Parent-Implemented AAC Narrative Intervention

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Submitted to the graduate degree program in Speech-Language-Hearing and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Date Defended: 30 August 2021

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Date Approved: 1 September 2021

Abstract

The current study investigated the implementation of a parent-implemented narrative intervention for individuals who use augmentative and alternative communication (AAC), *Storytalker*. A nonconcurrent multiple baseline across participants design was conducted with three parent-child dyads. Parent implementation fidelity of the *Storytalker* intervention was assessed along with parent language outcomes. Child narrative macrostructure and microstructure was assessed from narratives generated from picture books. The acceptability and generalization of the intervention was assessed through parent surveys, interviews, and book sharing probe measures. Parents demonstrated gains in their use of language facilitation strategies after training was provided and implemented the intervention with high levels of fidelity. Mixed effects were observed for parent language measures. Child participants also demonstrated mixed effects in both narrative macrostructure and microstructure measures. Parents rated the intervention with high levels of acceptability. They also qualitatively reported changes in their child's daily communication after the intervention.

Contents

Chapter 1: Introduction

Augmentative and alternative communication (AAC) is used to supplement or supplant the speech of individuals who are unable to fulfill their communication needs through verbal speech alone. The literature base of AAC interventions has experienced large growth in recent years and we now have effective ways to teach children to communicate with AAC systems to fulfill their basic wants and needs. In order to achieve communicative competence, individuals who use AAC must be taught to communicate in a variety of contexts for a variety of purposes. One important communicative context to teach individuals is storytelling.

There is a need to create an effective narrative intervention to teach individuals who use AAC the skill of storytelling. Being able to tell stories will bring them beyond the stage of early communicators and allow them to communicate in a variety of settings for different purposes. The current study investigated the use of a parent-implemented narrative intervention, *Storytalker*, with individuals who use AAC. *Storytalker* employs effective teaching strategies and methodologies from both the narrative intervention and AAC intervention literature while also incorporating an evidence-based framework for teaching communication partners to implement intervention.

The Need for Advancing Communication Skills

There has been some work to classify the current state of the communication intervention literature for individuals with significant disabilities and complex communication needs. One literature review that covered articles published between 1987-2007 found that the majority of intervention studies focused on improving expressive communication (81%). The primary behavior targeted was the ability to change the behavior of another person (53.4% of studies), such as through requesting or rejecting (Snell et al., 2010). The participants in the studies

reviewed by Snell et al. (2010) primarily used gestures or speech to communicate. However, the focus of intervention literature on the early communicative skills of requesting and rejecting is seen in the AAC intervention literature as well. Between 2005 and 2015, about half of the intervention studies published in *Augmentative and Alternative Communication* focused on teaching requests (Light & McNaughton, 2015). While it is important to teach individuals to communicate their wants and needs, without interventions that further advance communication skills past requesting and simple comments individuals who use AAC are extremely limited in the contexts in which they can communicate and participate. Interventions need to continue to be developed to advance the communication skills in the population that uses AAC (Biggs & Hacker, 2021).

As Light et al. (2019) summarized in their more recent review, the technological advances in AAC provide many opportunities that can be leveraged for individuals who use AAC. Yet, the AAC implementation science being conducted is limited and the research that has been published is not transferring to common practice among practitioners (Light et al., 2019). There is a need for effective interventions that can be easily implemented with individuals who use AAC and that target more advance communication skills that will increase opportunities for participation.

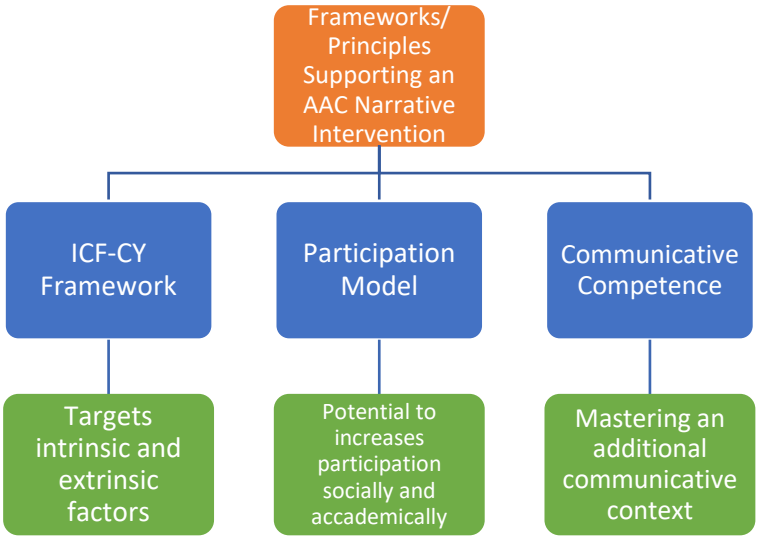
Frameworks Supporting AAC Interventions

Due to the complexity of the population that uses AAC and their diverse needs, frameworks have been designed to best understand how to serve this population. Three frameworks or principles have been used to guide the current investigation into narrative intervention for AAC: the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY; WHO, 2007), the Participation Model (Beukelman & Mirenda,

2013) and communicative competence (Light, 1988, 1997). All three frameworks or principles were reviewed when developing the *Storytalker* intervention to ensure the intervention resonated with the existing models.

Figure 1.

Frameworks Supporting AAC Narrative Intervention.



ICF-CY Framework

The framework that best outlines the global development of children and youth and the context in which that development occurs is the ICF-CY (WHO, 2007). The ICF-CY outlines both the intrinsic factors of the child's disability (body function, body structure, activities & participation) and the extrinsic factors of the disability (environmental factors). According to the ICF-CY framework we must address both the factors external and internal to the person in our interventions (WHO, 2007). In applying the ICF-CY to individuals who use AAC to communicate, interventions that target external factors include those that coach communication partners. The interventions that target the internal factors are those that directly teach communication skills. *Storytalker* addresses both factors. The primary aim of the study was to teach parents to reliability use strategies to effectively teach their children to tell stories. The child's extrinsic factors were addressed by changing the way one of his/her primary communication partners conversed with and taught the child. Secondly, the child's intrinsic factors were addressed, particularly in the area of activity and participation, by directly teaching the child a communication skill.

The section of the ICF-CY of activity and participation allows a practitioner to evaluate an individual on their ability to execute a variety of life tasks (activity) or take part in different life situations (participation). The individual can be evaluated in two different ways within the category of activities and participation. The *capacity* of the individual to do a given task is evaluated by removing the external factors of the environment. The *performanc*e of the individual measures the ability to do a task within their typical environment. The parent-implemented *Storytalker* intervention made changes to external factors of the environment by changing the way the parent interacts with the child. Therefore, we measured the child's *performance* on narrative tasks as they were within their typical environment (WHO, 2007).

The parents were trained to implement specific teaching strategies in order to change their behaviors, attitudes, and beliefs about the child's ability thereby addressing "e410 individual attitudes of immediate family members" (WHO, 2007, p. 207) of the ICF-CY framework. The intervention also addressed child's intrinsic factors in the areas of activities and participation of the ICF-CY including, "d1331 combining words into phrases, d1332 acquiring syntax, and d1338 acquiring language, other specified" (WHO, 2007, p. 133). In addition to language activities storytelling also involves multiple areas of "d163 thinking" including "pretending and speculating" (WHO, 2007, p. 136). There is also a possibility that by increasing the capacity of storytelling in the population that uses AAC, we can also increase their participation in areas of "d350 conversation, d355 discussion, d750 informal social relationships, d760 family relationships and d7203 interacting according to social rules" (WHO, 2007, pp. 147-175). *Storytalker* targeted factors intrinsic and extrinsic to the individual by increasing the language performance of the individual within the storytelling context with a trained communication partner.

Communicative Competence

The ICF-CY framework allows us to break down communication and participation into unique and specific skills to achieve. However, the goal for individuals who use AAC is ultimately, communicative competence. Communicative competence means effectively communicating one's wants and needs, establishing social closeness with communication partners, giving and receiving information and effectively following social rules for interaction. The goal is that individuals who use AAC will be able to communicate for any purpose necessary to participate in all the same activities and life events that his/her peers participate in (Light, 1988, 1997).

Achieving communicative competence requires long term intervention that focuses on building communication over time (Light, 1997). It is important that we do not stop teaching communication after an individual learns how to meet their basic wants and needs, because the desire for social closeness and engagement with others is also an important need to meet. The field of AAC research continues to create interventions to help individuals achieve communicative competence, but there are many skills that are still unaddressed (Light & McNaughton, 2015). Storytelling is one such skill that has only started to be investigated, yet it has the potential for making great strides in achieving communicative competence. Storytelling can help establish social closeness and is the act of exchanging information with a communication partner (Nelson, 1991). Therefore, covering two of the principal areas of communicative competence.

Participation Model

The participation model developed by Beukelman and Mirenda (2013) takes into account all barriers that hinder communication competence of individuals who use AAC. In the

participation model, practitioners are asked to identify the need of the individual and then identify the barriers that are stopping the individual from fulfilling that need. It mirrors the ICF-CY by considering both external and internal factors prohibiting individuals from participating and/or communicating (Beukelman & Mirenda, 2013).

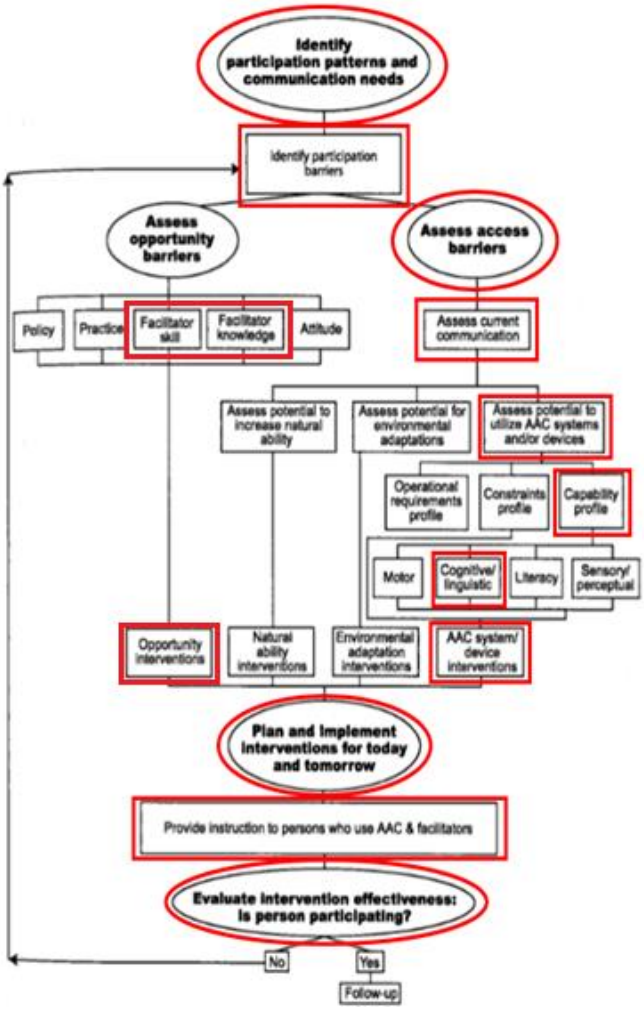
The practitioner must first decide whether the individual cannot meet their need because of a lack of opportunity to communicate or participate (external) or a lack of access to communication (internal). The opportunity barriers to communication or participation can include such things as the facilitator's skill and knowledge and the policies and practices surrounding the individual's participation. A need that is not being met due to an opportunity barrier requires an opportunity intervention such as training communication partners to increase the opportunities for participation. The internal barriers to meeting the participation and/or communication needs of the individual who uses AAC are labeled as "access barriers". To assess access barriers, one must assess the current communication of the individual and determine which of the following three interventions will best meet his/her communication needs: increasing natural ability, modifying the environment, or implementing an AAC system intervention. Depending on the need, one or more interventions may be needed. If it is assessed that an AAC intervention is the best path to meet the need, multiple other areas must be assessed to determine the appropriate intervention (Beukelman & Mirenda, 2013).

Figure 2 depicts how *Storytalker* is rooted in the participation model. First the communication need is identified as the need to tell a story. Without the skill of telling a story the individual is unable to participate in many social and academic activities including sharing what happened over break with the class, telling their peers about their weekend or special event, telling their parents what happened during the school day and retelling stories for class projects.

The need of developing storytelling skills is due to both an access barrier and an opportunity barrier. The child has not fully developed the ability to tell a story and the communication partner is unable to facilitate the child's storytelling skills in a way that leads to more independent communication.

Figure 2

Participation Model



First the capability of the individual to tell a story must be assessed, specifically the individual's linguistic abilities. The child's current storytelling skills were assessed through the baseline phase of the current study. It was determined that all three children did not yet demonstrate the linguistic skills to tell a comprehensive narrative. Therefore, a narrative intervention was implemented to increase the child's linguistic capability and provide access to the skill of storytelling. The parents current abilities to teach the child to tell stories were also assessed at baseline. After determining the strategies, the parents used at baseline, they underwent training (opportunity intervention) to learn how to better support their child's narrative development and provide more opportunities for independent production.

The *Storytalker* intervention was implemented in the child's natural environment and with a natural communication partner. However, it is still important to assess the carryover effects to real life situations, especially in single case design (Ledford & Gast, 2018). Both the child's participation and parents use of the strategies taught were evaluated in a naturalistic setting. Questionnaires and observational measures were administered to assess whether the individual was using the new skill of storytelling to increase participation in their real life and whether the parent used the newly acquired skills in a more natural context of book sharing.

The frameworks and principles of ICF-CY, communicative competence, and participation model all support the need for an AAC narrative intervention. The development of *Storytalker* was guided by these three frameworks. The goal of all three frameworks is to evaluate and increase participation in daily activities (Beukelman & Mirenda, 2013; Light, 1988, 1997; WHO, 2007). The external validity of the *Storytalker* intervention was a focus of the current study to determine if parents used more language facilitation strategies outside of the targeted context and whether developing the skill of narration would increase the child's participation and overall communication skills.

Narrative Elements

Narratives are constructed of two elements, narrative macrostructure and narrative microstructure. Narrative macrostructure measures the use of specific elements that make up a story and the overall organization of the story (Kintsch & van Dijk, 1978). Story grammar is a term often used to describe the essential story elements and often includes the following elements: characters, setting, initiating event, problem/complication, plan, feelings, actions, resolution, and conclusion. Story grammar elements are the skeleton on which the rest of the story is built around. The inclusion of story grammar elements makes the story engaging for the

listener (Stein & Glenn, 1979). If the narrator leaves out elements, does not provide details or tells the story in a disorganized fashion, the narrative becomes confusing and a communication breakdown may occur. Therefore, narrative interventions may promote the use of story elements and narrative structure that result in a comprehensive narrative.

Narrative microstructure is a measure of the language used within the narrative (Kintsch & van Dijk, 1978). Microstructure is not always measured or targeted in a narrative intervention (Petersen, 2011). However, microstructure is an important aspect of the narrative as it encompasses the variety of vocabulary and the sophistication of the language used in the narrative. A good narrative consists of sophisticated vocabulary to provide detailed descriptions of the characters and settings and the use of transition words to link events together. Transition words such as, first, next, after, before, etc., provide a temporal structure and increase the fluidity of the narrative (Stadler & Ward, 2005). Both narrative macrostructure and microstructure are important measures to consider when designing a narrative intervention, as both will affect the quality of the narrative.

Narrative Intervention

Narrative intervention teaches individuals how to use a new communication context of storytelling by directly teaching the necessary parts of a story, modeling the structure of a story through example narratives, and providing children opportunities to practice storytelling while providing constructive and specific feedback. Narrative intervention has been effectively used with a variety of populations to teach the use of narrative macrostructure and microstructure (Petersen, 2011).

Petersen (2011) reviewed the narrative intervention literature written from 1980 to 2008. He found nine narrative intervention studies that targeted the storytelling abilities of individuals

with language deficits. Although all of the studies reviewed used a narrative intervention, they differed greatly in their procedures. The only common procedures among the narrative interventions reviewed were the use of repeated narrative retellings and narrative generations, the use of wordless picture books and the participant's drawing of the stories. All other teaching strategies either differed or were not documented in the methods of the studies. The effects on narrative macrostructure were moderate to large and all but two studies reported moderate to large effect sizes on microstructure (Petersen, 2011). Therefore, narrative interventions can be highly effective for the teaching of narrative macrostructure and microstructure among individuals with language impairment. However, further investigation into the most effective procedures for delivering narrative intervention is needed.

Further narrative intervention studies have been conducted since the review by Petersen (2011). Narrative intervention has been used extensively with preschoolers and kindergarteners who were at risk of language delay (Brown et al., 2014; Petersen & Spencer, 2016; Spencer & Slocum, 2010). The interventions took part in small group settings and had similar components. All interventions provided multiple opportunities for the participants to tell stories either in a narrative retell, narrative generation, or both. Most interventions used visual supports and explicit instruction focusing on the parts of a story. The instructors all provided forms of scaffolding for the participant's narratives.

For the purposes of the current study, narrative interventions that have been conducted with children with more significant disabilities will be discussed. Ten narrative interventions that addressed the storytelling skills of children with disabilities, published after Petersen (2011)'s review, were found in the literature. The populations included children with language impairment (Gillam et al., 2018; Green & Klecan-Aker, 2012; Hessling & Schuele, 2020; Pauls

& Archibald, 2021), Down syndrome (Finestack et al., 2017), language disorder comorbid to neuromuscular impairments (Petersen et al., 2010), Williams syndrome (Diez-Itza et al., 2018) and autism spectrum disorder (Favot et al., 2018; Gillam et al., 2015; Petersen et al., 2014).

The more recent narrative interventions provide more detailed methodologies than those in Petersen (2011); however, the methods continue to vary greatly. Two recent interventions used the commercially available Supporting Knowledge in Language and Literacy (SKILL) narrative intervention with children with autism spectrum disorder (Gillam et al., 2015) and with children with language impairments (Gillam et al., 2018). In both studies a three-phase intervention was implemented. Participants were first taught the essential story elements, then more elaborate linguistic structures and complex stories were taught, and finally the participants were taught to self-evaluate their narratives (Gillam et al., 2015; Gillam et al., 2018). Green and Klecan-Aker (2012) and Favot et al. (2018) also administered narrative interventions that consisted of progressive phases. The most basic story elements were taught and reinforced first, before adding more complex story elements to their narratives.

Most other narrative interventions addressed all targets of the intervention in every session rather than in progressive phases. Three of the studies used the *Story Champs* intervention which is also commercially available (Hessling & Schuele, 2020; Petersen et al., 2014; Petersen et al., 2010). *Story Champs* was often delivered in a group format and sessions followed a similar structure throughout the intervention with multiple opportunities for hearing modeled narratives, practicing retells, and identifying narrative elements.

Two of the interventions reviewed targeted personal narratives of the participants. Petersen et al. (2014) taught three school-age boys with high-functioning autism to tell personal narratives. The intervention was highly individualized to the individual participants as their

personal narratives were assessed before the intervention began and the lessons targeted the individual weaknesses of each participant. Finestack et al. (2017) also targeted personal narratives with children and adolescents with Down syndrome. Finestack et al. (2017)'s intervention used a standardized procedure and was personalized to the individual participants by asking participants to take photos on an iTouch device which were then used to generate stories (Finestack et al., 2017).

The ten narrative interventions reviewed covered participants with different disabilities and differing strengths and needs profiles. As expected, the interventions varied greatly to match the variability in the populations. Despite the variability in the reviewed narrative interventions, some similar components are seen across multiple interventions. The common components appear to be effective across multiple different populations and include: the use of repeated practice, an adult model of a cohesive story, the use of self-evaluation, systematic use of prompts and fading of support, visual aids, and the use of a criterion. Each of the components will be reviewed below.

Narrative Intervention Components

Repeated Practice. The most common theme across the narrative interventions reviewed was the use of repeated practice of storytelling within a given session. Repeated practice includes both the telling of the same story multiple times (Favot et al., 2018; Finestack et al., 2017) and the telling of multiple different stories in a given session (Gillam et al., 2015; Gillam et al., 2018; Green & Klecan-Aker, 2012; Pauls & Archibald, 2021; Petersen et al., 2010). The SKILL intervention is an example of using multiple different stories in a session. Three different story-based activities including a wordless picture book, creating new stories from a story board, and a literature-based activity were all included in phase 1 sessions of the SKILL intervention. (Gillam

et al., 2015). The *Story Champs* intervention also used several different stories in a given session. Participants retell a modeled story from pictures, generate their own personal narrative related to the story and create a fictional narrative (Petersen et al., 2014).

Interventions that included multiple opportunities to tell the same story allowed participants to refine their story based on feedback and to practice the newly learned skills several times in a controlled environment. Favot et al. (2018) asked the participants to tell the same story three to four times in a given session. The interventionist provided support when needed and modeled the complete narrative twice for the child. The interventions targeting personal narratives had the participants practice telling their personal narratives multiple times as clinician support was faded (Finestack et al., 2017; Petersen et al., 2014). Both the SKILL and *Story Champs* interventions included both practice with telling multiple different narratives and the opportunity to tell the same narrative multiple times. The *Story Champs* intervention included multiple stories in a group setting by taking turns telling the same story (Petersen et al., 2014; Hessling & Schuele, 2020). The SKILL intervention included the telling of the same story in phase 3 when participants were asked to generate and edit their own stories with and without visual support (Gillam et al., 2015).

Adult Models. Another common practice among narrative interventions is the use of a modeled narrative from an adult. The purpose of the modeled stories is to provide the child with a story that contains all the components that are being taught in the intervention. The modeled narrative demonstrates to the child how a narrative that includes all the components is engaging and easy to understand. Green and Klecan-Aker (2012) included five example narratives at the beginning of each session. After each narrative was told, the group would discuss why the story sounded good and the components that the story included. In some interventions the adult model

was also used for story retells. The child would first listen to the narrative modeled by the adult and then the child would retell the same story that they heard (Petersen et al., 2014).

Modeled narratives were also an important part of the personal narrative interventions. In both Finestack et al. (2017) and Petersen et al. (2014), the clinician modeled a personal narrative and then the participants were asked to retell the clinician's personal narrative multiple times before generating their own personal narratives. The modeled personal narratives were carefully selected to correspond with an experience the participant had likely experienced so the participant had a framework from which to build his/her own personal narrative (Finestack et al., 2017; Petersen et al., 2014)

Self-Evaluation. Self-evaluation was used to varying degrees in several interventions. In the simplest form, participants were asked to choose an action and result to pair with a given initiating event. The teacher then asked the participants to evaluate the appropriateness of the pairs they chose and discuss how and why the pairs go together (Green & Klecan-Aker, 2012). Other studies used a more sophisticated method of self-evaluation, self-scoring their own narratives. Participants were taught to use scoring rubrics to evaluate the quality of their narratives toward the end of the interventions (Gillam et al., 2015; Gillam et al., 2018). Self-evaluation of the narratives taught the use of metacognitive skills to evaluate the organization and quality of their own narratives.

Varying Levels of Support. In each of the narrative interventions reviewed, the clinician or teacher provided varying levels of support dependent on the task. Some studies detailed the systematic process for providing and fading support (Petersen et al., 2010) while others provided a more generic description of support (Green & Klecan-Aker, 2012). In the SKILL intervention there was a clear reduction in the amount of support as the participants progressed through the

three phases (Gillam et al., 2015; Gillam et al., 2018). In phase one the clinician provided highly scaffolded assistance, whereas in phase two the clinician reduced the amount of support to prompts and leading questions. As the participants became more independent in phase three of the study the clinicians primarily provided support through visual aids (Gillam et al., 2018).

Other studies described the levels of support provided within each session. *Story Champs* systematically faded support within each activity of the intervention. The child or children, if done in a group, first told the story with visual supports and clinician prompts and then the visual supports were removed and prompting was reduced. The types of support provided in *Story Champs* included expectant pauses, prompts for imitation, questions, expanding the child's response and cloze utterances (Petersen et al., 2014). In their narrative intervention with individuals with down syndrome, Finestack et al. (2017) used a narrative map to co-construct personal narratives with the participants. The participants would then retell their narratives multiple times with clinician support. The clinicians prompted the participants to include the narrative elements in their stories. Each of the interventions reviewed began with the most support provided and then faded the support as the participants acquired the skills. Toward the end of the intervention or a given session the participant would tell a narrative with little to no clinician support. The fading of support was meant to challenge the student to generate independent narratives without frustrating them (Petersen et al., 2014).

Visual Supports. All narrative interventions reviewed utilized some visual support in the intervention. The most common visual support was a set of icons used to represent the story grammar terminology (Gillam et al., 2015; Gillam et al., 2018; Petersen et al., 2014; Petersen et al., 2010). The images of the icons varied by intervention, but all were relatively simple images. Most interventions included icons for the following story grammar elements: characters, setting,

initiating event, feelings, plan, actions, complication, resolution, and conclusion (Gillam et al., 2015; Gillam et al., 2018; Petersen et al., 2010). The story grammar icons were used to help the participants organize their narratives and were often placed in front of the child or on story boards as the narratives were told (Gillam et al., 2015; Petersen et al., 2010). Other visual supports used during the interventions often provided the narrative context of the task. One such context is a wordless picture book which is used to elicit a narrative generation or retell (Gillam et al., 2015; Gillam et al., 2018; Petersen et al., 2010). Other visuals used included complex picture scenes, simple picture scene (Petersen et al., 2010), personal photos (Finestack et al., 2017), and still images from a short film (Diez-Itza et al., 2018).

Learning Criteria. Several narrative interventions were designed to teach increasingly difficult narrative elements throughout different points in the intervention. The purpose of the systematic increase in difficulty was to ensure that the participants could successfully tell basic narratives before teaching more complex narrative elements such linguistic structures (Gillam et al., 2018). Before participants could progress to a more difficult phase in the intervention, they had to reach set criteria on narrative measures. Assessments were given to determine if the participants understood what was previously taught. If the participants did not reach the criteria, they received further instruction and were reassessed. Once the participant met the criteria the next phase of the intervention could begin and more difficult narrative components were taught (Gillam et al., 2015; Gillam et al., 2018; Green & Klecan-Aker, 2012).

Assessment of Learning. Most of the narrative interventions reviewed included a measure of narrative macrostructure and microstructure to assess the effectiveness of the intervention. However, the measures used differed based on the intervention. A theme found across three of the interventions was to use a narrative scoring rubric that measured both

narrative macrostructure and narrative microstructure. The measures included the Monitoring Indicators of Scholarly Language (Gillam et al., 2015; Gillam et al., 2018) and the Test of Personal Generation: School Age (Petersen et al., 2014). Both measures included some items that measured story structure and some items that measured linguistic complexity. The other studies measured narrative macrostructure and microstructure separately. Both Petersen et al. (2010) and Finestack et al. (2017) used the Index of Narrative Complexity (INC) as their narrative macrostructure measure because it ranks the quality of multiple story grammar elements in the narrative. Others used similar measures by ranking each story grammar element on a 2-point (Favot et al., 2018) or a 4-point (Hessling & Schuele, 2020) scale. The Pragmatic Evaluation Protocol for the analysis of oral Corpora used by Diez-Itza et al. (2018) generates a gold standard story and rates the child's inclusion of scenarios, episodes and events relative to the gold standard with a total percent of elements included as the summative score. Green and Klecan-Aker (2012) used a less precise measure of narrative macrostructure by assigning a developmental story level to the narrative. Separate microstructure measures that were used included number of different words (NDW) (Gillam et al., 2018; Petersen et al., 2010), mean length of utterance (MLU) (Diez-Itza et al., 2018; Finestack et al., 2017; Petersen et al., 2010), and number of T-units (Green & Klecan-Aker, 2012) or clauses (Diez-Itza et al., 2018).

Overall, past narrative intervention studies demonstrated positive results. All narrative interventions demonstrated some effect on the narrative macrostructure of the participants' stories (Diez-Itza et al., 2018; Favot et al., 2018; Finestack et al., 2017; Gillam et al., 2015; Gillam et al., 2018; Green & Klecan-Aker, 2012; Hessling & Schuele, 2020; Pauls & Archibald, 2021; Petersen et al., 2014; Petersen et al., 2010). Results of the narrative interventions varied. Some effects were small or moderate such as the small-to-large gains in story complexity in

Gillam et al. (2018) and the small to modest improvements in macrostructure measures in Finestack et al. (2017). Other narrative interventions demonstrated large effects in the macrostructure measures such as the moderately large to extremely large gains in narrative proficiency in Gillam et al. (2015) and the significant increase in developmental story level in Green and Klecan-Aker (2012).

The effects of the interventions on narrative microstructure were more mixed. Many of the interventions showed an effect for only some of the microstructure measures (Green & Klecan-Aker, 2012; Petersen et al., 2014; Petersen et al., 2010). Microstructure measures that did demonstrate an effect from some of the interventions included mean number of T-units (Green & Klecan-Aker, 2012), NDW (Gillam et al., 2018; Petersen et al., 2010) and MLU (Finestack et al., 2017; Petersen et al., 2010). However, promising carryover effects were seen when Pauls & Archibald (2021) examined other cognitive and linguistic outcomes of children with language impairment who took part in a narrative intervention. They found that 80% of participants improved on at least one language or literacy measure and 62% of those children also improved on working memory tasks. Oral language gains were maintained at follow-up for 60% of participants. Follow-up occurred one month after the end of treatment and follow-up probes continued for three months. They found that the participants who showed a greater response to intervention had stronger verbal short-term memory and receptive language skills at baseline than the participants who did not demonstrate significant gains.

AAC Narrative Intervention

Two previous AAC narrative intervention studies have been documented in the literature. Both studies developed unique narrative interventions not based on previously established narrative interventions. In one case study, multiple story retells and story generation tasks were

conducted with an eight-year-old child with muscular atrophy who used a Dynavox™ 3100 voice output communication device with switch scanning access (Soto et al., 2007). The tasks during the intervention included the retelling of storybooks using a story grammar map, the generation of personal narratives using fill-in-the-blank stories and fictional story generation using graphic cards that she could choose from to create a story. The participant showed improvements in measures of vocabulary complexity and increased her use of story elements.

Soto et al. (2009) conducted three case studies using a narrative intervention with children who used AAC. Three participants who were proficient users of AAC and between the ages of 6-12 participated in a narrative intervention that contained two primary activities. The first activity was a personal photo description in which a photo was shown to the participant and they were asked to tell what happened that day. Support in generating the narrative was given through a variety of language elicitation strategies and the use of a visual story map. The clinician would write out the story on a large piece of paper as the participant narrated. The participant was then encouraged to edit the narrative after the story was complete and the clinician programmed the story into the device for later use. The second activity focused on describing emotional states. Different photographs of children showing emotions were shown to the participant and he/she was asked to describe how the child in the picture felt and why he/she felt that way. The participant was then asked to tell about a time when he/she felt the same way and a second narrative was generated using the same procedures as the first activity (Soto et al., 2009).

The narrative assessment profile (NAP) and story complexity coding was used to score the macrostructure of the participants narratives. Narrative microstructure was measured through NDW, number of total words, number of clauses and other morpho-syntactic structures. The

participants demonstrated gains in their narrative quality including greater lexical diversity and clause formation and an increase in relevant story elements and the organization of story plot. The results must be interpreted with caution as all three participants entered the intervention phase at the same time and therefore the design does not meet the criteria for single case design (Soto et al., 2009).

Initial investigations into AAC narrative intervention demonstrate that positive results can be achieved through a narrative intervention with children who use AAC. An AAC narrative intervention will help to fill the gaps in the AAC intervention literature by addressing the breadth of communication goals as called for by Light & McNaughton (2015). By targeting narrative macrostructure and microstructure, narrative intervention teaches the skills of sentence formulation, vocabulary development, and story structure in an integrated fashion while addressing multiple communication goals. Narrative intervention thereby addresses the long-term outcome of communicative competence, by providing the individual an additional linguistic context in which the child can communicate. A narrative can be used in multiple real-world contexts including telling a story from a book, an account of the day or a past event. Narratives provide a rich opportunity to practice language through a motivating activity (McCabe & Marshal, 2006).

Current AAC Narrative Analysis Studies

Apart from AAC narrative intervention studies, there has been some investigation into the baseline narrative and descriptive skills of children who use AAC. The purpose of the narrative analysis studies conducted was to capture the current strengths and weaknesses of individuals who use AAC to better inform intervention development. The most comprehensive AAC narrative analysis study was conducted by Soto and Hartmann (2006) who analyzed the

narrative production of four children with physical disabilities who used AAC to communicate through five different narrative tasks. Smith et al. (2018) analyzed the generated narratives produced from video clips by 15 children who had a diagnoses of cerebral palsy and used AAC. Finally, Murray et al. (2018) reported on a related communication skill of descriptive abilities of 81 children who used AAC (with no intellectual disability or diagnosis of autism spectrum disorder) when describing pictures and video events to a communication partner who could not view the visual media.

Across all studies, participants demonstrated a strength of topic maintenance with few unrelated utterances (Murray et al., 2018; Smith et al., 2018; Soto & Hartmann, 2006). When compared to their same age peers, children with AAC provided less information when describing visual media (Murray et al., 2018) or telling a story (Smith et al., 2018). When analyzing the narrative macrostructure, several measures were used. The NAP was used by the two narrative studies and evaluates six discourse dimensions. The highest scores were found for the dimensions of topic maintenance and some children received high scores on event sequencing and explicitness. The ability to accurately sequence events and provide enough details to construct a complete story depended on the child (Smith et al., 2018), the task, and the child's age (Soto & Hartmann, 2006). The Narrative Scoring Scheme (NSS) was also used by Smith et al. (2018) to evaluate the children's narratives. Through the NSS, children who used AAC demonstrated strengths in the introduction of their stories, developing their characters during the story and identifying the conflict resolution pairs. Children assessed had more difficulty with including the mental states of the characters and creating cohesion within the story by connecting events and using linking words. The lack of fluency and linking words was also identified in the Soto and Hartman (2006) sample.

AAC narrative analysis studies show that children who use AAC that have minimal to no intellectual disability can stay on topic when telling a story or describing visual media. They can also generally include the basic events of the story, although they provide less detail than their same age peers. Finally, they have difficulty connecting events together and providing more of the higher-level details in the story including mental states of the characters. However, outcomes also suggest that many AAC communicators already have some basic story structure but could benefit from an intervention aimed at teaching them how to organize their narratives and include all the information necessary for the listener.

Evidence Based AAC Teaching Strategies

The literature was reviewed for effective AAC teaching strategies that would apply to and enhance the *Storytalker* intervention. The following teaching strategies were selected as they aligned with previous evidence based narrative interventions and could be easily implemented by parents to teach storytelling.

Aided AAC Input

An empirically supported strategy to teach communication and vocabulary to individuals who use AAC is aided AAC input. Aided AAC input is an effective AAC teaching strategy that can be used across a diverse group of participants as evidenced by several review articles (Allen et al., 2017; Biggs et al., 2018; O'Neill et al., 2018; Sennott et al., 2016). Aided AAC input involves the indication of an AAC symbol (either by pointing or activating) and the speaking of a message related to the AAC symbol during an interaction with the individual who uses AAC (O'Neill et al., 2018). The purpose of Aided AAC input is to model the use of language through the same mode as the child communicates (i.e., AAC). Aided AAC input helps the child understand where the words on the device are as well as how to construct meaningful messages.

Aided AAC input has been used in a variety of contexts (e.g., play, requests for food, requests for favorite objects, etc.). It has also been used both in isolation and together with other instructional strategies. Biggs et al. (2018) reviewed AAC input studies and categorized studies based on the instructional strategies used during the interventions. Categories included interventions using aided AAC input alone, packaged interventions using aided AAC input, packaged interventions using aided AAC input within a least-to-most prompting hierarchy, packaged interventions using aided AAC input within short instructional demonstrations, and packaged interventions using multiple modeling approaches. Although it is difficult to separate the effects of adding aided AAC input to the packaged interventions reviewed, there was evidence in several studies that adding aided AAC input improved outcomes of the packaged intervention. Most studies using aided AAC input targeted pragmatic goals, such as taking communicative turns. The remaining studies targeted semantic goals (e.g. building vocabulary) or morphologic/syntactic goals (e.g. increasing utterance length; Biggs et al., 2018).

Across aided AAC input studies, participants have shown consistent, positive results in different communication domains and the changes in level have generally been large (Sennott et al., 2016). Overall large effect sizes have also been seen from aided AAC input studies. Some differences in effect sizes were found depending on the administration of aided AAC input. For example, when the message was verbally spoken at the same time as activation of the device, the effect size was lower than when the message was verbally spoken after activation. Additionally, adding other teaching strategies (e.g. expectant delay, prompting, expansions, etc.) to aided AAC input increased the effect size of the intervention (O'Neill et al., 2018). In the review of O'Neill et al. (2018) only three studies were found that modeled phrases using multiple symbols during aided AAC input; the majority of studies modeled one symbol utterances. However, the studies

that targeted multi-symbol phrases demonstrated the most positive outcomes (O'Neill et al., 2018).

In addition to aided AAC input, prompting the child to communicate using his/her device also leads to gains in expressive language. In a group parent-implemented intervention study three groups were compared. Parents were either instructed to model language on an SGD (aided input), prompt the child to use the SGD to communicate (aided output), or prompt the child to use spoken communication. Both the aided input and aided output groups had larger expressive vocabularies than the spoken communication group. Furthermore, the aided output group outperformed the aided input group. Both methods were effective in isolation and further investigation is needed on the combined effectiveness in a group intervention (Romski et al., 2010).

Aided AAC input was included as a strategy in the *Storytalker* intervention given its strong evidence as an important AAC teaching strategy. The use of aided AAC input in Storytalker most closely resembles the studies that used aided AAC input as part of a packaged intervention in combination with other teaching strategies. The parents were asked to model multi-symbol phrases in the *Storytalker* intervention. Although few studies have used multi-symbol phrases with aided AAC input it has proven highly effective (O'Neill et al., 2018).

ImPAACT Program

The ImPAACT program has taught parents and educational assistants to use similar language facilitation strategies as the *Storytalker* intervention. I also modeled the *Storytalker* parent training from the same training framework used in the ImPAACT program. Parents and educational assistants were taught to provide input using their child's AAC device within the context of story book reading using the ImPAACT intervention. ImPAACT involves the use of

asking WH- questions, expectant delay, modeling responses using the device and expanding on the child's responses (Binger et al., 2008; Binger et al., 2010; Kent-Walsh et al., 2010). Parents effectively modeled the use of two-symbol combinations on their children's AAC systems and their children demonstrated 100% PND for use of multi-symbol utterances themselves through the ImPAACT intervention (Binger et al., 2008). Additionally, ImPAACT was proven to improve the communicative turn taking of children when parents effectively implemented the strategies (Kent-Walsh et al., 2010). Finally, the intervention was also shown to be effective when educational assistants implemented the program. The educational assistants effectively used multiple language facilitation strategies including expanding, imitating, extending and correcting child utterances. With educational assistants implementing ImPAACT, students started using multi-symbol messages after only one hour of intervention (Binger et al., 2010).

ImPAACT taught communication partners to use similar skills as *Storytalker*. The skills of expectant delay, WH questions, aided AAC input and expanding on child's utterances are all used in the *Storytalker* intervention. Studies on ImPAACT demonstrated that multiple language facilitation strategies can be effectively taught to parents and other communication partners. It also demonstrated that books are an effective language context through which to elicit and model language of individuals who use AAC. Children improved in their communication skills through the parents use of language facilitation strategies.

Least-to-Most Prompting

A prompting strategy that has been found to be effective at teaching individuals who use AAC to communicate is the least-to-most prompting hierarchy. The prompts delivered within the hierarchy can differ, but the basic principle remains in which the instructor administers a prompt with the least amount of assistance first, with an expectant delay, and then gradually administers

more intrusive prompts until either the individual demonstrates the behavior, or the maximum assistance prompt is given. Least-to-most prompting allows the instructor to determine the amount of assistance the individual needs to demonstrate the behavior (Ault & Griffen, 2013). The prompts used in *Storytalker* were implemented in a least-to-most hierarchy.

Least-to-most prompting has been used in AAC interventions to teach communication skills. Finke et al. (2017) taught children to use multi-symbol messages to tell what was happening in a book using the least-to-most prompting method. The prompting hierarchy included: (1) general verbal prompt, (2) verbal prompt and verbal model, (3) verbal prompt, verbal model, and graphic model (model on AAC), (4) verbal prompt, verbal model, graphic model, and verbal cue, and (4) hand-over-hand prompting. All participants demonstrated gains in their use of multi-symbol utterances with effects of 75-100% PND. Least-to-most prompting, along with constant delayed prompting and differential reinforcements, has been used effectively to teach multi-symbol requests using and AAC device with children with autism (Alzrayer et al., 2017). It has also been used in evaluations of the preferred AAC system for individuals who require AAC. In comparing the use of two AAC systems, least-to-most prompting was used to determine which system was easier and more effective for individual students to communicate a request for a desired snack. The prompting hierarchy used was less intensive with only three levels of: verbal prompt, visual prompt toward the correct symbol, and finally hand-over-hand prompting (Seung-Hyun et al., 2006).

Parent Involvement in AAC Interventions

As discussed, many of the AAC interventions in the literature use a parent or another common communication partner (educational assistant, sibling, or peer) to implement the intervention, as performed in the current study. When done effectively, training a communication

partner to be the interventionist can help in several ways. Children who require AAC often have significant needs that requires intensive and long-term intervention. However, intensive clinician-implemented intervention is expensive and time consuming. By training the communication partner, who interacts regularly with the child, to administer the intervention it can be delivered more regularly and at a lower cost.

Secondly, children who use AAC experience a mismatch between the language input they receive (spoken language) and the language they use to communicate (multimodal AAC; O'Neill et al., 2018; Smith & Grove, 2003). Typically developing children hear millions of spoken words before they begin talking (Hart & Risley, 1995). Therefore, we cannot expect children to communicate with a system that they have not observed being used successfully and received input from in a variety of settings and for a variety of functions. By training the communication partner to provide input on the child's device, the child can receive more regular multimodal input throughout their day that better matches how they will communicate. Finally, interventions that train communication partners often focus on changing the partners behaviors to allow for more opportunities for the child to communicate (Kent-Walsh, Murza, et al., 2015). Adults who interact with children who use AAC often limit the opportunities for the child to communicate by asking yes/no questions and taking the majority of turns in a conversation (Light et al., 1985). Therefore, communication partners can be taught to allow more opportunities to communicate by asking open ended questions and providing sufficient wait time (Binger et al., 2008; Rosa-Lugo et al., 2008). By shifting how the communication partner converses with the child, the child's communication increases by creating more opportunities for initiations and more equal turn-taking (Kent-Walsh et al., 2010; Kasari et al., 2014).

A number of interventions have been documented in the literature that teach the child's natural communication partners to implement AAC interventions including the child's parents (Kasari et al., 2014; Kent-Walsh et al., 2010; Kent-Walsh, Binger, et al., 2015; Romski et al., 2010), educational assistants (Binger et al., 2010; Chung & Carter, 2013; Cihak et al, 2012; Pitman, 2015; Sennott, 2013), and peers (Hughes et al., 2000; Johnston et al., 2003; Trembath et al., 2009; Trottier et al., 2011). A meta-analysis of communication partner instruction found very large effect sizes (.83 IRD value) on the communication outcomes of the children who used AAC (Kent-Walsh, Murza, et al., 2015). Parents have been taught to effectively employ the strategies of providing aided AAC input, asking open ended questions, responding, and expanding on child utterances, and providing pause time (Binger et al., 2008; Kasari et al., 2014; Kent-Walsh et al., 2010; Kent-Walsh, Binger, et al., 2015; Romski et al., 2010; Rosa-Lugo & Kent-Walsh, 2008). Individual strategies alone, or in combination, have been used to teach children to use multi-symbol messages (Binger et al., 2008), take turns during book sharing (Kent-Walsh et al., 2010; Rosa-Lugo & Kent-Walsh, 2008), produce different types of words using AAC (Romski et al., 2010), comment and initiate during play (Kasari et al., 2014), and produce yes/no sentences (Kent-Walsh, Binger, et al., 2015). Although a wide range of communication skills have been targeted with communication partner interventions, many are early communication skills such as commenting, using different words, and combining words. Early communication skills are important to focus on when a child is introduced to the AAC system. However, as the child becomes more familiar with the device and successfully communicates to meet his/her basic wants and needs, communication partners need instruction on how to further the child's communicative development.

Teaching communication partners how to teach more complex communicative skills, such as storytelling, is challenging but has the potential to have broad carryover effects to the child's everyday life. A large part of teaching more complex communication skills is helping the child to become more independent in their communication and initiate new ideas and topics. Communication partners may benefit from instruction on how to allow the child to initiate as this is often a shift in the communication dynamic in the dyad (Kent-Walsh, Murza, et al., 2015). The communication partner often must transition from being the initiator who is modeling and prompting the child, to a responder who is helping to coach the child in how to successfully communicate in a new context. As the communication partner witnesses the child's success with communicating more independently, the skills taught in the targeted communicative context have the potential to generalize to other contexts.

Parent-Implemented AAC Narrative Intervention

Narrative intervention has been shown to effectively increase the language skills of other populations with language disorders (Petersen, 2011). Narrative intervention systematically instructs individuals in creating a story by teaching necessary story grammar elements and providing opportunities to tell stories and receive feedback. Therefore, narrative intervention teaches individuals to use a new communicative context while targeting specific linguistic skills in the linguistically rich environment of a story. Initial positive results have been found when implementing a narrative intervention with individuals who use AAC to communicate (Soto et al., 2009). A narrative intervention for the population that uses AAC may increase the communicative competence of some individuals and increase their participation in their daily life. Although AAC narrative intervention is a relatively new area, interventions developed for other populations may prove beneficial.

Current Study

The proposed narrative intervention is a modification of the LNI intervention (Petersen et al., 2010). The intervention was modified to allow for increased communication time and evidence based AAC intervention strategies have been integrated. Additionally, the *Storytalker* intervention was implemented by a natural communication partner --the child's parent. The use of the child's parent as the interventionist allowed for possibly broader generalization effects for the child as the strategies used in a narrative intervention can be used for a variety of other contexts. As this is one of the first narrative interventions to be implemented by a parent, the parent's ability to successfully implement the intervention was the primary focus of the study, with a secondary investigation into how the intervention affects the child's narrative skills. The study addressed three aims to determine the effect of a parent-implemented AAC narrative intervention, *Storytalker*, on both the language facilitation strategies of the parents and the narrative abilities of their children.

Aim 1- Determine the effects of a parent training program on the language facilitation strategies parents use and language input they provide while teaching their children to tell a story. I measured parents use of language facilitation strategies through the *Storytalker* Parent Implementation Measure (SPIM) which generated a score of 0-100% of fidelity of intervention administration. I also used measures of mean length of utterance in morphemes (MLU-M), number of different words (NDW), words per minute (WPM) and proportion of AAC utterances to assess change in parents' language input during the study. I hypothesized parents use of language facilitation strategies and measures of language input would increase after parents received training on and successfully implemented the *Storytalker* intervention.

Aim 2- Determine the effects of a parent-implemented narrative intervention on the narrative macrostructure and microstructure of children who use AAC to communicate during a storytelling context. I analyzed the narratives produced by the child participants each session. I assessed two components of narrative growth. First, I measured changes in the number and quality of story grammar elements (macrostructure) used through the narrative macrostructure scoring scheme-AAC (NMSS-AAC). Second, I measured the language used in storytelling (microstructure) through MLU-M, NDW, number of utterances, and number of AAC utterances used in the narratives. I hypothesized measures of narrative macrostructure and microstructure would increase after the intervention was introduced.

Aim 3- Determine the acceptability and generalization of the *Storytalker* intervention through parent responses on an AAC storytelling parent survey, a semi-structured interview with parents, and parent and child behaviors during probed book sharing interactions. To examine acceptability of the *Storytalker* intervention, I asked parents to rate aspects of the intervention on a Likert-type scale. I also asked parents questions about the usefulness and feasibility of the intervention in post-intervention interviews that were transcribed and qualitatively coded. To measure generalization of the *Storytalker* intervention, I compared the parents responses regarding their child's daily communication and AAC use on the AAC Storytelling Parent Survey at baseline and post intervention. I also analyzed both the child's expressive language (NDW, NTW, number of turns) and the parent's language facilitation strategies (wait time, modeling, praising, asking open ended questions) during probed parent-child book sharing interactions with the child's own preferred books. I hypothesized parents would

have high levels of acceptability of the intervention with suggestions of how to improve the intervention. I also hypothesized the intervention would generalize to the parents interactions with their children in a book sharing task and that children would show an increase in overall communication and AAC use in everyday interactions.

Chapter 2: Methods

Study Design

A nonconcurrent multiple baseline across participants design was used. A single case design was used to provide an initial investigation into the application of a parent-implemented narrative intervention to individuals who use AAC. A single case design allows for the control of variability due to the heterogeneous profiles of the population that uses AAC. The goal of the current study was to demonstrate effectiveness of the intervention across three parent-child pairs. It was hypothesized that parent participants would improve their use of language facilitation strategies and child participants would acquire the skill of storytelling through the *Storytalker* intervention and would maintain the learned skills after the intervention was removed. Therefore, a withdrawal single-case design was not applicable. A multiple baseline across participants design also demonstrates that the results can be replicated across multiple individuals with different strength and needs profiles.

Participants

Four child participants between 6-15 years of age who use AAC devices and their parents were recruited. Participants were recruited through local therapeutic clinics, social media groups of providers and families, local speech-language-pathologists, device representatives and professional contacts. The inclusionary criteria were as follows: use of an AAC device for at least two years, a vocabulary set that is based on core vocabulary and could be replicated on an

iPad application, demonstration of understanding the WH- questions *who*, *where* and *what doing*, functional vision and hearing with or without correction and parent was fluent in English. Length of AAC use, vision and hearing abilities, and English language proficiency were confirmed through parent report. I reviewed the vocabulary on the child's device to confirm it contained a set list of core vocabulary words necessary to complete the intervention activities and could be replicated on my iPad for modeling. Each child's understanding and answering of WH- questions was assessed through a comprehension task and a parent questionnaire. The ability to comprehend WH- questions was assessed through a picture identification task. The participant was asked to identify the picture that matched the question out of a field of four. Eight items were assessed on four categories: *who, where*, *what doing* (actions) and *feelings*. To meet inclusion criteria, participants had to answer five of the eight questions correctly in the categories of *who*, *where* and *what doing* within two administrations of the measure. The child's ability to expressively answer WH- questions was assessed through a parent survey. Parents rated the frequency that their child preforms a variety of communication acts on a scale from never to almost always. The parent was asked the degree to which her child answers who, where, and what questions appropriately. To be included the parent had to report that the child at least sometimes answered two of the three categories of questions correctly. The goal was to obtain participants who understood the basic concepts of story grammar (people, places, and actions) so they could successfully learn how to express story grammar concepts in the context of a story within the study's timeframe. Three of the four children passed the screening criteria and were enrolled in the study. Pseudonyms were given to participants here to protect confidentiality.

Sam

At the time of the study, Sam was a six-year-old boy. He has autism spectrum disorder (ASD) and attention deficit hyperactivity disorder. His vision and hearing are within normal limits. At enrollment, he had used Touch Chat with Word Power for 2.5 years and was proficient at making requests on his AAC device. He had a few verbal words but required significant prompting. He made requests using complete sentences on his device independently and could answer some questions and state his feelings when prompted. Sam was enrolled in school full time and receives private speech and language therapy, occupational therapy, and applied behavior analysis services. Sam's mom is a licensed practical nurse with some college. At baseline, she reported working part time and worked with Sam on a regular basis on his communication development and schoolwork. Sam's mom was very familiar with Sam's device and knew how to search for words and program buttons.

Emily

At enrollment, Emily was a seven-year-old girl. She has Spinal Muscular Atrophy with Respiratory Distress- Type 1 (SMARD1), hypotonia and a permanent tracheostomy with a ventilator. Her vision and hearing are within normal limits. Emily is typically seated in a wheelchair and operates a motorized wheelchair with her hand. At the time of the study, Emily primarily communicated verbally. Her speech was dysarthric, but her family and caretakers understood the majority of her speech. She used Snap Core First on a Microsoft Surface Pro tablet with a Tobii PCEye bar for eye gaze access. At baseline she had used Snap Core First for 4.5 years and primarily used the word predictive keyboard to communicate on the device. She used the device frequently at school but only occasionally at home. She attended a private school in-person and had a paraprofessional. She also received private speech and language therapy and physical therapy as well as regular nursing care. Her spelling skills were excellent and she

communicated in full sentences on the device. She demonstrated a limited expressive vocabulary both orally and on the device for her age and was often frustrated when not understood.

Emily's mom is a homemaker with a Doctor of Medicine. At baseline, she reported she was familiar and comfortable with Emily's device and could troubleshoot and find vocabulary. She had received some outside help with programming in the past. She expressed a need to become more confident with modeling on the device and had minimal knowledge regarding the programming of the device. She worked with Emily on her schoolwork and took care of her daily needs.

Claire

At the time of the study, Claire was a nine-year-old girl. She has Spinal Muscular Atrophy Type 1 (SMA), hypotonia and a permanent tracheostomy and a ventilator. Her hearing is within normal limits. She has impaired distance vision and wears glasses for correction. Claire often lies in a prone position and is sometimes seated in a reclined wheelchair. She activates a switch with her finger but had little to no other voluntary motor control. At enrollment, Her primary means of communication was verbal. Her speech was severely dysarthric due to minimal oral movements; however, her family and caretakers understood the majority of her speech. She used SnapCore First on a Tobii I13 and had used AAC since she was 18 months old. She recently transitioned to the using the word predictive keyboard instead of the core vocabulary on the device. At baseline she demonstrated complex language and a diverse vocabulary in her oral speech but had significant difficulties with spelling and forming complex sentences on the device. She often reduced her sentences and simplified her vocabulary when typing on SnapCore First.

Claire's mom is a homemaker with a bachelor's degree. At baseline, she reported she was very proficient with Claire's device and regularly programed it to meet Claire's needs. Claire transitioned from virtually attending a private school to homeschooling at the beginning of the study. Claire's mom was her primary instructor and her primary caretaker. Claire also received tutoring, physical therapy, and regular nursing care. Until recently she also received private speech and language therapy services but her provider retired.

Descriptive and Screening Measures

The pre-baseline screening session used parent questionnaires, a child administered task and observation to determine if the child was eligible for the intervention. Prior to the session, all necessary paper materials were mailed to the participant's home. The pre-baseline screening session was then conducted via zoom and phone. In some cases, the screening spanned multiple days. Before any data were collected, informed consent was gathered from the parent participant and verbal assent was collected from the child participant. A series of tasks and parent questionnaires were administered to characterize the sample and to assure inclusion criteria were met.

Story Grammar Comprehension Measure

The story grammar comprehension measure was a receptive test of four concepts: people (*who*), places (*where*), actions (*what doing*) and *feelings*. The test was administered in two different formats depending on the child's available access methods. For children who had the ability to point to select, the items were administered using a paper ring-bound booklet of half-sheet pages. An electronic version was administered for children who required eye-gaze access. Each test item contained a 2x2 grid of four clip-art images. A total of 32 items were administered, equally divided across the four categories. The first three items in each category

contained foils that were not in the same category as the concept assessed (e.g., if assessing *who* foils were objects or places). The remaining five items contained more difficult foils that were in the same category as the target concept. The participant was asked to identify the picture that matches the prompt (e.g., who is the mom?). Children either pointed to the item on the paper copy or used eye gaze to select the item on the electronic copy through their cursor or magnifying the picture (whichever was the child's typical response pattern for school).

As testing was done remotely, the parent sat beside the child and held the camera so the test booklet or screen was in view. The examiner's camera was turned off and only her voice was heard to administer the items. If the participant identified five items correctly in the categories of *who, where,* and *what doing*, and qualified on the other components through questionnaires, he/she was enrolled in the study. If the participant did not meet the criteria on the story grammar comprehension measure it was administered on a second day. The two attempts could be combined to qualify for participation such that if the child identified five *where* items correctly in the first attempt and identified five *who* and *what-doing* items correctly on the second attempt, the participant would be enrolled. Individual items within the same category were not combined across the two administrations. No feedback was given on responses so that learning did not occur across the two administrations.

Parent-Child Book Sharing Measure

A parent-child interaction was also recorded during the screening session. The parent was asked to choose several books the child enjoys and to share the books with their child as they normally would for about 10 minutes. The parent was informed when 10 minutes had elapsed. The book sharing interaction was used as a baseline measure of parent-child book-sharing. 5-minute book sharing interactions were also collected throughout the intervention phase. Book

sharing probes were evaluated for parent use of language facilitation strategies and child communication as a measure of generalization of the intervention.

AAC Storytelling Parent Survey

An AAC Storytelling Parent Survey was administered to the parent which asked about the child's use of his/her AAC device and about the child's ability to respond to WH- questions. The survey is found in appendix A. I developed the first half of the AAC Storytelling Parent Survey to measure child communication with the AAC device. The second half of the survey was administered only at the end of intervention to measure intervention acceptability. The second half of the survey was adapted from Finestack et al. (2017)'s acceptability measure.

As mentioned previously, the parent needed to report the child "sometimes" responds to at least two of the three WH- questions asked. The measure also served to capture the child's daily use of the device in a variety of contexts. Seven questions about device use were rated on a scale of 1-5. Then a list of possible communication purposes was given to the parent and she indicated which purposes the child communicated for using the device in the last week. The AAC Storytelling Parent Survey was administered again after the intervention was complete to measure ways AAC use may have changed as a result of the intervention.

Vineland Adaptive Behavior Scale-3

The Vineland Adaptive Behavior Scale-3 (VABS-3; Sparrow et al., 2016) was administered to each parent to achieve a measure of the child's communication, social, and daily living skills. The VABS-3 was often done on a separate day over the phone. The VABS-3 is highly correlated with other measures of language and adaptive skills (Sparrow et al., 2016). I decided the VABS-3 would most accurately capture the child's overall developmental level given the restrictions of virtual testing. The VABS-3 was used only for descriptive purposes.

Language Questionnaires

Three additional questionnaires were used to describe the participants. Two paper questionnaires were sent prior to the session for the parent to complete. The Macarthur Bates Communication Developmental Inventory-Words and Sentences (MCDI; Fenson et al., 2007) was administered to obtain the child's number of words produced. A demographic questionnaire was also administered to capture information for screening purposes (hearing, vision, English language proficiency), child's current services and parent education. Finally, the Language Use Inventory (LUI; O'Neill, 2009) was sent via email for the parent to complete regarding the child's overall communication.

Table 1

Child Descriptive Measures

Participant	**Sam**	**Emily**	**Claire**
Story Comprehension Measure			
Who	5	8	8
Where	5	7	8
What doing	7	8	8
Feeling	1	8	8
VABS-3			
Communication Standard Score	52	71	102
Daily Living Skills Standard Score	71	65	68
Socialization Standard Score	56	70	90
Adaptive Behavior Composite	61	69	83
MCDI			
Total number of words (out of 680)	39	414	669
LUI			
Total (out of 161 possible points)	11	79	155

Storytalker Intervention

I developed the *Storytalker* intervention based on the narrative interventions in the literature and the two pilot studies I conducted. The first pilot study was conducted from May to August 2018. The participant demonstrated gains in his narrative macrostructure during the

intervention phase. The first pilot used pre-existing picture books and the SKILL narrative icons. The intervention was then adapted from the results of the first pilot. The second iteration of *Storytalker* was clinician-implemented and contained multiple narratives per session including both story retell and probed story generation narratives. The clinician-implemented version of *Storytalker* was implemented with one participant who showed gains in his narrative macrostructure after the introduction of the intervention. The clinician-implemented intervention study was halted due to the COVID-19 pandemic. The *Storytalker* intervention was adapted to be parent-implemented to allow for virtual implementation of the intervention. A parent training program was designed using Kent-Walsh & McNaughton (2005)'s recommendations for communication partner training. The following study presents the results of the parent-implemented *Storytalker* intervention.

The books were shortened and simplified when adapted for parent implementation. Therefore, two different formats of the parent-implemented *Storytalker* intervention were developed to allow children who already mastered basic story retell to participate in the study. The two formats included *story retell* and *story generation*. If a child received the maximum score on the scoring criteria for their baseline *story retell* narrative in the first or second baseline session they were switched to the *story generation* format for the remainder of the study. The two intervention formats differ only in the first part of the session. In the *story retell* format, parents told the story to the child first and the child then retold the story. In the *story generation* format, the parent showed all the pictures to the child first and then the child created his/her own story from the pictures.

Storytalker Intervention Steps and Strategies

The parent-implemented *Storytalker* intervention was designed to teach parents to support their child's narratives. Parents learned to use a systematic series of prompts and language facilitation strategies to support their child's independent telling of a narrative. The steps and strategies used in the *Storytalker* intervention are dependent on the child's responses and are designed to allow maximum opportunities for the child to tell the story independently. The steps are designed in a least-to-most support model (Ault & Griffen, 2013; Finke et al., 2017) starting with opportunities for independent production (expectant wait time and general story prompt) and ending with a parent's model and prompt for repetition. Each page contained a target story element that the parent tried to elicit from the child using the intervention steps. The steps will be outlined in this section and the subsequent section will elaborate on the individual teaching strategies used. Figure 3 shows the flow chart of the intervention steps which acted as a visual aid to the parents.

Video Example. I began each intervention session by playing a video that introduced the story grammar elements. The baseline sessions did not contain the instructional video. Each story grammar cue card was presented and defined and where the corresponding vocabulary could be found on the AAC device was shown. For example, for the *where* cue the video would show the *where* picture cue and a picture of the *places* button from the child's device. The video would say "this picture is where the story happens. You can find where the story happens in your places button on your home page". The videos for the *story retell* format also provided examples from the story of the day for each story grammar cue card with the relevant vocabulary. For example, for the *where* picture cue the first picture of the story would be shown with the *where* picture cue and the vocabulary sequence for the correct word (e.g., Where today's story happened is at the school). An example of the instructional video is shown in appendix C. The video for the *story*

generation format was 1:20 in length and the videos for the *story retell* format averaged 2:30 in length.

Parent Narrative/First Viewing. The next step of the intervention contained the largest discrepancy between the *story retell* and *story generation* formats. In the *story generation* format the parent showed each picture of the book to the child for a minimum of 5 seconds. The *story retell* format contained a parent's model of the story. A sentence that matched the page was written on the back for the parent to read with half of the words bolded. Parents were instructed to read the sentence and provide aided AAC input for at least the bolded words (50% of the words in the sentence). During aided input the parent would say the word while also selecting the word on the child's device. The bolded words also contained the icon sequence for the child's device. Some parents chose to use aided input for more than 50% of the words.

Child Narrative. During the last portion of the session, the parent supported the child's narrative by providing a systematic series of prompts. The parent began by turning the page of the book and providing prompt 0. Prompt 0 had two parts. First 10 seconds of expectant wait-time was given (0a). If the child did not provide a story related utterance, the parent would proceed to give a general story prompt (0b; e.g., "Tell me about the story"). If the child responded with a story related statement to prompt 0 the parent would proceed to prompt 1 *Repeat-Praise-Prompt*. The parent repeated the child utterance, praised the child, and prompted the child for more (e.g., "Park, great job the boy is at the park. Tell me more."). The parent then waited for 10 seconds. If the child had independently produced the targeted story element for that page and either did not add any information or told the parent he/she had no more to add the parent would move to the next page. If the child did provide more information to prompt 1,

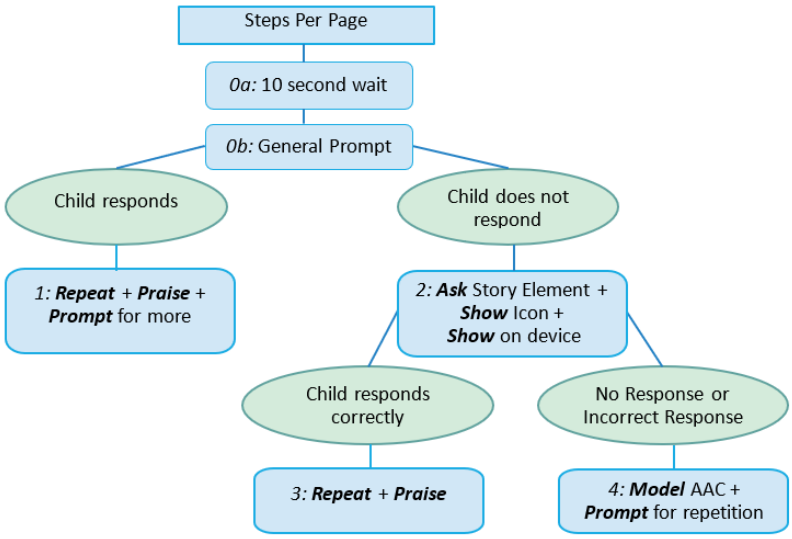
prompt 3 (*Repeat-Praise*) was administered (e.g., “Swinging. Awesome job the boy is swinging at the park”).

If the child did not independently generate the targeted story element for the page through prompts 0 or 1, then prompt 2 was used. Prompt 2 was designed help the child generate the targeted story element through verbal and visual support. Prompt 2 was labeled *Ask-Show x 2*. The parent would ask for the targeted story element, show the child the corresponding story grammar cue card and show where the related vocabulary was on the child’s device. (“What is the boy doing? *Show what doing cue card to child*. Remember you can find what he’s doing in your green action buttons”). The parent would then provide at least 10 seconds of wait time. If the child correctly responded to the prompt 2 then the parent would proceed to prompt 3 *Repeat-Praise* (e.g., “Running. Great job the boy is running”). Some parents prompted for more as part of prompt 3, but it was not required. The parent’s use of prompting for more during prompt 3 was not documented. After prompt 3 the parent would turn to the next page.

However, if the child did not provide the targeted story element to prompt 2 the parent would proceed to prompt 4, *Model-Prompt*. The parent would model the sentence using aided AAC input for 50% of the words and then ask the child to repeat the story element (“The **boy** was **running in** the **woods**. Tell me run”). The parent would provide a 10-second wait time, and whether the child responded or not, would then proceed to the next page. The steps repeated for each story element on each page.

Figure 3

Storytalker Steps Flow Chart



Session Materials

After the child qualified for the study, all materials for the baseline session were sent to the family via mail. At the end of the baseline session a second package with all parent training materials and remaining intervention materials was sent. The materials included paper books for the baseline and intervention sessions, story grammar cue cards, parent visual aids, and parent handouts for training sessions.

Storybooks. I created the picture story books with the assistance of a graduate research assistant. PowerPoint and clipart images obtained from google were used to create the books. Each child received the same set of books and books were administered in the same order to maintain consistency. The books were printed on full sheets of cardstock and bound with comb binding. Each book contained 10 pages and the order the story grammar elements were presented in was the same across all books. Table 2 demonstrates the frequency of each story grammar component in a single book and a visual layout of the story order and one example book is presented in appendix B.

Each story began by introducing the main character (*who*) and setting (*where*) on the first page. A character then preformed a single action (*what doing*) that began the story on page 2. Next the character would have a reaction (*feeling*) to that event on page 3. Page 4 consisted of the character planning what action to perform next (*thinking*). *Thinking* was depicted with a thought bubble above the head of the character and a corresponding picture inside the bubble. The character then preformed the action (*what doing*) on page 5 which resulted in a *problem* on page 6. The character had a resulting reaction (*feeling*) on page 7. The character then developed a second plan (*thinking*) on page 8. Page 9 depicted the character performing the action planned (*what doing*). The story then wrapped up on page 10 with an action and a resulting good feeling from the character (*ending*). The order of story elements was maintained in each book. The only aspects that varied were the timing of the introduction of the second character and the number of background settings used. All backgrounds were simplistic to ensure clarity of images.

Table 2

Story Grammar Elements Present in Books

Story Grammar Element (related story grammar cue card)	**Number of times present in the story (script & images)**
Character (*Who*)	2
Setting (*Where*)	1 (minimum)
Action (*What doing*)	3
Feelings (*Feeling*)	2
Plan (*Thinking*)	2
Problem (*Problem*)	1
Ending (*Ending*)	1

Each page of the books contained a corresponding sentence on the back of the page for the parent to read. The words were kept out of view of the child so the child could not copy the sentence. For the baseline books, only the text was written on the back with at least half of the words bolded for each sentence. The intervention books contained both the text and the

corresponding icons for the bolded words on the back of each page to assist parents when providing aided input. The children were not able to see the text or icons. For parents modeling using core vocabulary, the entire button sequence was pictured for the given word (e.g., for "forest": places button, nature button, forest). For parents modeling on the keyboard, only the corresponding icons displayed in the predictive word bar was given (e.g., forest icon).

Story Grammar Cue Cards. Seven story grammar cue cards were used in the intervention and are depicted in figure 4. The story grammar cue cards were used to directly teach story grammar elements and as a visual prompt for the inclusion of story elements. The cue card was shown to the child by the parent during prompt 2. The pictures for the cue cards were obtained from opensymbols.org (OpenAAC, 2019) and colored to increase visual interest. They were printed and laminated for parent use.

Figure 4

Story grammar cue cards

Parent Training Materials. Parents were given a handout version of the PowerPoint information that was reviewed during the training sessions. The handout allowed them to take notes and follow along with the presentation. Parents were also supplied with a laminated card that contained a visual aid of the steps necessary for the intervention. Parents were allowed to use the visual aid during the training and intervention sessions.

Additional materials were made and sent upon request. Sam's mom requested a visual schedule to maintain Sam's motivation. Claire's mom requested a paper copy of the book script due to Claire's positioning needs.

Teaching Strategies

Several evidence-based teaching strategies developed for children with developmental disabilities and for children who use AAC were used in the *Storytalker* intervention. The strategies included aided AAC input, least-to-most prompting, expectant wait time, open ended questions, visual and verbal prompts, and specific praise. The adherence to the use of the teaching strategies was measured through Aim 1 and the results of the use of the strategies on the child's narrative macrostructure and language output was measured through Aim 2.

Aided AAC Input

Aided AAC input denotes a communication partner's indication of a symbol on an individual's AAC device while simultaneously speaking the message aloud during a continuous interaction (O'Neill et al., 2018). Aided AAC input has been demonstrated to be a highly effective means of teaching vocabulary and the use of multiple symbol messages for individuals who use AAC to communicate (Allen et al., 2017; Biggs et al., 2018; Binger & Light, 2007; O'Neill et al., 2018). Aided AAC input was used during two portions of the *Storytalker* intervention. First, the parent implementing the *story retell* format used aided AAC input when telling the story to the child. By telling the story using aided AAC input, the child heard the story from both the parent's verbal production and through the production on the device. It allowed the child to see how to construct the message and where the vocabulary items could be found on their device. Second, the parent used aided AAC input to model the sentence for the child in prompt 4 in both *story retell* and *story generation* formats. Prompt 4 was the maximal level of

support given if the child could not generate the story element through the other prompts. Prompt 4 set the child up for success by stating the targeted story element and showing the child where the word was ("The ***boy ran away.*** Tell me ran"). However, the parent still modeled the word within the sentence so the child was not simply repeating the motor action of the parent but also heard the story element in the context of a sentence.

Least-to-Most Prompting

Least-to-most prompting is a series of at least three prompts that progress from the lowest level of support of a natural cue to the highest level of support. The instructor advances through the series of prompts until a target skill is demonstrated (Ault & Griffen, 2013). It has been proven effective at teaching school-age children who use AAC to create multi-symbol messages (Finke et al., 2017). The steps and strategies of the *Storytalker* intervention are designed in a least-to-most prompting format. Increasing support strategically allowed the child to independently produce as much of the story as possible before the parent offers support. Then the child was guided to produce the targeted story element through open ended questions before an example response was modeled by the parent.

Expectant Wait Time

Expectant wait time was used as the natural cue for the first prompt in the *Storytalker* intervention. Expectant wait time consisted of providing enough time for the child to take a communicative turn. The parent could look expectantly at the child or just wait in the presence of the child for the child to respond. Parents were taught to use a wait time of 10 seconds. The parent waited for at least 10 seconds (or less if the child responded sooner) after every question they asked or prompt they gave. Expectant wait time allowed the child time to process the prompt and produce an answer. Parents judged whether 10 seconds was sufficient or if the child

needed longer to produce an utterance by reading the child's nonverbal cues (e.g., looking at the screen, searching for words).

Open Ended Questions

Parents were encouraged to ask open ended questions rather than yes/no questions. Specifically, in prompt 2 parents were instructed to ask an open ended WH question about the targeted story element. Open ended questions were used to encourage a more descriptive response from the child rather than a yes/no response (Light et al., 1985; Binger et al., 2008). The question provided context for the child on what part of the story they should be including without telling them an exact response.

Visual and Verbal Prompts

Both visual and verbal prompts were included in the *Storytalker* intervention. Parents used general verbal prompts in prompts 0b (tell me about the story) and prompt 1 (tell me more). General verbal prompts allowed the child additional chances to elaborate on their story independently without the parent directing what should be included in the story. Parents also used specific verbal prompts in prompt 2 (Who is in the story?, What is he doing?). The open-ended WH question in prompt 2 was paired with a visual prompt of the corresponding story grammar cue card. The pairing of the question with the cue card provided the child a visual link to the story element targeted (Gillam et al., 2015; Petersen et al., 2010). Prompt 2 also provided an additional specific verbal prompt that told the child where the relevant vocabulary could be found on their device for that story element. The child was provided context of where vocabulary could be found to answer the question.

Praise

Finally, parents were taught to provide specific praise to their child when he/she produced a story related utterance. Parents were encouraged to not only tell their child that they did well but why their utterance was good. For example, if the child said “boy” the parent could say “great job the boy is who is in the story”. Behavior-specific praise is an effective teaching strategy that encourages the child to demonstrate the same skill again in the future and leads to improved student outcomes (Gage & MacSuga-Gage, 2017). However, the parents use of general versus specific praise was not scored in the parent fidelity measure of the current study.

Baseline Phase

I conducted all sessions via Zoom for telehealth license. All participants began with the *story retell* format. Baseline sessions for the *story retell* format consisted of a parent’s model of a story from a picture book and the participant’s retell of the story from the same book. The parent was instructed to read the book to the child as they normally would, given the script provided. Claire received the maximum score on the narrative macrostructure scoring scheme-AAC (NMSS-AAC) measure in her first baseline session when preforming story retell narratives. Thus, the first baseline session was removed from analysis and she began the *story generation* format of the intervention. For the *story generation* format, Claire’s mom was instructed to show Claire each picture for at least 5 seconds so she could view the whole story. Then parents were instructed to have their child tell the story to them using the strategies they currently use to help their child communicate. Baseline storytelling sessions allowed for analysis of the strategies parents were already using with their child and strategies that needed further instruction. The child’s current storytelling skills were also assessed. A new book was administered at each baseline session.

Each participant entered the baseline phase before moving to the training and then intervention phases; however, the length of the baseline phase differed for each participant. The number of intervention sessions was randomized but response-guided decision making was used to confirm baseline length. Response-guided decision making uses visual analysis of the data during the study to make phase change decisions to reduce type 1 error (Ferron & Jones, 2006). In the current study response-guided decision making required several conditions, set during the design of the study, to occur before the individual was moved into the training phase. Data were required to be stable or show a declining trend for the previous three sessions before entering the training phase. The parent's use of strategies as assessed through the *Storytalker* Parent Implementation Measure was used to determine the consistency of the data and confirm the decision of phase changes for each participant. Parents last three scores in baseline were required to be within 20% of one another to be considered stable.

Randomizing the number of baseline sessions increased the external validity of the study and making a response-guided decision assured practice effects were not occurring for the parent fidelity measure and reduced the chance of type 1 error (Ferron & Jones, 2006). The randomization of intervention phase entry and consistency criterion limits the possibility of change due to extraneous variables (Ledford & Gast, 2018).

Training Phase

After the parent and child participants completed the baseline phase, they entered the training phase. The training phase taught the parent participants the skills and strategies of the intervention and provided the parents opportunities to practice with support. The parent was required to meet multiple mastery criteria in the training phase before moving to the intervention sessions to ensure accurate administration of the intervention. The parent training was designed

using Kent-Walsh & McNaughton (2005)'s recommendations for communication partner training. Kent-Walsh & McNaughton proposed an 8-stage strategy instruction for communication partners who use AAC that is based off the strategy instruction model of Ellis et al. (1991). The ImPAACT program has successfully trained parents (Kent-Walsh et al., 2010) and educational assistants (Binger et al., 2010) to provide AAC intervention using the 8-stage model (Kent-Walsh & McNaughton, 2005). The current study used a four phased training program based on the 8-stage model.

Phase 1

Phase 1 of the training aligns with stage 2 of Kent-Walsh & McNaughton (2005)'s model, *Strategy Description*. Phase 1 of training consisted of one 1-hour session with the parent. I directly taught the strategies that would be used in the intervention and facilitated discussion with the parent. The session started with praising the parent for the strategies she was already using in baseline and introducing the basic strategies on which the parent could improve. An example of each of the strategies to be used on a given page was provided so the parent had a general understanding of the structure of the intervention. Next, each strategy used in the intervention was reviewed in more detail. The strategy was defined and an example was provided, including the appropriate timing for implementing the strategy when supporting storytelling. Finally, the benefits of using the strategy were reviewed along with uses for the strategy outside of the storytelling context. At the end of the session, the parent was asked to set a goal for themselves to work on throughout the intervention.

Phase 2

Phase 2 was one 40-minute session. I modeled how to provide aided AAC input and to implement the steps of the intervention for an entire book. A visual flow chart for each of the

steps on each page was presented so the parent. The parent could ask questions throughout the process for clarification. The parent then named each of the steps and strategies in order while I provided feedback. Phase 2 encompassed stages 3 and 4 of Kent-Walsh & McNaughton (2005)'s model, *Strategy Demonstration* & *Verbal Practice of Strategy Steps*.

Phase 3

During the third phase of the training, the parent practiced using the steps and strategies on training books while I responded as the child. Parents using the *story retell* format also practiced using aided AAC input for each page of the book. Phase 3 aligns with stage 5 of the communication partner training, *Controlled Practice and Feedback*. I also provided coaching through corrective feedback and praise during the sessions. Phase 3 allowed the parents to practice the steps of the intervention and increase their confidence before adding additional variables their child provided. The criterion for mastering phase 3 was at least 90% accuracy on two different consecutive books with minimal support provided from myself. Parents completed phase 3 in two to four sessions.

Phase 4

In phase 4 the child was introduced back into the sessions. Parents administered all of the steps of the intervention to the child and tailored the strategies to the child's responses. I continued to give online feedback to the parent. The parents could also ask questions during the session. Once a parent demonstrated 80% or greater accuracy across two different and consecutive practice books with minimal support, she had mastered the training and could move to the intervention sessions. Phase 4 aligned with stage 6, *Advanced Practice and Feedback*, of Kent-Walsh & McNaughton (2005)'s model. Stages 7 and 8 of Kent-Walsh & McNaughton (2005)'s model were accomplished through the intervention phase with ongoing assessment of

parent's use of their skills and measures of generalization in the book sharing context during probed sessions.

Child Intervention Phase

The intervention phase focused on teaching the child participant to tell a story. The maintenance of the parents skills and fidelity of administration was also measured across sessions. The sessions mirrored the phase 4 sessions however, I did not give online feedback to the parent. Coaching was only provided during breaks or at the end of the session. The coaching during intervention sessions included answering parent questions and providing summative feedback. At the end of every session, I told the parents what they did well during the session. I also gave parents feedback on how to improve their use of the strategies with their child when necessary. If a parent missed a step in the prompting hierarchy several times during the session, I would remind them of how to preform the step for the next session.

Sessions were conducted twice a week as much as possible given family schedules. The length of sessions varied by child participant performance but averaged 41.5 minutes (range 24.5-61.2 minutes) in length. Each intervention book was administered a maximum of three times. If the child participant included each of the story elements independently, then that book was considered mastered and the subsequent book was used at the next session. A total of five intervention books were administered for a maximum of 15 sessions. If the child mastered books in less than three sessions he/she had less than 15 sessions.

Dependent Measures

Aim 1

Aim 1 was measured through the *Storytalker* Parent Implementation Measure (SPIM) The SPIM measures the parent's implementation of the steps of the intervention. The full SPIM

measure is in appendix D First, the parent's use of aided AAC input during the storytelling portion was assessed on each page for the *story retell* format. If the parent used aided AAC input for at least 50% of the words then a point was given for that page. The parent could earn a total of 10 possible points during her telling of the story.

In the *story generation* format, the parent was assessed on whether or not they showed each page to the child for at least 5 seconds at the beginning. The parent received a total of 1 possible point for showing the pages. In the *story retell* and *story generation* formats, parent adherence to the steps of the intervention was assessed. The number of steps necessary on each page was dependent on the child's responses. If the step was necessary, the scorer assessed whether it was administered correctly. Each step was broken into its individual components. For example, the *Ask-Show x 2* prompt 2 was broken into four components: (1) asking for the element, (2) showing the cue card, (3) telling the child where to look on the device and (4) a 10 second wait time. A parent received a point for each component they completed. The number of components completed by the parent was divided by the number of necessary components and then multiplied by 100 to achieve a percent fidelity out of 100. I scored the SPIM live during each sessions. I used the video recordings to confirm scores when necessary (e.g., confirming a 10 second wait time). Recordings were also used by reliability coders.

Measures of parents' language use were secondary dependent variables. All sessions were transcribed by myself and graduate research assistants. Every file was listened to at least twice for accuracy. Utterances were segmented by C-unit, coded with the Systematic Analysis of Language Transcripts (SALT; Miller & Iglesias, 2016) conventions, and analyzed in SALT software (SALT Software, LLC, 2017). Parents' mean length of utterance in morphemes (MLU-M), number of different words (NDW), words per minute (WPM) and the number of AAC

utterances were measured for each session. MLU-M measured the length of parent utterances. NDW measured the diversity of vocabulary that the parent was using during the session. WPM gave a measure of overall rate of speech and also indicated the amount of pause time the parent gave the child to communicate. As pause time increases the parents rate of speech should decrease. Finally, the number of utterances where the parent produced at least one word on the AAC device were totaled. The measures of parent language use demonstrate whether the intervention changed the language input the child received during the sessions.

Aim 2

Aim 2 was measured through the NMSS-AAC. I scored all narratives from transcripts of the sessions. The elements scored are seen in table 3 and the full NMSS-AAC is presented in appendix E. The NMSS-AAC assessed the child's inclusion of key story grammar elements in the story: *who, where, actions, feelings, plans, problem,* and *conclusion*. Each page corresponds to one item on the NMSS-AAC except the first page which covered two items (*who* and *where*). Scoring each element separately allowed for the assessment of the inclusion of each story grammar element at each opportunity as well as an overall score for the element. For example, each story had two plans/*thinking* elements. The child was given individual scores for each plan and then the two sub-plan scores were totaled for a total plan score. The categories of *who, feeling, plan* and *conclusion* were rated on a scale of 0-3 and all others were scored on a scale of 0-2 for a total possible score of 28.

The total NMSS-AAC score reflected the participant's ability to include the story grammar elements, to structure and organize a story and to provide the necessary details and events that the story needed to be understood. The total narrative scores from the participant's stories were measured to assess growth for aim 2. I was interested in the child's growth of

independent story telling skills. Therefore, only the responses generated from prompts 0 and 1 were scored for the child's independent storytelling skills. The responses generated from prompt 2 were scored for Sam and plotted next to his independent scores to demonstrate his growth in his ability to answer questions about the story due to his slow progress in independent storytelling.

The NMSS-AAC was an adaptation of the index of narrative complexity rubric (INC; Petersen, Gillam, & Gillam, 2008). Significant adaptations were made to match the complexity of the books and to allow for more variance in the lower score ranges. The NMSS-AAC did maintain the concepts scored in the INC and some of the scoring language.

Table 3

NMSS-AAC Narrative Macrostructure Aspects and Definitions

Narrative Macrostructure Aspect *(Scale item is scored on; corresponding INC element)*	**Definition**
Who *(0-3; Character)*	References the subjects in the story.
Where *(0-2; Setting)*	References a location or time of day in the story.
First action *(0-2; Initiating Event)*	References an action that starts the story.
First Feeling *(0-3; Internal Response)*	Reference to the character's emotion or state of mind.
First Plan *(0-3; Plan)*	Uses a cognitive verb that shows a character is thinking about the initiating event and plans to act.
Second Action *(0-2; Action/Attempt)*	Action taken by the main character to solve the problem and fulfill the plan.
Problem *(0-2; Complication)*	An event that stops the character from following through with the plan or action.
Second Feeling *(0-3; Internal Response)*	Reference to the character's emotion or state of mind.
Second Plan *(0-3; Plan)*	Uses a cognitive verb that shows a character is thinking about the initiating event and plans to act.

Third Action *(0-2; Action/Attempt)*	Action taken by the main character to solve the problem and fulfill the plan.
Conclusion *(0-3)*	The final event that wraps-up the story and talks about the character's feelings.

The child's language outcomes in **Aim 2** were measured through number of utterances, number of AAC utterances, MLU-M, and NDW. The child's number of utterances provided a measure of the overall production of the child during the session and the measure of AAC utterances provided a measure of the amount of AAC use. MLU-M provided a measure of change in utterance length and syntactic complexity. The measure of NDW provided a gross measure of change in semantic diversity.

Interrater Reliability

One-third of the sessions were scored by trained graduate research assistants on the SPIM measure for reliability. Point-by-point agreement was conducted on the SPIM measure and the average reliability was 94.43% (range 86.76% - 99.16%). One-third of the narratives were scored by trained graduate research assistants. Krippendorff's alpha (Krippendorff, 2004) was calculated to ensure reliability to the coding scheme. Krippendorff's alpha for the total NMSS-AAC narrative scores was .96 and when computed across all scoring components was .88.

Aim 3

Aim 3 was measured through an AAC storytelling parent survey, a semi-structured parent interview, and parent-child book sharing probed interactions. The AAC Storytelling Parent Survey, described previously, was given at baseline and post-intervention. An additional set of questions regarding the acceptability of the intervention was added to the post-intervention survey and parents were asked to rank different components of the intervention. The parent's response to items regarding their child's communication and AAC use was compared at baseline

and post-intervention to measure generalization. Additionally, each parent-child duo was asked to share a book together for 10-minutes at the pre-baseline screening session and for 5-minutes during probed sessions during the intervention phase. Parents rate of using language facilitation strategies taught during the intervention were analyzed to determine if their use of strategies transferred to a different context. Child language use was analyzed through measures of MLU-M, NDW, and number of utterances.

Acceptability of the *Storytalker* intervention was measured through the final questions of the AAC Storytelling Parent Survey and the semi-structured parent interview. Parents were asked questions regarding the usefulness of the intervention, adverse side effects, and changes they would recommend for future. The interviews were qualitatively coded for the codes of positive intervention effects, carry over effects and suggested intervention changes. The themes that emerged from parent responses are reported descriptively.

Data Analysis

All dependent variables of the first two aims were analyzed through visual analysis. Visual analysis was be used to determine if there was a functional relation between the intervention and the change in the dependent variables. Effect size measures were completed on the tiers that demonstrated an effect through visual analysis. The effect size measures were used to determine the magnitude of effect of the intervention on the dependent variables.

I determined if a functional relationship was present through visual analysis of the graphed data. I examined six factors: level, trends, variability, immediacy of the effect, overlap and consistency of data patterns across similar phases (Kratochwill, 2013). The criteria by which each factor of visual analysis was measured is detailed below in table 4.

Two measures of effect size were used based on the data collected. The effect size measure of within-case log response ratio (LRR) quantifies the effect magnitude and direction the intervention had on an outcome (Pustejovsky & Ferron, 2017). LRR is calculated by taking the log of the mean value of phase B divided by the mean value of phase A. LRR can be converted into percent change by the following equation (% Change = 100% x (e^{LRR} – 1). The percent change is relative to the child's own data and can exceed 100%. LRR can only be used for cases which have baselines above an average of 0 and outcomes that are measured using a ratio scale (Pustejovsky, 2018). As baselines with a mean of 0 existed for at least one participant for the variable of parent use of AAC, Tau-U was calculated for parent use of AAC (Parker, Vannest, Davis, & Sauber, 2011). All other variables used LRR for an effect size measure. The Tau-U and LRR estimated effect sizes and percent change for each case was calculated using an online calculator (Swan & Pustejovsky, 2016). For the measures requiring the use of Tau-U the overall average effect size was reported.

As aim 3 consisted of probe, survey data and interview responses there were not sufficient data points to conduct a visual analysis. Instead, the nonparametric Wilcoxon signed-rank test was conducted on the pre-post AAC use survey scores to determine if there was a significant difference in AAC use before and after the intervention. The parent-child book sharing probe data were examined descriptively.

Table 4

Criteria to Evaluate the Presence of a Functional Relation when Conducting Visual Analysis

Criteria	Description
Level	The mean value for the parent fidelity measure and all parent language input measures (aim 1) in the intervention phase was expected to be greater than the mean value in the baseline phase with the exception of WPM which was expected to decrease.

	The mean value for the macrostructure score and child language measures (aim 2) in the intervention phase was expected to be greater than the mean macrostructure score and language measures in the baseline phase.
Trend	A flat trend line was expected to be seen for parent variables during baseline. Child variables were expected to be flat or highly variable during baseline. As parents were being trained in the training phase, the parent measure of the SPIM was expected to have a flat or slightly increasing trendline in the intervention phase. Parent language use measures were expected to have a positive trend line. The child macrostructure and language scores were expected to have a positive trendline.
Variability	A high degree of variability was expected in the child variables in baseline with some variability was expected in the beginning of the intervention phase. Variability was expected due to the complex disorders associated with the population that uses AAC that may affect day to day performance. Additionally, I expected a drop in performance when each new book was introduced. Any outside factors that could influence variability (e.g., fatigue, medication change, etc.) were documented. Parent data were expected to remain relatively stable throughout both phases.
Immediacy of Effect	I predicted that the effect of the treatment on the child variables would be delayed due to the complex nature of the participants' disabilities which may slow the rate in which they can demonstrate their learning. As a delay in effect was predicted in the intervention, the immediacy of effect played a smaller role in determining the functional relation for the child variables and a delay in effect would lower the threat to internal validity. However, an immediate effect was expected for the parent variables given the criterion level required for the training phase.
Overlap	A small amount of overlap was predicted for all child variables during the first several intervention sessions due to the predicted delayed effect of the intervention in the population that uses AAC. Minimum to no overlap was expected for the parent SPIM measure.
Consistency within phase	A positive trend was expected in the treatment phase of every child participant. Variability between participants was likely as they each had their own unique communication and learning style. I expected for a similar pattern to occur within the same phase for each participant; however, the magnitude of change may vary by participant. The trend lines for the parent SPIM measure were expected to be similar across participants.

Chapter 3: Results

A nonconcurrent multiple baseline across participants design was used to analyze the effects of the *Storytalker* intervention on the parents use of language facilitation strategies and secondary effects on the parents use of language (aim 1) and secondarily the effects on children's

narrative macrostructure and microstructure (aim 2). Parents were each randomly assigned a number of baseline sessions that had to be completed before training began. Parents baseline scores on the SPIM also had to be stable or show a declining trend in order to enter into the training phase. Therefore, the intervention effects on the SPIM measure was the primary variable of interest. The SPIM was the only variable for which control was demonstrated. All other measures collected were secondary and were not used to make phase change decisions. Visual analysis was used to determine if there was a change from baseline to intervention. Each tier was analyzed for changes in level, trend, variability, immediacy of effect, overlap and consistency within phase (across tiers). When a change from baseline to intervention was noted in a tier the effect size measure LRR was computed. For variables that showed three demonstrations of an effect, the average LRR was computed. LRR could not be computed for parent use of AAC as two parents had baselines with means of 0 thus Tau-U was calculated.

Aim 1

Determine the effects of a parent training program on the language facilitation strategies parents use and language input they provide while teaching their children to tell a story.

Parent Intervention Implementation

Aim 1 was analyzed through multiple measures. The primary measure was the SPIM. The SPIM yields a score that indicates the percentage of steps and strategies correctly implemented by the parent. The parent participants' scores on the SPIM are presented in figure 5. All three parent participants demonstrated strong immediacy of effect to the intervention after the training sessions. Both baseline and intervention data were relatively stable as predicted. Trend lines were flat for both phases for all three parents which was expected in intervention given the fidelity requirement during training. Consistency of trend was also seen within phases

across the three mothers. The average LRR across the three tiers was 1.5 with an average relative percent change of 332%.

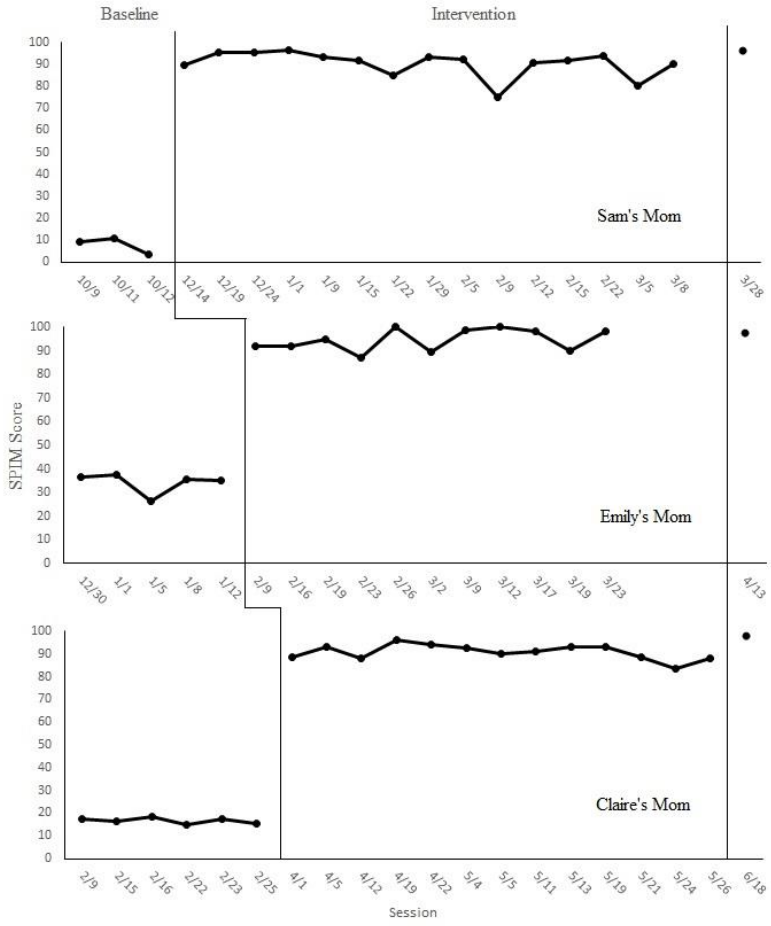
Sam's Mom. During baseline, Sam's mom used 10% or less of the intervention steps in a given session. The strategies she used during baseline were asking some open-ended questions about story elements, modeling on the device, and repeating his utterances. However, she used strategies inconsistently and with minimal pause time. After training, she was able to maintain fidelity of 80% or above for all sessions except session 13. A short booster training session was completed before session 14 and she returned to acceptable levels of fidelity. Sam's mom's LRR was 2.41 with a relative percent change of 1009%.

Emily's Mom. Emily's mom used the greatest number of strategies at baseline. She averaged 34.3% on the SPIM during baseline with no instruction on strategy use. She consistently used the strategies of asking open-ended questions about story elements, wait time, and repeating Emily's utterances during baseline sessions. Emily's mother maintained high levels of fidelity during the intervention phase with an average SPIM score of 94.7%. Emily's mom had an LRR of 1.01 equating to a relative percent change of 175%.

Claire's Mom. The SPIM measure varied slightly for Claire's mom as she did not need to model the story for Claire, only show the pictures. The total possible points she could receive in a given session decreased by 9; however, the majority of points of the SPIM come from supporting the child's narrative. Claire's mom's baseline SPIM scores averaged 16.7%. She consistently provided sufficient wait time but used few other strategies to support Claire's storytelling during baseline. After training, she demonstrated an immediate improvement in strategy use and her data were stable with an average score of 90.8%. Claire's mom had an LRR of 1.69 equating to 443% change.

Figure 5

Parent Scores on SPIM Fidelity Measure



Parent Language Input

Parent Speech Rate and Pause Time. Parents' rate of speech was measured using WPM. WPM indicates both the rate of language input the parent provided and the amount of wait time given to the child. Parents' WPM was calculated from the portion of the session when the parent supported their child's narrative and excluded their telling of the narrative. Parents' data for WPM is in figure 6. Levels of rate of speech decreased for Sam's mom from baseline to intervention immediately after intervention began. Emily's mom did not immediately or

consistently decrease her speech rate. Claire's mom's rate increased after intervention began. Therefore, an intervention effect for rate of communication was not observed.

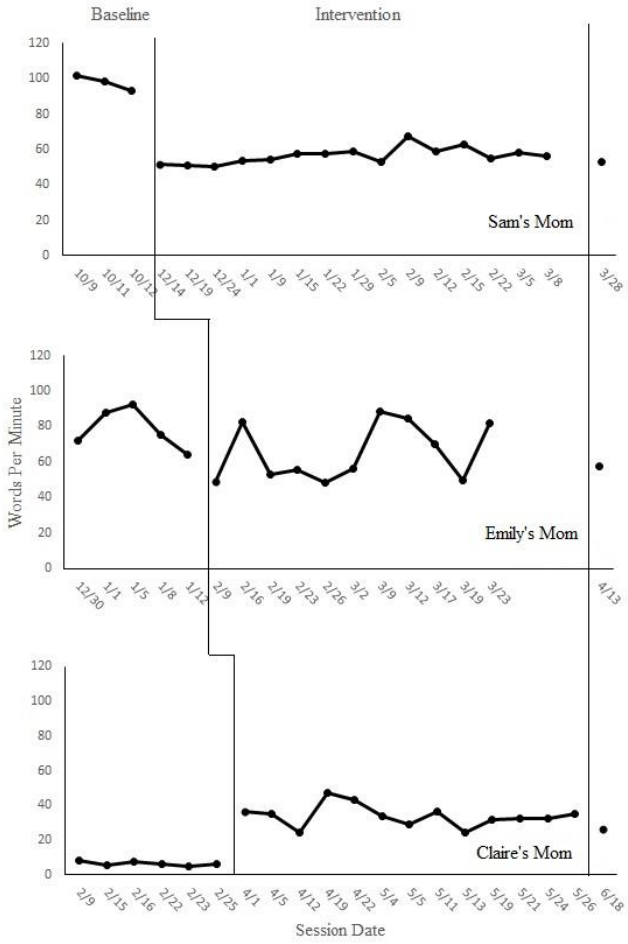
Sam's Mom. Sam's mom demonstrated an immediate decrease in her WPM in the intervention phase. The trend lines were flat in both baseline and intervention and her lower rate of speech was maintained at follow-up. Her rate of speech decreased from an average of 97.8 WPM during baseline to 56.4 WPM during intervention. LRR was -.55 equating to a relative 42.6% decrease.

Emily's Mom. Emily's mom's data were highly variable in both baseline and intervention phases, resulting in overlap. Her rate of speech appeared to vary on factors other than the intervention. The intervention did not result in a clear decrease in her rate of speech.

Claire's Mom. The intervention had an opposite effect on Claire's mom rate of speech than what was predicted. She showed an immediate increase when the intervention was introduced. Claire's mom produced very little speech during baseline resulting in a stable, low rate of speech. During intervention she spoke more frequently, as the intervention required, therefore increasing her rate of speech. However, her average rate still remained relatively low during intervention, compared to the other mothers, at 34.1 WPM, indicating she still provided adequate pause time for Claire to communicate. Her LRR was 1.62 equating to a relative 406.2% increase.

Figure 6

Parent Words per Minute



Parent MLU-M. The length of parent's utterances was measured through MLU-M. It was not expected that drastic change in level of MLU-M would be observed as parents language was fully developed and the intervention did not directly teach parents to use longer utterances. However, MLU-M is an important factor in the language input a child receives. Sam and Claire's moms demonstrated an immediate change in level after the introduction of the intervention. Both remained stable in the intervention phase and no overlap with baseline data was present. Emily's mom's MLU-M level and data path were the same in both the baseline and intervention phases. Three demonstrations of effect were not observed for change in MLU-M.

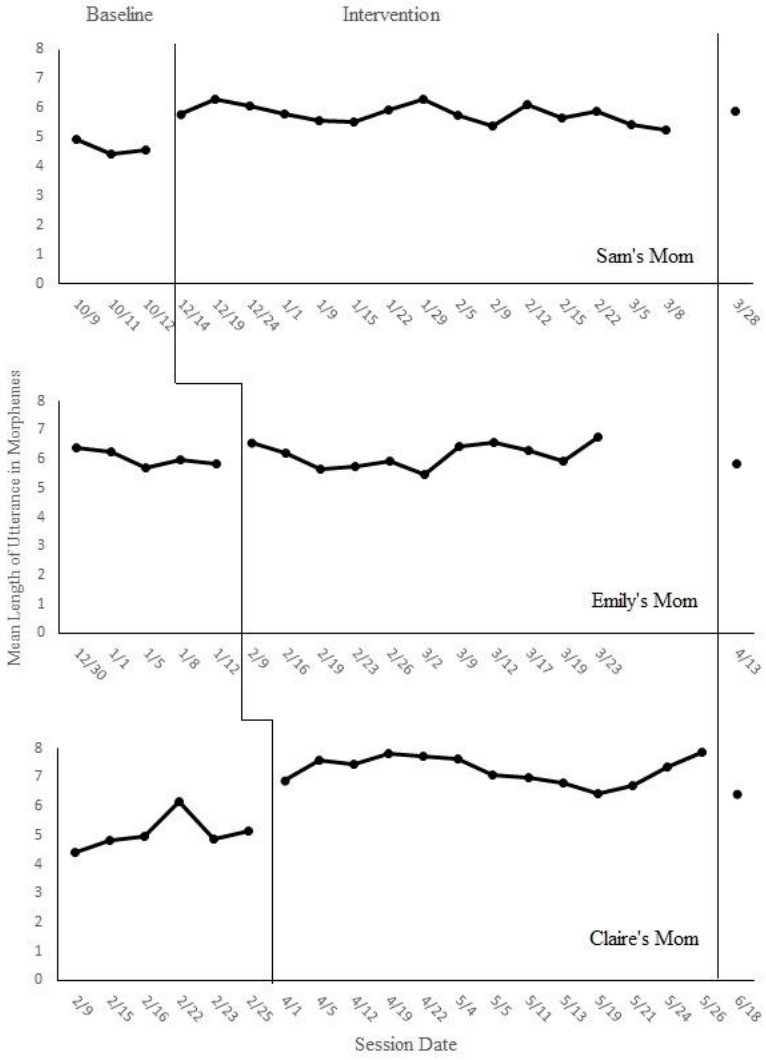
Sam's Mom. Sam's mom's MLU-M increased from baseline to intervention. Baseline MLU-M averaged 4.6 and the average in the intervention phase was 5.8. The trend line in intervention remained relatively flat with a slight decrease at the end of intervention. However, her MLU-M increased again at follow-up. There was no overlap between phases. Sam's mom used longer utterances and provided more sophisticated language input in the intervention phase compared to the baseline phase. LRR for Sam's mom was .22 which equates to a relative percent change of 25%.

Emily's Mom. No change was demonstrated in Emily's mom's MLU as a result of the intervention. Trend lines and level were similar in baseline and intervention with high degrees of overlap. Emily's mom did not change the sophistication of language she was providing to Emily in the intervention phase compared to baseline.

Claire's Mom. Although her baseline was more variable, Claire's mom demonstrated a change in level for the MLU-M measure. Her baseline average MLU-M was 5.1 compared to an average of 7.3 in intervention. There was no overlap in the intervention and baseline phases and a positive trend line was observed at the end of intervention. Claire's mom increased both the amount of language input she provided (number of utterances) and the length of her utterances (MLU-M) in the intervention phase. Her follow-up MLU-M dropped to slightly above the highest baseline MLU-M. Claire's mom had a LRR of .36 which equates to a relative percent change of 43%.

Figure 7

Parent Mean Length of Utterances

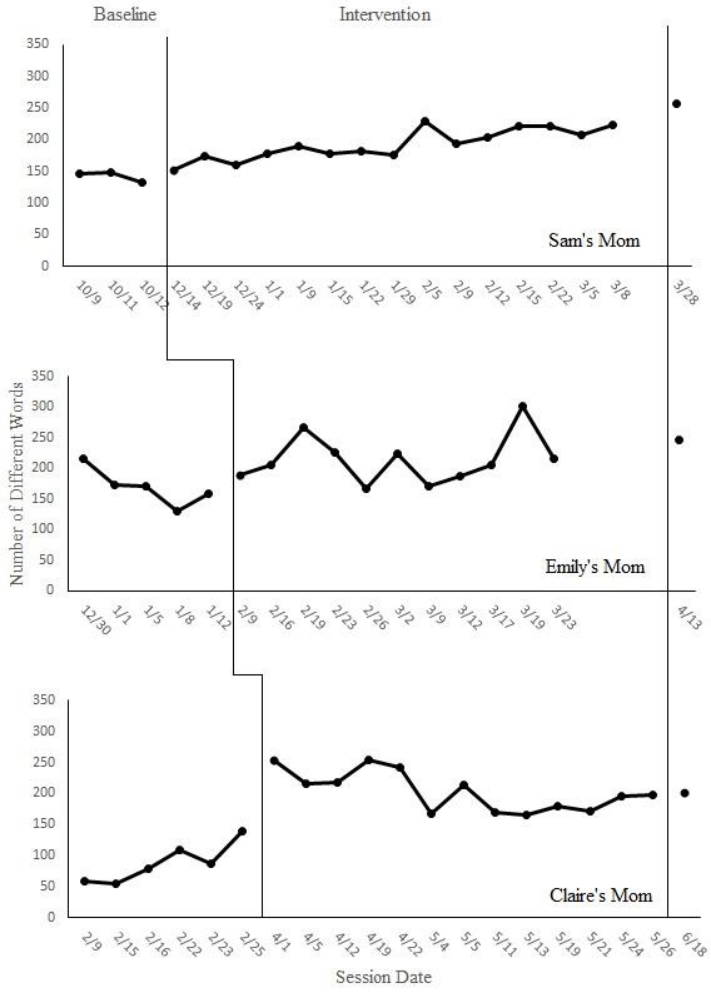


Parent NDW. The parents' diversity of vocabulary was measured through NDW. The three parents demonstrated varying degrees of variability in the baseline and intervention phases. The trendlines also varied by parent and therefore consistency within phases did not exist. However, all three parents demonstrated a change in level after the intervention was introduced. The intervention may increase the diversity of words the parent uses when participating in a narrative activity with their child but further investigation is needed. The average LRR across the three tiers was .45 with an average relative percent change of 57.58%.

Sam's Mom. Sam's mom showed a flat trend line in baseline and a positive trend line in the intervention phase which continued through the follow-up session. Immediately after the intervention was introduced, she demonstrated a small change in level and there was no overlap between phases. She increased the diversity of vocabulary she used in the intervention phase compared to the baseline phase. LRR for Sam's mom's tier was .32 which equates to 37.6% change.

Figure 8

Parent Number of Different Words



Emily's Mom. Emily's mom had the greatest variability in her data in both the baseline and intervention phases. However, there was a change in baseline compared to intervention. Her baseline phase showed a decreasing trend line and her intervention phase demonstrated a slight positive trend line. The change in trendlines is promising to demonstrate a change in vocabulary diversity as a result of the intervention but there are likely other factors that contributed to the variance. Her LRR value was .24 which equates to 27.8% change.

Claire's Mom. The data paths for NDW for Claire's mom were different than the other two parents. She showed a positive trendline in baseline, a large change in level at the onset of intervention, and then a negative trendline during the intervention phase. Despite the negative trendline, her intervention NDW never overlapped with her baseline NDW. Her tier has a LRR of .82 which equates to a 126.2% change.

Parent Use of AAC. The number of parent utterances that contained AAC (dots) is graphed in conjunction with the total number of parent utterances (bars) to demonstrate the proportion of AAC use in relationship to all of the parents' utterances. Emily and Sam's moms both demonstrated a change in level after the intervention was introduced. Flat trend lines were present in baseline and intervention across tiers. However, three demonstrations of effect were not observed.

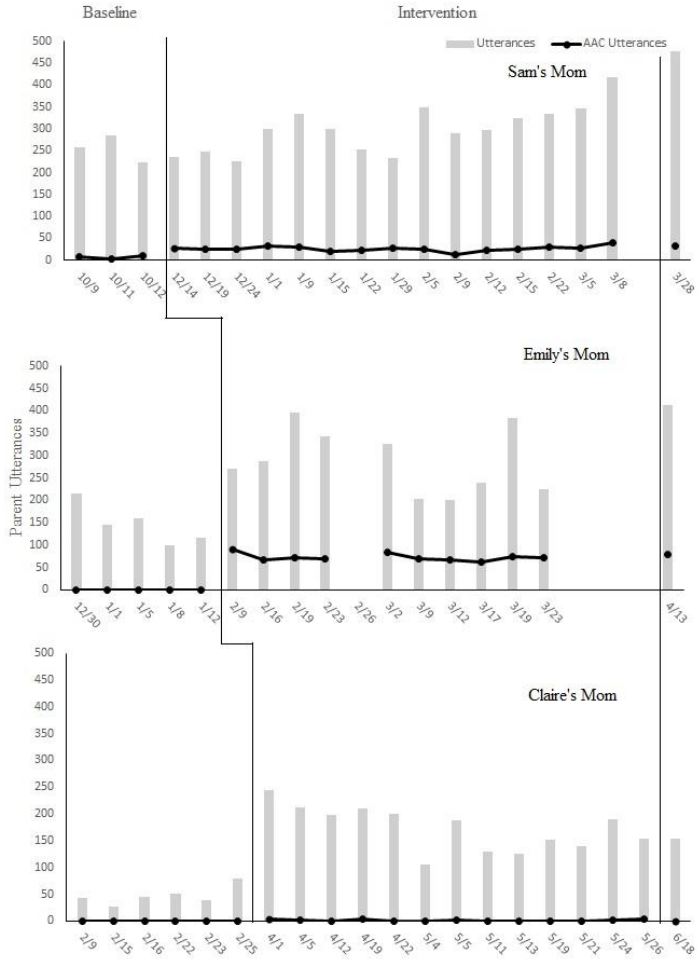
Sam's Mom. Sam's mom was the only participant that used the AAC device during baseline. She used it to model words in the story when encouraging Sam to tell part of the story. There was a small increase in AAC use, relative to total utterances, during the intervention phase and the change was immediate. She used aided AAC input more consistently during intervention compared to baseline. The Tau-U value was .98 for Sam's mom.

Emily's Mom. A clear change in level and immediacy of effect was demonstrated in the second tier with Emily's mom. She increased both her number of utterances and the number of utterances containing AAC. She provided no aided AAC input at baseline; however, during the intervention she modeled beyond what was required. She used aided AAC input for all words of each sentence of the story instead of the required 50%. Her data were stable during intervention and no overlap was present. Emily's mom had a Tau-U effect size of 1.0.

Claire's Mom. Claire's mom did not demonstrate a clear change in her use of aided AAC input in the intervention phase. She provided no aided AAC input during the baseline phase and only occasionally modeled during the intervention phase. The *story generation* format of the intervention was used with Claire and therefore Claire's mom was not required to model the story using aided AAC input. The only opportunity she had to provide aided AAC input during the intervention was in prompt 4. Claire is very proficient at using her device and has strong language skills. She often did not require prompt 4 in order to produce an acceptable response on each page.

Figure 9

Parent AAC Use



Aim 2

Determine the effects of a parent-implemented narrative intervention on the narrative macrostructure and microstructure of children who use AAC to communicate during a storytelling context.

Child Narrative Macrostructure

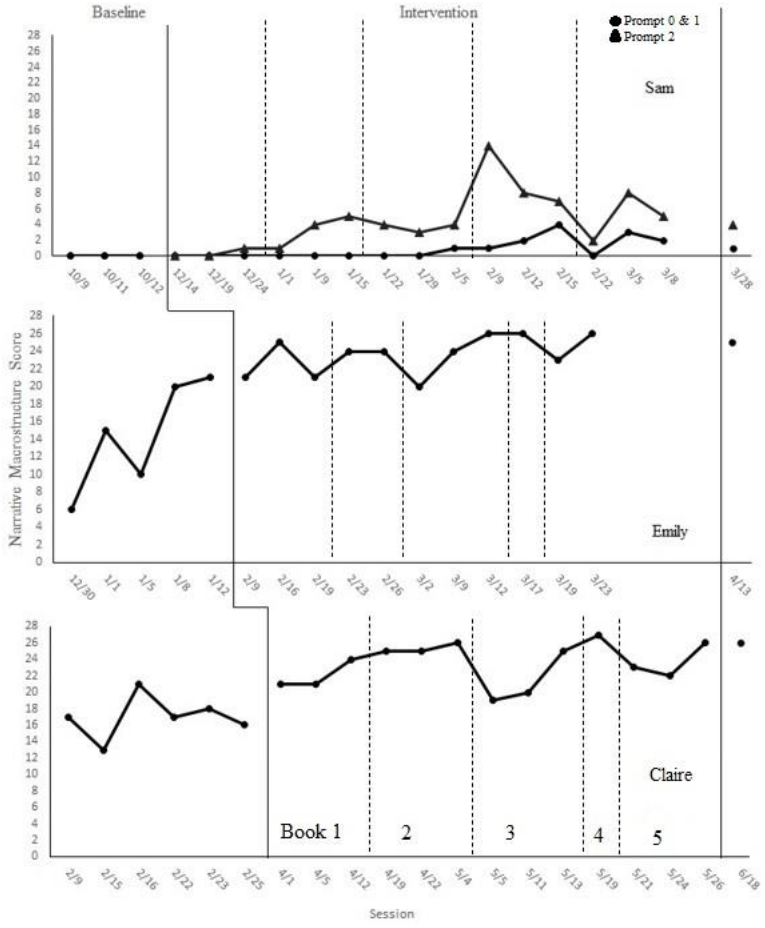
Child NMSS-AAC Scores. Children's narrative retells were rated using the NMSS-AAC. All children's independent narrative retells were scored, including responses to level 0 or level 1 prompts. Sam's responses to level 2 prompts were also scored and are depicted as triangles in the graph below. Figure 10 shows scores on the NMSS-AAC for all three participants. Emily and Claire both demonstrated an immediate response to intervention with increase in NMSS-AAC scores. Both girls demonstrated variability in intervention. However, Emily had a decrease in variability compared to baseline and Claire demonstrated an overall positive trendline. Emily demonstrated a rising baseline which prevents interpretation of a positive effect for her tier. Sam showed a delay in response to intervention for his independent storytelling skills. A slight increase was present at the end of the intervention phase. Therefore, the criteria of consistency within phase and a flat or variable trendline at baseline are not demonstrated which prohibits the interpretation of an intervention effect.

Sam. Sam demonstrated small gains in his independent narrative scores at the end of the intervention phase. He demonstrated larger gains in his ability to respond to level 2 prompts. Sam was not able to respond to any story related question during baseline and did not include any story elements independently. In intervention, he began to answer his mom's questions about the story elements, specifically the thinking and feeling components. He also regularly included the character and sometimes included the actions and setting when asked.

Emily. Emily's NMSS-AAC scores show a wide variability in baseline with an increasing trend. Emily appeared to already be learning the skill of storytelling through her mother's use of a portion of the *Storytalker* strategies in baseline. However, when her mom began implementing all of the intervention strategies Emily continued to improve in her independent narratives during intervention and showed decreased variability. Emily included basic story elements during baseline but more consistently included sophisticated story elements, such as characters' *feelings* and descriptions of the characters' *plan*, once intervention was introduced. She mastered several books in less than three sessions and therefore had a shorter intervention phase. She maintained her gains in narrative macrostructure during follow-up.

Figure 10

Child Scores on NMSS-AAC Narrative Measure



Emily had a LRR of .48 for her NMSS-AAC measure which equates to a relative percent change of 61%.

Claire. Claire also demonstrated variable narrative skills during baseline. Claire often included basic story elements during baseline (e.g., *who* and *what doing*). Once the intervention was introduced she showed an increasing trendline. She began to include the *feelings* of the characters, the *where*, and a

more descriptive ending. She showed decreases on her seventh and eleventh intervention sessions but an increasing trendline was present again after those sessions. Claire also maintained growth at her follow-up session. Claire had a LRR of .32 which equates to a 37% change in her NMSS-AAC measure.

Child Language Use

Child Language Productivity. The child participants' overall language productivity during storytelling was measured by number of utterances. All utterances produced during the session were included. Two of the three participants demonstrated a change in their number of utterances after the intervention was introduced. Emily and Claire both demonstrated a large amount of variability in the intervention phase, however, each of their overall levels was higher than in baseline.

Sam. Sam demonstrated variability in his baseline data that matched the variability in his intervention data. The level did not change between baseline and intervention phases. Therefore, the intervention did not have an effect on the number of utterances Sam produced during a narrative activity.

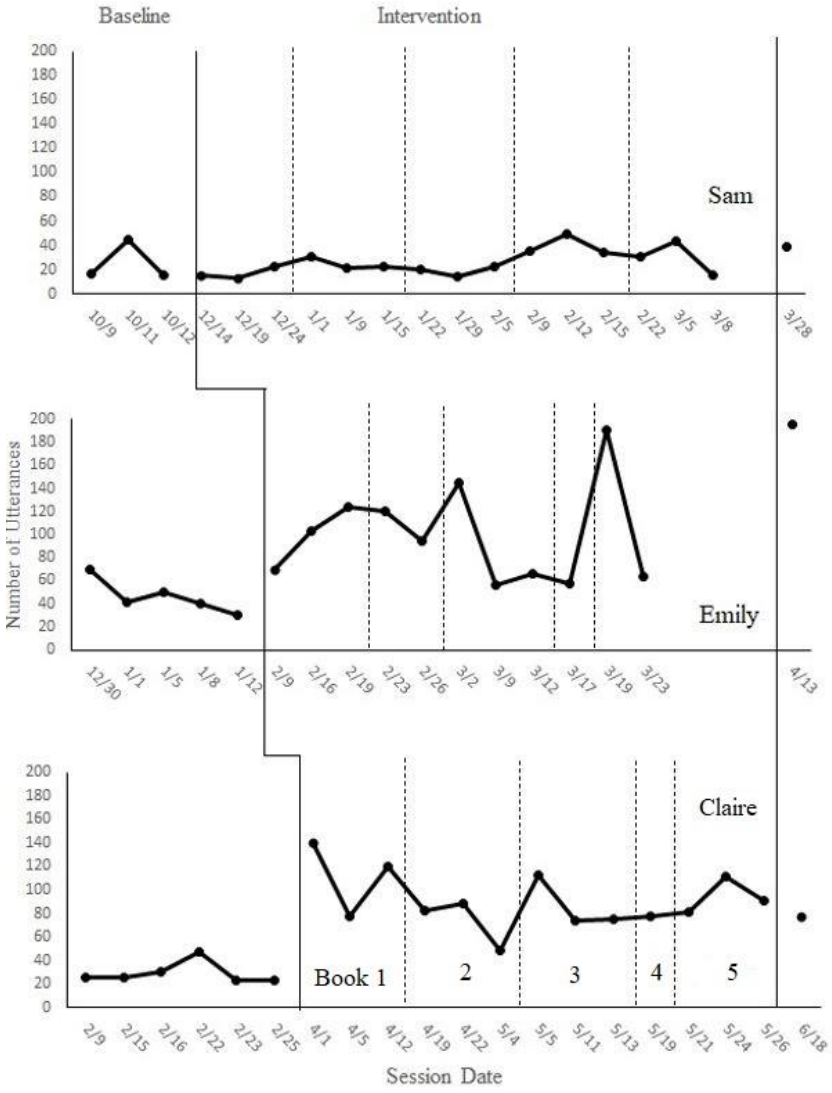
Emily. Emily had a decreasing trendline in baseline. After the intervention was introduced the trendline increased over the first three intervention sessions demonstrating an immediacy of effect. She then demonstrated a large amount of variability in her intervention data with intervention sessions 7-9 resulting in number of utterances closer to baseline. During the follow-up session she produced the greatest number of utterances showing there may be a maintenance of effect. Emily had an LRR of .84 which equates to a 131.5% change.

Claire. Claire demonstrated an immediate response to intervention. Her baseline data were relatively stable and she demonstrated a large increase in level during the first intervention

session. Her intervention data were more variable; however, only one session overlapped with her baseline data. Claire had a LRR of 1.11 which equates to a 202.9% change.

Figure 11

Child Number of Utterances



Child Use of AAC. The child participants' number of utterances that contained at least one word using their SGD were also totaled for each session. Only one child, Claire, demonstrated a clear increase in AAC use in the intervention phase over baseline. Sam was highly variable during baseline and intervention. Emily used almost no AAC during baseline.

She used more AAC at the beginning of intervention but then stopped using it at the end of intervention.

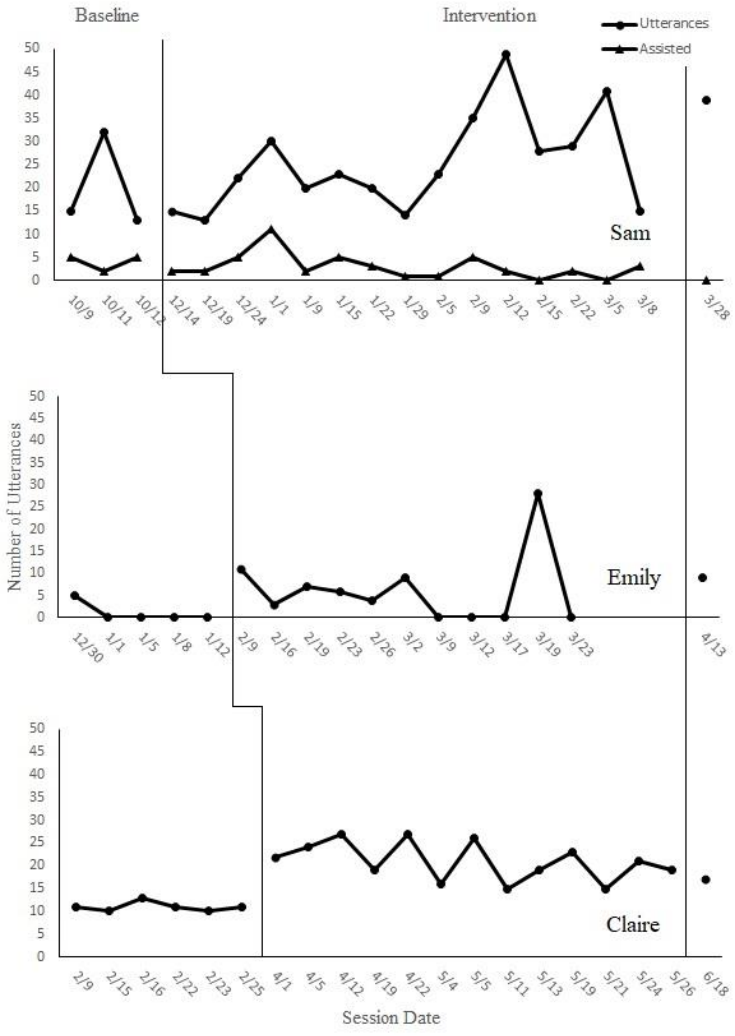
Sam. Sam required more assistance using his AAC device. Therefore, a second data path with triangles is depicted in his tier which shows the number of utterances which required parent assistance. Parent assistance included when Sam's mom either pointed to the word and he immediately activated it or she navigated to the page where the target word could be found and he then activated it. Sam's mom also preformed hand-over-hand assistance during baseline sessions which were transcribed as parent utterances and are not counted here. Sam's baseline data were highly variable and that variability continued in intervention. At the end of the intervention phase, his total number of AAC utterances in three sessions were above his highest baseline session and he maintained that use in the follow-up session. Additionally, the proportion of assisted AAC utterances decreased at the end of intervention. In the initial intervention sessions, the data path of the number of assisted AAC utterances mirrored his total AAC utterances. However, at the end of intervention, as his number of AAC utterances increased, the number of assisted utterances decreased indicating more independent productions. Additional sessions would be needed to see if the pattern continued and if a positive trendline would be established.

Emily. Emily used AAC during only one session in baseline. After the intervention was introduced, she began using AAC for a portion of her utterances. She stopped using AAC for intervention sessions 7-9. Then in session 10 she used AAC for the majority of her narrative and finally did not use it during session 11. Additional sessions would be needed to establish a pattern and determine if the intervention had a lasting effect on Emily's use of AAC. However, she did use AAC for a portion of her utterances in the follow-up session.

Claire. Claire was the only participant who demonstrated a clear increase in her AAC use after intervention was introduced. Her baseline phase was stable in number of AAC utterances with an average of 11 AAC utterances. An immediate increase in AAC utterances was present after the intervention was introduced. More variability was observed in the intervention phase than in baseline and there was a slight decreasing trend. She used AAC for 21 utterances on average. There was no overlap between intervention and baseline. The declining trend in her number of AAC utterances also matched the increasing trend in her MLU-M indicating that she was producing fewer but more complex utterances as the intervention progressed compared to more frequent, simpler utterances in the beginning of the intervention. Her LRR value was .65 which equates to a 91% change.

Figure 12

Child Number of AAC Utterances



Child MLU-M. Syntactic development of the children's stories was measured through MLU-M. Only the story related utterances were analyzed from the transcript for child MLU-M. Any conversing with the parent that was unrelated to the story or a yes/no response was removed. Analyzing story related utterances provided a better assessment of the change in the child's sophistication of utterances during storytelling. Emily demonstrated a small increase in her MLU-M during the intervention phase. The other two participants showed little to no change in MLU-M as a result of the intervention.

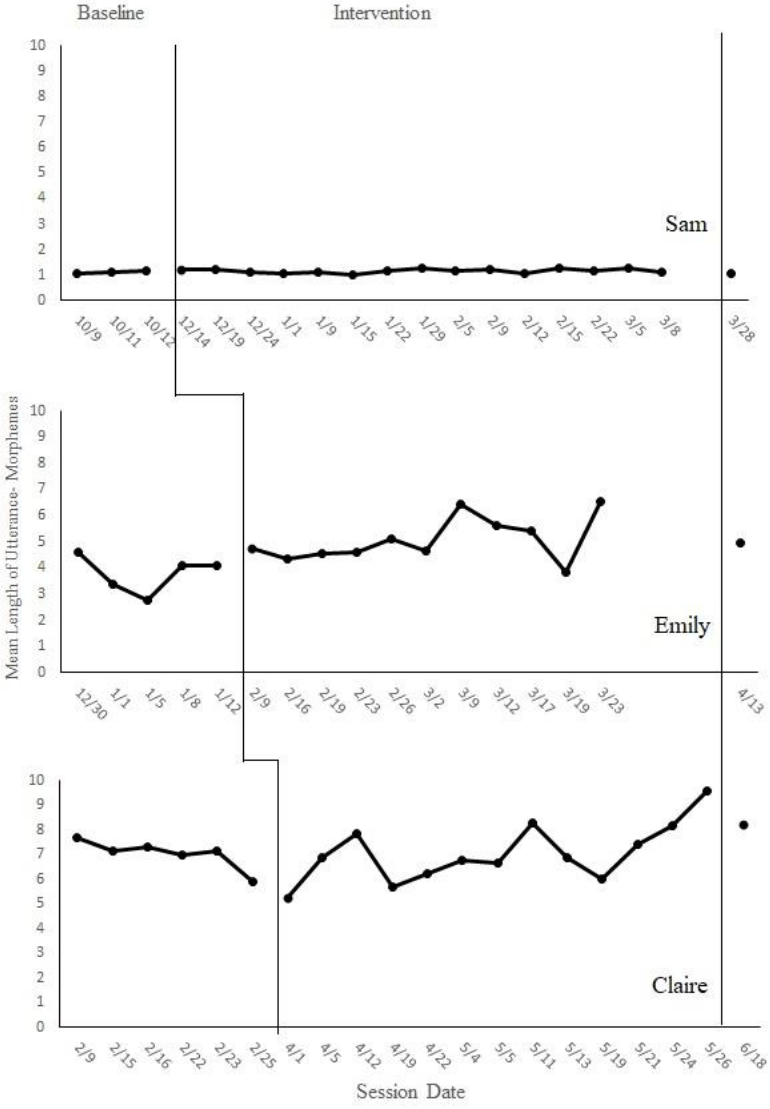
Sam. Sam's trendlines were flat across baseline and intervention. He averaged 1.15 MLU-M indicating he used a majority of one-word utterances in the storytelling context. He did not demonstrate a change in level or trend. The intervention did not affect the length of his utterances.

Emily. Emily had the most variability in baseline MLU-M out of all three participants with an average MLU-M of 3.79. Her MLU-M increased in the intervention phase with an average of 5.07. She had a slight positive trendline in the intervention phase with the exception of the second to last session. The LRR was .29 with a percent change of 34%.

Claire. Claire had a high baseline MLU-M at an average of 7.04 with a decreasing trendline. Her MLU-M maintained the same level during the intervention phase with an average of 7.05 MLU-M but the data were more variable. She had a sharp increasing trendline in the last four intervention sessions that did not continue into the follow up phase.

Figure 13

Child Mean Length of Utterance



Child NDW. The total number of different words per session was used to measure change in the children's vocabulary diversity in their stories. Claire demonstrated a clear change in the diversity of words during intervention. Emily showed a small increase in her NDW during the intervention phase, and Sam showed no change from baseline to intervention.

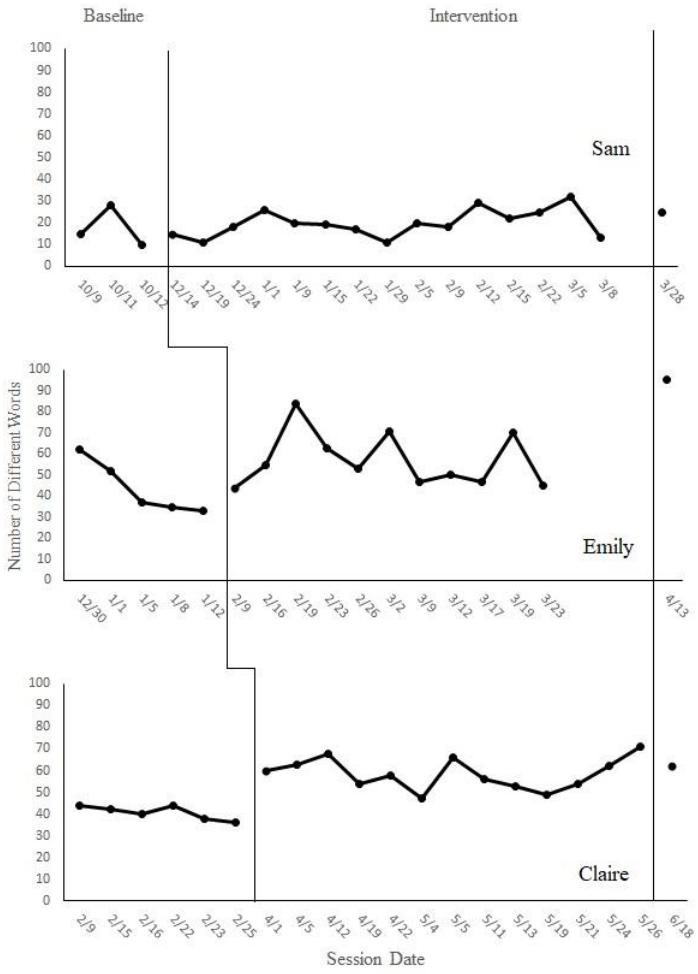
Sam. Sam's NDW was variable in baseline and intervention. He did not demonstrate a change in level or trend indicating he did not use a greater NDW as a result of the intervention.

Emily. In baseline, Emily's NDW had a decreasing trend line with an average of 44 different words. The first three intervention sessions showed an increasing trend line that then decreased again. The pattern of increasing then decreasing was repeated so that she had three sessions with NDW above her highest baseline session. The average NDW in intervention was higher than baseline at 57 different words. She had an LRR of .26 and a percent change of 30%.

Claire. Claire had a stable baseline in NDW with an average of 41 different words. An immediate change in level was observed when the intervention was introduced. She maintained the increased level during intervention with a slight increase in variability over baseline. Her average NDW during intervention was 59 different words. She also maintained the greater diversity of words in follow-up. Her LRR was .36 with a percent change of 44%.

Figure 14

Child Number of Different Words



Aim 3

Determine the acceptability and generalization of the Storytalker intervention through parent responses on an AAC storytelling parent survey, a semi-structured interview with parents, and parent and child behaviors during probed book sharing interactions.

Acceptability

The AAC Storytelling Parent Survey were administered after the conclusion of the intervention sessions. Parents responses to the second half of the questionnaire, that addressed acceptability of the intervention, are shown in table 5. Parents were asked to rate statements about the intervention on a scale of 1 (strongly disagree) to 6 (strongly agree). Overall parents believed the intervention helped improve their child's ability to tell stories as demonstrated by responses of agree and strongly agree to the first three items. Parents also felt the intervention and training improved their abilities to help their child's storytelling skills and support their language use as evidenced by response to items 6-8. Emily and Claire's moms did not believe there were disadvantages or undesirable side effects to the intervention (rated as 1). Sam's mom felt there was a disadvantage to the intervention, being that the interventionist could not be in-person to administer the intervention. Sam presented with behavioral challenges that she would have liked in-person assistance with. The behavioral challenges also led to her rating item 5 (child's enjoyment) as a 2 (disagree).

Table 5

Parent Acceptability Responses to the AAC Storytelling Parent Survey

Statement	Sam's Mom	Emily's Mom	Claire's Mom
1. I am satisfied with my child's progress with storytelling.	5	6	6
2. This intervention helped my child with storytelling.	5	6	6

3. Thinking in the long term, it is likely that this type of intervention might make permanent improvements in my child's success in telling stories.	5	5	6
4. I believe there are disadvantages to this intervention.	5	1	1
5. My child enjoyed participating in the sessions.	2	6	6
6. I received sufficient training to use the strategies to support my child's language.	5	6	6
7. This intervention helped with my ability to support my child's language (vocabulary, sentence length, etc.).	5	6	6
8. This intervention helped with my ability to support my child's storytelling skills.	5	6	6
9. I have made changes in the way I communicate with my child outside of the storytelling sessions.	3	6	5
10. I feel more comfortable using my child's AAC device after this intervention.	5	6	4
11. My child and I share more books together as a result of the intervention.	5	4	4
12. There were undesirable side effects associated with this intervention.	2	1	1
The approach of this intervention is appropriate for parents and children who use AAC.	5	6	6

Generalization

Parents responses to the first half of the AAC storytelling parent survey at baseline and post-test are presented below in table 6. Parents were asked about their child's communication and use of AAC. Responses ranged from 1 (never) to 5 (almost always). Sam's mom rated his communication higher on four items at post-test compared to baseline. Most notably her rating of his response to what and who questions improved from sometimes to almost always. Scores on two items decreased from occasionally to never. Emily's mom rated five items higher at post-test compared to baseline. Each of the items improved by 1 point and no items decreased. Claire's mom rated two of the items as improved at post-test over baseline and decreased the scores on two items. Most notably Claire's score on joining in on family conversations using her device progressed from never to often.

Parents were also asked to identify what purposes their child communicated for using their device in the week prior to survey administration. Sam's mom identified three additional purposes at post-test than she reported at baseline for a total of a total of 8 out of 15 possible communication purposes. The additions at post-test included talking to a friend, telling his feelings, and talking about a book. Emily's mom reported an additional five purposes at post-test. Emily was using the device for a total of 10 out of 15 possible purposes at the end of intervention. The new additions after intervention included retelling something that happened at home, telling a story, talking to a friend, retelling something that happened at school, and telling her feelings. Claire's mom did not report that Claire was using her device for any additional purposes of those listed but did add that she used it when on a date. The scores on all items were summed and that value was used for nonparametric analysis. A Wilcoxon signed rank test indicated that the post-test scores were not statistically significantly higher than the baseline scores $Z = 5$, $p = .28$.

Table 6

Parent Generalization Responses to the AAC Storytelling Parent Survey

	Sam		Emily		Claire	
Statement	B	P	B	P	B	P
My child uses his/her device to communicate at home.	5	5	3	4	3	3
My child uses his/her device to communicate at school.	5	5	4	4	5	5
My child uses his/her device to communicate with friends.	1	2	4	4	5	4
My child makes requests using his/her device.	2	5	3	4	3	4
My child makes comments about things happening around him/her using the device.	2	1	2	3	2	2
My child correctly answers the what questions I ask him	3	5	4	5	5	5
My child correctly answers the where questions I ask him	3	3	5	5	5	5
My child correctly answers the who questions I ask him	3	5	5	5	5	5
My child joins in family conversations using his/her device.	2	1	3	3	1	4
On a given day I feel my child's communication needs are met.	4	4	3	4	4	3

Interview Results. The parents responded positively to the intervention in the post-interview. When asked about feedback on the intervention Sam's mom said, "it was really great and helped him and helped me". Emily's mom said, "It was amazing. It was so well timed I mean she really needed help. So did we. So no it was wonderful thank you". Claire's mom rated the intervention "a ten, off the charts".

Parents discussion of overall positive effects of the intervention or specific intervention elements that were helpful for their child were coded as *positive intervention effects*. Each mom gave specific examples of positive effects of the intervention that included improvements for the child and parent. All three mom's mentioned the improvement they experienced in their own skills. Sam's mom mentioned she learned where more words were on the device and improved in her ability to help Sam with talking about a book and answering WH- questions ("getting into having him use his device more and asking those you know important questions like what's happening, where are we … so the wh kinda questions"). Emily's mom shared that her knowledge on what Emily needed to work on improved ("I didn't realize some of the components of the sentences that she wasn't using"; "just knowing the structure of a story to help give her the framework") as well as her knowledge of the device ("was a good revisit to it… it helped me remember where a lot of those words are"). Claire's mom remarked on her improvement in her wait time and observation of her daughter:

> I don't think I spent as much time observing her patterns and so that was really helpful to me… to recognize her thinking, the way she was thinking, and how she was learning the device and learning how to master it on her own without me just saying you do this you do this.

Each parent also mentioned the elements of the intervention that they found most helpful. Sam's mom found the response time and the cue cards the most helpful for Sam. Emily's mom found setting the expectation for Emily to try and retell each page first independently was helpful. She also felt Emily benefited from the questions about specific story elements and wait time. Claire's mom found the prompt level 1 of "tell me more" helpful as well as the cue cards. Both Emily and Claire's moms mentioned that they liked the books. They felt they were at the right level for their daughters. For examples, Emily's mom expressed, "I feel like the storylines for her were maybe technically below her reading level but the way it was constructed was perfect". Finally, both Emily and Claire's moms found the pattern and repetition of the books and prompting levels to be helpful for their daughters. Claire's mom said, "the patterning was extremely helpful to help her kind of jog her memory".

Parents were asked if they saw any changes to their or their child's behavior outside of the storytelling context. Relevant responses were coded as *carry-over effects*. Sam's mom reported she was encouraging him to use his device to communicate more and to communicate about books ("I definitely make him tell me more things using his AAC device"; "now when we read him a story I'm making him get involved in it"). Emily's mom reported that they were providing her more wait time when around other people and encouraging others to give more wait time. She also reported that Emily's "sentences have gotten more complex" and that her speech is clearer. She also reported that Emily was independently telling stories and using more descriptive language. She described that before the intervention when something would happen Emily would say "look mom look mom" and "she would want to relate it to us but … there wasn't anything to it" and now after the intervention "that's definitely gone away and now she has more complex sentences". Claire's mom also reported an increased complexity in Claire's

utterances saying, “she just exploded in her ability because before we started everything was like three-word sentences it was just I want to get it done … so it totally opened her up to an imaginative place”. She also reported Claire’s confidence in her ability to converse with others had increased and reported several recent incidences where Claire communicated to friends independently. Claire’s mom summarized by saying:

> We would constantly try to get her to talk to friends and she didn’t really get that bouncing back conversation piece and somehow through this intervention she just developed a confidence in her to where she was actually telling a story about the lion and about things that happened.

Claire’s mom also reported changes in her own behavior by realizing that Claire could use the device more independently and could “come up with repair strategies on her own”.

Parents also had recommendations on how to improve the intervention. Relevant responses were coded as *suggested intervention changes*. Sam’s mom felt he needed more sessions and was concerned that he did not attend to her modeling on the device. Emily’s mom expressed a desire for more check-ins with parents during the intervention to see if they had questions or things they wanted to modify. She also felt the videos were too fast. Finally, Claire’s mom wanted to know how to help Claire with her spelling while also teaching her storytelling. She expressed interest in a series of interventions and felt Claire was ready for the next step of storytelling interventions.

Parent Child Book Sharing. Five-minute parent-child book sharing probes were collected at baseline and throughout the intervention phase. The book sharing probes were designed as a generalization measure to determine if the parents’ learning of language facilitation strategies would carry over to the novel task of book sharing. Five language facilitation

strategies used in the Storytalker intervention (WH- questions, open ended prompts, repeating, positive comment, aided AAC input) were coded from the book sharing interactions. Parents use of yes/no questions was also coded to determine if it would decrease. The results from each book sharing session are reported in table 7. All reported codes, except yes/no questions, were summed for a total score. Sam's mom used a wider variety of strategies during the intervention probes than during baseline. Emily's mom used fewer yes/no questions during intervention probes than during baseline and increased her use of open-ended prompts. Claire's mom used very few strategies during her probe sessions, as all but session four consisted of her reading verbatim to Claire.

Table 7

Parent Strategy Use during Book Sharing Probes

	Yes/No Questions*	WH-Questions*	Open Ended Prompt*	Repeating	Positive comment	Aided AAC input
Sam's Mom						
Baseline	2 (0%)	3 (33%)	0	0	0	0
Session 3	0	0	2 (100%)	2	2	7
Session 6	4 (75%)	1 (0%)	1 (100%)	6	11	0
Session 9	5 (40%)	4 (50%)	4 (75%)	8	7	0
Session 12	3 (0%)	9 (11%)	6 (0%)	5	7	0
Session 15	2 (0%)	6 (33%)	1 (0%)	3	3	2
Emily's Mom						
Baseline	11 (82%)	5 (100%)	0	10	0	0
Session 3	5 (100%)	1 (100%)	1 (100%)	6	4	0
Session 6	2 (100%)	5 (60%)	3 (100%)	1	1	0
Session 9	2 (50%)	7 (86%)	4 (100%)	8	0	0
Claire's Mom						
Baseline	2 (0%)	0	0	0	0	0
Session 4	4 (75%)	4 (75%)	1 (100%)	1	0	0
Session 10	1 (100%)	0	0	0	0	0
Session 13	0	0	0	0	0	0

* Percent with wait time given is included in parentheses

Child utterances during the book sharing probes were transcribed and analyzed in SALT. Child language measures are presented in table 8. Sam was the only child who showed improvement from baseline to intervention. He participated more in the book sharing activity as evidenced by his number of utterances. Emily often took turns reading with her mom and her number of utterances varied more by the book that was chosen than by progress with the intervention. Finally, Claire only read at the session four probe and otherwise primarily listened to her mother.

Table 8

Child Language during Book Sharing Probes

	Number of Utterances	MLU-M	NDW	AAC	Reading Utterances
Sam					
Baseline	1	0	0	0	0
Session 3	3	1	2	3	0
Session 6	11	1	9	11	0
Session 9	10	1	9	9	0
Session 12	12	1.08	11	12	0
Session 15	6	1.17	7	6	0
Emily					
Baseline	42	1.95	26	0	14
Session 3	28	3.14	18	0	6
Session 6	19	1.43	6	0	9
Session 9	35	2.07	17	0	11
Claire					
Baseline	10	3.5	4	0	0
Session 4	30	1.2	5	0	13
Session 10	5	1.8	5	0	0
Session 13	9	1.25	5	0	0

Chapter 4: Discussion

There is a need for evidence-based interventions that advance individuals who use AAC beyond the early communication skills of requesting and commenting. The *Storytalker* intervention was designed to teach children who use AAC how to tell stories. Teaching the skill

of storytelling provides the child with an additional context in which to communicate and brings the child closer to the ultimate goal of communicative competence (Light, 1988, 1997). Learning to tell a story can also increase the child's participation in social and academic contexts by reducing the child's access barriers to an important communicative context (Beukelman & Mirenda, 2013). Narratives are a particularly important communicative skill to target in children who use AAC as stories integrate multiple communicative skills including narrative macrostructure and microstructure (Kintsch & van Dijk, 1978). Interventions that address the breadth of communication goals and integrate multiple communicative skills are needed in the AAC literature (Light & McNaughton, 2015). The nonconcurrent multiple baseline across participants design demonstrated that parents could learn to effectively implement the intervention when provided virtual training and coaching. Children with some storytelling skills at baseline improved in their narrative abilities after the intervention was introduced.

Parent Outcomes

Despite differing skills at baseline, all three parents learned the language facilitation strategies used in the *Storytalker* intervention and effectively implemented the strategies with high levels of fidelity. The training was effective at teaching the parents to implement the intervention and all three parents demonstrated an immediate change in level in the intervention phase.

The telehealth format of the training proved to be effective at training parents to be intervention implementors. Sufficient coaching was provided as evidenced by parent gains in skills and parent responses on the acceptability questionnaire. Parents received online coaching during training sessions and summative feedback at each intervention session. The coaching provided enabled parents to get and stay reliable when administering the intervention. Booster

sessions were used if a parent received a SPIM score below 80% during the intervention phase, which only occurred with Sam's mom. As Sam did not begin responding independently until the end of the intervention, his mom had not practiced some parts of the prompting hierarchy since training. After a short refresher and practice with a couple pages she returned to levels of fidelity of above 80%.

The current study demonstrates preliminary evidence that parents can be trained virtually to use multiple language facilitation strategies and implement them in a strategic manner to teach the sophisticated communication skill of storytelling to their children who use AAC. Parents learned multiple strategies including aided AAC input, expectant wait time, open ended prompts, WH- questions, repeating the child's utterances, and specific praise. Previous work in parent-implemented AAC interventions have taught parents to use one (Kent-Walsh, Binger et al., 2015) to four (Binger et al., 2008) strategies at a time. Additionally, results from the current study expand previous work as the strategies in *Storytalker* were implemented in a hierarchy dependent upon the child's response and each page contained a different target. The response-based prompts add a complexity to the intervention as parents must make decisions on the appropriateness of their child's response for that page and targeted story element. Then the parent must decide which steps of the intervention are appropriate to use to support their child's story. *Storytalker* is one of the most complex parent-implemented AAC interventions in the literature. Despite its complexity, all three parents were able to carry the intervention out successfully and felt more knowledgeable and confident in their ability to help their child at the end of the intervention.

The parents success in learning the complex *Storytalker* intervention, when provided virtual training and coaching, is an important finding both for the AAC literature and for clinical

practice. Results from the parent-implemented *Storytalker* intervention show that parents can be capable interventionists when provided with sufficient training and can learn to implement multiple strategies with their children. Clinically, many individuals who use AAC may live in areas that have low resources or may have medical complications and/or mobility issues that make traveling to receive services difficult and sometimes dangerous. The current study demonstrates the feasibility and benefits of coaching parents through telehealth to implement AAC intervention to advance their child's communication skills.

The secondary parent outcomes of language use showed mixed effects. The variable that showed improvements for all three parents in the intervention phase was NDW. After parents were introduced to the language facilitation strategies in training they increased the diversity of vocabulary they used when communicating with their child. Increasing NDW is important because the quality of the language input the parent provides is important for the child's language development (Hoff & Naigles 2002). The increase in NDW that coincided with the increase in SPIM scores may indicate that as parents use more language facilitation strategies they use more diverse words as well.

The majority of language use variables changed for two out of the three parents. Both Sam and Claire's moms demonstrated a change in their rate of speech and MLU-M after the intervention was introduced. However, the moms had opposite effects on their rate of speech. Sam's mom decreased her rate after the intervention was introduced. She provided many directives and little wait time in baseline and provided more open-ended prompts and questions with sufficient wait time in intervention. Claire's mom demonstrated a contrasting pattern in baseline as she provided sufficient wait time in baseline but very little instruction. Her rate then increased after she learned how to help Claire with her stories. Both increased their MLU-M,

indicating they were using longer utterances with more complex syntax after the intervention was introduced. Emily's mom did not demonstrate a change in rate of speech or MLU-M after intervention was introduced. Her lack of change may be due to her higher SPIM score in baseline in which she already was providing wait time and using language facilitation strategies.

Emily's mom demonstrated a change in her use of AAC after the intervention was introduced. Sam's mom also increased her use of AAC but to a much smaller degree. The difference in level between the two moms was due to Sam's mom using aided AAC input on the required 50% of words and Emily's mom using the device for 100% of her words during her telling of the story. Claire's mom did not have the same number of opportunities to provide aided AAC input as the *story generation* format was used and she did not model the story first. She occasionally used aided AAC input when Claire required prompt 4.

Despite the differences in maternal education, experience with the AAC device, and baseline use of language facilitation strategies, all three moms learned the steps and strategies of the intervention and implemented it with high levels of fidelity. The maternal demographics may have impacted the effect of the intervention on the language input the parent provided; however, results are promising and support further investigation.

Child Outcomes

The primary child outcome was the measure of narrative macrostructure, NMSS-AAC score. The baseline scores on the NMSS-AAC are not a pure measure of the child's pre-existing storytelling skills, but the ability to tell a story with the existing support they were receiving from their mother. The adult-supported stories collected in baseline were representative of their daily communication as all three children required high levels of support or interpretation by their parents when communicating to an unfamiliar person. Although any one of the participants may

have been able to produce more story elements independently in baseline if assessed by a clinician with a set prompting hierarchy, for the purposes of the current study we were interested in the child's daily communication style when provided with the regular support they receive from their parent.

The two girls, Emily and Claire, could independently tell a basic story at baseline and showed an increase in their narrative macrostructure scores after the intervention was introduced. Sam had no baseline storytelling abilities either prompted or unprompted. Therefore, Sam's progress was slower than Emily and Claire's. He first began accurately answering WH-questions about the story elements and then at the end of intervention began to include a few story elements independently. Although the intervention did not have the same effect on Sam, his increase from no story related utterances to answering questions about the book is an important area of growth in his communication skills.

The nature of the baseline sessions impacted Emily's baseline data. As Emily's mom was already skilled at using several of the intervention strategies it was not a true measure of Emily's baseline storytelling skills without intervention. Emily began to improve in her storytelling skills during baseline and an increasing trendline was seen. However, when Emily's mom began to use all of the steps and strategies of the *Storytalker* intervention in the intervention phase, Emily's NMSS-AAC stabilized and the majority of sessions were above her highest baseline score. The increase in NMSS-AAC scores indicates that after intervention was introduced she was more consistently including all of the story elements and maintained gains across multiple books.

Claire's baseline NMSS-AAC scores were the closest to a true baseline of storytelling skills as her mom provided minimal input. She also demonstrated the strongest response to the intervention as she increased in level after the intervention was introduced and her scores had a

positive trendline. Claire's recall abilities were very strong and she maxed out on scoring criteria for the *story retell* context in the first baseline session. Therefore, she received the *story generation* format of *Storytalker* for her baseline and intervention sessions. Typically developing children include more story elements during a story retell task compared to a story generation task as it is more difficult to create a story than to retell (Schneider & Dube 2005). Claire's greater variability in intervention NMSS-AAC scores may be explained by her more difficult task of story generation. Certain books (3 and 5) were also more difficult for Claire when generating a story. The images in books three and five had some actions that were not as clearly depicted as other books, which is likely why a dip in her scores was observed. She was able to improve on books three and five across multiple sessions and maintained a high NMSS-AAC score at follow-up.

The secondary child outcome of narrative microstructure had mixed results. Sam did not demonstrate changes in his narrative microstructure in any of the variables. Emily and Claire both increased in their number of utterances and number of different words after the intervention was introduced. The increase in number of utterances indicates that as their parents allowed more opportunities to communicate through open ended prompts and wait time the girls took more equal turns and initiated more. The result of increased number of utterances is in line with previous work (Binger et al., 2008; Rosa-Lugo et al., 2008 Kent-Walsh et al., 2010; Kasari et al., 2014). Additionally, as their parents used more diverse words in the intervention phase, the girls also used more different words in their stories. Only Claire demonstrated a clear increase in her use of AAC. She increased the number of utterances she produced with the device after the intervention was introduced. She also increased her MLU-M indicating that she was producing more and longer utterances with her device. Emily increased her use of AAC at the beginning of

the intervention phase but then stopped using it toward the end of intervention. The clarity of Emily's speech varied day-to-day and therefore she needed the AAC less some days compared to others.

The intervention was more effective for the two girls who were able to tell basic stories at baseline and regularly constructed sentences on their devices. The girls were also very compliant and excited about telling stories which made it easy for their mothers to intervene. Sam's baseline communication skills were much lower and he often displayed refusal and self-stimulatory behaviors that required his mom to manage his behavior and give more frequent breaks. Sam, and children like him, may need a modified intervention with more simplified stories and shorter, more frequent sessions.

Generalization

Generalization of the intervention was measured through parent-child book sharing probes, a parent survey, and parent interview. The parent-child book sharing probe proved to be only an effective measure of generalization effects for Sam and his mother. Emily and Claire were already proficient readers at baseline and therefore participated in more book reading than book sharing. Sam's mom did increase the number of language facilitation strategies she used during book sharing with Sam during the intervention probe sessions compared to baseline. Sam participated more in the book sharing activity and went from an observer to a participant in book sharing, demonstrated by an increase in his number of utterances and number of different words. However, across all three participants no significant generalization effect was found.

The generalization effects for Emily and Claire were more evident in the post-intervention parent interviews. Both girls' moms reported that their daughters were more confident in their communication as a result of the intervention and were using longer sentences

and more descriptive language. Their change was not captured in the book sharing activity but parents reported a change in their everyday communication. Sam's mom also reported improvements in his communication during the parent interview. She reported he was answering more WH- questions about his day and his surroundings. She also confirmed the change seen in the book sharing probes by reporting he was more engaged with preferred books and labeled items and sight words. Emily and Sam's moms also reported gains in the AAC storytelling parent survey when comparing baseline to post-test. They both reported that their children was communicating in more contexts and for more purposes using the AAC device.

Given the mixed results on the child language outcomes, parents' reports of generalization effects are encouraging. The parents reported that the intervention made meaningful change in their children's communication. The overarching goal of the *Storytalker* intervention was to increase the children's activity and participation in their daily communication by addressing both intrinsic and extrinsic factors of their disabilities (WHO, 2007). Parents reported their children increased their daily communication, participation in activities and confidence in communicating. The generalized effects parents observed indicate that by targeting the child's performance on narrative tasks, overarching effects were observed in each child's participation in life activities (WHO, 2007), fulfilling the goal of the intervention. Better measures of generalization are needed to capture change in daily communication in future studies. The high social validity of the intervention, via parent report, is encouraging for future development of the *Storytalker* intervention.

The parents also self-reflected on changes in their interactions with their children. In the parent interview, changes in parent knowledge and understanding of their child's communication and the AAC device were noted. Additionally, parents reported an increased use of the language

facilitation strategies outside the storytelling context, namely wait time and open-ended questions. The *Storytalker* intervention targeted the extrinsic factors to the child's disability by teaching the parents to provide more opportunities for independent communication and to provide support using effective teaching strategies (WHO, 2007). Targeting the extrinsic factors to the children's disabilities helped the effects to generalize outside the narrative context and increase the children's participation in daily activities.

Intervention Changes

The results of the intervention are promising and call for future investigation of the *Storytalker* intervention. Modifications to the intervention are needed as evidence by the results and parent feedback. The modifications fall into 4 categories: screening modifications, material modifications, coaching modifications, and measurement modifications.

Screening Modifications

The screening criteria needs to be more stringent to recruit participants who are more similar in baseline abilities and characteristics. Recruiting more similar participants should increase the likelihood that all participants will show similar patterns in response to the intervention. The screening activity used in the current study (receptively identifying the story elements *who, where,* and *what doing*) was not sufficient to determine appropriate candidates for the intervention as evidenced by Sam's different response to intervention compared to Claire and Emily. A screening storytelling activity will be added in which a child will hear a short story told to them with accompanying pictures and will have to retell the story. The new screening measure will mirror the baseline sessions; however, the clinician will administer the activity so that the amount of support given to the child is controlled. The activity will determine if the child can

minimally comment about the pictures and/or if he/she has already mastered the story retell context and needs the *story generation* format.

Material Modifications

The storylines of the current books will be re-evaluated to determine if they are equal in difficulty and if they can be told as both story retell and story generation narratives. For example, book 3 was more difficult for the children in the current study, possibly because the actions were not as clearly depicted compared to the other books. Additionally, the books used in this parent-implemented version of *Storytalker* were shortened versions of the clinician-implemented version. The books were shortened to simplify the story elements for the parent to target and reduce sentence length. Some of the complexity of the stories will be added back, including the reasons the character had a feeling ("He was sad that he fell down") and the description of the characters ("A tall boy"). The added complexity will give more variability in the scoring criteria as discussed below. The videos introducing the story elements for the book of the day will be edited to allow parents and children more time to view the sequence of the vocabulary depicted in the video. Finally, the parents will be given a slant board with an adhesive strip to attach the cue cards as they use them. Attaching the cue cards to a strip will allow the child to view the cue cards at any time and will be less distracting to the participants if the cue cards are stationary.

Coaching Modifications

The training phase of the *Storytalker* intervention was effective and parents learned the skills quickly. I developed several visual aids while training the parents that I will continue to use moving forward. The primary change to the coaching that will be made is in the intervention phase. As Emily's mom mentioned, more frequent check-ins with the parents during the intervention sessions are needed to answer parent questions. Some parents initiated questions

during the summative feedback at the end of the session. However, many parents may need a direct invitation to voice any questions or concerns they have. I will continue to give summative feedback during the intervention phase and provide booster sessions when fidelity drops below 80%.

Measurement Modifications

The original version of the NMSS-AAC that was created for the in-person, clinician-implemented version of *Storytalker* had a greater range of scoring criteria for some of the story elements. The range of criteria was reduced when the stories were shortened for the parent-implemented version. The reduced criteria matched the level of description provided in the story model (a boy versus a tall boy). In the future I will bring back the original version of the NMSS-AAC to match the increased complexity of the books so the child has a greater range of scores he/she can achieve. Finally, a different probe task to measure generalization will be chosen as the storytelling task was not appropriate for literate children. The new probe task will be the parent helping the child complete a homework assignment, such as a math worksheet. The homework probe task will measure the parent's ability to support their child's independence and the child's communication during the activity.

Limitations

A nonconcurrent multiple baseline across participants design was used in the current study. A nonconcurrent design was used due to issues with recruitment in the population that uses AAC and with difficulty coordinating with families during the COVID-19 pandemic. By its nature, the nonconcurrent multiple baseline design is more vulnerable to history and maturation effects as threats to internal validity (Ledford & Gast, 2018). To help reduce history threats I ensured that all three participants received services from different providers and attended

different schools at the time of the study. However, the results should be interpreted with caution as visual analysis across tiers is limited. To increase transparency, the date of each session was given along the X-axis rather than the session number.

The primary variable of interest that was used to make phase change decisions was parent SPIM score. Therefore, the SPIM score was the only measure that could be evaluated for effect of intervention. In other words, parent implementation of the *Storytalker* intervention measured by SPIM was the only variable that was controlled. Although the parent participants were similar, the child participants differed significantly in their baseline communication and narrative skills. For multiple baseline across participants all participants should be similar in skills (Ledford & Gast, 2018). The variability in participants was likely a result of using the nonconcurrent design and the lenient screening criteria. The use of two different formats of the intervention, *story retell* and *story generation*, was not ideal for multiple baseline across participants. The two formats were combined in this study as the primary measure was of parent implementation and parent steps were very similar across formats. In future studies, all three tiers should receive the same format of intervention.

Parents use of the Storytalker intervention outside the study sessions was not recorded and parents were given no instruction regarding outside practice. Outside practice was an uncontrolled variable that could have impacted both parent and child outcomes and should be controlled in future studies. Additionally, universal symbols were chosen to depict the story elements on the cue cards and the symbols from the child's device were only presented in the introductory video. The introduction of a separate set of symbols may have confused the children. In the future the symbol dictionary of the child's device should be considered when creating the cue cards.

The intervention sessions averaged 41.5 minutes in length across all three children. The length of the sessions could be a deterring factor for some parents and children as it is a significant time commitment twice a week. The session length could also be taxing on both parent and child engagement and attention. The *Storytalker* intervention is an intense multi-step intervention for parents to learn and carry-out. It requires a significant amount of time and energy to devote to learning the intervention. It may be difficult for families with less resources to realistically learn and carry-out the *Storytalker* intervention, given the pre-existing skill and time requirements. Future work will investigate how the intervention could be modified and realistically implemented with populations and families with fewer resources.

Future Work

The *Storytalker* intervention is well suited to be modified to a multi-level, series intervention in which participants can be evaluated for their current narrative skills and systematically build their skills through multiple phases of intervention. The same intervention steps and strategies can be used on different levels of books and the targets can change as the child improves his/her narrative skills. Claire and Emily's moms both expressed interest in the next step in the narrative intervention now that their daughters had made gains in their storytelling skills.

In the long term, I plan to create four variations of the *Storytalker* intervention. Level one would include a shorter, more simple set of books that focus on the *who, where, what doing* and *feelings* of the story. Level one would be appropriate for kids like Sam who receptively understand story grammar concepts but have difficulty expressing them. Simplifying the story targets removes more of the complex story elements such as *thinking* and *problem* and focuses on describing what is happening in the picture. Level two would resemble the *story retell* format

used in the current study. Level three would resemble the *story generation* format in the current study. Finally, level four would use the *story generation* format and contain more complex stories with greater levels of detail. The more complex books would allow a greater focus on the child's microstructure growth in level four. The new screening activity of retelling a story would determine the level of intervention the child needed. Then individual studies would be conducted on each level of intervention.

In the short term, several single-case research designs will be conducted to further investigate the efficacy of the intervention. First, the originally planned clinician-implemented *Storytalker* intervention study will be conducted. The clinician-implemented study will allow for control of the child macrostructure variable as phase change decisions would be made on the NMSS-AAC score rather than the intervention implementation measure. Therefore, the effectiveness of the *Storytalker* intervention on improving the child's narrative macrostructure and microstructure could be evaluated.

After the effectiveness of the *Storytalker* intervention on child storytelling skills is established, focus will be shifted back to communication partner implementation of the intervention. In future studies, I will instruct the communication partner to collect a true baseline narrative of the child by only providing wait time and general prompts for more. By removing communication partner support of the narrative in baseline, NMSS-AAC scores should be more stable and phase change decisions will be made on the NMSS-AAC measure. Communication partners will then receive instruction on how to implement the intervention and will again be required to reach a level of implementation fidelity. Then they will implement the intervention with the child and child narrative macrostructure and microstructure gains will be the primary outcome. Future iterations of communication partner implemented *Storytalker* studies may

include parents, educational assistants, and/or siblings. A group component will be included in future studies to give communication partners the opportunity to learn from each other and provide feedback about the intervention in a supportive environment.

Conclusion

All three parent participants learned to effectively implement the *Storytalker* intervention with their children and maintained acceptable levels of fidelity. Two of the three child participants showed an increase in their narrative macrostructure skills following the onset of intervention. The intervention was highly rated by parents and they reported promising generalization effects on their own and their children's everyday communication. Further investigation of the *Storytalker* intervention is warranted to examine the effectiveness of the intervention on children's narrative skills.

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Appendix A

	Never	Occasionally	Sometimes	Often	Almost Always
My child uses his/her device to communicate at home.	1	2	3	4	5
My child uses his/her device to communicate at school.	1	2	3	4	5
My child uses his/her device to communicate with friends.	1	2	3	4	5
My child makes requests using his/her device.	1	2	3	4	5
My child makes comments about things happening around him/her using the device.	1	2	3	4	5
My child correctly answers the what questions I ask him (e.g. “What is that?” “What are you doing?”)	1	2	3	4	5
My child correctly answers the where questions I ask him (e.g., “Where are we going?” “Where are your shoes?”)	1	2	3	4	5
My child correctly answers the who questions I ask him (e.g., “Who is that?” “Who is your teacher?”)	1	2	3	4	5
My child joins in family conversations using his/her device.	1	2	3	4	5
On a given day I feel my child’s communication needs are met.	1	2	3	4	5

In the last week my child communicated on his/her device for the following purposes (indicate all that apply):

Request food/drink
Refuse to do something
Request an activity/toy
Comment on something he/she saw
Tell about something that happened recently at home
Argue
Tell a pretend story
Ask a question
Participate in the classroom
Talk to a friend
Tell about something that happened at school
Tell his/her feelings
Complete a homework assignment
Talk about a book
Tell a joke

ONLY ADMINISTERED AT POST

Please circle the number from 1 (strongly disagree) to 6 (strongly agree) that best matches your response to each of the statements below.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
I am satisfied with my child’s progress with storytelling	1	2	3	4	5	6
This intervention helped my child with storytelling	1	2	3	4	5	6
Thinking in the long term, it is likely that this type of intervention might make permanent improvements in my child’s success in telling stories	1	2	3	4	5	6

I believe there are disadvantages to this intervention.	1	2	3	4	5	6
My child enjoyed participating in the sessions.	1	2	3	4	5	6
I received sufficient training to use the strategies to support my child's language.	1	2	3	4	5	6
This intervention helped with my ability to support my child's language (vocabulary, sentence length, etc.)	1	2	3	4	5	6
This intervention helped with my ability to support my child's storytelling skills.	1	2	3	4	5	6
I have made changes in the way I communicate with my child outside of the storytelling sessions.	1	2	3	4	5	6
I feel more comfortable using my child's AAC device after this intervention.	1	2	3	4	5	6
My child and I share more books together as a result of the intervention.	1	2	3	4	5	6
There were undesirable side effects associated with this intervention.	1	2	3	4	5	6
The approach of this intervention is appropriate for parents and children who use AAC.	1	2	3	4	5	6

Appendix B

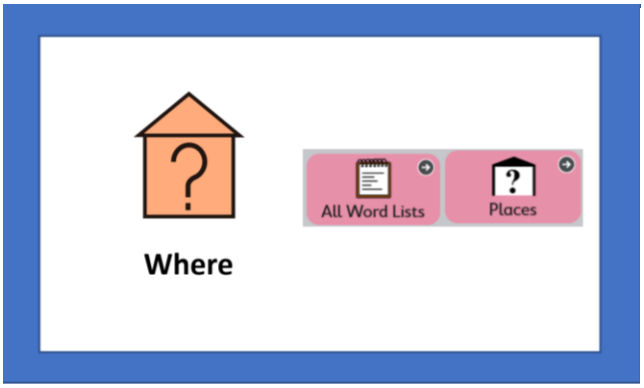
Order of story elements in books.

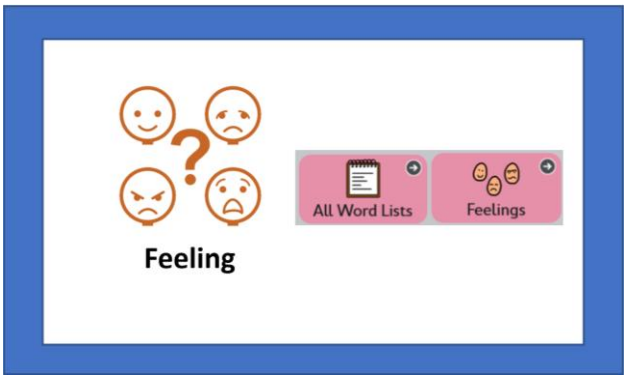
Page 1 *Who & Where*	**Page 2** *What Doing (initiating event)*	**Page 3** *Feelings*	**Page 4** *Thinking (Plan)*	**Page 5** *Action*
				
Page 6 *Problem*	**Page 7** *Feelings*	**Page 8** *Thinking (Plan)*	**Page 9** *What Doing*	**Page 10** *Ending (action & feeling)*
				

Escape the Cave: Intervention Book 2

Appendix C

Example slides from introduction video.





Appendix D

Storytalker Parent Implementation Measure

		Step Completed
OR	Story retell: Parent uses the AAC device to tell half the words on each page	__/10
	Story generation: Parent shows each page to the participant for 5 secs	___/1

- Level 0a: Parent provides 10 second wait time after turning the page
- Level 0b: If child doesn't respond to level 0a parent provides a neutral prompt i.e. "tell me about the story/tell me what's happening"
- Level 1: If child responds parent repeats the child's utterance, provides praise, prompts for more and waits 10 seconds
- Level 2: If child doesn't respond to level 0 or does not provide story element to level 1 parent prompts the child for the story element on the page by asking a question, showing the cue card, directing the child on the device and providing 10 second pause time
- Level 3: If child responds to level 2 parent repeats child utterance and provides praise
- Level 4: If child doesn't provide story element to level 2 parent models the element on AAC, asks for repetition and waits 10 seconds

The following chart below will be used a total of 11 times for each of the following targeted story element. The steps necessary will be dependent on the child's responses. Level 0a is always necessary.

Page 1- Who
Page 1- Where
Page 2- What doing
Page 3- Feeling
Page 4- Thinking
Page 5- What doing
Page 6- Problem
Page 7- Feeling
Page 8- Thinking
Page 9- What doing
Page 10- Ending

Story Element	Necessary	Used
Level 0		
Level 0a: 10 sec wait time		
Level 0b: General prompt		
Level 1		
1-Repeat utterance		
1-Praise		
1-General prompt		
1-10 sec wait time		
Level 2		
2-Ask for element		
2-Show story cue card		
2-Show where relevant vocab is on device		
Level 3		
3-Repeat utterance		
3-Praise		
Level 4		
4-Model sentence using AAC		
4- Ask for repetition		
4- 10 sec wait time		
		Total____/_____

Appendix E

Narrative Macrostructure Scoring Scheme-AAC

In order to receive points for a particular item the sentence must correspond to what is happening in the picture. If the child tells something that happens in later in the story too early they do not receive points for that.

0 Points	**1 Points**	**2 Points**	**3 Points**
Who- *Includes any subject in the narrative*			
No main character is mentioned in the story. Only pronouns are used.	The main character is named at some point in the story using a noun.	The main character is named at the beginning of the story using a noun *e.g., boy, man, etc.*	The main character is named at the beginning of the story and the sub-character is named at some point in the story using a noun (man, cat, dog) (Sub-characters are those that are not continuous throughout the entire story)
Where- *Includes any mention of a place or time in a narrative*			
No reference to a specific or general place or time.	Includes a reference to a place or time using 1 word *e.g., outside, daytime, forest*	Includes a reference to a place or time using a sentence *e.g., The boy is outside.*	
First Action- *An action that starts the story.*			
No events or problems likely to elicit a response from a character is stated. *e.g., Boy blue. Green hat*	Includes the action that starts the story in a single word. Or uses prepositions to describe the action *e.g., fall, drop, in the tree* OR Includes an action in a sentence that is not the initiating event	Includes the action that starts the story in a sentence. *e.g., The cat falls*	
First Feeling - *Reference to the characters emotions or state of mind..*			
No statement is made about any character's psychological state in reference to the first action.	The character's first emotion is stated with a single word. *e.g., sad*	The character's first emotion is stated in a phase or sentence *e.g., Boy sad. Boy feels sad.*	The character's first emotion is stated in a sentence and is related to the first action. *e.g., Boy sad rain outside.*
First Plan- *The use of a cognitive verb in the narrative. Cognitive verbs may include: think, want, etc.*			

No overt statement is provided about the character's plan to act on or solve the event or problem.	A general statement about how the character might solve the complication or problem is made but no cognitive verb is used. *e.g., Girl run fast.* OR A cognitive verb is used without stating what the character is thinking *e.g., think* or *boy think*	A statement about what the character is thinking is made with the use of a cognitive verb. *e.g., Girl thinks dog.*	A statement about what the character is planning to do to solve the problem is made with the use of a cognitive verb AND an action. e.g., *Girl **thinks run** for dog.*
Second Action- *Actions are taken by the main character to solve the problem and fulfill the plan.*			
No verbs are used to describe the second action of the character.	A verb is used in isolation to describe the action of the character.	A verb is used in a sentence that references the character to describe the action.	
Problem- *A problem is an event that prohibits the execution of a plan or action taken.*			
No problem is mentioned	A verb or adjective is used to describe the problem in the story using a single word *e.g., Fall. Fast.* A statement is used to describe a problem but it does not relate to the previous action/ parts of the story.	A statement is used to describe the problem that references the character involved (if applicable) and the verb or adjective to describe the problem. e.g., bear fast, boy fall	
Second Feeling - *Reference to the characters emotions or state of mind..*			
No statement is made about any character's psychological state in reference to the problem.	The character's second emotion is stated with a single word. *e.g., sad*	The character's second emotion is stated in a phase or sentence *e.g., Boy sad. Boy feels sad.*	The character's second emotion is stated in a sentence and is related to the problem. *e.g., Boy sad rain outside.*
Second Plan- *The use of a cognitive verb in the narrative. Cognitive verbs may include: think, want, etc.*			
No overt statement is provided about the character's plan to act on or solve the problem.	A general statement about how the character might solve the complication or problem is made but no cognitive verb is used. *e.g., Girl run fast.* OR A cognitive verb is used without stating what the character is thinking *e.g., think* or *boy think*	A statement about what the character is thinking is made with the use of a cognitive verb. *e.g., Girl thinks dog.*	A statement about what the character is planning to do to solve the problem is made with the use of a cognitive verb AND an action. e.g., *Girl **thinks run** for dog.*

Third Action- *Actions are taken by the main character to solve the problem and fulfill the plan.*			
No verbs are used to describe the third action of the character. Or a nondescriptive statement is used "he did it" "it happened"	A verb is used in isolation to describe the action of the character.	A verb is used in a sentence that references the character to describe the action.	
Conclusion- *The final event that wraps-up the entire story.*			
No action or feeling is given to end the story *e.g., the end*	A verb OR a feeling word is given to end the story as a single word. *e.g., happy; run* An action is mentioned but does not relate to the rest of the story.	An action is described that ends the story in a phrase or sentence that references a character and verb but no feelings are mentioned. *e.g., Boy run*	An action is described that ends the story AND the characters feelings are described. The character must be mentioned. *e.g., Boy runs and happy.*
			Total ____/28