The pen had a voice output and record function to assist with automatic pronunciation. The researcher helped Jenny understand how to operate the communication pen (for example, how to turn it on and off, adjust the volume, and ask for help) and click on the functional

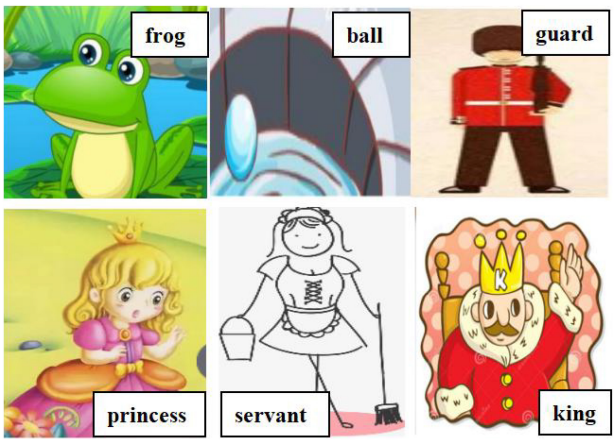

FIGURE 1 | Layout of functional character graphics.

communication graphics. The researcher contacted one of Jenny's classmates and recorded the classmate's voice as the output generated by the communication pen.

Visual Analysis

The researcher collected data from the baseline period (the first week), as well as from the time of intervention to generalization (from the second to sixth week). A visual analysis was developed to present the trend of development, the change between data points, and to conduct a data analysis of each phase and between phases. The purpose of visual analysis was to indicate the stability of data from the same phase. There were a number of principles that guided the analysis. First, the phase length was the duration of a specific phase. Second, a minimum of three data points was recorded for each phase to determine trends and levels of stability. Stability existed when 80–90% of data points fell within 15% of the trend line. The research continued to the next phase only once the trend showed a stable pattern of effectiveness regarding functional communication graphics. Third, the level change indicated the improvement or regression from one phase to the next. Change was calculated by subtracting the value of the first data point from the last one in the same phase. The visual analysis between phases indicated the change that occurred following the intervention. The level change was measured within each phase. Fourth, the trend of change represented a comparison of two adjacent phases. Finally, the overlap of data points between two adjacent phases also was calculated. A lower percentage of overlap indicated a greater effect of the intervention.

Inter-Rater Agreement

Inter-rater agreement was determined using video recordings of each intervention session that were scored by both Jenny's speech therapist and the researcher. The researcher trained the speech therapist on the appropriate way to score. At the end of each intervention, the efficiency of Jenny's learning of targeted functional communication graphics was evaluated by observers. The two observers simultaneously and independently evaluated the same communication events. Results from each observer were chosen for addressing inter-rater agreement. The formula used to calculate the percentage of agreement (95%) was as follows:

Agreement frequency ÷ (Agreement frequency + Disagreement frequency) × 100% = Inter-rater agreement.

RESULTS

The intervention was divided into five phases: identification of functional communication graphics representing characters or social words, identification of functional communication graphics representing verbs or nouns, use of the communication pen, use of and LAT, and generalization of functional communication graphics. At the end of the intervention period, Jenny was able to identify the target of 50 functional communication vocabulary words. The researcher divided the number of words used correctly by the total number of 50 to calculate the percentage. Findings from the initial baseline and intervention period were recorded separately. **Figure 2** illustrates Jenny's ability to recognize functional communication graphics following the AAC interventions.

Figure 2 illustrates consistent improvement and accuracy of Jenny's responses over time. At baseline (A), Jenny could not recognize functional communication graphics. During Phase B1 Jenny could recognize only 20–30% functional communication graphics. During the final phase, B5, the percentage changed from 95 to 100%. She was able to finish the task, acquire vocabulary, and recognize image-text functional communication graphics soon after intervention. Jenny needed little assistance for words with which she was unfamiliar during the course of the exercise. During the first phase of the intervention, Jenny communicated with only two peers. However, by the final phase of intervention, she spontaneously participated in drama activities with five other children. Additionally, Jenny became quite flexible in using the different expressive language modes available to her for communication. She shifted from using the communication pen to oral speech with gestures and body movements. At times she would speak while making facial expressions. Moreover, she offered help to others during the dramatic storytelling activities.

Table 2 shows a visual analysis of the internal phase changes in the identification of functional communication vocabulary. Within each phase, the trend and level remained stable (100%). At baseline (A), the level change was 0% and the mean value was zero. During Phase B1 there was a level change from 20 to 30, for a mean value of 27. From the table, the trend increased in all phases from phase B2 through B5. During Phase B2, the trend increased and the level changed from 35 to 40, with a mean value of 37. During Phase B3, the level changed from 58 to 68 and the mean value was 64. In Phase B4, the level changed from 78 to 90 and the mean value was 86. During the final phase, B5, the level changed from 95 to 100, with a mean value of 97.

Table 3 illustrates a consistent increase between subphases from baseline to the post-intervention scores. From baseline to B1, the level score changed from zero to 30. The trend from phase B1 to B2 was stable and positive with a change in score from 30 to 40. The trend between B2 and B3 remained stable

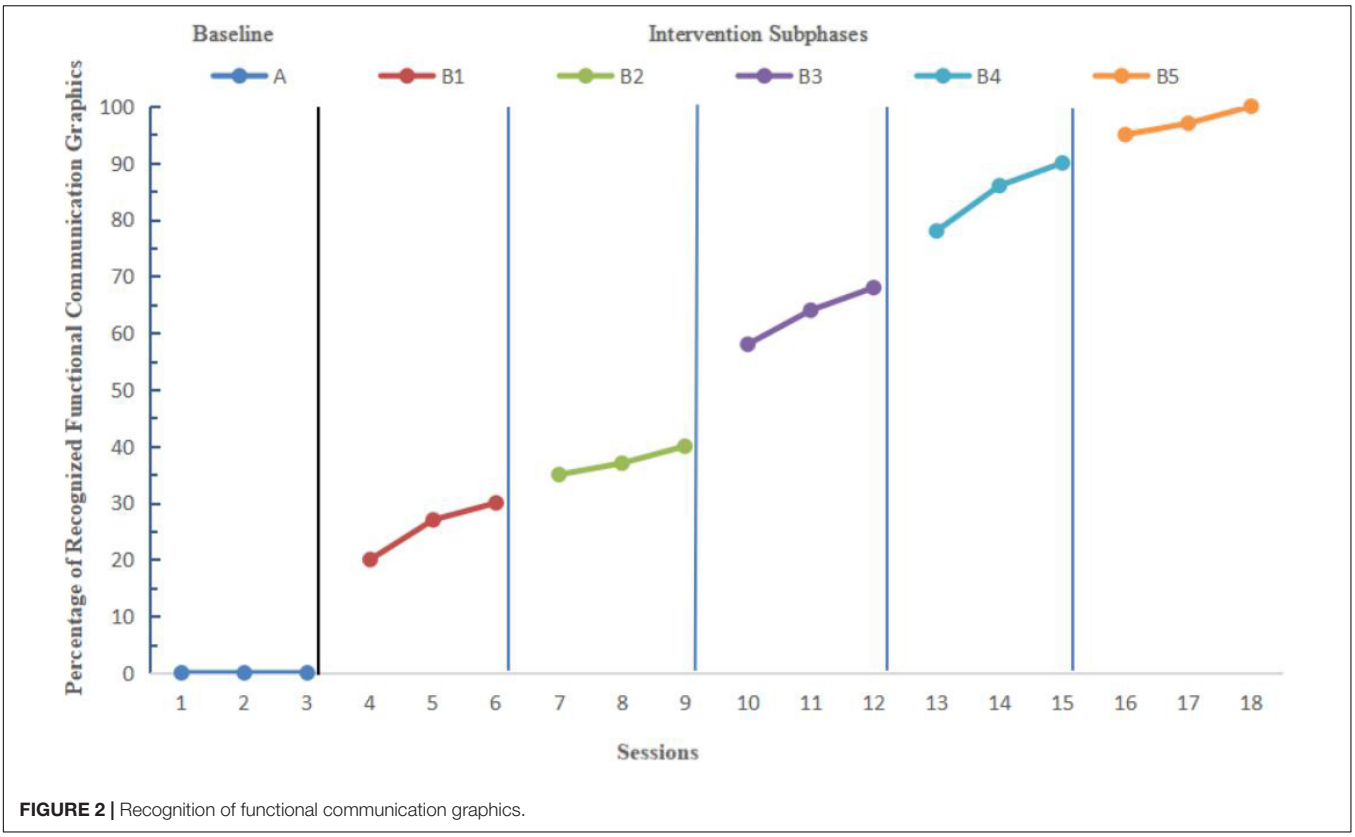

FIGURE 2 | Recognition of functional communication graphics.

and the score went from 40 to 68. There were similar results for the analysis of data points from phase B3 to B4 and from B4 to B5. Jenny became distracted or tired after activities of more than 11 min. The absence of overlap indicates that Jenny achieved learning efficacy of functional communication vocabulary during each subphase of the intervention.

Three questions guided the follow-up interviews conducted with the focus group. The group participants noted that Jenny's speaking was "sporadic," "unclear," and incomprehensible." The parents were concerned that the use of the communication pen would decrease Jenny's oral expression, "because the communication pen generates sound instead of the child. . . the child will be too lazy to speak out." However, the study revealed that Jenny became more confident when she could say many words, and she was able to articulate them more clearly than before. Often when Jenny was using the communication pen to click on a grid, she would think about how to pronounce a word before the device emitted a sound. She also would correct her pronunciation. The vocabulary Jenny learned helped her to express herself during the storytelling and generate words in varied situations according to her needs.

TABLE 2 | Functional communication vocabulary recognition (individual subphases).

	Baseline	Subphases of intervention phase				
	A	B1	B2	B3	B4	B5
Data points	3	3	3	3	3	3
Trend	→	→	↗	↗	↗	↗
Trend stability	Stable	Stable	Stable	Stable	Stable	Stable
Level change	0–0	20–30	35–40	58–68	78–90	95–100
Level stability	Stable	Stable	Stable	Stable	Stable	Stable
Mean value	0	27	37	64	86	97

Generalization of Functional Communication Vocabulary

The researcher classified and summarized data on communication mode and oral expression, as shown in **Tables 4**, **5**. The data demonstrate that Jenny could spontaneously speak 100% of the characters and social words following AAC interventions. She also spoke 60% of the verbs and 75% of the nouns. In the final phase, she used LAT as a main communication supplement to interact with her friends. Following the application of AAC in drama activities, Jenny quickly learned to use the communication pen. The overall number of communication expressions steadily increased during the intervention phases. The communication pen increased opportunities for successful communication. Jenny expressed the major part of her communication using her own voice and that of the communication pen, instead of using simple gestures or movements. According to recorded data, the overall number of oral expressions increased from 28 to 78 following the AAC interventions. Additionally, spontaneous vocabulary use increased significantly during the dramatic storytelling activities.

Characters

Prior to the intervention, Jenny could only articulate "frog" and "little princess," and her peers could not understand her pronunciation. From her parents' feedback, that experience of not being understood frustrated her and decreased her motivation to initiate interactive communication with others. Following the intervention, she could communicate successfully in a variety of ways. At the beginning of the study, Jenny would use only her fingers to click on the communication graphics. She learned to use the communication pen's voice output to communicate with her peers. The additional support that she received from the communication aids encouraged her peers to communicate with her. She no longer used only movements or gestures for communication. By the final phase of the intervention, Jenny was able to call out the researcher's name as well as the words "frog prince," "princess," "king," and "servant." She was more likely to use gestures when referring to herself. Interestingly, Jenny often would mimic the voice of the communication pen or the LAT application.

TABLE 3 | Functional communication vocabulary recognition (between subphases).

	Subphases of intervention phase				
	A-B1	**B1-B2**	**B2-B3**	**B3-B4**	**B4-B5**
Trend	↗	↗	↗	↗	↗
Trend stability	Stable	Stable	Stable	Stable	Stable
Level change	0–30	30–40	40–68	68–90	90–100
Range gap	30	10	28	22	10
Overlap (%)	0	0	0	0	0

TABLE 4 | Communication mode following augmentative and alternative communication interventions.

Communication mode	**Functional communication vocabulary**			
	Characters	**Social words**	**Verbs**	**Nouns**
Gestures			5%	
Graphics				
E-read pen				
Listen and Talk (LAT), 2022			35%	25%
Spoken language	100%	100%	60%	75%
Total	100%	100%	100%	100%

TABLE 5 | Oral expression following augmentative and alternative communication interventions.

Oral expression	**Functional communication vocabulary**			
	Characters	**Social words**	**Verbs**	**Nouns**
Imitation from AAC aids			8%	5%
Spontaneous speech	100%	100%	92%	95%
Total	100%	100%	100%	100%

Social Vocabulary

Prior to the intervention, Jenny primarily relied on body movements and gestures to express herself. For example, she nodded to indicate "yes" and bowed to indicate "thank you." When she wanted to ask for help, she touched a person's shoulder to get their attention. After the intervention, Jenny used the communication pen and also would speak phrases such as "please do me a favor" and "thank you." Jenny's favorite picture cards were selected as fortifiers.

During the dramatic storytelling activities, Jenny initiated conversation and sometimes spontaneously improvised. For example, she once said that she was a fairy in the forest who loved to play with the little princess. She would use the functional communication verb "I want," and would verbalize or use the communication pen to say "thank you" after having received assistance. Her social vocabulary was more generalized and skillfully used than other functional communication vocabulary such as characters, verbs, colors, and animals. This could be because social vocabulary is more frequently used in her daily life.

Nouns

Jenny loved many different animals and would imitate their sounds. For example, she pronounced "woof woof" for puppy, and "quack quack" for duck, but she did not pronounce the words "puppy" or "duck" properly. Animals with three-word names, such as "da xiong mao (giant panda)" were difficult for her to say. Following the intervention, Jenny used the communication pen and imitated functional animal vocabulary. During the generalization phase, Jenny practiced functional animal vocabulary and articulation of that vocabulary by playing hopscotch with spaces represented by characters such as the frog prince and little princess from the dramatic storytelling activities.

Verbs

Before the intervention, Jenny had a weak understanding of verbs but was able to follow instructions to jump, smile, sit, or stand. However, her age peers could not understand when she spoke. Therefore, Jenny often depended on gestures to communicate. Verbs used in this study included "jump," "swim," "drink," "run," "skip," "open," "close," "lie," "promise," and "marry." Jenny began to correctly recognize these image-text verbs in a short period of time. In addition to correctly identifying the graphics, she used the E-read pen and the LAT application for generalization. She chose the role of the little princess in the dramatic storytelling activities and had dialogues with the frog prince.

In the final phase of intervention, Jenny and her peers presented a short play based on the story of the frog prince. The dramatic storytelling activity provided a natural opportunity for children to communicate spontaneously as would happen in real-life experiences. Jenny played the role of little princess during the first act. She was playing with a golden ball in the forest. She threw her ball high up into the sky and then lost it in an old well. She cried and asked for help. She had a short conversation with a frog swimming in the well. She promised the frog that if he would help her, she would eat

from the same plate, drink from the same cup, and sleep on the same bed with him. Jenny correctly used a total of 12 observed functional communication vocabulary components during that exchange, with social vocabulary being the most frequently used.

During the second act, there was an exchange between the frog and the little princess. When the princess was eating with her father, the king, the frog arrived and knocked at the door. Then the little princess kept her promise under the king's strict instructions. Jenny used communication appropriately in this whole act.

In follow-up interviews, the focus group participants reported that Jenny had mastered most of the functional communication vocabulary and had become more flexible in her ability to express herself in school settings. Jenny learned to use LAT to meet her communication needs.

DISCUSSION

This single-case study of a pre-schooler with cochlear implant was designed to integrate AAC instruction and dramatic storytelling activities as a means to help the child overcome her severe communication difficulties. The interventions used functional communication graphics, the E-read communication pen, and a LAT application to improve her receptive and expressive language abilities. For the first 5 weeks, the researcher focused on target functional communication words, and in the final week the focus was on generalization and flexible use in dramatic storytelling activities.

After working with AAC and engaging in dramatic storytelling activities, Jenny was able to use the communication pen to match, identify, and speak target functional communication vocabulary. The video recordings were analyzed to identify expressive language use, including spoken communication, gestures, and the use of communication aids. Jenny became more flexible and confident in her use of spoken language in interactions with others to meet her communication needs. Jenny was able to learn functional communication vocabulary.

Previous research also has identified effective vocabulary acquisition with AAC interventions (Millar et al., 2006; Binger and Light, 2007; Stephenson, 2007; Schlosser and Wendt, 2008; Page and Quattlebaum, 2012; Nasfikur et al., 2017). The use of AAC including the communication pen has been shown to improve the sustained communication ability of children with severe communication deficits (Binger and Light, 2007).

In this case study, the AAC intervention improved Jenny's expressive language. The use of AAC together with participation in dramatic storytelling activities enabled Jenny to initiate interactive communication in the context of a group play. In natural interactive activities, the intervention of AAC with speech output has improved the vocabulary acquisition of children with intellectual disabilities (Green et al., 2018). A dramatic storytelling context provided the complexity and diversity of communication interactions for establishing communication competence and to maximize natural speech and language skills (Frankoff and Hatfield, 2011). The communication aids used in this study facilitated Jenny's engagement in enjoyable dramatic play on equal terms with her peers. Jenny's initiation of activities and spontaneous use of vocabulary in the storytelling also increased significantly. The generalization of functional communication vocabulary, including generalization vocabulary of characters, social words, nouns, and verbs appeared in the dramatic storytelling activities as well. Jenny's successful experience could serve to alleviate concerns that AAC interventions necessarily result in diminished speech production.

In summary, this study demonstrated that a child with a severe communication disability could benefit from AAC interventions. The AAC aids improved both active and passive communication abilities as well as generalized expression in a pre-schooler with a cochlear implant and severe communication disorders. The results showed that when AAC was integrated into dramatic storytelling activities, Jenny was able to combine functional communication vocabulary with a learning experience to improve the effectiveness of learning functional communication vocabulary and increase the frequency of oral language communication. Following the AAC intervention, Jenny quickly learned to operate the communication pen and use it for communication. The amount of speech that she was able to imitate also increased.

LIMITATIONS

Several limitations of this study merit mention. First, it was conducted on a single pre-schooler who had a cochlear implant and severe communication disorders, and so the sample is not representative of all pre-schoolers with disabilities. A larger sample of pre-schoolers with disabilities could provide additional evidence-based information regarding the effectiveness of this intervention. Also, the specific situation and physical and intellectual challenges of each individual should be taken into consideration when choosing AAC aids. For example, individuals who are paralyzed from the neck down could benefit from assistive technology designed to increase, maintain, or improve existing functional capabilities. Future studies also could target pre-schoolers with severe communication difficulties combined with Down syndrome, autism spectrum disorder, or cerebral palsy to see whether interventions could produce similar changes.

Additionally, this study did not examine change over an extended period of time. The research period lasted for only 6 weeks. Future studies could be longer and track the permanence of observed changes in communication skills. Finally, the vocabulary list could have been more extensive. This study focused on 50 image-text functional communication graphics from the vocabulary that appears in the story *The Frog Prince*. The vocabulary included characters, verbs, colors, and animals that are used frequently in pre-school classrooms. Nevertheless, additional settings could be explored from which to glean appropriate vocabulary. A larger vocabulary

list could increase the opportunities for generalization in different settings.

Implications

This study's focus on the improvement of practices oriented toward pre-schoolers with severe communication disabilities, their families, and professionals contributes important understandings to the field of early intervention. Interdisciplinary approaches could prove useful in different situations. In this study, the use of AAC aids was pursued in1 conjunction with attention to the ways that other participants in the environment responded to individuals who used those aids. At times, Jenny did not rely on any technological device. There were times when she used low-tech and high-tech communication aids. This varied use of aids demands specialized guidance on the part of professionals who attend to children with communication disorders. The use of AAC to support individuals with severe communication disorders demands an interdisciplinary assessment to determine the modality most appropriate for each person (Mirenda, 2013). These should include considerations of the individual's clinical status, educational needs, economic situation, and family members' attitudes. For example, attention to the complex health, motor, sensory, learning, and communication needs of children with cerebral palsy would require an AAC assessment and intervention from a multi-disciplinary perspective (Clarke et al., 2016). Additionally, children's speech production has improved the most when their caregivers have used AAC strategies to support language development. Healthcare providers are uniquely positioned to help identify and support children with severe communication difficulties. They could begin by helping caregivers to access AAC services for these children (Page and Quattlebaum, 2012). It is need bear that although many individuals in early care centers could benefit from AAC intervention and services, understaffing in early intervention settings precludes the implementation of these strategies (Cress, 2002).

Care should be taken in the choice of the AAC modality. Regardless of whether an AAC device is purchased new, modified, or customized, it should be light, small, and portable. Usually, a high-tech AAC device has a voice output function. The voice output function not only provides feedback on the individual's voice, but also increases speech stimulation. That feature could be appealing for individuals interested in developing an ability to imitate speech. Individuals also could choose a user-friendly and universally designed computer-based solution to use with software applications that have updates to meet their complex communication needs. These computer-based products frequently are designed to assist people with severe communication disorders to improve the quality of their communication.

The study demonstrated that the selection of the story should be intentional and purposeful. The participant may be distracted by a boring story. Does the story allow for play? Do the characters allow for critical conversations? Teachers should read through the story to choose functional communication contents and vocabulary. Once the story is chosen, the teacher could select characters/roles and situations/plots with which the pre-schoolers could engage. The drama activities in this study were created using inexpensive materials that may be typically found in pre-school classrooms, such as construction paper, color pencils, puppets, and dolls. The choice of communication contents also could be objects found in the individual's daily life or adopted from their daily routine. They should be familiar to the children. The design of functional communication graphics or words must match with individuals' cognitive characteristics. For the individuals with severe intellectual disabilities, fully transparent color pictures would be easier for them to recognize. On the contrary, words or other abstract communication symbols could be used for individuals who have typical or even gifted intelligence. In the early part of an intervention, it would be best to use an appropriate number of functional communication graphics to avoid frustrating the participants with too much information.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University Committee on Human Research Protection. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

Both authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

FUNDING

We disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by grants from Guizhou Humanities and Social Sciences Project (No. 2020QN027), Guizhou Provincial Project (No. 2021SCJZW05), Ministry of Education of the People's Republic of China (No. 2021120040), and National Social Science Foundation Project (No. 20BYY093).

ACKNOWLEDGMENTS

We thank Jenny and other respondents who participated in the study for their important contributions.

REFERENCES

American Speech-Language-Hearing Association (2005). *Roles and Responsibilities of Speech-Language Pathologists with Respect to Augmentative and Alternative Communication: Position Statement*. Available Online at: http://www.sac-oac.ca/sites/default/files/resources/aac_position-paper_en.pdf [accessed August 13, 2021].

Barton, E. E., and Ledford, J. R. (2018). Effects of reinforcement on peer imitation in a small group play context. *J. Early Interv.* 40, 69–86. doi: 10.1177/1053815117748409

Binger, C., and Light, J. (2007). The effect of AAC modeling on the expression of multi-symbol message by preschoolers who use AAC. *Augment. Altern. Commun.* 23, 30–43. doi: 10.1080/07434610600807470

Clarke, M., Price, K., and Griffiths, T. (2016). Augmentative and alternative communication for children with cerebral palsy. *Paediatr. Child Health* 26, 373–377.

Cress, C. (2002). "Expanding children's early augmented behaviors to support symbolic development," in *Implementing an Augmentative Communication System: Exemplary Strategies for Beginning Communicators*, eds J. Light, D. R. Beukelman, and J. Reichle (Baltimore, MD: Paul H. Books Publishing Co), 219–272.

Dada, S., and Alant, E. (2009). The effect of aided language stimulation on vocabulary acquisition in children with little or no functional speech. *Am. J. Speech Lang. Pathol.* 18, 50–64. doi: 10.1044/1058-0360(2008/07-0018)

Downey, D., Daugherty, P., Helt, S., and Daugherty, D. (2004). *Integrating AAC into the Classroom: Low-Tech Strategies*. Available Online at: https://leader.pubs.asha.org/doi/10.1044/leader FTR2.09172004.6 [accessed February 14, 2021].

Frankoff, D. J., and Hatfield, B. (2011). Augmentative and alternative communication in daily clinical practice: strategies and tools for management of severe communication disorders. *Top. Stroke Rehabil.* 18, 112–119. doi: 10.1310/tsr1802-112

Frueh, S. (2013). *Social Communication between Intellectually Disabled Severe Middle School Students who use Augmentative and Alternative Communication and their Typically Developing Peers*. Master's thesis. Greenville, NC: East Carolina University.

Green, K. B., Gallagher, P. G., and Hart, L. (2018). Integrating mathematics and children's literature for young children with disabilities. *J. Early Interv.* 40, 3–19. doi: 10.1186/s12913-016-1423-5

Guangzhou Childhood Technology Co., Ltd. (2008). *E-read*. Available online at: http://www.e-readbook.com/english/ (accessed August 13, 2021).

Handberg, C., and Voss, A. K. (2017). Implementing augmentative and alternative communication in critical care settings: perspectives of healthcare professionals. *J. Clin. Nurs.* 27, 102–114. doi: 10.1111/jocn.13851

Hynan, A., Goldbart, J., and Murray, J. (2015). A grounded theory of internet and social media use by young people who use augmentative and alternative communication (AAC). *Disabil. Rehabil.* 37, 1559–1575. doi: 10.3109/09638288.2015.1056387

Jones, S. (2004). Augmentative and alternative communication: management of severe communication disorders in children and adults. *J. Appl. Res. Intellect. Disabil.* 17, 133–134. doi: 10.1111/j.1360-2322.2004.0182a.x

Lane, K., Wolery, M., Reichow, B., and Rogers, L. (2007). Describing baseline conditions: suggestions for study reports. *J. Behav. Educ.* 16, 224–234. doi: 10.1007/s10864-006-9036-4

Listen and Talk (LAT) (2022). *Listen & Talk*. Available online at: https://apps.apple.com/fm/app/listen-talk/id1193891139 (accessed February 13, 2022).

Lonigan, C. J., Farver, J. M., Phillips, B. M., and Clancy-Menchetti, J. (2011). Promoting the development of preschool children's emergent literacy skills: a randomized evaluation of a literacy-focused curriculum and two professional development models. *Read. Writ.* 24, 305–337. doi: 10.1007/s11145-009-9214-6

Millar, D. C., Light, J. C., and Schlosser, R. W. (2006). The impact of augmentative and alternative communication intervention on the speech production of individuals with developmental disabilities: a research review. *J. Speech Lang. Hear. Res.* 49, 248–264. doi: 10.1044/1092-4388(2006/021)

Mirenda, P. (2003). Toward functional augmentative and alternative communication for students with autism: manual signs, graphic symbols, and voice output communication aids. *Lang. Speech Hear. Serv. Sch.* 34, 203–216. doi: 10.1044/0161-1461(2003/017)

Mirenda, P. (2013). *Augmentative and Alternative Communication. Encyclopedia of Autism Spectrum Disorders*. New York, NY: Springer.

Mullen, E. M. (1995). *Mullen Scales of Early Learning*. Circle Pines, MN: AGS Publishing.

Nasfikur, M., Pias, M. N. H., Habib, K., Hossain, M., Sarker, F., and Mamun, K. A. (2017). "Bolte chai: an augmentative and alternative communication device for enhancing communication for nonverbal children," in *International Conference on Medical Engineering, Health Informatics and Technology (MediTec)*, (Dhaka: IEEE).

Odom, S. L., and Strain, P. S. (2002). Evidence-based practice in early intervention/early childhood special education: single-subject design research. *J. Early Interv.* 25, 151–160. doi: 10.1177/10538151020250 0212

Østvik, J., Ytterhus, B., and Balandin, S. (2017). So, how does one define a friendship?: identifying friendship among students using AAC in inclusive educational settings. *Eur. J. Spec. Needs Educ.* 33, 334–348. doi: 10.1080/08856257.2017.1312799

Page, C. A., and Quattlebaum, P. D. (2012). *Severe Communication Disorders. Handbook of Children with Special Health Care Needs*. New York, NY: Springer.

Pousada, G. T., Pereira, L. J., Groba, G. B., Nieto-Riveiro, L., and Pazos, S. A. (2011). The use of computers and augmentative and alternative communication devices by children and young with cerebral palsy. *Assist. Technol.* 23, 135–149. doi: 10.1080/10400435.2011.588988

Sandall, S., Hemmeter, M. L., Smith, B. J., and McLean, M. E. (2005). *DEC Recommended Practices: A Comprehensive Guide for Practical Application in Early Intervention/Early Childhood Special Education*. Longmont, CO: Sopris West.

Saturno, C. E., Ramirez, A. R. G., and Piucco, E. C. (2015). An augmentative and alternative communication tool for children and adolescents with cerebral palsy. *Behav. Inf. Technol.* 34, 632–645. doi: 10.1080/0144929x.2015.1019567

Schladant, M. (2011). Parent perspectives on communication and use of augmentative and alternative communication systems in children with fragile x syndrome. *Dissertations Theses Gradworks* 43, 3741–3747.

Schlosser, R. W., and Wendt, O. (2008). Effects of augmentative and alternative communication intervention on speech production in children with autism: a systematic review. *Am. J. Speech Lang. Pathol.* 17, 212–230. doi: 10.1044/1058-0360(2008/021)

Sigafoos, J., and Drasow, E. (2001). Conditional use of aided and unaided AAC focus on autism and other developmental disabilities. *J. Spec. Educ. Technol.* 13, 3–32.

Smith, A. L., and Hustad, K. C. (2015). AAC and early intervention for children with cerebral palsy: parent perceptions and child risk factors. *Augment. Altern. Commun.* 31, 336–350. doi: 10.3109/07434618.2015.1084373

Stephenson, J. (2007). The effect of color on the recognition and use of line drawings by children with severe intellectual disabilities. *Augment. Altern. Commun.* 23, 44–55. doi: 10.1080/07434610600924457

Thistle, J. J., and Wilkinson, K. (2009). The effects of color cues on typically developing preschoolers' speed of locating a target line drawing: implications for augmentative and alternative communication display design. *Am. J. Speech Lang. Pathol.* 18, 231–240. doi: 10.1044/1058-0360(2009/08-0029)

Winston, J., and Tandy, M. (2009). *Beginning Drama 4-11*. Abingdon: Routledge.

Winston, J., and Tandy, M. (2012). *Beginning Shakespeare 4-11*. Abingdon: Routledge.

Wolery, M., Dunlap, G., and Ledford, J. R. (2011). Single-case experimental methods: suggestions for reporting. *J. Early Interv.* 33, 103–109. doi: 10.1177/1053815111418235

Wolery, M., and Hemmeter, M. L. (2011). Classroom instruction: background, assumptions, and challenges. *J. Early Interv.* 33, 371–380. doi: 10.1177/1053815111429119

Wu, J. J., Chen, K. Q., Ma, Y., and Vomocilová, J. (2020). Early intervention for children with intellectual and developmental disability using drama therapy techniques. *Child. Youth Serv. Rev.* 109:104689. doi: 10.1016/j.childyouth.2019.104689

Wu, J. J., and Vomocilová, J. (2019). "Gifted and talented school activities for students with special educational needs through drama therapy," in *Software for Gifted and Talented School Activities in K-12 Classrooms*, ed. S. Ikuta (Hershey, PA: IGI Global), 282–302. doi: 10.4018/978-1-7998-1400-9.h013

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