THE USE OF AIDED LANGUAGE MODELING TO SUPPORT SOCIAL INTERACTIONS OF CHILDREN WHO USE AUGMENTATIVE AND ALTERNATIVE COMMUNICATION: TRAINING AND COACHING SIBLINGS

BY

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DISSERTATION

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ABSTRACT

Researchers have indicated that the use of natural communication partners (e.g., parents, caregivers, teachers, and peers) can be effective in supporting individuals who have complex communication needs (CCN) and use augmentative and alternative communication (AAC). However, limited research has been conducted to determine the effectiveness of having typically developing siblings as communication partners to support the social communication skills of children who have CCN and use AAC. In this single-case multiple-probe design study a training and coaching intervention was implemented to teach typically developing siblings to use the aided language modeling (ALM) strategy with high fidelity. Changes in children's independent communication and the overall acceptability of the intervention by family members were also explored. Results revealed that typically developing siblings can use the ALM strategy with high fidelity. The independent communication of children who use AAC had high variability and overall, family members were pleased with the intervention's goals, procedures, and outcomes.

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CHAPTER 1: INTRODUCTION

Communication is the process that occurs between at least two individuals with the purpose of exchanging information and ideas. The National Joint Committee for the Communication Needs of Persons with Severe Disabilities (NJC; 2016) noted that all people with disabilities, regardless of the extent or severity of their disabilities, have the basic right to communicate and fully participate in all daily interactions. Language refers to how individuals share their ideas (i.e., pragmatics, semantics, syntax, morphology, phonology, and phonetics) and communication refers to the form in which ideas are shared between individuals (e.g., gestures, verbal, and communication aids). At birth, children acquire language from those in their immediate environments, beginning with their parents. The impact parents have in supporting children's language development depends on the amount and quality of (a) parent-child interaction, (b) parent responsiveness to the child, (c) language input, and (d) language support strategies (Roberts & Kaiser, 2011). Language development contributes to the communication skills children have when they begin to communicate with other partners such as siblings, peers, and teachers. Communication and language skills are needed to communicate for a variety of purposes including requesting, initiating, and commenting. Through communication skills and social interactions, individuals can begin to form meaningful social relationships and friendships, which could promote positive psychological states (e.g., happiness and self-efficacy; Cohen, 2004). Typically developing children learn these skills through experience and modeling; however, for children with disabilities the process can be much more difficult, and they may not be able to learn communication skills through observation. Without effective communication skills, individuals with language delays or disabilities could have difficulty developing social relationships and friendships.

Individuals with disabilities who have complex communication needs (CCN) have impairments in speech, language, reading, and/or writing and can benefit from the use of augmentative and alternative communication (AAC). Augmentative communication methods include those that supplement current speech, whereas alternative communication methods include those that take the place of spoken language. Approximately 1.3% of individuals (i.e., 4 million Americans) are unable to communicate through natural speech to achieve daily needs (Beukelman & Miranda, 2013) and various forms of AAC can support these individuals. AAC includes both unaided communication (e.g., gestures, signs, facial expressions, and vocalizations) which does not require any equipment, and aided communication (e.g., communication boards, symbols, and speech-generating devices [SGDs]) which provides external support to aid the individual. Communication and language learning are critical from early stages of development and with the use of AAC, individuals with disabilities can develop functional communication skills, cognition, and social communication skills (Drager et al., 2010).

Given the amount of support necessary for individuals with CCN, it is important to consider the expertise that is needed to provide meaningful intervention in natural environments. AAC interventions have been used in isolation and as part of multicomponent interventions. While research with AAC interventions has predominately focused on increasing expression, some have included comprehension goals (e.g., object labeling) as well. Augmented input (e.g., pairing verbal model and an AAC model) interventions have been implemented and shown to be effective in supporting individuals with disabilities who use AAC (Binger & Light, 2007; Cafiero, 2001; Drager et al., 2006; Goossens, 1989; Romski & Sevcik, 1996). For children who use aided AAC, without seeing others model, the learning process can be unnatural and make

observational learning challenging. By providing a natural language-rich environment, children who use AAC can observe and imitate the model provided to them. This can be done through the use of the aided language modeling (ALM) strategy (Drager et al., 2006). This strategy involves the communication partner pairing a verbal model with a model of the AAC. Recent systematic reviews have found that the ALM strategy is effective at increasing the independent communication acts of children who use aided AAC (Allen et al., 2017; Biggs et al., 2018; Douglas et al., 2021; O'Neill et al., 2018; Sennott et al., 2016). With a natural communication partner (e.g., parent, teacher, peer, or sibling) and natural opportunities, the ALM strategy can be used throughout the child's daily routine.

Interventions designed for individuals with disabilities who use AAC have been used in various natural settings (e.g., home and school) using naturalistic, behavioral, and developmental approaches. To support language skills, researchers have developed effective and meaningful interventions to include those within the individual's immediate environment, the natural communication partners (e.g., teachers, parents, peers, and siblings; Biggs & Meadan, 2018). Communication partner can assume the following roles: (a) interventionist, (b) cointerventionist, and (c) communication partner. As a primary interventionist, the communication partner takes on the lead role in using strategies provided to them by a researcher/professional, through training and/or coaching. As a cointerventionist, the communication partner works alongside the researcher/professional to implement strategies to support the communication goals of the target child. Lastly, the communication partner refers to the person who is also receiving a dyadic communication intervention concurrently alongside the target child. For the purposes and goals of this study, the naturalistic approach of having the sibling as a communication partner was used and will be discussed in more detail in Chapter 2.

The Individuals with Disabilities Education Improvement Act (IDEIA, 2004) stressed the importance of implementing interventions with young children with disabilities within natural and authentic environments. Home is a natural environment for young children and their parents are natural communication partners who can provide language interventions and support children's communication skills. One way to support parents is to teach and coach them on specific interventions. These interventions are called parent-implemented interventions and have primarily been conducted with young children. Extensive literature supports parent-implemented communication interventions as these interventions primarily focus on young children with disabilities and target both verbal and nonverbal communication outcomes. Researchers have reported that after receiving training and coaching, parents can implement specific strategies with fidelity, and use them across different daily routines (Akamoglu & Meadan, 2018; Douglas et al., 2020).

As children transition to school, caretaking roles become shared between parents and educators (e.g., teachers and paraprofessionals); thus, teachers can become natural change agents and schools can be another natural environment for children. This gives children opportunities to have social interactions with more natural change agents. Given the extent of time children spend in schools, after parents, teachers can also be ideal candidates to implement communication interventions in natural environments. Extensive literature supports teacher-implemented communication interventions for students with disabilities. The literature also supports teacher-implemented communication interventions that are specifically designed for students with disabilities who use AAC (Douglas et al., 2012; Douglas et al., 2013; Howlin et al., 2007; Olive et al., 2007; Shepis et al., 1998). While research supports the use of teacher-implemented communication interventions in schools, as children develop, they begin to transition from

primarily communicating with adults to communicating and building social relationships with their peers.

At school, children have extensive opportunities to learn from and practice communication with their peers. Researchers have implemented interventions to support the social communication skills of students with disabilities who use AAC within school settings both with teachers and peers (O'Neill et al., 2018). Considering the process in which friendships form, supporting interactions through peers is an optimal way to embed natural opportunities that can develop into meaningful relationships. Research on peer-implemented interventions has been conducted with children representing a variety of ages (e.g., early childhood, elementary, middle, and high school) in both single-case research (SCR) and group research designs. Peers as communicators can play diverse roles in peer-mediated interventions such as supporting communication skills of children with disabilities and facilitating social interactions between themselves and children with disabilities. In this regard, peer relationships can be very critical as children learn from each other. Thus, researchers highlight the importance of creating opportunities for dyadic instruction so that children in schools are considered as having an equal status (Biggs & Meadan, 2018).

An area that is not prevalent in the research literature is having siblings as intervention implementers to support social communication skills of their siblings with disabilities by using AAC. Researchers have adapted school-based peer-implemented interventions and conducted them as sibling-implemented interventions in home settings (Wright & Benigno, 2019). While researchers generally have shown that this is a moderately effective approach, it is also important to note that the relationships between siblings are often different than relationships between peers as classmates. Within school-based peer-implemented interventions, typically developing

students are chosen based on their individual behaviors (e.g., personality, communication skills, and attentiveness), whereas in home-based sibling-implemented interventions this is often not possible. Children with CCN often have increased challenges of building friendships due to the communication difficulties they experience (Douglas et al., 2018). Yet, siblings can be ideal candidates to support the social communication skills of their brothers or sisters due to the inherent nature of the opportunities and interactions that are embedded in their natural home routines and as they are the longest lasting relationships in one's life (Douglas et al., 2018). However, sibling-implemented interventions have received little attention as a potential context to support the communication skills of children with disabilities (Allen et al., 2017; Biggs et al., 2018; O'Neill et al., 2018; Sennott et al., 2016).

Given the limited research supporting such interventions, there is a need for additional research on the use of sibling-implemented interventions in natural settings. Therefore, the purpose of this study was to examine the effectiveness of a training and coaching program that aimed to increase the high fidelity use of the ALM strategy with siblings in supporting social communication of children with disabilities who use AAC during semi-structured activities in natural environments. Specifically, Douglas et al.'s study was replicated with modifications to train and coach typically developing siblings to use the ALM strategy to improve the social communication skills of their siblings with CCN who use AAC.

CHAPTER 2: LITERATURE REVIEW

This chapter includes a review of literature on (a) the communication development of children with typical and atypical development, (b) communication interventions for individuals with CCN, (c) the use of augmentative and alternative communication AAC, and (d) the ALM strategy. The chapter focuses on the importance of embedding interventions into the child's natural environment (e.g., home and school) with natural change agents (e.g., parents, teachers, peers, and siblings). In recent years, telepractice has become more prevalent in communication intervention research (Akemoglu et al., 2020), thus literature regarding telepractice as a means for delivering communication interventions is also reviewed. The chapter includes the following sections: (a) the importance of communication, (b) communication partners as interventionists, (c) telepractice use in communication interventions, and (d) the purpose of this study.

The Importance of Communication

All people have the fundamental need and right to communicate; however, individuals with disabilities who have CCN often face challenges in communicating with those around them in effective and efficient ways (Biggs et al., 2019). Communication, the exchange of information between people, is a complex process that is affected by several individual and environmental factors and can be intentional or unintentional, linguistic or nonlinguistic, and conventional or unconventional (Biggs & Meadan, 2018; Brady et al., 2016). In addition, communication skills are a core aspect of people's quality of life, as they are needed for engaging in social interactions, building friendships, and creating a meaningful support system (Cohen, 2004). To have meaningful social interactions that lead to friendships, both communication partners need to have effective communication skills (e.g., initiating, responding, commenting, and repairing breakdowns). Thus, communication skills are essential because they provide children with

opportunities to interact with peers and adults in meaningful and functional daily contexts (Roberts & Kaiser, 2011).

Typical Communication Development

Communicative interactions between family members and children lay the foundation for later social communication interactions and language growth. Everything a child does during the day, whether at home or in childcare, has the potential for communication interactions (Barton & Smith, 2014; Bass & Mulick, 2007; Brown et al., 2001; Hollingsworth & Buysse, 2009). Furthermore, there are various people in a child's environment who can support language development and communication skills by being their communication partners. Natural change agents, such as parents, provide extensive language samples to children as the children begin to rapidly develop linguistically (Hart & Risley, 1995; Huttenlocher et al., 1991). By the age of 2 years, children with typical development often acquire 900 words (Carey, 1978), and while words cannot yet be combined into structured sentences, children are able to demonstrate receptive language skills from an early age. Given the significant relation between parent speech and child vocabulary growth, it is evident that the language input that is provided to children is extremely important for language development. Yet, language input is not limited to parents. Children also learn language from other communication partners such as teachers, peers, and siblings. Thus, children who grow up in environments where a communication partner engages in meaningful conversations with them develop knowledge of how language works and have the potential to develop language rapidly in the first few years of life.

Individuals with Complex Communication Needs

Individuals with CCN, also referred to as individuals with limited verbal communication, are those for whom spoken language is not sufficient to meet their communication needs. An

average of 1.3% of individuals cannot use natural speech to meet their communication needs (Beukelman & Mirenda, 2013). For some populations the average is much higher; for example, it was reported that approximately 30-40% of individuals with autism remain minimally verbal throughout their lives (CDC, 2020; Tager-Flusberg & Kasari, 2013). Challenges with communication skills could be associated with developmental disabilities such as individuals with autism, cerebral palsy, or Down syndrome, but can also be due to acquired disabilities such as a traumatic brain injury. Koegel and colleagues (2020) completed a systematic review of the literature to identify the definition of *minimally verbal* in autism research. They discussed the diversity of definitions of both *minimally verbal* and *nonverbal* used in this literature. Notably, there was a consensus that after the age of 5 years, it becomes increasingly more difficult to develop expressive language (Koegel et al., 2020). Koegel et al. reported that the term *minimally verbal* should be used for individuals over the age of 30 months who have word production in the 10th percentile (i.e., fewer than 50 spoken words) and *nonverbal* should be used for individuals over the age of 18 months who do not have consistent verbal expression (2020).

Individuals without a communication system may have difficulties in expressing their wants and needs and interacting with other similar-aged individuals which in turn could result in a lower quality of life. Additionally, the difficulties in expressing their wants and needs may lead these individuals to engage in challenging behavior as a means of expression (Drager et al., 2003). Fortunately, individuals of any ability level can be taught to communicate more conventionally and effectively (Beukleman & Mirenda, 2013). Teaching communication skills at an early age can lead to positive outcomes in social interaction skills for children with disabilities. (Koegel et al., 2020). Children with CCN who receive intervention that incorporates

supportive communication strategies within natural environments (e.g., homes and school) are likely to make substantial gains that impact functional development throughout the lifespan.

Augmentative and Alternative Communication

For children who are not communicating verbally, AAC can be used to supplement and support communication. AAC can be unaided, thus solely relying on the body of the user (e.g., gestures, facial expressions, and sign language) and aided, requiring external supports (e.g., communication board and speech-generating devices). Aided communication can come in many different forms and technologies (e.g., communication board with symbols, single-switches, tablets, and speech-generating devices). Children with disabilities who use AAC have different and often more difficult learning trajectories than typical verbal communicators due to the increased steps and mechanisms needed to express complete thoughts and communicative output (Brady et al., 2010). To support individuals with CCN, researchers have implemented various interventions utilizing evidence-based strategies to teach communication skills with different communication partners through augmented input.

AAC interventions have been shown to be effective across a variety of ages, disabilities, and language skills and are used to improve both comprehension and expressive communication (O'Neill et al., 2018). Allen and colleagues (2017) noted that many children who use AAC may not have the ability to use more complex syntactic structures, potentially because they are not provided with models of advanced language forms. Ganz and colleagues (2015) added that most of the communication related AAC interventions have been implemented to teach individuals how to request.

Aided Language Modeling

A variety of interventions involving augmented input that increase children's use of AAC and their object symbol comprehension have been implemented and reviewed by researchers. Researchers suggest that the use of aided-input AAC may reduce input-output asymmetry for individuals and increase their communication skills (O'Neill et al., 2018). All of these revolve around a specific action: the communication partner points to and/or activates aided AAC symbols while speaking with an individual who uses AAC (O'Neill et al., 2018).

Social communication intervention research is supported by a variety of theories. The modeling aspect of aided language is supported by the naturalistic developmental behavioral interventions (Schreibman et al., 2015). The behavioral theory of learning serves as the foundation for several language intervention techniques. Since Skinner's (1963) studies, the behaviorist approach has focused on operant learning and the action of pairing a behavior with a consequence. However, communication does not always follow typical operant behaviors and embedding naturalistic approaches can support aspects of communication such as termination or communication breakdowns. In addition, children learn through observation and imitation, and often by those to whom they feel they can most relate (e.g., parents, teachers, peers, and siblings), specifically noting the importance of natural environments with natural opportunities. Naturalistic approaches draw upon aspects of traditional behavioral approaches while embedding natural opportunities for meaningful communication. For the purposes of this study, the naturalistic approach are used as a guide to support the natural opportunities between communication partners.

Specifically noting aspects of communication (e.g., initiation, termination, repair) throughout natural communication opportunities, rather than focusing on traditional behavioral

approaches aligned with operant conditioning, communication partners must provide language input models. These types of naturalistic approaches must include natural environments and routines, responsiveness to all child communication acts, models to the child, reinforcement for the communication, and natural shaping of the communicative behavior (Ingersoll, 2010). These language input models provide the learner with a language rich environment with diverse types of examples of communication. Similar to typical language development, a communication partner may give extensive amounts of language models without the child communicating.

One strategy that is supported widely in the research to enhance communication through AAC is ALM (Drager et al., 2006; Kasari et al., 2014; O'Neill et al., 2018; Quinn et al., 2020; Romski & Sevcik, 1996). This strategy includes a communication partner who models both verbal language and aided AAC during natural interactions. In other words, spoken words are paired with aided input. The communication partner can be any natural communicator such as a parent, sibling, teacher, or peer. Various systematic reviews have found that ALM interventions are effective in increasing communicative acts through the use of aided AAC, yet interventionists in the reviewed studies have been primarily researchers and less often natural change agents (Allen et al., 2017; Biggs et al., 2018; O'Neill et al., 2018; Sennott et al., 2016).

Sennott and colleagues (2016) conducted a systematic review of the effects of interventions that include aided AAC modeling on language acquisition. The review included nine SCR studies. Findings showed that the use of aided AAC modeling led to meaningful gains in the areas of (a) pragmatics, (b) semantics, (c) syntax, and (d) morphology (Sennott et al., 2016). Another recent review by Allen and colleagues (2017), which identified and summarized 19 SCR studies involving 56 participants plus two group studies involving 75 participants, found

that augmented input can improve expression (i.e., single-word vocabulary, multi-symbol utterances) for individuals with developmental disabilities who use AAC.

In 2018, Biggs and colleagues published a scoping review focusing on natural communication partners who implemented AAC modeling strategies. This review included 29 studies focusing on natural change agents (e.g., teachers, speech language pathologists [SLPs], paraprofessionals, and peers) as implementers for school-aged students who used AAC. The authors reported that 13 of these studies used augmented input, seven used models as prompts, five used a combination of models as prompts and augmented input, three used models within instructional demonstrations, and one study used a combination of all four models for the intervention; the researchers noted that the interventions were generally effective (Biggs et al., 2018). O'Neill and colleagues (2018) conducted a meta-analysis to investigate the effects of AAC interventions and included 26 studies in their review. They noted that these interventions focused on both comprehension and expression and were highly effective across diverse participants. The researchers noted that communication partners need to use the ALM strategy when communicating with children who use AAC (O'Neill et al., 2018). Given the findings of these four systematic reviews, evidence is clear that the use of augmented input can increase both the comprehension and expressive communication skills of individuals with CCN who use AAC. Researchers discussed the diverse populations of individuals who benefitted from augmented input and the importance of using natural change agents (e.g., parents, teachers, SLPs, and peers) as communication partners, yet siblings as communication partners were never mentioned in any of these systematic reviews.

Communication Partners as Interventionists

Natural Communication Partners

Children with disabilities often communicate at a much lower rate than their typically developing peers (Kamps et al., 2014). Communication is a reciprocal process; hence, when children communicate at lower rates, their communication partners also often communicate at decreased rates (Brady et al., 2010). This decreased reciprocal dynamic can be more prevalent among children with disabilities who use AAC and their family members (Brady et al., 2010). This is related to the transactional model of development which emphasizes that language learning is bidirectional and reciprocated through the environment such that the interactions between a child's behavior and the environmental response influence the child's future behaviors as well as biological development (Sameroff, 2009). Communication partners' behavior is critical for the development of communication skills and language of individuals with CCN who use AAC. Researchers describe the benefits of using communication partners who are within an individual's natural environments (e.g., parents, teachers, peers, and siblings) and emphasize the importance of supporting these natural communication partners in using effective strategies, such as the ALM strategy. Communication partners could be trained and coached to increase their knowledge and understanding of how to use these strategies effectively for individuals with CCN who use AAC.

For young communicators, cascading intervention models have been used in communication interventions. Within the cascading model approach, the focus turns to training and coaching the natural change agent to implement the communication intervention. While there is research to support the importance of intervention taking place in the natural environment with natural change agents, these individuals may not be equipped with the

knowledge, skills, or expertise to provide effective communication interventions for individuals with CCN (Biggs & Meadan, 2018).

Parent-Implemented Interventions

As their first communication partners, parents have ideal relationships with their children to foster and support communication by providing opportunities for social interaction, language modeling and shaping, and responding to communication attempts (Biggs & Meadan, 2018). Parent-implemented interventions have been found to be effective in promoting children's language and communication outcomes and are an evidence-based practice for children with disabilities (Akamoglu & Meadan, 2018; Chang & Locke, 2016; Meadan et al., 2009; Roberts & Kaiser, 2011; Steinbrenner et al., 2020; Watkins et al., 2015). Noteworthy, parent-implemented interventions have primarily been used with younger-aged children. Specifically, in the AAC field, parent-implemented interventions have been found to be effective in promoting children's communication skills (Binger et al., 2008; Kasari et al., 2014; Kent-Walsh et al., 2015; Romski et al., 2010).

Binger and colleagues (2008) taught three parents how to support multi-symbol utterances use of their early childhood-aged children with disabilities who used AAC during storybook reading. Parents increased their use of the modeling strategy, and the children increased their use of multi-symbol utterances. Romski and colleages (2010) conducted a study with 62 toddlers with fewer than 10 spoken words; participants were randomly assigned to parent-coaching language intervention groups (i.e., augmented input, augmented output, and spoken language). Results indicated that children in the augmented input and output groups increased their vocabulary production, whereas children who only received spoken language showed minimal increases. For individuals ages 5 years old and above, Kasari and colleagues

(2014) conducted a longitudinal study including parents through a blended, adaptive treatment design to improve spontaneous, communicative utterances with aided AAC. They noted that the participants increased their independent communication utterances but the authors did not discuss in detail the role or behaviors of the parents in the intervention phase. Overall, researchers have demonstrated that parents can learn new teaching strategies and use these to support their children's use of AAC devices. In addition, children who participated in parent-implemented interventions demonstrated an increase in communication skills and use of their AAC systems.

Teacher-Implemented Interventions

Within schools, research supports the use of natural communication partners for intervention implementation (e.g., teachers, service providers, paraprofessionals, and peers). As children grow, a significant amount of their time is spent in schools or educational settings with various adults (e.g., teachers, service providers, and paraprofessionals). These adults play a significant role in supporting children's communication and language development; however, teachers and paraprofessionals may not have the necessary training or expertise to support children with CCN (Biggs & Meadan, 2018). Researchers have found that teacher-implemented interventions are effective in supporting communication development for children with CCN in both early childhood and elementary settings, demonstrating treatment effects such as increasing the frequency of students' communicative behaviors (Douglas et al., 2012; Howlin et al., 2007; Olive et al., 2007; Schepis et al., 1998). The researchers of these four studies also concluded that it is important to ensure high-fidelity implementation so that the behavior of the communication partners remains consistent postintervention (Howlin et al., 2007). Olive and colleagues (2007)

suggested that future research continues to document the needs of the communication partners as both coaching and training are needed.

Peer-Implemented Interventions

Children with typical development can provide extensive language samples to their peers who use AAC (Barker et al., 2013; Huttenlocher et al., 1991). However, Chung and colleagues (2012) reported that while students were placed in inclusive settings, children who used AAC were much more likely to interact with adults (e.g., teachers and paraprofessionals) rather than their similar-aged peers. This finding supports the current literature on embedding interventions in the child's natural environment and utilizing peers to promote social communication interactions. Typically developing peers also can be interventionists to support communication skills of children with CCN.

The role of peers as interventionists has been researched both in SCR and group design studies (Chang & Locke, 2016; Watkins et al., 2015), and peer-implemented interventions have been found to be effective. There are three types of peer-implemented interventions including peer instruction, individualized peer and child instruction, and dyadic instruction (Biggs & Meadan, 2018). Within peer instruction, the typically developing child receives the intervention to then support the child with CCN. Individualized peer and child instruction includes teaching each child skills based on their own needs to support interactions with one another. Lastly, dyadic instruction is when both the communication partner and the target child receive the same instruction. Teaching peers to implement communication interventions can support and foster social relationships that can lead to friendships.

Roles of Friendships

Friendships are developed through interactions with strangers or acquaintances that are often guided by similarities between individuals. Researchers have proposed various processes in which friendships develop (Butkowski et al., 2009; Gottman & Graziano, 1983). For example, Gottman and Graziano explained that the process of a friendship develops over six stages: (a) establishing a connection and clear communication, (b) sharing information, (c) sharing common interests and values, (d) expressing personal feelings, (e) establishing a balance between each of the communicators, and (f) resolving conflicts. According to Gottman and Graziano's stages, interactions are essential to build and maintain social relationships and/or friendships. There is limited research on peer relationships and friendships between those with and without disabilities. Researchers suggest that there continues to be a gap of interaction opportunities between children with and without disabilities due to participation, activities, and relationships (Kamps et al., 2014).

Peers as Implementors

Although some research reports indicate that children benefit from increased opportunities for interactions with typically developing peers (McLeskey et al., 2012), Carter and colleagues (2008) noted that even when there are increased opportunities for interaction in inclusive settings, social interaction still occurs infrequently. Yet, it is known that children with CCN can benefit from inclusive school experiences when there is effective and meaningful planning to support their interactions with typically developing peers (e.g., peer-implemented interventions). To improve the effectiveness of peer-implemented interventions, the following four main components should be in place: (a) creating a peer support plan, (b) recruiting peers

from the same classroom, (c) providing peers with roles, and (d) providing ongoing feedback and guidance (Biggs et al., 2017).

Therrien and colleagues (2016) conducted a literature review and identified 19 intervention studies that focused on promoting peer interactions among children who used AAC. This literature review specifically focused on peer-implemented research that supports social interactions. The intervention components of the various studies included (a) interventions specifically developed for and implemented with children with disabilities, (b) teaching the peers to implement the intervention, and (c) creating environmental arrangements to support both children. Therrien et al. (2016) noted that all studies showed a positive increase in the frequency of interaction behaviors ranging from 40% to 100%. Currently, there is some research to support social interactions of children with CCN with their typically developing peers, whereas there is very limited research conducted on sibling-implemented interventions for children with CCN who use AAC.

Sibling-Implemented Interventions

While many individuals grow up with siblings, current theoretical frameworks to guide sibling relationship research is limited. Whiteman and colleagues (2011) discussed the theoretical frameworks that support sibling relationships across the lifespan, noting that relationships cannot be accounted for by one perspective in isolation. Family systems theory (Bowen, 1974) examines the dynamics within and between family members. These roles within and between family members, such as siblings, change over time and can be affected by other dynamics such as parent relationships, parent-child relationships, number of siblings, genders, and ages (Whiteman et al., 2011). Theories to support siblings research are less common and research suggests this can be directly related to the number of sibling relationship structure

possibilities (e.g., twins, gender, age, interests, and stepsiblings) and the diverse types of relationships siblings may have (Treffers et al., 1990). Most theoretical research on sibling relationships noted that these relationships are directly related to marital quality and parent-child relationships and are built off family hierarchies between both dyads and triads of family members (Whiteman et al., 2011). Researchers suggest that considerations should be made to support siblings of children with disabilities by including other family members as guides to the goals and outcomes of the intervention (Mactavish & Schleien, 2004). Researchers also have suggested that interventions be designed to ensure that relationship dynamics remain constant throughout the intervention by learning about both sibling and individual characteristics (e.g., age, gender, interests, and abilities) to limit hierarchical concerns (Wright & Benigno, 2019).

Social learning theory suggests that children learn behavior and language from people they observe and that family members are the first people to model language and behavior for children (Bandura, 1977). Therefore, siblings can be the leading models as they can provide learning opportunities to their brother or sister with a disability. Studies have found that parents, teachers, and peers are effective in supporting social interactions for individuals who use AAC; however, research with siblings is still limited (Douglas et al., 2018; Douglas et al., 2021; Wright & Benigno, 2019). Given that the home environment provides consistent opportunities for children to interact with constant communication partners, family members, including siblings, are ideal interventionists to support social interactions and increase the independence of children who use AAC (Kent-Walsh et al., 2015).

Sibling Relationships

Most children grow up with at least one sibling, and sibling relationships stand apart from other peer relationships due to their enduring nature that lasts across various stages in one's

lifetime (White & Hughes, 2018). Sibling relationships are unique and lifelong, while growing and developing as individuals age. Given this, siblings can play a significant role in the development of communication and social interactions for children with disabilities. As young children, siblings spend a considerable amount of time with one another, however, researchers have found that as children transition to adulthood there is an increase in independence and decrease in intimacy between siblings (Orsmond & Seltzer, 2007). These finding can suggest the importance of strengthening sibling relationships from an early age and continue to support these throughout life stages.

It is suggested that sibling relationships are often second to the emotional ties between a child and their parent (Furman & Buhrmester, 1985). However, there is limited research to explain the sibling dynamics between those with and without disabilities (Shivers & Plavnick, 2015). Researchers suggest that children with disabilities can have a variety of atypical or idiosyncratic behaviors that can potentially explain the diverse relationship characteristics between siblings (Kim & Horn, 2010). Petalas and colleagues (2015) interviewed typically developing children about their perceptions of their siblings with disabilities. They noted that children expressed that they took pride in the skills their siblings had but also had difficulty expressing themselves to their siblings, and had trouble talking about their siblings to their peers. The various dynamics of sibling relationships often contribute to family systems, enabling understanding of the unit as a whole (Wright & Benigno, 2019). Through the lens of the family systems framework (Bowen, 1974), siblings make strong candidates to support communication interventions.

Siblings as Implementors

Typically developing siblings could create frequent opportunities to support individuals with disabilities to communicate throughout their routines and within their natural environments (Tsao & Odom, 2006). A majority of sibling-implemented intervention studies focused on interventions that were developed for peers in the classroom but were conducted at home with siblings (Ferraioli et al., 2012). For example, Coe et al. (1991) taught older elementary school children how to provide prompting and praise to increase the social interactions of their younger siblings through speech. Later, Strain and Danko (1995) conducted a parent-facilitated, sibling-implemented intervention and taught parents how to prompt typically developing siblings to increase social interactions in the home. Strain and Danko noted that families reported interest in having more family-friendly packages that would improve the feasibility of implementation of the intervention. However, there has been limited research since then to support the need for additional parent-facilitated, sibling-mediated social interaction interventions. Trent-Stainbrook and colleagues (2007) investigated the effects of a sibling intervention to facilitate verbal utterances during social interactions between older typically developing siblings and their young siblings with Down syndrome. By teaching the older siblings to use four responsive interaction strategies (i.e., written materials, modeling, role play, and oral feedback) intentional communication of the younger siblings with disabilities increased. The research findings indicated modest results, supporting the effectiveness of sibling-implemented interventions to increase spoken communication acts (Trent-Stainbrook et al., 2007).

Shivers and Plavnick (2015) conducted a systematic review focusing on sibling involvement for individuals with autism, not specifically focusing on AAC. This review sought to understand typically developing sibling involvement and roles in interventions for children

with disabilities. The review included 17 articles focusing on various skills (i.e., play, social, academic, skill teaching, and physical fitness) and explored both typically developing siblings as corecipients (n = 3) and as the instructors (n = 9) or modelers (n = 5). Sibling ages ranged from 4 to 15 years and the studies included both genders. Specially focusing on communication, 10 studies targeted either play or socials skills. Two studies (Baker, 2000; Castorina & Negri, 2011) focused on social skills and both siblings were corecipients of the interventions. Both studies focused on play skills such as joint attention and social cues. While Castorina and Negri did not note any positive behavior change, Baker reported an increase in the communication for both the typically developing siblings and the siblings with disabilities. Six studies focused on play or social skills with the typically developing siblings as instructors (Celiberti & Harris, 1993; Coe et al., 1991; Ferraioli & Harris, 2011; Oppenheim-Leaf et al., 2012; Tsao & Odom, 2006; Walton & Ingersoll, 2012). These six studies involved typically developing siblings using prompts and reinforcement to invoke positive communication behaviors; all studies noted positive changes and improved relationships. The six studies included children with varied levels of communication (e.g., nonverbal, minimally verbal, and no description). Lastly, two studies focused on play skills using typically developing siblings to model behavior (Reagon et al., 2006; Taylor et al., 1999). Within these two studies, typically developing siblings were video-recorded modeling the desired behavior; these videos were then shown to the children with autism to promote behavior change (i.e., play-related statements and scripted statements). Shivers and Plavnick's (2015) noted that over the past two decades, there has been limited research on sibling interactions and involvement in various natural routines. This literature review, however, focused only on individuals with autism and their typically developing siblings; that leaves gaps that need to be further investigated such as exploring how children who

use AAC are supported by their typically developing siblings. Since Shivers and Plavnick's (2015) literature review was published, there has been limited research on sibling interventions. Recently, Tsao (2020) utilized a single-case multiple-baseline design to understand the feasibility of having typically developing siblings as intervention agents and to support social interactions between the siblings. Siblings were taught to use social skills strategies during play and results showed that all children increased social interaction behaviors using both verbal and nonverbal behavior.

While there is a growing body of research to support the training of communication partners, siblings research focused on communication with AAC is scarce. There has been only one study (Douglas et al., 2018) that specifically focused on AAC and siblings. Douglas et al.'s study evaluated a sibling training program, replicating the training components from Kent-Walsh and McNaughton (2005). The training components included a pretest, two live training sessions with a quiz, role-playing, and self-reflection. Siblings were taught the strategy Play, Talk, Wait, and Respond. Douglas et al.'s results showed that this intervention can increase the frequency of siblings' communication supports and communication acts for children with CCN. The authors noted that while typically developing siblings did not perform as adult participants in previous research, sibling research is relevant and important to focus on (Douglas et al., 2018). The researchers emphasized the need for specific training of typically developing siblings that is age appropriate (e.g., short and engaging) with an added component of coaching to support the ongoing learning of the typically developing siblings to promote the active engagement of their siblings with disabilities (Douglas et al., 2018).

Telepractice in Communication Interventions

Telepractice and telecoaching is becoming a viable option to deliver interventions to parents and their children (Heitzman-Powell et al., 2014; Machalicek et al., 2016; Meadan et al., 2016; 2020; Neely et al., 2017; Snodgrass et al., 2017). Telepractice employs technology to connect people from a distance and this support can be provided to those in classrooms, homes, and other community settings. Telepractice services can be synchronous (e.g., audio or video conferencing) or asynchronous such as self-paced training (Chung et al., 2020). Although much of the literature addresses telepractice with caregivers of children who are deaf or hard of hearing (e.g., Behl et al., 2017; McCarthy et al., 2019) and children with autism (e.g., Ingersoll et al., 2016; Meadan et al., 2016; Vismara et al., 2013), it has also been used to teach parents language and communication interventions (e.g., Akemoglu et al., 2020; Snodgrass et al., 2017).

Research has demonstrated many benefits to using telepractice with natural change agents such as parents and teachers. These benefits included improvements in parents' use of strategies with their children (Ingersoll et al., 2016; Meadan et al., 2016; Vismara et al., 2018), reduced drive time and mileage and reduced costs (Blaiser et al., 2013), and the ability to reach families in rural areas and with underserved populations (Cason, 2009). Studies examining the use of telepractice to support adult-implemented interventions have also shown improvements in target child outcomes, such as communication and social skills (Coogle et al., 2019; Meadan et al., 2019). In addition to the ability to reach underserved populations, the need for telepractice to support families of children with disabilities was heightened due to the COVID-19 pandemic (ASHA, 2020).

Researchers have examined the use of telepractice as a means of supporting parents and their young children with a variety of disabilities. Most recently, Douglas and colleagues (2021)

implemented a communication intervention to support a child with CCN using a cascading model approach through telepractice. The purpose of their study was to understand if the use of telepractice was effective and socially valid to deliver training and coaching to teach family members (i.e., parents and siblings) how to use the ALM strategy. The findings supported the use of telepractice as a viable way to teach and coach natural change agents in communication interventions for individuals who use AAC. The findings of this study highlight the importance of including various family members for meaningful and long-term intervention outcomes.

In addition to the benefits of telepractice, challenges exist, particularly difficulties with technology (Ashburner et al., 2016; Blaiser et al., 2013; Lerman et al., 2020). Despite the challenges faced when working with technology, the benefits make it possible for professionals to reach families with whom they might otherwise not be able to meet in person because of distance. Thus, often, the benefits can outweigh the technology difficulties when it comes to providing services via telepractice. Although there is a growing body of literature on telepractice research, most studies included adult participants (e.g., parents, teachers, and professionals). To my knowledge, aside from Douglas and colleagues (2020), there are no other existing studies that directly involve typically developing siblings in telepractice interventions specifically for children with CCN.

Summary of Literature Review

Researchers have explored various individuals (e.g., parents, teachers, peers, and siblings) as intervention implementers and reported effective and meaningful increases in communication skills for individuals with disabilities (Akamoglu & Meadan, 2018; Binger et al., 2008; Chang & Locke, 2016; Chung et al., 2012; Howlin et al., 2007; Meadan et al., 2009; Olive et al., 2007; Roberts & Kaiser, 2011; Schepis et al., 1998; Steinbrenner et al., 2020; Watkins et

al., 2015). Furthermore, theories support the importance of learning communication and language skills through observation from those who are most relatable to the learner, and this has provided a guide for including those people within the natural environment. Overall, theory and research alike draw on the importance of using natural change agents within natural environments (Bandura, 1977), yet limited research is available to guide sibling-related interventions (Kent-Walsh et al., 2015; Mandak et al., 2017; Wright & Benigno, 2019).

Meaningful research has been conducted to highlight the importance of using peers as interventionists for school-aged children with disabilities who use AAC. However, most of the research to date focused on young children and there is a need to explore additional communication interventions for school-age children. Research with peers has been replicated and adapted to meet the needs of siblings; however, this is still an emerging area with limited research to support it (Wright & Benigno, 2019). For example, siblings often have more diverse characteristics than those found in peers in traditional classrooms and, therefore, consideration of these diverse characteristics should be considered in sibling interventions. Noting that peers in classrooms play different roles than siblings in the home, support for sibling-implemented interventions should be discussed to better promote the training and coaching of typically developing siblings.

Telepractice is an area that continues to become more prevalent in research, primarily with caregivers. While telepractice is showing effective changes and promises for those who need remote services, children are often not included in telepractice interventions. Now more than ever, the importance of telepractice is clear. Additional research should be designed to support interventions for children with disabilities who use AAC in natural environments by natural change agents, especially siblings, through telepractice.

Purpose of the Study

While the current literature supports the effectiveness of the ALM strategy to promote communication skills of children who use aided AAC in schools, there is limited research on the use of this strategy with children with disabilities and their typically developing siblings. Natural communication agents take an active and critical role in the learning of children who use AAC, and it is also important that family members learn to interact with AAC. Given that research is primarily conducted with parents, teachers, and peers in schools, and that siblings play an important role in supporting each other's development, sibling research should be further explored. Through the lens of the naturalistic approaches and family systems theory (Bowen, 1974), a framework for a sibling social interaction intervention was used as a guide to guide the current study.

The purpose of this study was to examine the effectiveness of a training and coaching program aimed to increase the use of the ALM strategy by siblings who support the social communication of children with disabilities who use AAC in the natural environment. The following research questions guided this study:

1. Is there a functional relation between training and coaching on the aided language modeling (ALM) strategy, via telepractice, and the high-fidelity and rate at which typically developing siblings use the ALM strategy with children with disabilities who use AAC?
2. Is there a relation between the use of the ALM strategy by typically developing siblings and an increase in the independent communication of children with disabilities who use AAC?

3. What are the perspectives of caregivers, siblings, children, and other family members of the goals, procedures, and outcomes of the intervention?

CHAPTER 3: METHOD

The aim of this study was to train and coach typically developing siblings to support the social communication of children with CCN who use AAC. A multiple probe single-case design across typically developing siblings was used to evaluate the effectiveness of the training and coaching intervention. Table 1 provides more details about the data source and analysis for each research question.

Table 1

Data Source and Data Analysis by Research Question

Research Question	Data Source	Data Analysis
1. Is there a functional relation between training and coaching on the aided language modeling (ALM) strategy, via telepractice, and the high-fidelity and rate at which typically developing siblings use the ALM strategy with children with disabilities who use AAC?	*Observations* -Siblings' high fidelity of implementation of the ALM strategy -Siblings' rate of ALM strategy use	*Visual analysis* -Within each phase (level, trend, variability) -Between phases (overlap, immediacy of change, level, trend, and variability) -Across tiers/dyads (vertical analysis)
2. Is there a relation between the use of the ALM strategy by typically developing siblings and an increase in the independent communication of children with disabilities who use AAC?	*Observations* -Siblings' language models -Children's independent communication	*Descriptive Analysis* -Siblings' rate and type of language model -Children's rate and type of independent communication mode
3. What are the perspectives of caregivers, siblings, children, and other family members of the goals, procedures, and outcomes of the intervention?	*Interviews* -Primary parent pre- and postintervention interviews -Other family member interviews (adults and siblings) -Child interviews	*Descriptive Analysis* -Pre- and post- sibling relationship questionnaire *Qualitative Analysis* -data analysis according to the framework of social validity: goals, procedures, and outcomes

Recruitment Process

Recruitment began after obtaining Institutional Review Board (IRB) approval (see Appendix A). To identify and recruit participants, a flyer describing the study was shared with local parent, special education teacher, and speech-and-hearing organizations within the United States (US; see Appendix B). The flyer and study information were also shared on social media platforms and in social media groups for parents who have children with disabilities; all participants were recruited from one Midwest state in the US. The flyer contained a Quick Response (QR) code and a link that led interested individuals to a Google Form screener. This screener included questions to determine eligibility (see Appendix C). Recruitment started in late December 2020 and continued through January 2021. In total, six families completed the online screener; one family was not eligible due to the child's communication level and two families did not reply when they were contacted to schedule preintervention interviews.

Inclusion Criteria

Caregivers and their children with and without disabilities were recruited for this study. For the purposes of this study, the child with a disability who used AAC will hereon be referred to as the child, and the typically developing sibling will hereon be referred to as the sibling. To participate, the child must (a) have had a developmental or intellectual disability, as reported on their Individualized Education Plan (IEP); (b) use a high-tech aided AAC device as their primary form of communication; (c) be an emerging symbolic communicator; and (d) be between the ages of 6 and 12 years. The sibling had to be between 7 and 12 years old with no disabilities or delays, based on parent report. The sibling and child must also be within 3 years of age of each other. The parent/caregiver must (a) be a primary caregiver to the sibling and child, and (b) had to speak English fluently.

Procedures

Intake Process

Upon completion of the Google screener, five eligible caregivers were contacted to discuss details of the study; three responded and participated in the study. The caregivers were asked to complete an informed consent form and the siblings were asked to complete an informed assent form (see Appendix D) prior to the beginning of the study. When the primary caregiver completed the consent form, they were sent a link to Google Forms containing an information questionnaire that included questions about their race/ethnicity, education, and family structures such as child diagnosis, child modes of communication, sibling information, and sibling and child interactions (see Appendix E). An initial meeting, the preintervention interview, with each family via Zoom, a HIPPA-compliant videoconference software, focused on better understanding the specific needs of the child-sibling dyad as well as the best activities to promote opportunities for their interactions. The meeting consisted of an overview of the study, consent, preintervention interview with the caregiver and sibling, and completing the Communication Matrix (Rowland, 2004). Based on the information from the preintervention interviews (see Appendix F), activities, materials, as well as a schedule for meetings were discussed.

Measures

Participants completed the following two measures: (a) Communication Matrix (Roland, 2004) and (b) Sibling Relationship Questionnaire (SRQ; Furman & Buhrmester, 1985; completed by both caregivers and siblings).

Communication Matrix. The Communication Matrix is a measure designed to help families understand the communication status, progress, and unique needs of individuals

(Roland, 2004). This matrix is designed to manage information to make informed decisions and goals for interventions and next steps. This measure assists in understanding exactly how an individual currently communicates to create meaningful and realistic goals for the future. This focuses on a pragmatic approach to communication development by viewing what an individual can achieve through their use of behaviors outside of traditional speech. Caregivers completed the Communication Matrix about their children with CCN at the beginning of the study during the preintervention interview. Using screen sharing, the caregiver responded to the prompts, and their responses were recorded. Results from this measure include children's areas of strength and areas of need. Through a construct validity study in 2011, stakeholders (i.e., service providers, university teachers, and researchers) were asked to rate the clarity and relevance of each question anonymously; results indicated both high relevance and clarity (Roland, 2011). The findings from this measure are discussed in the participants section.

Sibling Relationship Questionnaire. To learn more about the siblings' relationships, the caregivers and siblings each completed separate Sibling Relationship Questionnaire (SRQ; Furman & Buhrmester, 1985). This 48-item scale measures the satisfaction with the relationships and the importance of the relationships, focusing specifically on (a) warmth/closeness, (b) relative status/power, (c) rivalry, and (d) conflict. Warmth and closeness items consist of questions related to intimacy, prosocial behavior, companionship, similarity, admiration, and affection. Relative status/power items focus on questions related to nurturance and dominance between siblings. The rivalry portion consists of questions focused on maternal and paternal partiality, and the conflict portion includes questions related to sibling quarreling, antagonism, and competition. The tool focuses on attributes that contribute to sibling relationship quality and how these interact to form diverse relationships. This can be a combination of characteristics of

the individual child, parent-child relationships, and family constellation variables. Derkman and colleagues (2010) conducted a confirmatory factor analysis and confirmed that the dimensions of warmth/closeness and conflict are aspects of sibling relationships and verified that this is a valid and reliable measure to assess sibling relationships. This measure was completed both pre- and postintervention. The measure was emailed to the family, completed, and returned via email or during the interview depending on the family's preference. The caregivers were asked to help the sibling complete this measure. The findings from this measure are discussed in the results section.

Setting and Materials

This study took place in the families' homes, and all aspects of the study were completed via telepractice with live recordings by me or a graduate research assistant. Neither I nor the graduate research assistant were in the families' homes for any of the sessions including the baseline, intervention, and maintenance phases. To support social interaction between the sibling and child, activities were selected based on family routines and the interests of both the children with disabilities and their siblings; these varied for each dyad and included items such as trains, a matching game, a basketball, farm animals, and dice. The routines and settings were determined based on a discussion with the family prior to beginning each session.

The materials needed for the participants in this study were: (a) aided AAC device with which the child primarily communicated; (b) device to record (e.g., iPhone or tablet); (c) tripod to hold the recording device; (d) wireless internet; and (e) family-chosen items for predetermined activities. All but one family had all necessary materials for participation; one family was provided a tripod to hold the recording device. The training and coaching materials (i.e., PowerPoint presentation and PDF visual) were shared with the participants immediately

preceding the training sessions through email. All intervention (i.e., training and coaching) sessions were recorded live via Zoom and stored in a University of Illinois at Urbana-Champaign (UIUC) HIPPA-compliant Box folder. More information about the SGDs, items/activities and words used during the activities is included in Table 2.

Participants

Four child-sibling dyads were recruited for this study; two dyads were from the same household with the same child and different siblings. For the purposes of this study, a family was considered all individuals who were living in one household full time. Three of the dyads were opposite gender, and all siblings were older than the children. Disability categories included Down syndrome, autism, and Angelman syndrome. Children's ages ranged from 7 to10 years and siblings' ages ranged from 7 to12 years, all within 3 years of age of their siblings. Detailed information about the participants and their families are found in Tables 2 and 3.

Table 2

Siblings, Children and Activities Description

	Sibling; Age	Child; Age	Child's Disability	AAC Device	Items/Activities	AAC Words Examples
Family 1	Naomi; 8	Michael; 7	Down Syndrome	iPad; Proloquo2Go	• trains • building blocks • basketball • hammer and balls • pretend play	• colors • shapes • night • sissy
Family 2a	Elizabeth; 12	Connor; 9	Angelman Syndrome	Accent 1000; CoreScanner	• cookie counting • shapes and color matching • Simon • book reading • basketball	• colors • shapes • book • numbers • blocks • puzzle
Family 2b	Luke; 11	Connor; 9	Angelman Syndrome	Accent 1000; CoreScanner	• cookie counting • shapes and color matching • pegs and pegboard • book reading	• colors • shapes
Family 3	Steven; 7	Ella; 7	Autism	Accent 800; LAMP Words for Life	• matching game • Legos • action figures/dolls • slime	• my turn • your turn • match • good job

Table 3

Family Demographics

	Primary Caregiver	Race	Age	Highest Level of Education	Occupation	Other Adult Family Members in Household	Children in the Household	Household Income
Family 1	Mother	White	50-59	Bachelor's degree	Stay-at-home mother	Father	Naomi; 8* Michael; 7*	> $100,000
Family 2	Grandmother	White	Over 60	Associate's degree	Stay-at-home grandmother	Grandfather Mother Father	Henry; 14 Elizabeth; 12* Luke; 11* Connor; 9*	> $100,000
Family 3	Mother	White	40-49	PhD	Stay-at-home mother	Father	Steven; 7* Ella; 7*	> $100,000

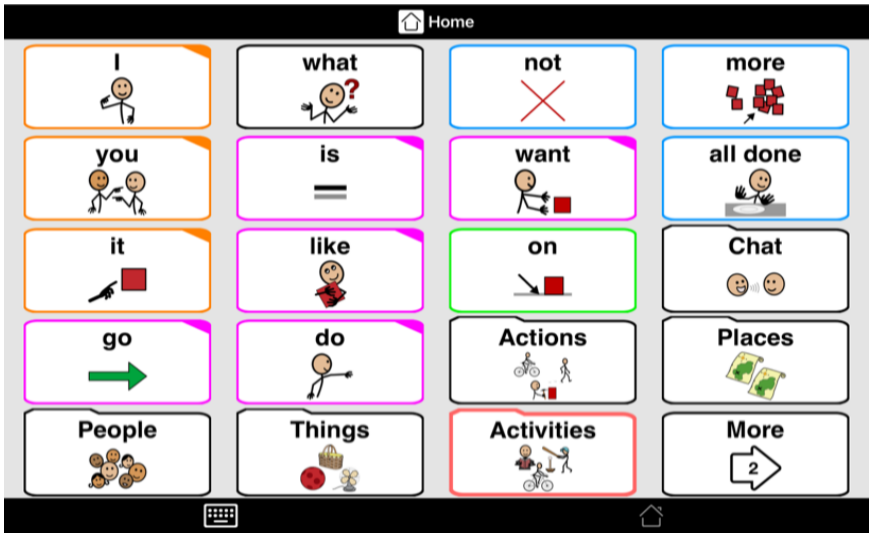
Note: Participants marked with an * indicate they participated in the study.

Family 1: Naomi and Michael

Family 1 consisted of a mother, father, daughter, and son. The primary adult for this study was the mother. She was a stay-at-home mother while supporting both her children with remote learning because of the COVID-19 pandemic. The father worked at the local university. Naomi, the typically developing child, was 8 years old at the start of the study. Her brother, Michael, had Down syndrome and was 7 years old at the start of the study. The mother and Naomi both completed the SRQ and when I met with the mother for the preintervention interview, she completed the Communication Matrix about Michael. Based on the Communication Matrix and the mother's report, Michael had already mastered communication skills such as whole-body movements, head movements, arm and hand movements, leg movements, facial expressions, and basic vocalizations. Michael showed emerging communication skills in various areas, all focused on the ability to conventionally use vocalizations and verbalizations, including one- and two-word combinations. Michael used a 20-cell Proloquo2Go on an iPad (see Figure 1). His mother explained that he knew where symbols were and would use it at school and on other occasions but would not regularly use it to communicate at home.

Figure 1

Michael's Proloquo2Go With a 20-Cell Display



The mother expressed during the preintervention interview that she was hopeful that the siblings would begin playing together as they were most often interested in their own activities. She did inform me that Michael was not often engaged on Zoom and online learning through his school so this might pose a challenge during the observations. While interviewing Naomi during the preintervention interviews, she expressed her excitement to learn how to better communicate with Michael and how to support his learning.

Family 2: Elizabeth, Luke, and Connor

Family 2 consisted of grandmother, grandfather, mother, father, three sons, and one daughter. The mother, father, and grandfather all worked full time outside of the home. Three of the family members participated in this study: two sons, and one daughter. The primary adult for this study was the grandmother. She expressed an interest in the study and helped organize all the meetings with the participants. Elizabeth was 12, Luke was 11, and Connor was 9 at the start of the study; Connor had a diagnosis of Angelman syndrome. Based on the Communication

Matrix, Connor had already mastered the ability to use whole-body movements, head movements, arm and hand movements, leg movements, and basic facial expressions. He showed emerging skills in using conventional gestures and vocalizations to express his needs or wants and did not yet use any verbalizations to communicate. He had areas of need in terms of using conventional communication and concrete symbols. Connor used an Accent 1000 with a 28-cell display and a keyguard to support his fine motor needs. The symbol sizes and keyguard fit the 28-cell display (see Figure 2). As seen in Figure 2, 16 cells included usable buttons.

Elizabeth was Connor's older sister and was described by the grandmother as a "primary caretaker" of Connor. She would help with school, speech, occupational therapy, and physical therapy. When talking with Elizabeth, it was clear that she was very eager to participate in this study because she was excited to support Connor's communication and to increase his skills when talking to others. On the other hand, the grandmother described Connor's brother Luke as someone who did not often engage with Connor. Luke was older than Connor but did not often participate in the same activities that Connor did. When discussing with Luke the goals for this intervention, he reported that he was looking forward to learning more about how Connor talks and helping him learn. The grandmother also noted that Connor would commonly have seizures, and this could potentially affect his engagement and participation in the sessions.

Figure 2

Connor's Accent 1000 With a 28-Cell Display

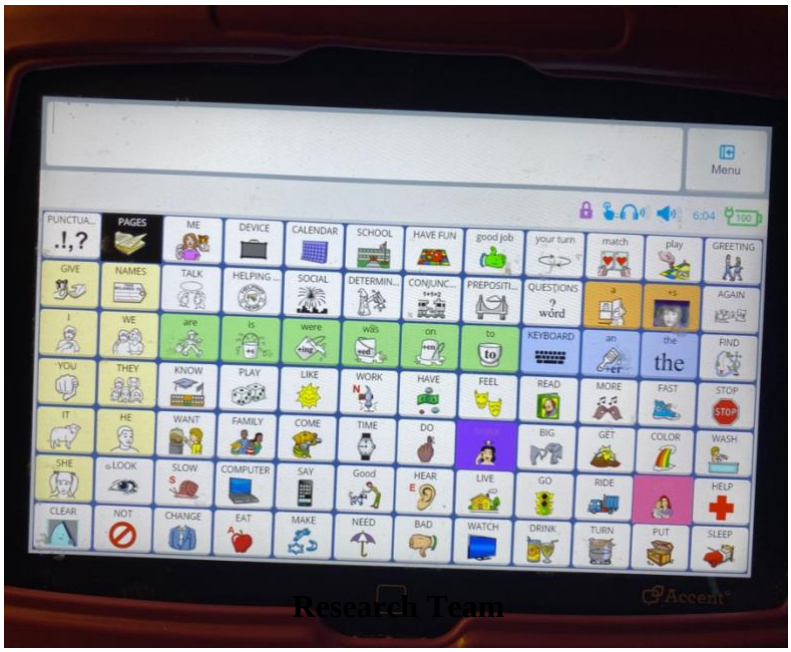
Family 3: Steven and Ella

Family 3 consisted of a mother, father, and 7-year-old fraternal twins. The father worked outside of the home, and the mother stayed at home with the children. The primary adult to support the children's participation in this study was the mother. She was eager to support the relationship between the siblings and increase their interactions. Steven was a 7-year-old typically developing sibling and Ella, his sister, had a diagnosis of autism. According to the information from the Communication Matrix and the mother's report, Ella had mastered skills of whole-body movements, head movements, arm and hand movements, leg movements, facial expressions, gestures, vocalizations, and verbalizations. However, the findings of the Communication Matrix indicated that while Ella could use a variety of communication modes, she was just beginning to use them as concrete symbols and symbolic communication to express her needs or wants. Ella often engaged in delayed echolalia. Ella used an Accent 800 with an 84-cell display (see Figure 3).

The mother expressed that Steven and Ella often participated in gross motor activities, but it could be a challenge to keep them engaged for the length of the observation. She explained that they often engaged in parallel play and did not often interact with one another in the same activities. Steven expressed his interest in participating in the study to help Ella communicate more and to help her play more.

Figure 3

Ella's Accent 800 With an 84-Cell Display



The research team included me and four additional graduate students. I was the primary investigator for this study. I am a doctoral candidate and was a special education teacher for Chicago Public Schools for 4 years. I currently hold a special education teaching license (i.e., LBSI and LBSII) and an early childhood license in the state of Illinois. As the primary investigator, I collected all baseline and maintenance observations videos for all the participants. In addition, there was a graduate research assistant, Kaori, who worked on the project on average

5 hours per week. She was a licensed SLP in Paraguay and practiced for over 3 years prior to beginning a Master's degree program in early childhood special education. I was the primary trainer and coach for two dyads (i.e., Naomi and Michael; Elizabeth and Connor) and she was the primary trainer and coach for two dyads (i.e., Luke and Connor; Steven and Ella). As I was the primary trainer and coach for Naomi and Elizabeth, Kaori was the primary behavioral coder for these siblings and I was the secondary coder. For the other siblings, Luke and Steven, Kaori conducted the training and coaching sessions, I was the primary coder and Kaori was the secondary coder. After coding was complete by the primary coder and secondary coder, a second graduate research assistant calculated the agreement between the two coders. A third graduate research assistant checked the fidelity of implementation of the training and coaching sessions by watching the recoded sessions. Finally, a fourth graduate research assistant, who did not have any interactions with the participants, conducted the social validity interviews at the end of the study.

Experimental Design

We implemented a training and coaching intervention using a single-case, multiple probe design across siblings. Threats to internal validity were addressed by features of the multiple probe design (e.g., introducing the intervention at three points in time addresses the threats of maturation and history), and having a sufficient number of data points in each phase (What Works Clearinghouse [WWC], 2020). Using a multiple probe design, we collected behavioral observation data to evaluate the effects over time (Kazdin, 2011). We collected data for a minimum of five data points in both baseline and intervention phases, and there were three study phases (i.e., baseline, intervention, and maintenance), which meets the design standards recommended by WWC (2020).

Baseline Phase

Using information from the preintervention interviews about the siblings' and children's interests, dyads had choices at the start of each session regarding which activity they were going to engage in. Caregivers often supported the setup of activities. Siblings were asked to keep the AAC devices in proximity of the children for every session. During the baseline phase, we gave the caregivers instructions to ensure that the children and siblings stayed within the camera frame and did not intervene unless challenging behaviors arose. After the activity was determined, we recorded a 10-min observation for each baseline session via Zoom. We provided instructions such as, "Play as you normally would" or "I'm going to watch you play with your sibling; we will see you in 10 minutes." We did not interrupt the observation and my camera and microphone were turned off to limit distractions. At the end of the 10 min, we waited to observe an appropriate stopping point as not to interrupt any interactions. All videos were at least 10 minutes long, some were up to 12 minutes in total. We then concluded the session by thanking them and confirming the time and date for the next session. After there was a stable baseline performance with at least five data points, the first participant dyad moved into the intervention phase. Then, after observing a change in behavior by the first sibling, and a stable baseline phase with the second dyad, the second dyad was moved to the intervention phase. This continued until all dyads were in intervention phases.

Intervention

The focus of this intervention was to teach siblings to use the ALM strategy through training and coaching via telepractice. After stable baseline performance was established, the participants engaged in two parts of the intervention phase: training and coaching.

Training

The initial portion of the intervention phase included two training sessions with the sibling. Participants were informed that trainings would last about 20 min; the training sessions ranged between 12 min 19 s to 22 min 22 s (*M* = 16 min 38 s). The training sessions were conducted only with the siblings. For two of participants (i.e., Luke and Steven) parents were nearby during the training while the other two siblings (i.e., Naomi and Elizabeth) were alone. In the first training, the ALM strategy was introduced using PowerPoint slides and video examples of desired behaviors (modified from Douglas et al., 2021) along with an ALM visual (see Appendix G). The first training session consisted of: (a) the goal and purpose of ALM strategy, (b) how ALM strategy can be used to support children who use AAC, and (c) the ALM strategy components. The second training session was held within 5 days of the previous training and it consisted of (a) a review of ALM, (b) a review of the ALM strategy components, (c) suggestions on how ALM can be used in their activities, and (d) review and answering questions. All training sessions were synchronous and recorded via Zoom by the coach. We used an intervention fidelity checklist (see Appendix H) to ensure that all aspects of both training sessions were completed. Immediately following the training sessions, the first session of coaching began. No behavioral data were taken during the training phase.

Sibling Coaching

All coaching sessions were conducted via Zoom and recorded by the coaches. Coaching consisted of (a) preobservation planning, (b) observation of the child and sibling engaging in an activity, and (c) postobservation reflection and feedback (see Appendix I; Douglas et al., 2021; Meadan et al., 2016; 2020). During preobservation, the sibling and coach discussed their action plan for the chosen activity. We provided support and ideas on how to implement the ALM

strategy given the activity and encouraged them to practice pairing their spoken words with the AAC device. During this preobservation, ALM strategy components were reviewed and the visual aid that was used during the training sessions was referenced, if needed. Then there was an uninterrupted 10-min observation of the child and sibling engaging in the chosen activity; we turned off the camera and muted the microphone to limit distractions for all observations. While watching the live interaction, the coaches noted aspects of the strategy that the sibling was doing correctly and areas that could be improved in order to provide meaningful feedback during the postobservation. The postobservation included sibling reflection on their use of the ALM strategy during the activity as well as supportive and corrective feedback from the coach. When a sibling demonstrated high-fidelity use of the ALM strategy, the dyad moved from the intervention phase to the maintenance phase. The siblings participated in coaching sessions until their performance demonstrated the completion of all five ALM steps (i.e., high-fidelity implementation) for 80% of the opportunities for three consecutive sessions. When the sibling met the performance criterion, they were moved from the intervention phase to the maintenance phase. For all aspects of the intervention, caregivers were asked not to intervene or support the communication between child and sibling; some caregivers were present and others were not for the training and coaching sessions.

Fidelity of Implementation

Implementation fidelity was measured for two aspects of the intervention (see Appendix H). During each training session, a fidelity checklist was completed by the trainer/coach. During coaching sessions, fidelity checklists were used by the coach to ensure all coaching aspects were completed. To assess reliability of the fidelity measures, a research assistant reviewed the recorded training sessions and completed the fidelity checklist for 100% of the training sessions

and 30% of the coaching sessions were randomly selected for each dyad. All training and coaching sessions showed 100% implementation fidelity, except the second training session for Steven in which a recording error occurred.

Maintenance Phase

Once the data reached the performance criterion (i.e., high-fidelity implementation of the ALM strategy for at least 80% of the opportunities for three consecutive sessions) the intervention phase was completed, and the participants moved into the maintenance phase. The purpose of the maintenance sessions was to assess the extent to which the siblings continued to implement the ALM strategy as well as to assess the target child's communicative behaviors. After intervention was complete, maintenance data were collected every 2 weeks, on average for up to 8 weeks. Similar to baseline sessions, during the maintenance sessions, participants were given an instruction such as, "Play as you normally would" or "I'm going to watch you play with your sibling; I will see you in 10 minutes."

Data Collection and Analysis

Independent Variable

The ALM strategy involves a communication partner providing a communication opportunity (i.e., simultaneous speech and aided AAC) through natural opportunities. The ALM strategy includes these components: prepare, show, wait, and respond (Douglas et al., 2021; O'Neill et al., 2018). The independent variable for this study included both training and coaching.

Dependent Variables

The first and second dependent variables (DVs) are related to the first research question and include aspects of the siblings' use of the ALM strategy (high-fidelity use and rate). The

third DV relates to the second research question focusing on the child's independent communication (see Appendix J for coding manual).

Typically Developing Sibling Dependent Variables

We measured and coded two DVs for the siblings: the fidelity and rate of their ALM strategy use. The primary sibling DV is the fidelity of the ALM strategy use which was coded on a scale from low to high fidelity (i.e., 0 to 1). The secondary DV was the rate at which the siblings used the ALM strategy (i.e., prepare, show, wait, and respond; Douglas et al., 2020) throughout the 10-min observation.

High-Fidelity Strategy Use. We coded each session and calculated the percentage of high-fidelity (score of 1) ALM strategy use. Steps to reach high fidelity included (a) the AAC device is within reach of the child and the sibling; (b) the sibling provides a natural stimulus (i.e., choice, question, response, or comment); (c) the use of the SGD model is within the child's current communication level, (d) a verbal model is provided by the sibling immediately before, after, or while using the SGD, and (e) the sibling waits before resuming the activity (approximately 3-5 s, predetermined prior to beginning the study, depending on the child's needs; Douglas et al., 2021). In order to reach high fidelity (score of 1), all five steps had to be completed correctly. In addition to the overall score of the fidelity of each strategy use occurrence, the type of model (i.e., choice, question, comment, response and other) was also coded.

Rate of Strategy Use. After each session was coded, data were calculated to determine the rate at which the siblings used the ALM strategy during the activity. We recorded the frequency (i.e., the number of strategies used), then divided that number by the number of

minutes in the recorded session. Rate data included strategy use with all levels of fidelity per minute.

Child Dependent Variable

Independent Communication Rate. The rate of each child's independent communicative acts for each observation session was calculated. All child responses and initiations to the sibling were coded and levels of independence (i.e., prompted, imitated, independent initiation, and independent response) were also coded. Prompted and imitated communication acts were recorded but were not counted as independent. We recorded the frequency (i.e., the number of independent communication acts), then divided that number by the number of min in the recorded session. The mode of the communication act (i.e., verbalization, vocalization, AAC, sign or gesture) was also coded (see coding manual specifically for information specific to each child).

Interobserver Agreement

All videos were coded by a primary coder and at least 30% of the videos from each phase and for each dyad were coded by a second coder; these videos were randomly selected. Kaori and I completed interrater reliability with one another's dyads. We met before the intervention phase to discuss the code book, individual participants, coding manual, and coding procedures. After the training was complete, we coded videos independently to reach agreement. All disagreements were discussed, and then we coded new videos to reach agreement. The videos that were used in training were not used for actual coding. Training for observational codes and definitions continued until we achieved a minimum of 80% interobserver agreement (IOA) in each DV category. We used a form to code the DVs which included (a) a time stamp, (b) sibling model type, (c) ALM fidelity, (d) child's communicative mode, (e) level of independence, and

(f) short description/comments (see Appendix K). Once agreement was reached, we began coding videos as they were recorded.

To reach agreement: (a) times stamps had to be +/- 3s of one another, (b) the same communication model must have been recorded, (c) high (score of 1) or low fidelity (0 - 0.8) must be the same, (d) the same communicative mode have been identified, and (e) the same level of independence must have been identified. We used a short description within the coding document as necessary to discuss any discrepancies. Disagreements addressing fidelity were only considered if one coder had high fidelity (1) and the other coder had low fidelity (0 – 0.8). If fidelity was not the same, but they were both noted as low fidelity, it was considered an agreement. A graduate research assistant calculated the IOA (at least 30% of the observations, for each dyad and each phase), the number of agreements for each item was divided by the total occurrences and then multiplied by 100. For all IOA calculations, agreement ranged from 69% to 100%. In total, 29 videos were randomly used for IOA with an average of 94.7% agreement: 98.00% for the sibling behaviors and 92.53% for the child's communication. For Family 1, the overall agreement was 97.33%, for Family 2a, the overall agreement was 94.33%, for Family 2b, the overall agreement was 92.13%, and for Family 3, the overall agreement was 95.00%. Detailed IOA results are found in Table 4.

Social Validity Interviews

Social validity evaluation is designed to ensure that societies and consumers' concerns are addressed, focusing on the intervention: (a) relevance and importance to everyday life, (b) acceptability to consumers and the community, and (c) impact changes in the individual's everyday life (Kazdin, 2011). Social validity data were collected through interviews with the caregivers, siblings, and children. Other family members in the home who did not participate in

the study (i.e., grandparents), were asked to complete an informed consent (see Appendix D) and to complete an in-depth interview at the end of the study. The purpose of the postintervention social validity interviews were to determine the overall satisfaction with the goals, procedures, and outcomes of the intervention and to elicit participants' perceptions and observations about changes in the target sibling and child's behavior. While I conducted the preintervention interviews, to minimize potential biases, a graduate student who was naïve to the project conducted the postintervention interviews. All interviews were recorded via Zoom and conducted at a time most convenient to the family.

After interviews were completed, the graduate research assistant and I used the social validity framework to independently code, then we met together to discuss agreements and disagreements. To develop a more contextualized and in-depth understanding of the social importance of the intervention, interviews were transcribed and analyzed into categories and themes and were reviewed using the social validity framework (Wolf, 1978; goals, procedures, outcomes). For evaluation, using subjective evaluation, the feedback from the participants (i.e., caregivers, sibling, and children) and household family members were used to determine the social validity of the intervention.

Table 4

Interobserver Agreement between Primary and Secondary Coder

		Average Percentage of IOA (range)					
		Sibling Language Models			Child Communication Acts		
Dyad	Phase (*n*, % of sessions coded)	Timestamp	Model Type	Fidelity	Timestamp	Communication Mode	Independence Level
Naomi & Michael	Baseline (2, 40%)	-	-	-	94 (90-97)	89 (87-91)	89 (87-91)
	Coaching (3, 43%)	100	100	96 (89-100)	100	98 (95-100)	94 (90-100)
	Maintenance (2, 50%)	100	100	100	100	100	100
Elizabeth & Connor	Baseline (3, 38%)	-	-	-	95 (85-100)	95 (85-100)	95 (85-100)
	Coaching (3, 43%)	97 (92-100)	94 (90-100)	90 (89-92)	84 (75-100)	81 (69-100)	84 (75-100)
	Maintenance (1, 33%)	100	100	100	100	100	100
Luke & Connor	Baseline (3, 33%)	-	-	-	90 (78-100)	87 (78-100)	90 (78-100)
	Coaching (3, 50%)	97 (92-100)	96 (92-100)	96 (92-100)	92 (89-94)	90 (88-94)	86 (75-93)
	Maintenance (1, 50%)	100	100	100	86	86	86
Steven & Ella	Baseline (4, 33%)	-	-	-	100	100	100
	Coaching (3, 30%)	92 (75-100)	100	98 (94-100)	97 (90-100)	97 (90-100)	97 (90-100)
	Maintenance (1, 100%)	100	100	95	83	83	83

CHAPTER 4: RESULTS

The purpose of this study was to evaluate the effectiveness of a sibling training and coaching program on the (a) sibling implementation of the aided language modeling (ALM) strategy with a child with disabilities who uses AAC, (b) child's independent communication, and (c) overall acceptability of the program by the sibling, child, and family members. First, I will present the observational data that address the first and second research questions, then I will discuss the results of the social validity interviews (see Appendix L) that focus on the third research question.

Observational Data

Single-case multiple probe design across participants was used to determine the effectiveness of a sibling training and coaching program to implement the ALM strategy with high fidelity with their siblings who used AAC. In Figure 4, the high-fidelity use of the ALM strategy is represented by closed circles and the rate at which siblings used the ALM strategy is represented by the bar graph. The time that training took place is designated by two solid black lines and the dashed line is between the coaching and maintenance phases.

Family 1: Naomi and Michael

Naomi participated in five baseline sessions, two training sessions, seven coaching sessions, and four maintenance sessions. The baseline phase data collection started in late January and the maintenance phase data collection ended in mid-April.

During the baseline phase, Naomi showed 0% high-fidelity use of the ALM strategy. After the two training sessions, during her first coaching session, her high fidelity immediately increased to over 65%, followed by a decrease to 44%, but then a gradual increase. The coaching phase lasted seven sessions for Naomi to reach the performance criterion of three consecutive

sessions of over 80% high-fidelity use of the ALM strategy. While there was a decrease during the last three sessions of coaching, she continued to reach over 80% high-fidelity use of the ALM strategy. After coaching, Naomi moved to the maintenance phase where she reached 100% high-fidelity use of the ALM strategy during the first session, then decreased to 75%, and then increased to 82%. Then, during the fourth and final maintenance session, only 60% of Naomi's attempts to use the ALM strategy were with high fidelity.

During the baseline phase, Naomi used the ALM strategy at a rate of 0 per min. Rate included any attempt at using the ALM strategy, regardless of fidelity. After training, during the coaching phase, her rate of attempts varied between 0.9 and 2.6 times per min (M = 1.3). During the maintenance phase's first session, when Naomi's fidelity was high, her rate was much lower (0.4 per min); however, for the second and third maintenance sessions, her rate had an increased, and then slightly decreased during the last session.

Family 2a: Elizabeth and Connor

Elizabeth participated in eight baseline sessions, two training sessions, seven coaching sessions, and three maintenance sessions. The baseline phase data collection started in late January and the maintenance phase data collection ended in mid-May.

During the baseline phase, Elizabeth had 0% high-fidelity use of the ALM strategy. After the two training sessions, her high-fidelity use of the ALM strategy increased to over 28%, gradually increasing over the next three sessions, to reach the performance criterion. While the coaching phase lasted for seven sessions, Elizabeth reached performance criterion within six coaching sessions. This extra data point was due to the seventh coaching session being conducted prior to the sixth coaching session being coded. The seventh coaching session did decrease to just below 80% high-fidelity use; however, because she had reached the performance

criterion, she moved on to the maintenance phase. During the maintenance phase, Elizabeth maintained over 70% high-fidelity use of the ALM strategy. During her first session her high-fidelity ALM strategy use was at 70%, the second session was at 92%, and the third was at 88%. Visual analysis of the rate of strategy use reveal that during the baseline phase, Elizabeth did not use the ALM strategy, then after training, during the coaching phase, her rate of ALM strategy attempts ranged from 1.3 to 3.1 times per min (M = 2.24). During the maintenance phase, her rate ranged between 1.7 and 2.6 (M = 2.1) times per min.

Family 2b: Luke and Connor

Luke participated in 10 baseline sessions, two training sessions, six coaching sessions, and two maintenance sessions. The baseline phase data collection started in late January and the maintenance phase data collection ended in late May.

During the baseline phase, Luke showed 0% high-fidelity use of the ALM strategy. After the two training sessions during the coaching phase, his high-fidelity use of the ALM strategy immediately increased to over 53%, gradually increasing over the next four sessions, reaching performance criterion by Session 6. While during the last coaching session Luke showed a decrease in percentage of high fidelity (88.88%), he still met the performance criterion to move to the maintenance condition. During the maintenance phase, Luke maintained over 80% high-fidelity use of the ALM strategy, the first session being at 100% and the second session being at 83%. Related to rate during the baseline phase, Luke did not use the ALM strategy, then after training, during the coaching phase, his rate of ALM strategy attempts ranged from 0.8 to 1.8 times per min (M = 1.35). Luke participated in two maintenance sessions, the first session with a rate of 0.9 per min and the second session with a rate of 1.2 per min.

Family 3: Steven and Ella

Steven participated in 11 baseline sessions, two training sessions, 10 coaching sessions, and one maintenance session. The baseline phase data collection started in early February and the maintenance phase data collection ended in early June.

During the baseline phase, Steven did not attempt to use the ALM strategy. During the first coaching session, Steven attempted to use the strategy once, but with low fidelity and during the second coaching session, he did not attempt to use it at all. During the third coaching session, while Steven did show 100% high-fidelity use of the ALM strategy, he only used it once. Beginning with the fourth coaching session, Steven had 64.29% high-fidelity use; this decreased for Sessions 5 and 6, but then increased gradually until he reached the established performance criterion. During the one maintenance session, Steven showed 90% high-fidelity use of the strategy. Related to rate, during the baseline phase, Steven did not use the ALM strategy; then, after training, during the coaching phase, his rate of ALM strategy attempts ranged from 0.8 to 1.8 times per min (M = 1.35). During the maintenance phase, Steven used the ALM strategy at a rate of 2.1 per min.

Primary Dependent Variables Across Dyads

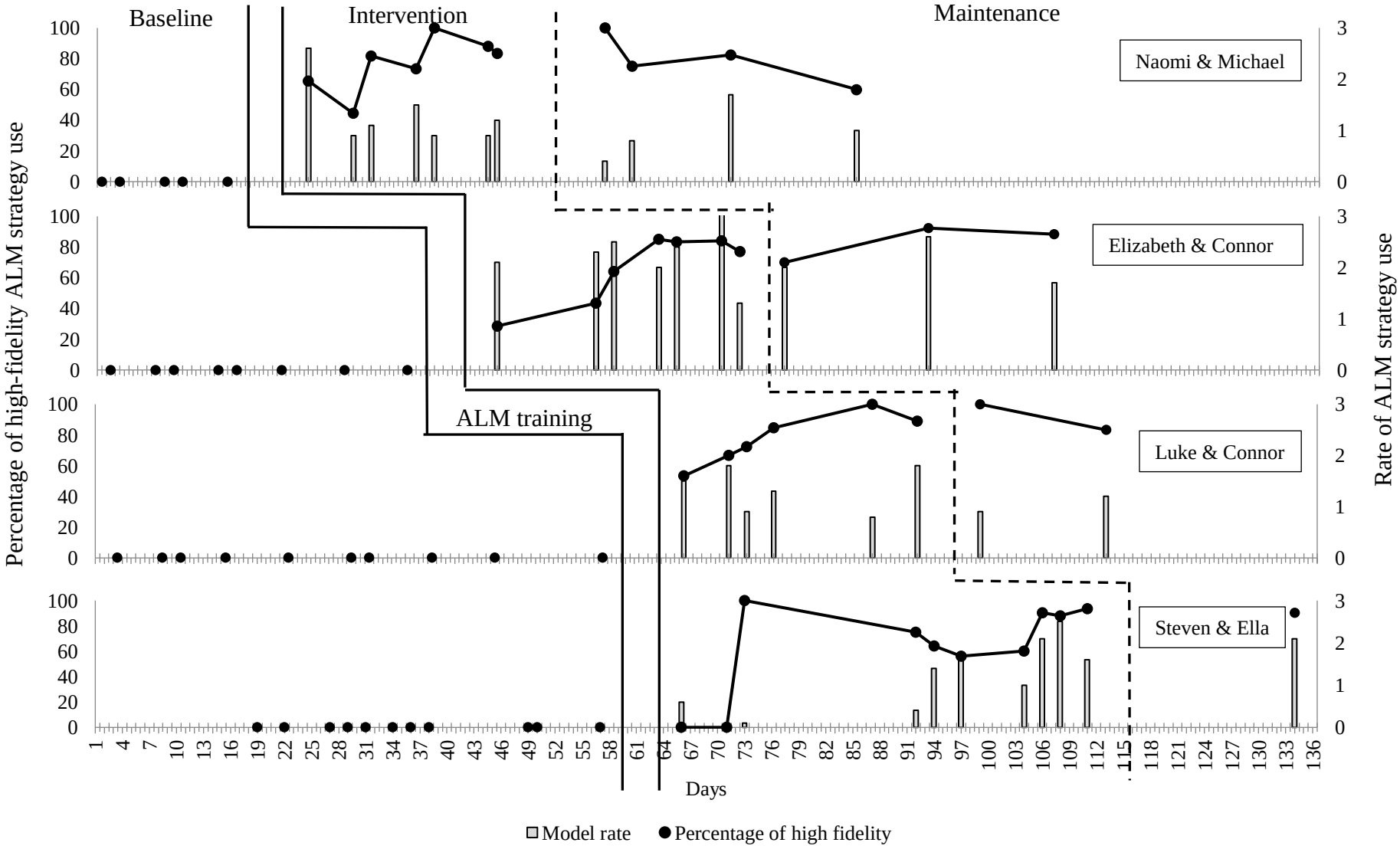
Across the four participant dyads, there were three basic effects at three different points in time. Due to the length of time in the baseline phase, the last two dyads (Luke and Connor; Steven and Ella) moved to the intervention phase at the same time. The first three participant dyads showed immediate effects and their fidelity ranged from 28% to over 65% and continued to increase as coaching continued. After the second coaching session, the fourth dyad (Steven and Ella) demonstrated an intervention effect and began to demonstrate an increased rate and high-fidelity use of the ALM strategy. After the intervention phase, a dotted black line represents

the change to the maintenance phase. During the maintenance phase, all participants continued to use the ALM strategy with high fidelity of over 84%; this ranged from 60% to100% across the dyads. The rate of attempts can be observed in the gray bars per session. Across the first three participant dyads, the rate ranged from 0.8 to 3.1 per min (M = 1.65) across the intervention and maintenance phases. The youngest participant who received training was Steven; during the first intervention session, he attempted to use the strategy at a rate of 0.6 times per min but he did not use it with high fidelity. During the second coaching session, Steven did not attempt to use the strategy. Following the second coaching session, he continued to increase his high-fidelity use with a rate ranging between 0.4 and 2.5 per min (M = 1.59).

Visual analyses within dyads and across dyads were used to determine functional relation between the IV (i.e., training and coaching of the siblings) and the primary DV (i.e., high-fidelity use of the ALM strategy). Visual analysis within dyads indicated there was a change in the level and trend between baseline and intervention phases, which then continued during the maintenance phase. There were immediate effects and no overlap between the baseline and intervention phases for the first three participant dyads which suggest basic effects of the intervention at three different points in time. There is also a clear change in the level and trend between baseline and intervention phases for the fourth dyad. Vertical analysis across dyads revealed that when the intervention was introduced to the first dyad and there was a clear change in the first sibling's behavior, there were no changes in the other three siblings' behavior. This was true across all dyads. Overall, visual analysis reveals functional relation between the IV and the DV. As shown in the graphic display, this study meets the WWC (2020) standards without reservations; it includes a probe session immediately before introducing the IV and a minimum of six phases with at least five data points per phase.

Figure 4

Single-Case Graphic Display of Results



Second Dependent Variable: Child Independent Communication

The second research question addresses the relation between the siblings' use of the ALM strategy and the independent communication of the children who used AAC. As part of the ALM strategy, each sibling was trained and coached to use a variety of language models when using the AAC. These included providing a choice, asking a question, commenting, responding to the child's communication, and other models. Models labeled "other" included communicative directives or questions with a correct response or that the child already knew (e.g., "Show me 'blue' on your talker" or "What color is this?") and while these other models did not meet the fidelity criterion, they were still coded as an attempt to use the ALM strategy. The siblings used a variety of language models to support the children who used AAC; across all siblings, 50.05% of the language models used were comments, 26.85% choices, 17.66% questions, 1.44% responses, and 1.98% other models. The children used a variety of independent communication modes throughout the observations. These included verbal speech, AAC, gestures, vocalization, and signs. Operational definitions of these communication modes are found in the coding manual (see Appendix J). None of the children used pictures symbols during the observations. All communication modes were coded however only independent communication modes (i.e., independent initiation and independent response) were analyzed and presented. When a child engaged in more than one communication mode simultaneously, a hierarchy was used: verbal speech, AAC, and sign. For example, if the child communicated using verbal speech and a gesture, verbal speech was represented in the data as it is more symbolic than a gesture. Most often, if the child engaged in multimodal communication, it included gestures and vocalizations. When these were used in unison, they were marked as multimodal; however, if the child engaged in a communication mode that was more symbolic,

the more symbolic acts were coded. Next, the findings that address this research question are explained in detail.

Family 1: Naomi and Michael

Naomi and Michael participated in five baseline sessions, seven coaching sessions, and four maintenance sessions. Figure 5 depicts Naomi's various language models that she used as part of the ALM strategy, including the proportion and rate of language models per minute. This stacked bar graph corresponds with proportions of type of language models per session, the left-side y-axis; and the right-side y-axis correspond with the line graph which is the rate at which Naomi used the ALM strategy. The solid black line indicates a phase change between baseline and intervention phases and a dotted black line indicates a phase change between intervention and maintenance conditions. During the baseline phase, Naomi did not use the ALM strategy and, therefore, had no language models paired with AAC use. During intervention and maintenance Naomi predominately used choices and questions. During the second session of the intervention phase and the last maintenance session, Naomi had a much higher usage of communication directives (i.e., other model) that did not count as high fidelity. During the first coaching session, Naomi's rate was higher, and she used mostly questions and some comments. As the sessions continued, she continued to use questions and choices; however, the rate at which she used the ALM strategy was lower.

Michael used a variety of modes of independent communication including verbal speech, AAC, signs, gestures and vocalizations. Data across baseline, intervention, and maintenance phases varied. Figure 6 displays Michael's rate and proportion of independent communication acts. The stacked bar graph corresponds with proportions of type of independent communication acts per session; the left-side y-axis and the right-side y-axis correspond with the line graph

which is the rate at which Michael independently communicated. While there was a decrease in Michael's rate of independent communication acts as the intervention continued, there was an increase in Michael's symbolic modes of communication, including AAC. During the baseline phase, Michael's rate ranged from 2.3 to 3.6 communication acts per min (M = 3.06). During the intervention phase, Michael's rate of communication acts ranged from 1.7 to 3 per min (M = 2.29), and during the maintenance condition, his rate ranged from 0.5 to 2.9 per min (M = 1.8).

Figure 5

Naomi's Rate and Proportion of Language Models

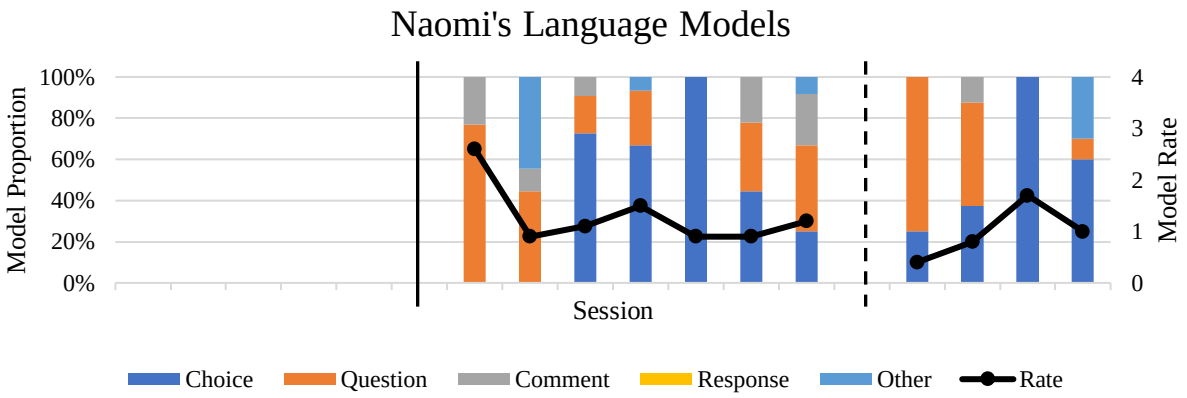
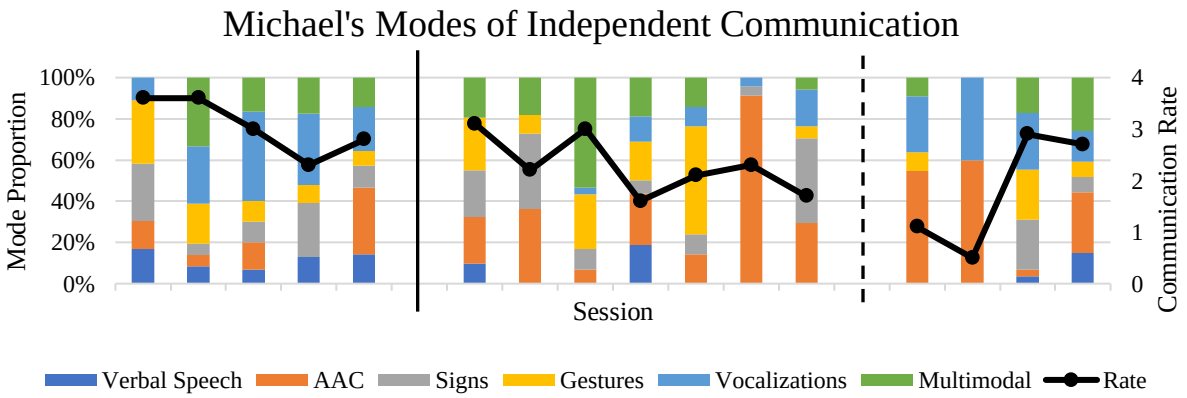


Figure 6

Michael's Rate and Proportion of Independent Communication Modes



Family 2a: Elizabeth and Connor

Elizabeth and Connor participated in eight baseline sessions, seven coaching sessions, and three maintenance sessions. Figure 7 depicts Elizabeth's various language models that were used as part of the ALM strategy, including the proportion and rate of language models. During the baseline phase, Elizabeth did not use the ALM strategy and, therefore, had no language models paired with AAC use. During the intervention and maintenance phases, Elizabeth used a variety of choices, questions, and comments as language models to communicate with Connor. The rate at which she used the ALM strategy remained stable once intervention began.

Connor used a variety of modes of independent communication including AAC, vocalizations and gestures. Figure 8 displays Connor's rate and proportion of independent communication acts. During the baseline phase, Connor did not use his AAC device at all to communicate with Elizabeth. However, as soon as intervention began and Elizabeth began to use AAC to model language, Connor immediately began to communicate using his AAC device. While he demonstrated a very high rate of communication acts in the first baseline session, he communicated at a much lower rate (M = .94) during the rest of the baseline phase; then during the intervention phase, his communication acts increased, ranging between 1.4 and 2.6 (M = 1.94).

Figure 7

Elizabeth's Rate and Proportion of Language Models

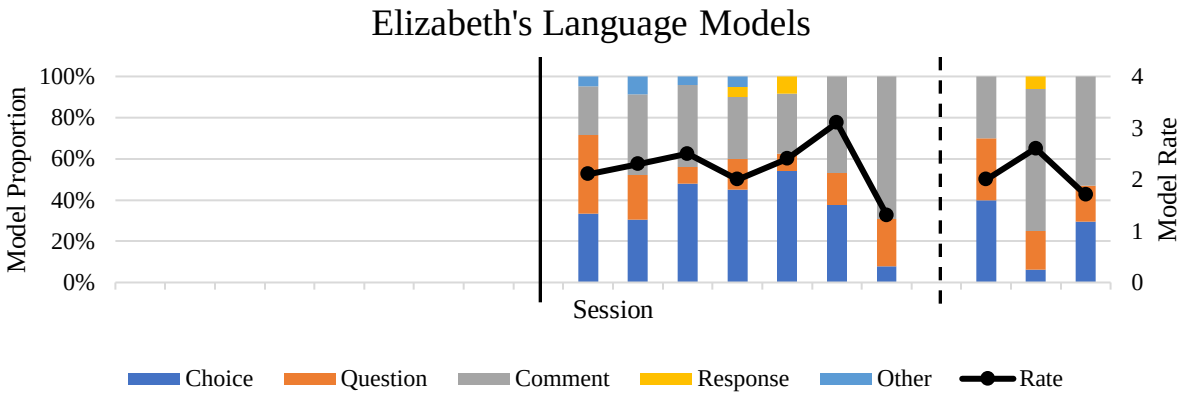
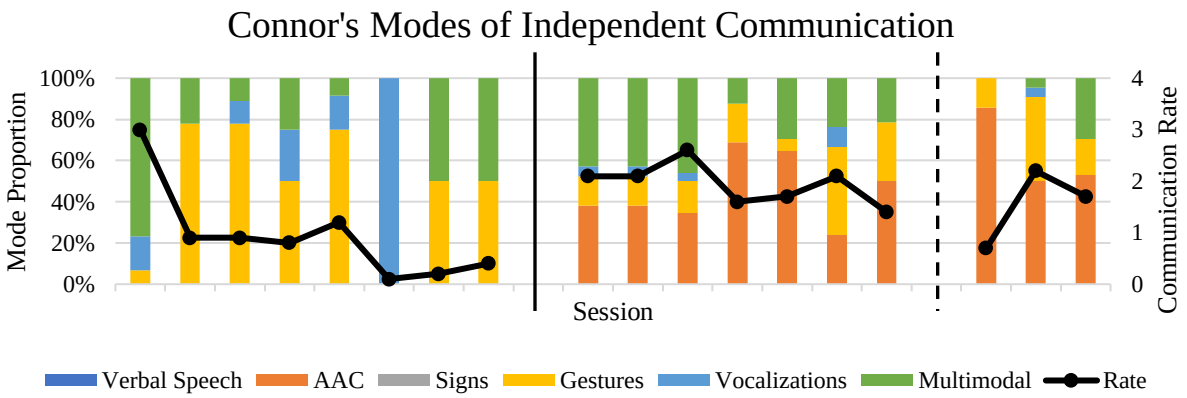


Figure 8

Connor's Rate and Proportion of Independent Communication Modes



Family 2b: Luke and Connor

Luke and Connor participated in 10 baseline sessions, six coaching sessions, and two maintenance sessions. Figure 9 depicts the various language models that Luke used as part of the ALM strategy, including the proportion and rate of language models. During the baseline condition, Luke did not use the ALM strategy and, therefore, had no language models paired with AAC use. During the intervention and maintenance phases, Luke predominately used comments throughout each session. Toward the end of the coaching sessions, he began to use

questions and provided choices. Compared with his typically developing sister, Elizabeth, he used different model types and at lower rates.

Connor used a variety of modes of independent communication including AAC, vocalizations, and gestures. Figure 10 displays Connor's rate and proportion of independent communication acts. During the baseline phase, Connor did not use his AAC device at all to communicate with Luke, however, he used his AAC during two of the intervention sessions. During the baseline phase, Connor's rate of independent communication ranged from 0.5 to 1.5 (M = 0.84). This was similar during intervention (range of 0.5 to 1.6; M = 0.87) and then decreased to 0.4 during both maintenance sessions.

Figure 9

Luke's Rate and Proportion of Language Models

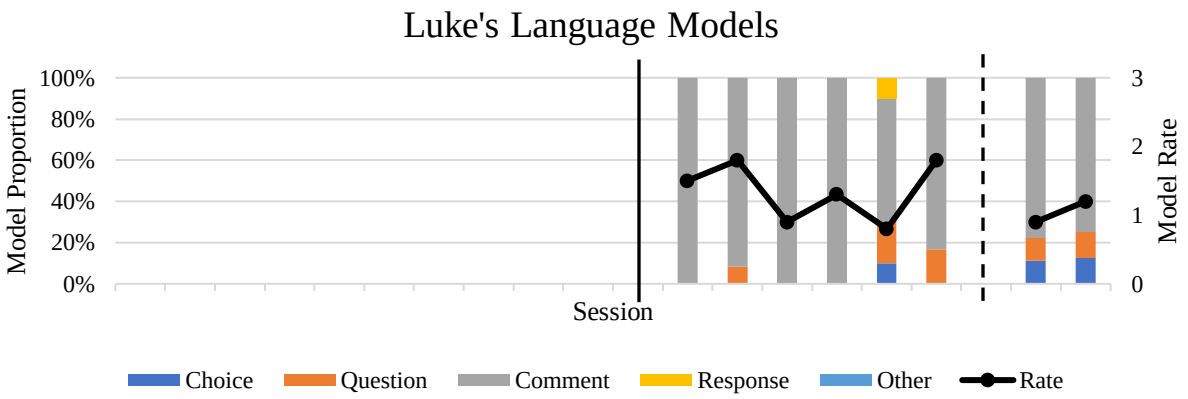
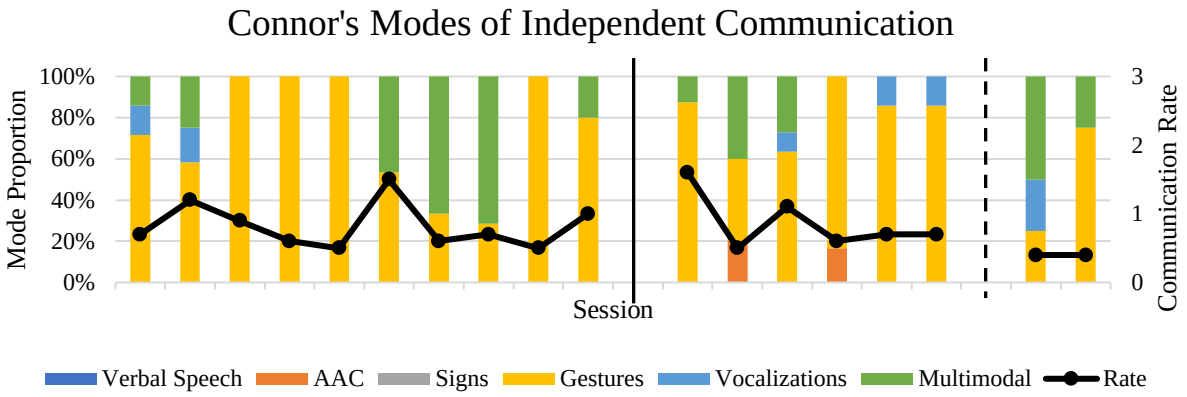


Figure 10

Connor's Rate and Proportion of Independent Communication Modes



Family 3: Steven and Ella

Steven and Ella participated in 11 baseline sessions, 10 coaching sessions, and one maintenance session. Figure 11 depicts the various language models that Steven used as part of the ALM strategy, including the proportion and rate of language models. Steven did not use the ALM strategy during the baseline phase, then during the beginning of the coaching sessions he began using questions and comments. Once intervention began, he continued to use the ALM strategy more, and this increased throughout the coaching session with variability; however, he continued to maintain only using comments as a model. During the maintenance phase, Steven used all comments at a rate of 2.1 per min.

Ella used a variety of independent communication modes that included verbal speech, AAC, signs, vocalizations and gestures. Figure 12 displays Ella's rate and proportion of independent communication acts. Overall, the independent communication acts were low during the baseline phase and then slightly increased during the intervention condition, with some variability. During the baseline phase, the independent communication rate ranged from 0.1 to 0.9 (M = 2.33), then ranged from 0 to 0.9 (M =3.2) during the intervention phase. Ella's use of

the AAC device did not increase during the intervention phase. During the maintenance condition, Ella's communication included both independent verbal speech and vocalizations at a rate of 0.6 per min.

Figure 11

Steven's Rate and Proportion of Language Models

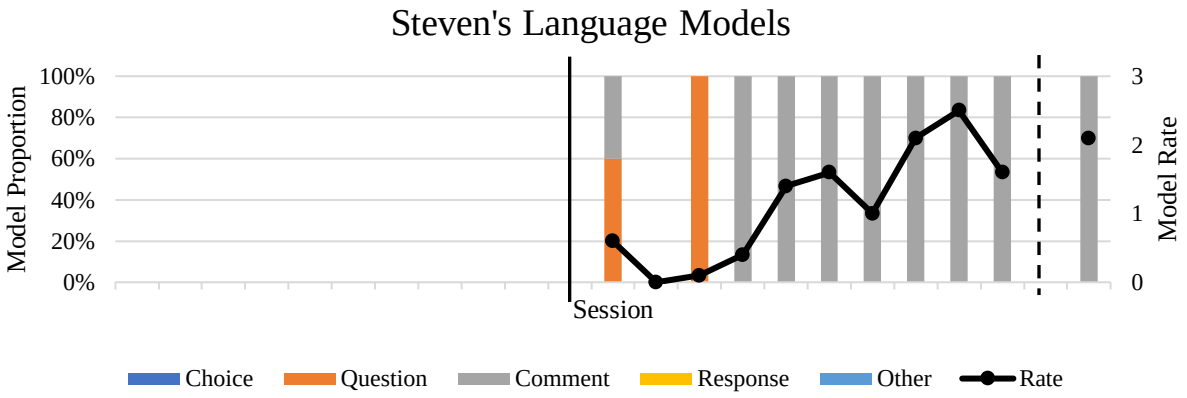
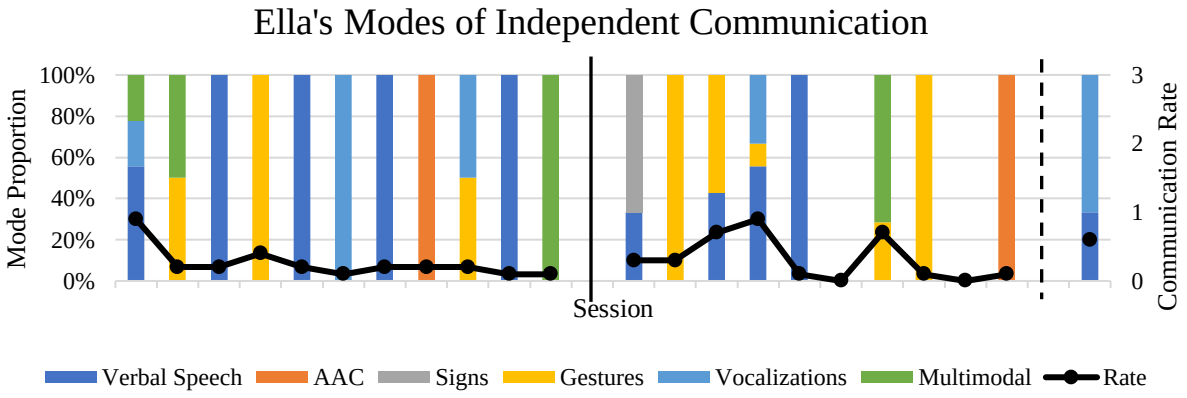


Figure 12

Ella's Rate and Proportion of Independent Communication Modes



Sibling Relationship Questionnaire

In addition to observational data, the questionnaire discussed in this section is a caregiver and sibling report that was collected pre- and postintervention. This was not a part of the experimental design but was intended to be used to supplement the behavioral data. Both the

typically developing sibling and the primary caregiver who participated in the study completed a sibling relationship questionnaire during the preintervention interview and at the postintervention interview. Pre- and postintervention questionnaire data were compared to determine changes in warmth/closeness, relative status/power, conflict, and rivalry on the 48-item scaled composition. All the scales were between 1 (hardly at all), 3 (somewhat), and 5 (extremely much).

Sibling Reports

For the first family, Naomi's responses scored her and Michael's relationship to be somewhat warm and close; there was a slight increase after the intervention from 2.71 to 2.76. At the beginning of the study, Naomi's responses indicated that there was not a strong power status between the siblings; however, this increased from 1.83 to 2.33 at the completion of the study. Naomi also scored low in conflict and while this slightly increased from 1.67 to 1.89, these scores stayed relatively similar. Lastly, she reported a slight sibling rivalry between her and Michael in how they are treated by their parents, and this stayed consistent at 0.5 from the beginning to the end of the study.

Elizabeth and her brother Connor scored very high in terms of warmth and closeness, and while this dimension decreased from preintervention at 4.23 to postintervention at 4.10, it remained high. Elizabeth scored a 1 during the preintervention period and increased to a 2.33 in relative status and power with Connor. Also, conflict increased from 1.11 to 2.11 after the intervention, yet there was no sibling rivalry noted with both pre- and postintervention scores of 0.

For the second dyad in the second family, Luke had a somewhat close relationship with Connor, and this remained consistent at pre-and postintervention (3.57; 3.61). Luke answered that there was no relative status or power between him and his brother; however, this changed

from 0 to 0.33 after the intervention. Luke reported that conflict between the siblings decreased after the completion of the study, changing from 1.67 to 1.11. And lastly, at the beginning of the study Luke's revealed scored that there was a slight rivalry between the siblings (0.17); however, this decreased to 0 during the postintervention questionnaire.

For the fourth dyad, Steven reported that his and Ella's relationship had increased in closeness between the pre-and postintervention (3.43; 3.67). He answered that there was no power status in the home between him and his sister and there was no change after the study was complete. Luke also reported that there was hardly any conflict between the siblings, and this remained constant after the intervention as well (1.44). He also reported there was no sibling rivalry between him and his sister.

Caregiver Reports

Naomi and Michael's mother reported that they were somewhat close, and this stayed consistent between the preintervention score (2.29) and postintervention score (2.10). Their mother reported a very low (0.5) power status between them, and this remained consistent after the intervention. She reported a very low score in conflict during the preintervention questionnaire (1.11) and this also stayed consistent with the postintervention questionnaire (1.00). Additionally, she reported that there was little sibling rivalry between Naomi and Michael with a consistent pre- and postintervention score of 0.33.

Elizabeth and Connor's grandmother reported consistent data noting that the siblings were somewhat close during both pre- (3.33) and postintervention (3.90) periods. Their grandmother scored there was a very low power status between the sibling and child, and this was similar between pre- and postintervention scores (1.00;1.33). However, she did report that there was an increase in conflict between the two siblings from the beginning (1.33) to the end

(2.89) of the study. She also reported that there was no sibling rivalry between Elizabeth and Connor.

Luke and Connor's grandmother also completed a second questionnaire for Luke and Connor's relationship. She reported that Luke and Connor had a somewhat close and warm relationship at the beginning (3.33) and the end of the intervention (3.52). Their grandmother also scored low in power status between the siblings, and this decreased from 1.00 during the preintervention interview to 0.67 during the postintervention interview. There was a slight increase in conflict between the two siblings, but it remained low throughout the study (1.33; 1.66). And lastly, she noted there was no sibling rivalry between Luke and Connor.

Steven and Ella's mother reported that they were somewhat close at both the beginning (3.67) and end of the study (3.33). She also answered that there was a slight decrease in power status between them from pre- to postintervention scores (2.67; 2.17). After the intervention was finished, Steven and Ella's mother scored that the conflict between the siblings had decreased from near "hardly at all" (2.11) to "not at all" (1.33). She also reported that there was no sibling rivalry between the siblings which remained consistent from pre-to postintervention. See Table 5 for pre- and postintervention mean scores for all participant dyads.

Table 5

Siblings Relationship Questionnaire Pre- and Post-Intervention Results

	Mean Score							
	Warmth/Closeness		Relative Status/Power		Conflict		Rivalry	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Family 1								
Sibling	2.71	2.76	1.83	2.33	1.67	1.89	0.50	0.50
Caregiver	2.29	2.10	0.5	0.5	1.11	1.00	0.33	0.33
Family 2a								
Sibling	3.57	3.62	0.00	0.33	1.67	1.11	0.17	0.00
Caregiver	3.33	3.52	1	0.67	1.33	1.67	0.50	0.00
Family 2b								
Sibling	4.24	4.10	1	2.33	1.11	2.11	0.00	0.00
Caregiver	3.33	3.52	1	0.67	1.33	1.67	0.50	0.00
Family 3								
Sibling	3.43	3.75	1.17	0.83	1.44	1.44	0.00	0.00
Caregiver	3.67	3.33	2.67	2.17	2.11	1.33	0.00	0.00

Note: Scale of mean scores is: 1-hardly at all, 2- not too much, 3- somewhat, 4- very much, 5- extremely much.

Social Validity

All household individuals were asked to participate in interviews focusing specifically on the goals, procedures, and outcomes of the study. This included parents, grandparents, and siblings living in the home. For Family 1, the mother, father, Naomi, and Michael participated in the interviews. Family 2 included the grandmother, grandfather, mother, father, Elizabeth, Luke, Connor, and an older sibling. Family 3 included the mother, father, Steven, and Ella. All family members were interviewed individually. For the children, modifications were made as needed on an individual basis to support their communication. For example, Michael's mother asked him the questions prior to meeting on Zoom as she mentioned he would be unlikely to participate on camera. Connor's grandmother expressed a similar interest and posed the questions to Connor prior to meeting with the graduate student and relayed the responses during the interview. Ella's mother prompted her during the interview to help her answer the questions.

Social Validity of the Goals

All families shared that the intervention was socially important. Specifically regarding the goals, families discussed the importance of supporting their children's social interactions throughout their natural routines. The target goals of this study included (a) training and coaching typically developing siblings to use the ALM strategy with high fidelity and (b) to see if there was an increase in independent communication acts by the children who used AAC. In the next sections, I discuss the findings from the interviews about the goals of (a) sibling learning and (b) child communication.

Sibling Learning

At the beginning of the study, Naomi and Michael's mother expressed her hopes for participating in this study: "if she can learn how to not just tell poop jokes, but – like - actually

communicate and learn things she can do to actually get responses from him or actually really communicate with him." At the end of the study, she confirmed that these goals had been met and that "she [Naomi] can understand him better and that really benefits him." Steven and Ella's mother reported that she had goals of Ella being able to increase her communication skills when participating in more structured activities and that Steven would be able to learn how to communicate with her and help support her communication. The grandmother of Elizabeth and Luke shared at the beginning of the study how she was hoping the children would have more guidance on how to use the AAC device to support Connor in more advanced ways. All caregivers expressed that using the AAC device was often used in school, but that using it at home was difficult and they hoped to be able to use it more throughout natural routines in their homes.

Child Communication

When interviewed at the beginning of the study, caregivers and siblings reported that while most times they knew what the children were trying to express, they also had a hard time understanding their communication to meet their needs. These participants also explained that families are not likely to use the AAC devices and that they are mostly kept for the times the children are in school or speech therapy. Given the circumstances of COVID-19 and, consequently, education happening within the home, caregivers were certain there were fewer opportunities for their children to use their AAC devices because families were not as engaged with the devices. Connor's caregiver expressed before the intervention that if the AAC device was going to be used, it was often when he was engaging with school, speech therapy, or working with Elizabeth. Caregivers expressed that they would like to see an increase in their children's intentional and symbolic communication. Ella's mother explained that she

"occasionally" had a difficult time understanding, "but when she [Ella] wants something, she usually is very persistent, and will figure out a way." All the caregivers described this as something they would like to see increase: their ability to better understand the needs and wants of their children through the various forms of communication. Ella's mother also expressed her thoughts using the AAC device: "I had never really thought about doing that and using that.... I've always kind of used the talker as hers, and for her to use and hadn't really used it as a tool for us." During the preintervention interview, the goals the caregivers had for their children aligned with the study's goals.

Social Validity of the Procedures

Categories related to the social validity of the procedures that arose during the analysis of these interviews included (a) coaching experience, (b) the feasibility of using the ALM strategy and AAC device, and (b) comfort with telepractice.

Coaching Experience

Both caregivers and siblings alike expressed their satisfaction with the coaching experience. Steven's mother explained, "They were really good; both kids looked forward to it and were excited to do it and that is not always the case, so that was good." In addition, Naomi's mother stated,

> Well, I think just to give Naomi feedback... here's what went really well and here are some suggestions I think... for a kid that age, is very helpful to give them ideas like specific things to try.

Naomi added that she appreciated the "screen share" to help her learn the steps of the strategy. All the siblings who participated in the coaching sessions noted they enjoyed the coaching experience. For example, when asked about the training and coaching experience, Elizabeth

responded, “She [the coach] is very open to ... questions, and things that I could do... better next time. Her teaching skills were great. Overall, everything she taught us was really great. I really liked the strategy.”

Feasibility of Using the ALM Strategy and AAC Device

The siblings who participated in the study expressed their appreciation for the opportunity to participate because it increased their knowledge on how to support their siblings to communicate and gave them dedicated time to interact with their siblings one on one. However, some of the adults who did not participate in the training and coaching reported that they would not be interested in learning about or using the strategy. For example, Elizabeth and Luke’s grandfather said,

> I've seen [AAC] devices used. I'm more in tune to him not in the device, because that's our relationship. I want to be able to communicate the way we communicate without trying to say, ‘okay, hang on, let me get the device; ... do you want to do this -- because I just talk to him.

However, Elizabeth and Luke’s grandmother expressed the opposite perspective, sharing that she spends so much time with him throughout the day, she would like to see him communicate more clearly to express his wants and needs.

All sibling participants stated they were able to use the ALM strategy with ease and that other children their age would be able to use it as well. For example, when Elizabeth was asked about the ease of use and other children her age being able to use the ALM strategy, she replied, “Definitely, yeah, it's really easy to pick up on. Yeah. Yeah, definitely.” Caregivers and family members agreed that using AAC is not something they often do outside of helping with school, but this strategy has pushed them to be more intentional about using children’s AAC devices and

being patient and waiting for the children to respond. They expressed how important it was for the siblings to learn how to communicate in similar ways and provide more opportunities by modeling a variety of ways to communicate.

Comfort With Telepractice

Given that this study took place during the COVID-19 pandemic, families were very familiar with how to use Zoom and the technology needed for this study. All participants confirmed that the technology was easy to use and understand. Other than typical glitches with technology (e.g., internet outage and Zoom interruptions), all expressed this was a feasible way to deliver the training and coaching. Naomi and her mother also described the challenge of staying within the camera frame during the entire session. The ability of the coach to turn off the camera during the observations was helpful as Naomi's mother explained, "I mean Zoom is convenient, don't get me wrong; when you're only talking 10 or 15 minutes it's nice to not have to haul kids out, but keeping them on camera was a little challenging sometimes." Elizabeth, however, state that she preferred meeting via telepractice rather than in person: "When you.. turn off your camera and stuff. I feel like in person, that'd be awkward because you just sit there and watch us the whole time. Yeah, I like that." With the exception of one participant, Elizabeth, all others stated that they would have liked to have experienced this intervention in person. Steven explained the challenges related to online learning, saying, "I've been on [Zoom] a lot because after that [training/coaching] every day on school I'm on Zoom."

Social Validity of the Outcomes

Categories that emerged and focused on social validity of the outcomes included (a) children's social communication, (b) siblings' behaviors, and (c) family member relationships.

Children's Social Communication

All participants and other family members said they observed an increase in the children's social communication throughout the study. Families expressed that after their participation in the study, they noticed an increase in the children's communication. For example, Connor's grandmother expressed that "He's a little more... he has more gestures." His mother added, "He does - is more proactive in some of the communicating. That's something that he didn't do before. So maybe he's getting more knowledgeable about what's going on and what he wants and how to communicate that." Ella's mother explained a recent interaction with extended family, expressing,

> [Extended family members] kept saying how much more she's talking and stuff. And so, and we hadn't really seen them much at all for months, so that's always good to kind of get a perspective of someone who hasn't been with us every day.

Michael's mother explained that he had been engaging in "more interaction than there was before we started, I think she [Naomi] seems a little more interested you know, 'What does that sign mean?' and playing on his talker and so I would say just the overall interaction has increased." Connor's sister reported that "he's become more fluent. It was definitely more practice for his device, and he's using it more and communicating better than he was."

Siblings' Behaviors

Not only did the family members note that there were changes in the children's communication, but they also observed changes in the siblings' behaviors. Connor's grandmother expressed how important this has been for the siblings (Elizabeth and Luke) to let Connor take the time to express himself:

> When they use the talker, or even with his gestures. She's a little more waiting for him to gather the information in his brain out he's gonna answer. 'Are you ready?' 'Do you want to eat?' 'Yes or no.' So, she's a little more patient, waiting for him to come up with an answer.

Connor's grandfather added, "Luke will help with some things but not really hands on. So, jumping in with both feet... I'd say probably 12 weeks since this study. Luke has kind of come out of his shell a little bit as far as playing with Connor." Similar to Connor's family, Michael and Steven's families both expressed similar opinions. Michael's mother explained, "most positive for Naomi because like I keep thinking... she can understand him better." At the beginning of the study, Ella's mother noted that Steven and Ella often engaged in parallel play and since this study, she noticed a specific change in Steven's behavior: "but being a little more patient and, you know, the waiting and asking questions and talks to her a little more."

Family Member Relationships

In addition to the changes caregivers and families members noticed in the social communication of the children as well as the behaviors of the siblings, overall relationships between family members improved. Beginning with the siblings and children who were directly involved in the study, Michael's mother expressed her satisfaction with the study impact on Michael and Naomi's relationship as they are starting to engage more often: "If she'll interact with him, he, he will interact with her so I think the fact that the change is more in her is probably more important that, you know, because they'll feed off of each other." While family members expressed that Elizabeth and Connor had a strong relationship before the study began, their mother added, "That was a great experience for the two of them because I think they became closer together, like the more that Luke worked with them on the talker the more Luke

started doing other things with him at home." She also described all the activities they participated in together, ending with, "It created a bigger bond between them two." Beyond just the individuals who participated in the study, all families agreed that other members of the household benefitted from this intervention. While they would have liked to see more people included in the study, they still noticed changes in all family members. Ella and Steven's mother described a recent interaction that Ella had with another family member: "Ella kind of looked at him and said, 'Daddy singing,' and then named the song. We don't usually get that kind of interaction." Connor's mother discussed how this experience affected all the children involved, even the older brother: "I think him and his older brother do a lot more, together; I think, I just think, their bond together is even stronger." In addition, Naomi and Michael's mother expressed, "I think the more bond you have between siblings, the stronger the family bond."

CHAPTER 5: DISCUSSION

The purpose of this study was to determine the effectiveness of training and coaching typically developing siblings to use the ALM strategy with high fidelity with children who use AAC. A single-case research methodology was used to explore this topic and the results revealed that the sibling training and coaching was (a) effective in increasing the high fidelity of the siblings' implementation of the ALM strategy, and (b) participants and family members found this intervention to be impactful and meaningful. The findings related to the second research question (i.e., children's independent communication) were variable. In this chapter, I will discuss the key findings related to (a) training and coaching siblings, (b) siblings' language models and children's communication acts, (c) family relationships, and (d) the feasibility of telepractice. Finally, I will describe the limitations and implications of the study.

Effectiveness of Sibling Training and Coaching

It is evident from the observational data that there was a functional relation between training and coaching typically developing siblings and their high-fidelity use of the ALM strategy with the children who used AAC. In addition, all family members found the intervention to be effective and were pleased with the goals, procedures, and outcomes of the study. Based on the methodological rigor and findings, this study meets the WWC standards and various SCR quality indicators (Horner et al., 2005). All siblings achieved the performance criterion and increased their high-fidelity ALM strategy use after training and coaching were complete. Furthermore, they maintained high-fidelity strategy use after the coaching sessions were complete. Findings from this study align with previous research on training caregivers, teachers, and peers to promote communication of individuals who use AAC. (Ingersoll, 2010). Recently, Douglas and colleagues (2021) focused on training and coaching family members to implement

the ALM strategy with high fidelity. The current study replicates and extends this study by focusing solely on siblings across three different families and contributes to the limited research on siblings interventions, specifically those that include children who use AAC devices. Researchers have found that augmented input is effective in supporting individuals who use AAC (Binger & Light, 2007; Cafiero, 2001; Drager et al., 2006; Goosens, 1989; Romski & Sevick, 1996); however, this study extends the existing research as it is specifically focused on supporting siblings as communication partners. Overall, the current study demonstrates that siblings can learn how to use evidence-based strategies, such as the ALM strategy, and implement them with high fidelity with children who use AAC.

Sibling Language Models and Child Independent Communication Modes

While the siblings' high-fidelity use of the ALM strategy increased, the children who used AAC demonstrated high variability in the rate and type of independent communication modes used throughout the study. Due to the inherent nature of communication as a reciprocal process, when a child communicates at a lower rate, it is likely that their communication partner will communicate less as well (Brady et al., 2010). These findings pose interesting questions that can be further explored in research on the types of language models that are provided and if those are related to children's independent communication modes. Although no clear relation between the siblings' and children's communication were identified, interesting findings from Elizabeth, Luke, and Connor were revealed. For example, there was an increase in Connor's use of the AAC device when interacting with Elizabeth, but not with Luke. This could be related to the types of models the siblings used. While Elizabeth used questions and choices at a high rate, Luke used primarily comments. Comments may not elicit responses from a child (compared to questions and choices) and is a limited bidirectional and reciprocal communication approach

(Sameroff, 2009). Comparing Connor's communication modes with Elizabeth to his communication modes with Luke highlights the importance of not only increasing the fidelity of ALM strategy use, but also the importance of using different types of language models.

Family Relationships

Another major finding from this study was the reported changes in family and siblings relationships following the intervention. According to family systems theory (Bowen, 1974), dynamic and diverse relationships occur between family members, and these can vary based on factors such as age, gender, and interests. In the current research, there were diverse sets of siblings in terms of gender and age. In each dyad, the typically developing sibling was older than the child who used AAC. Additionally, the siblings' ages ranged from 7-12 and the children's ages ranged from 7-9 years old. Three dyads had opposite-gender individuals and one dyad included two boys. Sibling and child relationships also can be affected by other factors in the family dynamics such as parent relationships, parent-child relationships, and other siblings' relationships (Whiteman et al., 2011). These relationships can be formed through experiences, shared interests, or outside variables that can be ever-changing within the family.

Researchers have noted the importance of including a variety of family members to help guide the goals and outcomes of interventions (Mactavish & Schleien, 2004). Caregivers who participated in both the beginning and end-of-study interviews emphasized how important this intervention was and how they not only saw an increase in the children's communication but also positive changes in the families' relationships. According to the caregivers, family bonds and relationships were strengthened between the child and their siblings as well as the child and other family members who did not participate in the intervention (e.g., other siblings, parents, grandparents). While there is limited research on sibling dynamics between those with and

without disabilities (Shivers & Plavnick, 2015), this study offers an initial investigation of how social communication interventions can potentially improve meaningful relationships between family members. These findings might also lead to more longitudinal studies which could provide more details about how to strengthen family relationships when there is a child with a disability who uses AAC. Not only do these findings support the use of siblings as implementors, it is also evident that relationships between siblings become stronger and interactions increased following the intervention.

Feasibility of Telepractice

Through prior research, telepractice has been found to be an acceptable and feasible way to implement interventions in natural environments (Heitzman-Powell et al., 2014; Machalicek et al., 2016; Meadan et al., 2016; 2020; Neely et al., 2017; Snodgrass et al., 2017). While this type of intervention delivery has been primarily used with adults (e.g., parents, teachers, and caregivers), this study aimed to understand if telepractice was a viable way to train and coach school-aged siblings. With the COVID-19 pandemic, the timing of the need to remotely support all family members aligned with the goal of this intervention. Given the effectiveness of this training and coaching intervention, telepractice could be used as a viable way to train siblings to implement the ALM strategy with children who use AAC. At the time of the study, those who participated in the dyads were in the process of transitioning back to in-person learning. Therefore, participants were familiar with online learning and using the Zoom platform.

Except for Elizabeth, all participants and family members expressed they would like to see aspects of this training and coaching intervention conducted in person. Many expressed that while it was convenient and there were aspects of the telepractice they appreciated, they would have liked to experience the training and coaching in person. Although studies found the

outcomes are similar between research conducted in-person and via telepractice, researchers should consider combining the use of in-person and remote learning (Hacker et al., in press). Though telepractice is feasible, there are fewer opportunities for personal interactions which can make the researcher/teacher and learner feel less connected (Hao et al., 2020). Telepractice also provides fewer opportunities for hands-on learning and individualized feedback (Hao et al., 2020).

Limitations

There are several limitations in this study that should be considered and discussed, including (a) a prolonged baseline for some participants with limited maintenance and generalization, (b) eligibility criteria that only included certain family members, (c) technology issues, and (d) limited diversity of families.

First, two dyads (e.g., Luke and Connor; Steven and Ella) had long baseline data collection periods. Luke and Connor's grandmother set up twice-a-week meetings and Steven and Ella's mother asked for sessions three times a week. After multiple data collection sessions, both caregivers continued to inquire about how long it would be until they could begin training. Prolonged baseline phase could potentially have changed the participants' experience during the intervention phase. In addition to the prolonged baseline phase, the maintenance phase was short for two of the dyads. Furthermore, while a variety of activities were used during each of the sessions, limited generalization was observed, and it was not observed across routines. Similarly, it should be noted that Connor did not generalize the AAC use between Elizabeth and Luke.

Second, the goal of this study was to include siblings and children within 3 years of each other's ages. However, in several of the end of the study interviews, the caregivers said they wished other family members also participated due to the positive changes observed in the

relationships between the siblings. With a more family-focused approach, this could have positively impacted all family members rather than just selected individuals.

Third, throughout the study, there were interruptions in video chats due to technology glitches. At certain times there were connectivity issues both from the coach and the participants. As Luke noted during the postintervention interview, he was frustrated with the Zoom features on his iPad. The Zoom app would shut down anytime his iPad received a text or call, requiring him to re-enter the session. While minor, this interrupted the flow and naturalistic approach to remote data collection. In another instance, Steven and Ella were preparing to participate in a coaching session when the battery died on the AAC device. This limited their opportunity to interact and communicate, interrupted the coaching session, and no data collection could occur. Lastly, all families came from middle-class backgrounds and there was limited diversity. All participants came from two- parent households with at least one caregiver at home with the children all the time. To get a more diverse sample of individuals and generalize to other individuals who use AAC to communicate, it would be important to attract families who come from different cultural, linguistic, and socio-economic backgrounds.

Implications

Implications for Research

Results from this study can lead to future research that can support various AAC intervention delivery methods. Future lines of research might include (a) whole-family and cascading model approaches, (b) longitudinal research, and (c) a sequential analysis of the types of sibling language models and child communication modes.

First, family members expressed a desire to be included in the research to better support the communication of their children who used AAC. Therefore, more research is needed to study

the effectiveness of the ALM strategy use with a variety of family members. Such a study was recently completed by Douglas and colleagues (2021). Alongside the inclusivity of family members, like Douglas and colleagues' approach, using a cascading model approach could narrow the research-to-practice gap. In the current study, families noted the challenges of trying to learn the ALM strategy through siblings. Future research could investigate the successfulness of both teaching an adult the ALM strategy and showing them how to train other families members. In addition to this, a longitudinal approach could be beneficial to see if using the ALM strategy for a longer intervention period would increase the child's independent communication using AAC. For example, by increasing the length of time in coaching or including all family members, it would be interesting to observe if there is an increase in the independent communication of the children, if the modes of communication become more sophisticated (e.g., symbolic communication), and if the children would then generalize between communication partners or across routines. This research could potentially strengthen the relationships for individuals who use AAC with natural communication partners throughout their environments, both within and outside the home.

In the current study, Connor's communication immediately increased to a symbolic communication with one sibling (Elizabeth), but not with the other (Luke). To better understand if there is a relation between the language models the siblings provided and the children's communication modes, a sequential analysis of these observational data could be completed, focusing specifically on the type of sibling model and the child's communication. This analysis could provide a more detailed explanation regarding the changes in the modes of child communication. It would be important to investigate how (or if) various language models can potentially change or elicit a specific respond from the child. Two factors can be further

investigated based on these findings: (a) if this was related to the rate at which the ALM strategy was used, or (b) if this was related to the type of language model that the sibling used. For example, when Luke and Connor moved into coaching, Luke used comments and there was not a clear change in Connor's independent communication modes, whereas, when Elizabeth began coaching, she immediately began using choices and questions as language models to interact with Connor and there was a clear change in Connor's independent communication modes. However, Elizabeth also provided language examples at a higher rate than Luke. Using a sequential analysis, conclusions may be drawn to better design future research focused on supporting communication partners who are interacting with children who use AAC, and even more broadly, language development.

Implications for Practice

The changes observed throughout this study demonstrate the need for more sibling and family-centered training to increase the use of AAC in the home. As noted through this study's findings, families were pleased with the goals, procedures, and outcomes; however, they also expressed their need for more support. While much of the research on individuals who use AAC has been conducted in classrooms (Therrien et al., 2016), siblings and families in general require more training. Utilizing sibling relationships, this study supports the roles of siblings as effective implementors of AAC interventions. Whole-family interventions can be individualized to meet each family member's needs and enhance more meaningful interactions within the home.

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APPENDIX A: IRB APPROVAL

ILLINOIS

OFFICE OF THE VICE CHANCELLOR FOR RESEARCH

Office for the Protection of Research Subjects
805 W. Pennsylvania Ave., MC-095
Urbana, IL 61801-4822

Notice of Approval: New Submission

October 19, 2020

Principal Investigator	Hedda Meadan-Kaplansky
CC	Rebecca Hacker
Protocol Title	*Training and Coaching Siblings to use Aided Language Modeling to Support Social Interactions with Children who use Augmentative and Alternative Communication*
Protocol Number	21259
Funding Source	Unfunded
Review Type	Expedited 6, 7
Approved Subparts	D
Status	Active
Risk Determination	No more than minimal risk
Approval Date	October 19, 2020
Closure Date	October 18, 2025

This letter authorizes the use of human subjects in the above protocol. The University of Illinois at Urbana-Champaign Institutional Review Board (IRB) has reviewed and approved the research study as described.

The Principal Investigator of this study is responsible for:

- Conducting research in a manner consistent with the requirements of the University and federal regulations found at 45 CFR 46.
- Using the approved consent documents, with the footer, from this approved package.
- Requesting approval from the IRB prior to implementing modifications.
- Notifying OPRS of any problems involving human subjects, including unanticipated events, participant complaints, or protocol deviations.
- Notifying OPRS of the completion of the study.

APPENDIX B: RECRUITMENT FLYER

Study Details

This study will consist of training your typically developing child to use Aided Language Model strategies with their sibling who uses AAC. This study will consist of training and coaching the child with 20-minute sessions, twice a week for up to 10 weeks.

Your family will receive up to $200 for participation in this research study.

Eligibility

Parent

a) primary caregiver to both children
b) primary language of English

Typically Developing Child

c) between the ages of 6-12 years old
d) have typical development
e) primary language of English

Child with a Disability

a) between the ages of 6-12 years old
b) diagnosed with a disability
c) use aided AAC as their primary form of communication
d) primary language of English

Scan the QR code below to determine elibility!

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

IRB Approval #21259

APPENDIX C: GOOGLE ELIGIBILTY SCREENER

Thank you for your interest in our research project. We are researchers from the Department of Special Education at the University of Illinois at Urbana-Champaign who are interested in supporting the social interactions between children who use augmentative and alternative communication (AAC) and their typically developing sibling.

During this study, you will participate in interviews, completes questionnaires and assessments, and have two weekly sessions (~20 hour each) with the researcher for about 10 weeks. These sessions will consist of observations (interaction between the siblings) and coaching (of the typically developing sibling by the researcher). All sessions will be videorecorded and stored on the University of Illinois' secure system. As an appreciation for your time and participation you will receive incentives incrementally throughout the study, totaling $200.

If you have questions or concerns about this study, please contact me at rhacke2@illinois.edu or my advisor, Dr. Hedda Meadan (meadan@illinois.edu).

Please complete the following screener to determine if you are eligible to participate, it can take you up to 10 minutes to complete.

Parent

What is your name? _____

What is your phone number? _____

What is your email address? _____

What is your primary language? _____

What is your preferred method of contact? (check all that apply)

☐ Email ☐ Phone (voice) ☐ Phone (text)

What is your primary role with the child who is uses AAC?

☐ Mother
☐ Father
☐ Legal Guardian

Do you have wireless internet in the home?

☐ Yes ☐ No

Do you have a smart device (e.g., iPhone, iPad, tablet, computer) you can use to videoconference with the researcher?

☐ Yes ☐ No

About your child with a disability

Do you have a child with a disability who is between the ages of 6-12 years old?

☐ Yes ☐ No

What is the child's date of birth?

_____

Does this child have an IEP?

☐ Yes ☐ No

What is the diagnosis of the child?

_____

Does your child use a speech generating device (high-tech AAC)?

☐ Yes ☐ No

Did your child acquire the AAC after the start of the 2019 school year (after August 2019)?

☐ Yes ☐ No

About the child's sibling(s)

Does your child have sibling(s) between the ages of 6-12 with typical development?

☐ Yes ☐ No

****If any of the questions about the child or sibling(s) are answered no, they will be directed to a page informing them they are not eligible****

APPENDIX D: INFORMED CONSENTS

Social Behavioral Research Consent Form

Training and Coaching Siblings to use Aided Language Modeling to Support Social Interactions with Children who use Augmentative and Alternative Communication

You are being asked to participate in a voluntary research study. The purpose of this study is to examine the effects of a training and coaching program for typically developing siblings of children with disabilities who use Augmentative and Alternative Communication (AAC). Participating in this study will involve pre-intervention questionnaires, interviews, and assessments, training and coaching a typically developing sibling, and post-intervention assessments, and your participation will last about 12 weeks. Risks related are minimal and contain no more risk than one would encounter in everyday life; benefits related to this research include useful information and strategies to support social interactions between siblings.

Rebecca Hacker, M.Ed and Dr. Hedda Meadan
Special Education, University of Illinois at Urbana-Champaign
Rebecca Hacker, rhacke2@illinois.edu or Dr. Hedda Meadan, meadan@illinois.edu

Why am I being asked?
You are being asked to be a participant in a research study about social interactions between typically developing siblings and children with disabilities. The purpose of this research is to examine the effects of a training and coaching program for typically developing siblings of children with disabilities who use Augmentative and Alternative Communication (AAC). You have been asked to participate in this research because you have indicated you have at least two children, one who has a disability and uses AAC and one who has typical development. Approximately 20 participants will be involved in this research at the University of Illinois at Urbana-Champaign.

Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future dealings with the University of Illinois at Urbana-Champaign. If you decide to participate, you are free to withdraw at any time without affecting that relationship.

What procedures are involved?
The study procedures for you and your child include:

a) Complete an information questionnaire online, only you (about 15 minutes)
b) Participate through Zoom in a pre- and post-intervention interview, both you and your typically developing child (about 30 minutes each)
c) Complete pre- and post- intervention assessments online, both you and your typically developing child (about 1 hour)
d) Participate through Zoom in two training sessions (about 20 min each), both you and your typically developing child
e) Participate through Zoom in coaching sessions (about 20 min each, twice a week, for about 10 weeks), you, your child with a disability and their sibling, through Zoom

This research will be performed within your home, all interactions will take place via a video conferencing platform (Zoom). You will need to attend regular sessions (approximately 2-3 times per week for 12 weeks). Each of those visits will last 20 minutes

What are the potential risks and discomforts?
Participation in this research will not expose you to a level of risk greater than what you would experience in your daily life. The study will be conducted online using videoconferencing applications (e.g., Zoom), and a secure online storage (e.g. Box) will host all recordings from the study. While all efforts will be made to protect participants information, data breach is a possible risk. Your typically developing child will be asked to agree to participate before the beginning of each session. For your child with a disability, ongoing discussion between you and the research will determine if any behaviors indicate an uncomfortableness or unwillingness to participate, in that case the session will be ended and rescheduled as needed.

Are there benefits to participating in the research?
Benefits related to this research include useful information and strategies to support social interactions between siblings.

What other options are there?
You have the option to not participate in this study.

Will my study-related information be kept confidential?
We will use all reasonable efforts to keep your personal information confidential, but we cannot guarantee absolute confidentiality. When this research is discussed or published, no one will know that you were in the study. But, when required by law or university policy, identifying information (including your signed consent form) may be seen or copied by: a) The Institutional Review Board that approves research studies; b) The Office for Protection of Research Subjects and other university departments that oversee human subjects research; or c) University and state auditors responsible for oversight of research.

Will I be reimbursed for any expenses or paid for my participation in this research?
For your participation, your family will receive a total of $200 as e-gift cards. This incentive will be disbursed throughout the study, after the first phase (i.e., questionnaire, pre-intervention interview, pre-interview assessments) you will receive $50, after the second phase (i.e., training and coaching sessions) you will receive $50, and after the third phase of this study (post-intervention interview and post interview assessments) you will receive $100.

Can I withdraw or be removed from the study?
If you decide to participate, you are free to withdraw your consent and discontinue participation at any time. The researchers also have the right to stop your participation in this study without your consent if they believe it is in your best interests.

Will data collected from me be used for any other research?
Your de-identified information could be used for future research without additional informed consent.

Who should I contact if I have questions?
Contact the researchers Rebecca Hacker or Dr. Hedda Meadan at rhacke2@illinois. if you have any questions about this study or your part in it, or if you have concerns or complaints about the research.

What are my rights as a research subject?
If you have any questions about your rights as a participant in this study, please contact the University of Illinois at Urbana-Champaign Office for the Protection of Research Subjects at 217-333-2670 or irb@illinois.edu.

I have read the above information. I have been given an opportunity to ask questions and my questions have been answered to my satisfaction. I agree to participate in the following:

I consent for my personal participation in (a) pre-intervention and post-intervention questionnaires, assessments, and interviews, (b) two training sessions with my typically developing child and (c) coaching sessions with my typically developing child and child with a disability 2-3 times per week for up to 10 weeks. I consent to have all sessions conducted via zoom to be videorecorded.

I consent for my child, (typically developing child) , to participate and in (a) pre-intervention and post-intervention assessments and interviews, (b) two training sessions, and (c) coaching sessions with their sibling with a disability 2-3 times per week for up to 10 weeks. I consent to have all sessions conducted via zoom to be videorecorded.

I consent for my child, (child with a disability who uses AAC), to participate and be video recorded in interaction with their typically developing sibling 2-3 times per week for up to 10 weeks.

Signature	Date
Printed Name	
Signature of Person Obtaining Consent	Date (must be same as subject's)
Printed Name of Person Obtaining Consent	

Minor Assent – Verbal

Training and Coaching Siblings to use Aided Language Modeling to Support Social Interactions with Children who use Augmentative and Alternative Communication

Rebecca Hacker and Dr. Hedda Meadan

Hello, my name is Rebecca Hacker. If you have any questions about what I am telling you, you can ask me at any time. I want to tell you about a research study we are doing. In this study, we want to find out more about how you interact with your sibling and provide you with some ways to help your sibling communicate.

You are being asked to participate in this research study because your sibling uses augmentative and alternative communication (AAC) to communicate. If it is okay with you, I will ask you to participate in (a) an interview at the beginning and at the end of the study, (b) two training sessions that will last about 20 minutes each, and (c) coaching sessions about 2-3 times per week for 10 weeks.

Your parents say it is okay for you to be in this study, but you do not have to be in it if you don't want to. If you have questions for me or them, you can ask them now or later.

If you start the study but get tired or don't want to be in the study anymore, just let me know. If you want to stop at any time, just tell me and we will stop. You do not have to be in this study. It is totally up to you. You can say yes now and still change your mind later. All you have to do is tell me. No one will be mad at you if you say no now or change your mind.

Do you understand what I'm saying? ☐Yes ☐No
Are you willing to participate in assessments, interviews, trainings, and coaching sessions? ☐Yes ☐No

_____

Child's/Participant's Name (printed)

_____ _____

Name (printed) and Signature of Person Obtaining Consent Date

Social Behavioral Research Consent Form

Training and Coaching Siblings to use Aided Language Modeling to Support Social Interactions with Children who use Augmentative and Alternative Communication

You are being asked to participate in a voluntary research study. The purpose of this study is to examine the effects of a training and coaching program for typically developing siblings of children with disabilities who use Augmentative and Alternative Communication (AAC). Participating in this study will a post-intervention interview that will last about 30 minutes. Risks related are minimal and contain no more risk than one would encounter in everyday life; benefits related to this research include useful information and strategies to support social interactions between siblings.

Rebecca Hacker, M.Ed and Dr. Hedda Meadan
Special Education, University of Illinois at Urbana-Champaign
Rebecca Hacker, rhacke2@illinois.edu or Dr. Hedda Meadan, meadan@illinois.edu

Why am I being asked?
You are being asked to be a participant because your family members participated in the intervention focusing on social interactions and the use of AAC. The purpose of this research is to examine the effects of a training and coaching program for typically developing siblings of children with disabilities who use Augmentative and Alternative Communication (AAC). You have been asked to participate in this research because your family members have recently participated in this intervention study. Approximately 20 participants will be involved in this research at the University of Illinois at Urbana-Champaign.

Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future dealings with the University of Illinois at Urbana-Champaign. If you decide to participate, you are free to withdraw at any time without affecting that relationship.

What procedures are involved?
The study procedures for include a recorded interview about the purpose, outcomes, and your perspective of this study, this one-time interview should last about 30 minutes.

What are the potential risks and discomforts?
Participation in this research will not expose you to a level of risk greater than what you would experience in your daily life. The study will be conducted online using videoconferencing applications (e.g. Zoom), and a secure online storage (e.g. Box) will host all recordings from the study. While all efforts will be made to protect participants information, data breach is a possible risk.

Are there benefits to participating in the research?
Benefits related to this research include useful information and strategies to support social interactions between siblings.

What other options are there?
You have the option to not participate in this study.

Will my study-related information be kept confidential?
We will use all reasonable efforts to keep your personal information confidential, but we cannot guarantee absolute confidentiality. When this research is discussed or published, no one will know that you were in the study. But, when required by law or university policy, identifying information (including your signed consent form) may be seen or copied by: a) The Institutional Review Board that approves research studies; b) The Office for Protection of Research Subjects and other university departments that oversee human subjects research; or c) University and state auditors responsible for oversight of research.

Will I be reimbursed for any expenses or paid for my participation in this research?
As a part of this research study, your family will receive a total of $200 as e-gift cards. This incentive will be disbursed throughout the study, after the first phase (i.e., questionnaire, pre-intervention interview, pre-interview assessments) you will receive $50, after the second phase (i.e., training and coaching sessions) you will receive $50, and after the third phase of this study (post-intervention interview and post interview assessments) you will receive $100.

Can I withdraw or be removed from the study?
If you decide to participate, you are free to withdraw your consent and discontinue participation at any time. The researchers also have the right to stop your participation in this study without your consent if they believe it is in your best interests.

Will data collected from me be used for any other research?
Your de-identified information could be used for future research without additional informed consent.

Who should I contact if I have questions?
Contact the researchers Rebecca Hacker or Dr. Hedda Meadan at rhacke2@illinois or meadan@illinois.edu. if you have any questions about this study or your part in it, or if you have concerns or complaints about the research.

What are my rights as a research subject?
If you have any questions about your rights as a participant in this study, please contact the University of Illinois at Urbana-Champaign Office for the Protection of Research Subjects at 217-333-2670 or irb@illinois.edu.

I have read the above information. I have been given an opportunity to ask questions and my questions have been answered to my satisfaction. I agree to participate in the following:

I consent in my personal participation and to be recorded in a post-intervention interview.

_____ _____

Signature Date

_____

Printed Name

Signature of Person Obtaining Consent

Date (must be same as subject's)

Printed Name of Person Obtaining Consent

APPENDIX E: INFORMATION QUESTIONNAIRE

Please take a moment to answer the following background questions.

1. What is your role with the child who uses AAC?
   - ☐ Mother
   - ☐ Father
   - ☐ Legal Guardian
   - ☐ Other: _____

2. What is your marital status?
   - ☐ Single
   - ☐ Domestic partnership
   - ☐ Married
   - ☐ Married- living separately
   - ☐ Divorced
   - ☐ Widowed

3. Please use the following categories to provide an approximate estimate of your family's annual income:
   - ☐ Less than $10,000
   - ☐ Between $10,000 and $25,000
   - ☐ Between $25,000 and $45,000
   - ☐ Between $45,000 and $65,000
   - ☐ Between $65,000 and $85,000
   - ☐ Between $85,000 and $100,000
   - ☐ Greater than $100,000

4. To what racial or ethnic group do you most identify with?
   - ☐ American Indian or Alaska Native
   - ☐ Asian
   - ☐ Black or African American
   - ☐ Latino or Hispanic
   - ☐ Native Hawaiian or Other Pacific Islander
   - ☐ White
   - ☐ Other: _____

5. What is your age?
   - ☐ 18-29
   - ☐ 30-39
   - ☐ 40-49
   - ☐ 50-59
   - ☐ 60 or over

6. What is your highest degree or the highest level of school you have completed?
   - ☐ Some High School

- ☐ High School Diploma or GED
- ☐ Some college
- ☐ Associate Degree or Technical/Vocational School Degree
- ☐ Bachelor's Degree
- ☐ Graduate Degree

7. What is your occupation?

   _____

(If they selected their marital status as married or domestic partnership, they will complete the following questions)

8. What is your partner's role with the child who is minimally verbal?
   - ☐ Mother
   - ☐ Father
   - ☐ Legal Guardian
   - ☐ Other: _____

9. To what racial or ethnic group does your partner most identify with?
   - ☐ American Indian or Alaska Native
   - ☐ Asian
   - ☐ Black or African American
   - ☐ Latino or Hispanic
   - ☐ Native Hawaiian or Other Pacific Islander
   - ☐ White
   - ☐ Other: _____

10. What is your partner's age?
    - ☐ 18-29
    - ☐ 30-39
    - ☐ 40-49
    - ☐ 50-59
    - ☐ 60 or over

11. What is your partners' highest degree or the highest level of school you have completed?
    - ☐ Some High School
    - ☐ High School Diploma or GED
    - ☐ Some college
    - ☐ Associate Degree or Technical/Vocational School Degree
    - ☐ Bachelor's Degree
    - ☐ Graduate Degree

12. What is your partner's occupation?

    _____

13. How many people live in your household?

_____

About child with a disability who uses AAC and sibling.

14. Please complete the table below about your children: (a) age (b) gender, and (c) development:

	Age	Gender	Grade Level	Does this child have a diagnosed disability?
1				☐ Yes ☐ No
2				☐ Yes ☐ No
3				☐ Yes ☐ No
4				☐ Yes ☐ No
5				☐ Yes ☐ No
6				☐ Yes ☐ No
7				☐ Yes ☐ No

15. What types of services does your child with a disability receive?

16. Thinking about your child with a disability who uses AAC, what types of interactions does (he/she) currently have with each of (his/her) siblings?

17. In what ways do you support social interactions between siblings?

APPENDIX F: PREINTERVENTION INTERVIEWS

Parent Script:

Thank you for your interest in participating in our research study, today we are going to review the outlook for the project, and I will ask you some questions about your family and children. Toward the end, I will ask that you bring your typically developing child into the room so I can ask (him/her) some questions as well.

All aspects of the study include:

a) *Complete an information questionnaire online (about 15 minutes)*
b) *Participate in a pre-and postintervention interview, both you and your typically developing child, through Zoom (about 30 minutes each)*
c) *Complete pre- and post- intervention assessments, both you and the sibling online (about 1 hour)*
d) *Participate in two training sessions (about 20 min each), both you and your typically developing child, through Zoom*
e) *Participate in coaching sessions (about 20 min each, twice a week, for about 10 weeks), you, your child with a disability and their sibling, through Zoom*

With the focus of this intervention being to support sibling interactions, I will be working directly with your typically developing child. We ask you as the parent to support aspects of the intervention such as technology and materials and that you will be present for all training and coaching sessions. We ask that during the training and coaching sessions you refrain from providing instruction or feedback directly related to the children's communication and/or social interactions. Do you have any questions before we begin?

After today, you will have completed: pre-intervention interview and we will have determined some activities that can focus on for this intervention as well as a schedule for training and coaching sessions. For the following questions, please keep (sibling's name) and (child with disability's name) in mind.

- ***How does your child currently interact with adults in the home?***
    - ***How do you support those interactions?***
    - ***Do you have difficulty understanding what your child's needs are?***
    - ***Would you like to see any changes in these interactions?***
- ***In what ways do the children currently interact?***
    - ***How do you support those interactions?***
    - ***Are you satisfied with these interactions?***
    - ***Would you like to see any changes in these interactions?***
- ***When thinking about social communication domain what are some of your hopes for your children?***
- ***What do you hope to gain from this project?***
- ***Have you ever heard of Aided Language Modeling before? If so, please describe.***

- ***Let's identify some activities or routines where you would like to see more social interaction between siblings.***

When activity/routine is established, work with parent to create a schedule to begin training and coaching.

Sibling Script:

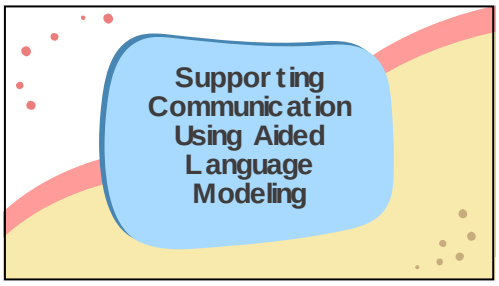
Thank you for your interest in participating in our research study. Today, I will ask you some questions about your relationship with (child's name). Are you willing to answer a few questions for me? (Wait for assent)

- ***Tell me a little about your sibling?***
    - ***What do they like/dislike?***
- ***How does (name) communicate with you?***
    - ***Can you understand what he/she wants or needs?***
- ***How do you communicate with (name)?***
    - ***How do you know if he/she knows what you mean?***
- ***What things do you do to help your brother/sister learn?***
    - ***Communicate?***
- ***How helpful are the things you do to help your brother/sister learn?***
- ***What activities do you like to do with (name)?***
- ***What do you hope (name) can do differently in those activities?***
- ***How would you describe a brother/sister with good communication?***
- ***What would you like to learn from this study?***

Thank you for answering my questions today!

Follow up when then their next meeting is and what is needed from them to prepare (i.e., positioning of technology and items to engage in)

APPENDIX G: AIDED LANGUAGE MODELING TRAINING MATERIALS



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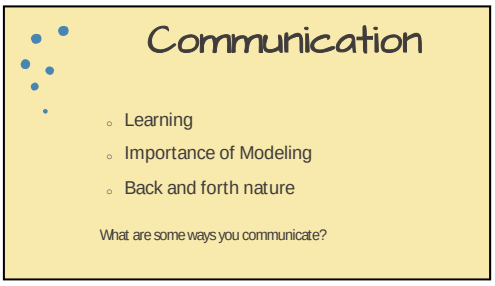

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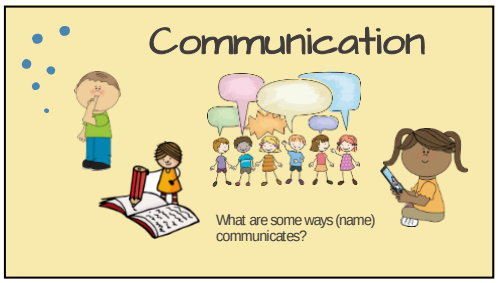

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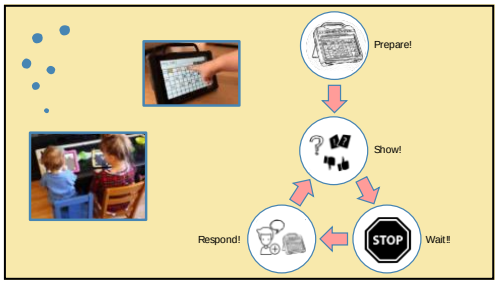

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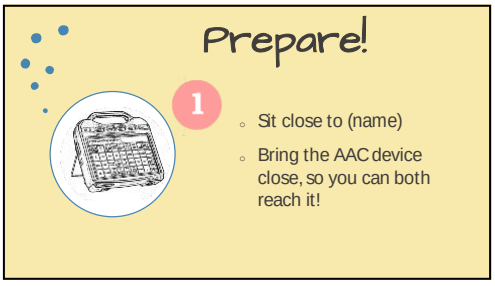


6

Prepare!

1

- Let's watch!

INSERT VIDEO DEMONSTRATION

7

Show!

2

- Pick 1-3 symbols
  - Give a choice
  - Ask a question
  - Comment
- Say the word and touch the symbol

8

Show!

2

- Let's watch!

INSERT VIDEO DEMONSTRATION

9

Wait!

3

- Count to 5!
- Give (name) time to respond

10

Wait!

3

- Let's watch!

INSERT VIDEO DEMONSTRATION

11

Respond!

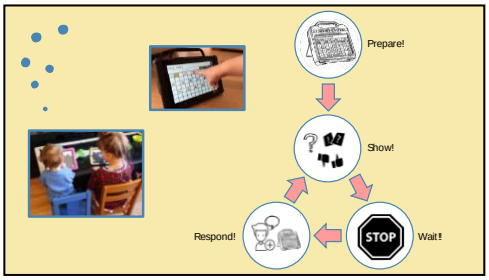
4

- Respond to (name)
  - Give a choice
  - Ask a question
  - Comment
- Use the AAC device while you talk

12


Respond!
4
Let's watch!
INSERT VIDEO DEMONSTRATION

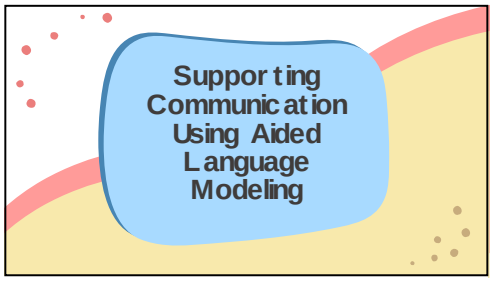
13


Prepare!
Show!
Wait!
STOP
Respond!

14


More next time!

15


Supporting Communication Using Aided Language Modeling

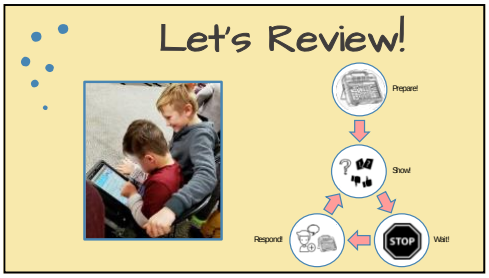
1


Let's Review!

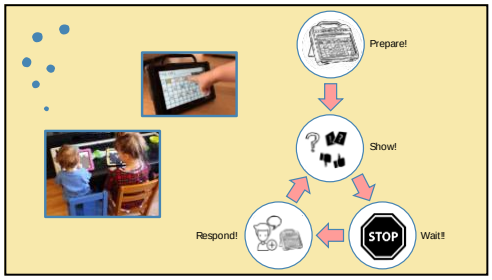
2


Supporting Communication
MODEL

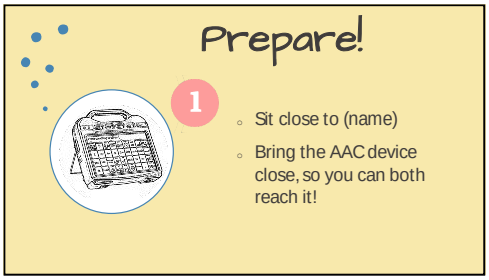
3


Let's Review!
Prepare!
Show!
Respond!
STOP
Wait!

4


Prepare!
Show!
Respond!
STOP
Wait!

5


Prepare!
1
Sit close to (name)
Bring the AAC device close, so you can both reach it!

6

Prepare!

1

- Let's watch!

INSERT VIDEO DEMONSTRATION

7

Prepare!

1

- Let's practice!

8

Show!

2

- Pick 1-3 symbols
  - Give a choice
  - Ask a question
  - Comment
- Say the word and touch the symbol

9

Show!

2

- Let's watch!

INSERT VIDEO DEMONSTRATION

10

Show!

2

- Let's practice!

11

Wait!

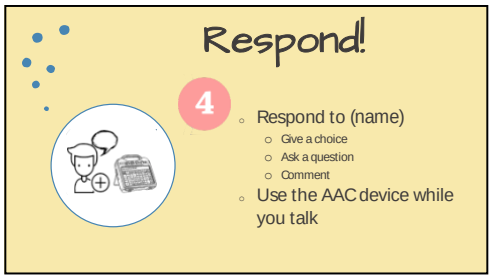
3

- Count to 5!
- Give (name) time to respond

12

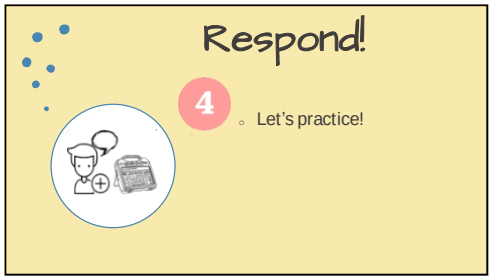
13

14

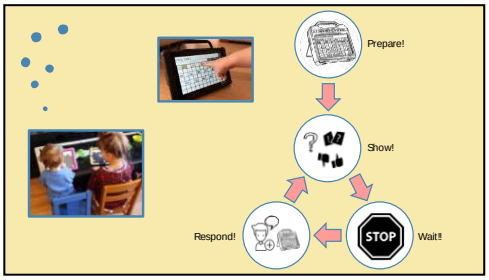


15

16

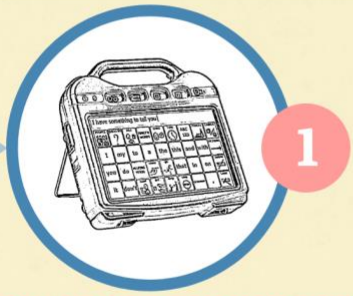


17



18

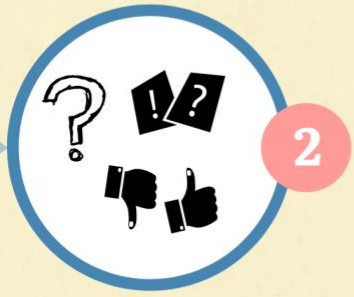
Aided Language Modeling



1

Prepare!

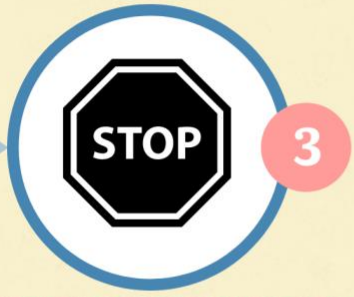
- Sit close to your brother or sister
- Bring the AAC device close so you can both reach it



2

Show!

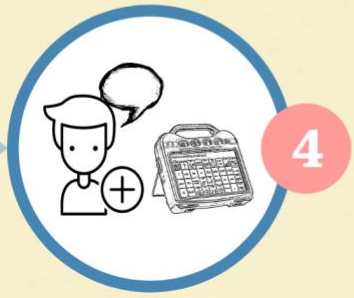
- Pick 1-3 symbols
  - Give a choice
  - Ask a question
  - Comment
- Say the work and touch the symbol



3

Wait!

- Count to 5



4

Respond!

- Respond to your brother/sister
- Use the AAC device while you talk

APPENDIX H: FIDELITY CHECKLISTS

Training 1	
Did the researcher...	
Goal and Purpose	
Talk about how we communicate	☐**Yes** ☐**No**
How we help others communicate	☐**Yes** ☐**No**
Describe ALM	☐**Yes** ☐**No**
ALM	
Describe how ALM can be used with the child	☐**Yes** ☐**No**
Explain how to use ALM	☐**Yes** ☐**No**
ALM strategies	
Explain and show video of *prepare*	☐**Yes** ☐**No**
Explain and show video of *show*	☐**Yes** ☐**No**
Explain and show video of *wait*	☐**Yes** ☐**No**
Explain and show video of *respond*	☐**Yes** ☐**No**
End	
Summarize the session	☐**Yes** ☐**No**
Tell the sibling what we will do next time	☐**Yes** ☐**No**
End my confirming the next meeting time	☐**Yes** ☐**No**

Training 2	
Did the researcher...	
ALM review	
Describe what ALM is	☐**Yes** ☐**No**
Describe how ALM can be used with the child	☐**Yes** ☐**No**
Explain how to use ALM	☐**Yes** ☐**No**
ALM strategies	
Explain and show video of *prepare*	☐**Yes** ☐**No**
Explain and show video of *show*	☐**Yes** ☐**No**
Explain and show video of *wait*	☐**Yes** ☐**No**
Explain and show video of *respond*	☐**Yes** ☐**No**
ALM suggestions/practice	
Practice using *prepare* with the sibling	☐**Yes** ☐**No**
Practice using *show* with the sibling	☐**Yes** ☐**No**
Practice using *wait* with the sibling	☐**Yes** ☐**No**
Practice using *respond* with the sibling	☐**Yes** ☐**No**
End	
Summarize the session	☐**Yes** ☐**No**
Tell the sibling what we will do next time	☐**Yes** ☐**No**
End my confirming the next meeting time	☐**Yes** ☐**No**

Coaching	
Did the researcher...	
Pre-Observation	
Ask: *How much do you use Aided Language Modeling with (name)?*	☐**Yes** ☐**No**
Ask: *In which routine(s) did you use the Aided Language Modeling?*	☐**Yes** ☐**No**
Ask: *How well do you think you use Aided Language Modeling?*	☐**Yes** ☐**No**
Review the ALM handout and/or slides	☐**Yes** ☐**No**
Ask: *What questions do you have?*	☐**Yes** ☐**No**
Action Plan	
Ask: *What activity are you going to use? What target word(s)?*	☐**Yes** ☐**No**
Ask: *What will you need during the activity?*	☐**Yes** ☐**No**
Ask: *Which strategy will you use (give a choice, ask a question, comment)?*	☐**Yes** ☐**No**
Ask: *How long will you wait?*	☐**Yes** ☐**No**
Ask: *How will you respond if (name) doesn't respond?*	☐**Yes** ☐**No**
Review the steps of ALM	☐**Yes** ☐**No**
Ask: *What questions do you have?*	☐**Yes** ☐**No**
Observation	
Did the researcher observe for 10 minutes?	☐**Yes** ☐**No**
Was the observation uninterrupted?	☐**Yes** ☐**No**
Post-Observation	
Ask: *How do you think it went?*	☐**Yes** ☐**No**
Provide supportive feedback	☐**Yes** ☐**No**
Provide corrective feedback	☐**Yes** ☐**No**
Ask: *What questions do you have*	☐**Yes** ☐**No**
End the session by confirming the next session	☐**Yes** ☐**No**

APPENDIX I: COACHING SESSION GUIDE

(Modified from Douglas et al., 2021)

Pre-Observation

☐ Discuss use of Aided Language Modeling since last session.

☐ Ask "How much do you use Aided Language Modeling with (*name)*?"

☐Not Used ☐Rarely (1-2x) ☐Sometimes (3-4x) ☐Often (5+ x)

☐ Ask "In which routine(s) did you use the Aided Language Modeling?"

_____

☐ Ask "How well do you think you use Aided Language Modeling?"

☐Not Well ☐Fairly Well ☐Well ☐ Very Well

☐ Collaborate with individual to develop action plan

☐ Identify adjustments to routine ☐ Identify words ☐ Identify materials

Activity/Word: *What activity are you going to use? What target word(s)?*	**Prepare:** *What will you need during the activity?*	**Show:** *Which strategy will you use (give a choice, ask a question, comment)?*	**Wait:** *How long will you wait?*	**Respond:** *How will you respond if (name) doesn't respond?*

☐ Review the steps for the Aided Language Modeling (use handout)

☐ Ask if they have any questions

Observation (10 minutes of observing interaction):

☐ Observe the interaction without interruption and check for use of Aided Language Modeling steps (see below) - take notes for providing feedback.

1. Partner is at the child's level (e.g., face-to-face)
2. Speech generating device is within reach of both the child and the partner
3. Partner presses one or more symbols on the SGD using a preferred interaction
    1. Preferred interactions - choice, question, comment, response
    2. Non-preferred interaction - test questions (questions with only one right answer; e.g., "what color is this?"), communicative directive (e.g., "show me where to find ____ on your device"), and behavioral direction (e.g., "sit down")
4. Partner immediately follows (or precedes) use of SGD (i.e., within 2 seconds) with spoken language (even if they don't use all the symbols in the spoken message)
5. Communication partner does not require a response but looks at the child and pauses for 3 seconds before resuming the activity, to give opportunity for the child to respond

Comments/Feedback to share with individual:

Post-Observation

☐ Have individual reflect on the interaction before providing feedback ("How do you think it went?").

☐ Provide supportive feedback first (Aspects of Aided Language Modeling they did well).

☐ Provided corrective feedback (Things they can do differently).

☐ Provide the opportunity to ask questions and respond to questions at any point during post-observation (If needed prompt "What questions do you have for me?")

☐ End the session.

APPENDIX J: CODING MANUAL

(Modified from Douglas et al., 2021)

Definitions

1. Communication partner uses symbols on the SGD to send a message. A turn ends when the child communicates or three or more seconds elapse (if partner is actively still searching for a symbol within system - vision directed towards the system - do not start time count). Select one of the types below
2. **Model Choice**
    - **a.** Definition: Communication partner uses symbols on the SGD to provide the child with a choice between 2 or more items/objects/activities.
3. **Model Question**
    - a. Definition: Communication partner uses symbols on the SGD to ask the child a question (should be meaningful, not "test" question)
4. **Model Comment**
    - a. Definition: communication partner uses symbols on the SGD to comment about the activity, what they are doing, or what the child is doing.
5. **Model Response**
    - a. Definition: Communication partner uses symbols on the SGD to respond to the child's communication (build on child's communication using a model)
6. **Other Model**
    - a. Definition: Communication Partner uses symbols on the SGD with one of the following
        1. asks a "test" question ("what color is this?"; Definition: question with a single correct answer or an answer that the partner already knows)
        2. provides a communicative directive ("show me ball on your AAC device."; Definition: communication which directs the child to communicate something specific on their device)

Aided Language Modeling Fidelity Checklist

For each occurrence of a partner's AAC model

1. Interactive context for model is appropriate (defined as meeting both sub-criteria below)
    - a. Communication partner is face-to-face at the child's level
    - b. Speech generating device (SGD) is in line of sight and accessible to both partners (e.g. within arm's reach when sitting and accessible location when not stationary)
2. Communication partner presses one or more symbols on the SGD (i.e., with sufficient pressure to produce speech output) within one of the four types of interactions below:
    - c. **Choice:** Partner uses symbols on the SGD to provide the child with a choice between two or more items/activities/other options
    - d. **Question:** Partner uses symbols on the SGD to ask the child a question (i.e., questions cannot be "test" questions - questions where there is only one right answer or partner already knows the answer), this includes yes/no questions

e. **Comment:** Partner uses symbols on the SGD to comment about the activity, what they are doing, or what the child is doing; can include labeling or describing objects, actions, etc. (Do not count directives where the partner tells the child what to do)
f. **Respond:** Partner uses symbols on the SGD to respond to the child's communication (any mode) in the form of a recast before 5 seconds elapses (*note, code as a response if partner repeats, extends, or expands the child's communication)*
g. **Other:** (if selected, does not meet fidelity criteria): Communicative directives ("show me ball on your AAC device"), behavioral directives ("sit down"), "test" questions ("what color is this?")

3. Communication partner uses aided language at **or** one level above child's assessed level (e.g., single symbols, two symbol combination). *At or above the child's level as identified within the communication matrix assessment (no more than 2 additional symbols from child's level*
4. Communication partner immediately follows **or** precedes use of SGD with corresponding spoken language (must meet both sub-criteria below)
    a. Partners' spoken utterance and SGD use are within 3 seconds of one another (combining spoken utterances with SGD use is ok - i.e., "Do you want a..." [presses pickle on device])
    b. Spoken utterance is grammatically correct (1:1 correspondence of spoken words to symbols on the SGD is not required)
5. Following the model, communication partner looks at the child and pauses at least 3 seconds before resuming play/the activity, or taking another communication turn OR the child responds before 3 seconds elapses. This response can either be communicative or not (e.g., grabbing an item, throwing an item).
    a. Code child communication (cc)
        i. Definition: Child sends a message to the communication partner using verbal means, aided AAC (e.g., computerized AAC, picture symbols), or sign and demonstrates intent: (a) looking at the partner immediately before, during, or after the communicative behavior, (b) doing something to gain the partner's attention, (c) waiting for or showing signs of expecting the partner to respond to the behavior, (d) persisting with the message and ceasing when the partner responds, (e) responding directly to a partner's preceding communication turn, or (f) the partner responds to their message. A turn ends when the partner communicates or three or more seconds elapse (if child is actively still searching for a symbol within system - vision directed towards the system - do not start time count). Provide all modes of communication. Code only the highest level of independence.
            1. **Mode**
                a. **Verbal-** Child uses speech, verbalization approximation to send a message to the communication partner. (Rely on information gathered from the family to help determine common verbalization and approximations). Must be with use of vocal chords to be considered verbal. <u>Non-examples</u>: laughing,

bouncing up and down, sounds noises with mouth (e.g., blowing raspberries). Must be with use of vocal chords to be considered verbal Examples: sshhhh (goldfish)

b. **Vocalization- S**ounds produce through the vocal chords that are intentional communication but are not symbolic. Example: uhhh uhhh, animal sounds, train sounds.
c. **Computerized AAC**– Child uses computerized AAC system to send a message to the communication partner. The child activates the SGD which produces output (e.g., word/phrase)
d. **Picture symbols**– Child uses a picture symbols to send a message to the communication partner. The child points at the picture symbol or take the picture symbol.
e. **Signs**- Child uses manual signs to communicate, using their hands to form a symbolic sign. This may differ per child. Example: touching chin 'dad' and 'mom'; shaking the letter 'p' for bathroom. This is a form of alternative communication.
f. **Gestures–** Child uses gestures to send a message to the communication partner. These behaviors are often universal and can be used without replacing them with speech/AAC. The can also be unconventional forms of communication. This includes but not limited to: head nod (yes/no), shoulder shrug, pushing away item/hand, tapping someone/something, reaching toward item, giving item to sibling, leading with the hand, hitting items/people, pantomimes gestures, pointing, clapping, throwing item. Example: child falls to the couch, to demonstrate they want to play their specific game. Non-examples: sign language, playing with a toy. Non-examples: grabbing something from sibling or table.

2. **Level of independence** (only code the highest)
   a. **Prompted-** Child's communication follows a prompt (visual, verbal, communicative directive, physical) from the partner. Non examples- if the siblings tells the child to 'take this" or "do you want this" while handing something to the child, this is not considered a prompt.
   b. **Imitated-** Child's communication imitates all or part of the partners immediately preceding message, occurs within 3 seconds of that message, and does not expand on the message.
   c. **Independent Initiation** - Child's communication is non-prompted, non-imitated, and independent from the partner's previous communication (unrelated content, or 5 seconds or more from the partner's communication).
   d. **Independent Response (r) -** Child's communication is non-prompted, non-imitated, and in response to the partner's previous communication (includes expansions).

h. Place any comments in the comment column (comments)

i. Be sure you have the correct onset and offset times for the behavior you are commenting about d.

i. Other tips
   i. Review each column after coding is complete.
   ii. When coding behaviors set onset and offset of each individual behavior.
   iii. Save file as you go and before you close the program/video.

Coding Directions

1. Save file as VIDEO ID_coded
2. Record general details on hand coding form:
   a. Coder initials
   b. Video ID
   c. Start timestamp (when interaction began)
   d. End timestamp (when interaction ended)
3. Code behaviors and record on coding form
   a. Code partner communication
      i. Record each instance of behavior in a new line
         1. Start time/end time of behavior
         2. Record Partner Model Type (select only one from the options below)

            Definition - Communication partner uses symbols on the SGD to send a message. A turn ends when the child communicates or three or more seconds elapse (if partner is actively still searching for a symbol within system - vision directed towards the system - do not start time count). Select one of the types below.

            a. Model Choice
               i. Definition: Communication partner uses symbols on the SGD to provide the child with a choice between 2 or more items/objects/activities.

            b. Model Question
               i. Definition: Communication partner uses symbols on the SGD to ask the child a question (should be meaningful, not "test" question)

            c. Model Comment
               i. Definition: communication partner uses symbols on the SGD to comment about the activity, what they are doing, or what the child is doing.

            d. Model Response
               i. Definition: Communication partner uses symbols on the SGD to respond to the child's communication (build on child's communication using a model)

            e. Other Model
               i. Definition: Communication Partner uses symbols on the SGD with one of the following

ii. asks a "test" question ("what color is this?"; Definition: question with a single correct answer or an answer that the partner already knows)
iii. provides a communicative directive ("show me ball on your AAC device."; Definition: communication which directs the child to communicate something specific on their device)

4. Record fidelity percentage (see checklist below - calculate percentage out of __/5; e.g., 4/5=.8)
5. Record any fidelity items missed in the comment section (partner area)

Sibling (Communication Partner)

For each occurrence of a partner's AAC model

1. ☐Interactive context for model is appropriate (defined as meeting both sub-criteria below)
   j. ☐Communication partner is face-to-face at the child's level
   k. ☐Speech generating device (SGD) is in line of sight and accessible to both partners (e.g. within arm's reach when sitting and accessible location when not stationary)
2. ☐Communication partner presses one or more symbols on the SGD (i.e., with sufficient pressure to produce speech output) within one of the four types of interactions below:
   l. ☐**Choice:** Partner uses symbols on the SGD to provide the child with a choice between two or more items/activities/other options
   m. ☐**Question:** Partner uses symbols on the SGD to ask the child a question (i.e., questions cannot be "test" questions - questions where there is only one right answer or partner already knows the answer)
   n. ☐**Comment:** Partner uses symbols on the SGD to comment about the activity, what they are doing, or what the child is doing; can include labeling or describing objects, actions, etc. (Do not count directives where the partner tells the child what to do)
   o. ☐**Respond:** Partner uses symbols on the SGD to respond to the child's communication (any mode) in the form of a recast before 5 seconds elapses (*note, code as a response if partner repeats, extends, or expands the child's communication)*
   p. ☐**Other:** (if selected, does not meet fidelity criteria): Communicative directives ("show me ball on your AAC device"), behavioral directives ("sit down"), "test" questions ("what color is this?")
3. ☐Communication partner uses aided language at **or** one level above child's assessed level (e.g., single symbols, two symbol combination). *At or above the child's level as identified within the communication matrix assessment (no more than 2 additional symbols from child's level*
4. ☐Communication partner immediately follows **or** precedes use of SGD with corresponding spoken language (must meet both sub-criteria below)

a. ☐Partners' spoken utterance and SGD use are within 3 seconds of one another (combining spoken utterances with SGD use is ok - i.e., "Do you want a..." [presses pickle on device])
b. ☐Spoken utterance is grammatically correct (1:1 correspondence of spoken words to symbols on the SGD is not required)

5. ☐Following the model, communication partner looks at the child and pauses at least 3 seconds before resuming play/the activity, or taking another communication turn OR the child responds before 3 seconds elapses. This response can either be communicative or not (e.g., grabbing an item, throwing an item).

Target Child (Child)

1. ☐**Mode**
   a. ☐**Verbal-** Child uses speech, verbalization approximation to send a message to the communication partner. (Rely on information gathered from the family to help determine common verbalization and approximations). Must be with use of vocal chords to be considered verbal. Non-examples: laughing, bouncing up and down, sounds noises with mouth (e.g., blowing raspberries). Must be with use of vocal chords to be considered verbal Examples: sshhhh (goldfish)
   b. ☐**Vocalization- S**ounds produce through the vocal chords that are intentional communication but are not symbolic. Example: uhhh uhhh, animal sounds, train sounds.
   c. ☐**Computerized AAC**– Child uses computerized AAC system to send a message to the communication partner. The child activates the SGD which produces output (e.g., word/phrase)
   d. ☐**Picture symbols**– Child uses a picture symbols to send a message to the communication partner. The child points at the picture symbol or take the picture symbol.
   e. ☐**Signs-** Child uses manual signs to communicate, using their hands to form a symbolic sign. This may differ per child. Example: touching chin 'dad' and 'mom'; shaking the letter 'p' for bathroom. This is a form of alternative communication.
   f. ☐**Gestures–** Child uses gestures to send a message to the communication partner. These behaviors are often universal and can be used without replacing them with speech/AAC. The can also be unconventional forms of communication. This includes but not limited to: head nod (yes/no), shoulder shrug, pushing away item/hand, tapping someone/something, reaching toward item, giving item to sibling, leading with the hand, hitting items/people, pantomimes gestures, pointing, clapping, throwing item. Example: child falls to the couch, to demonstrate they want to play their specific game. Non-examples: sign language, playing with a toy. Non-examples: grabbing something from sibling or table.
   g. ☐**Prompted-** Child's communication follows a prompt (visual, verbal, communicative directive, physical) from the partner.
   h. ☐**Imitated-** Child's communication imitates all or part of the partners immediately preceding message, occurs within 3 seconds of that message, and does not expand on the message.

i. ☐**Independent Initiation** - Child's communication is non-prompted, non-imitated, and independent from the partner's previous communication (unrelated content, or 5 seconds or more from the partner's communication)
j. ☐**Independent Response (r) -** Child's communication is non-prompted, non-imitated, and in response to the partner's

APPENDIX K: OBSERVATIONAL CODING FORM

Coder Initials: Video ID:						Start Timestamp: End Timestamp:					
Partner Communication						**Target Child Communication**					
#	Start time	Stop time	Model type	Fidelity	Comments	#	Start time	Stop time	Comm. Mode (may indicate more than one)	Level of Ind.	Comments
Ex	0:00:00	0:51:03	Choice **C** Question **Q** Comment **O** Response **R** Other model **N**	1 .8 .6 .4 .2 0	Missing 1.1 and 5	Ex	0:55:03	0:57:23	Verbal **V** Vocalization **Z** Computerized **AAC** Picture symbols **P** Sign **S** Gesture **G**	Prompted **P** Imitated **M** Independent initiation **I** Independent response **R**	Child said "boo" while selecting "blue in the computerized system"
1						1					
2						2					
3						3					
4						4					
5						1					
6						2					
7						3					
8						1					
9						2					
10						3					
11						4					
12						1					
13						2					
14						3					
15						4					
16						1					

APPENDIX L: SOCIAL VALIDITY INTERVIEWS

Primary Caregiver Script

Thank you for participating in this study, we would know to know about the outcomes and experiences about the study.

1. *How does [child] currently interact with adults in the home?*
    a. *How do you support those interactions?*
    b. *Do you have difficulty understanding what [child]'s needs are?*
2. *In what ways do [sibling] and [child] currently interact?*
    a. *How do you support those interactions?*
    b. *Are you satisfied with these interactions?*
3. *Please describe your experience participating in this study.*
4. *Have you observed changes in [sibling]'s interactions with [child] throughout this study? If so, describe.*
5. *Have you observed changes in [child] throughout this study? If so, describe.*
6. *Have interactions changed between others who were not involved in the study (siblings or adults)? If so, describe.*
7. *What is your perception about the Aided Language Modeling strategy?*
8. *Are you satisfied with the procedures used during the training and coaching sessions? If so, in what ways? If not, why?*
9. *Are you satisfied with the outcomes of the training and coaching sessions? If so, in what ways? If not, why?*
10. *Would you be interested in being trained and coached on how to use ALM with [child]?*
11. *What aspects of the study were most beneficial to you? Your children? Your family?*
12. *How comfortable did you feel using Zoom for this study?*
13. *What aspects of this study would you have like to change?*
14. *Anything else you would like to share with us?*

Target Child Script

Thank you for participating in our research study. Today, I will ask you some questions. (Ask parent to assist in asking these questions if needed)

1. *Did you like playing with [sibling]?*
2. *Will you continue to play with [sibling]?*
3. *Did you like meeting with [coach]?*

Sibling Script

Thank you for participating in our research study. Today, I will ask you some questions about your experience with this study. Are you willing to answer a few questions for me? (Wait for assent)

1. *What things did you like about meeting with [coach] on Zoom and learning about the Aided Language Modeling strategy?*
2. *What things didn't you like about meeting with [coach] on Zoom and learning about the Aided Language Modeling strategy?*
3. *Do you think [child] is communicating more with you? If so, when and how?*

4. *Do you think [child] is communicating more with other family members? If so, when and how?*
5. *Do you think other kids your age would be able to use the Aided Language Modeling strategy? (Follow up with prompt for description)*
6. *What did you like about learning through Zoom? Dislike?*
7. *Would you like to do more learning through Zoom? Why?*
8. *Do you think you will be able to use this strategy without me in the future? (Follow up with prompt for description)*
9. *Is there anything else you would like to share with us?*

Other Household Member Script

Thank you for participating in this study, we would know to know about the outcomes and experiences about the study.

(If the interviewee is under the age of 18, I will include assent. Example: *Your siblings* (names) *recently participated in a study, would you be willing to answer a few questions for me?*)

1. *Have you observed changes in [sibling]'s interactions with* [child] *since we started the study? If so, describe. [sibling's] and [child]'s? If so, describe.*
2. *Have you observed changes in* [child]'s *communication since we started this study? If so, describe.*
3. *Have interactions changed between others who were not involved in the study (siblings or you)? If so, describe.*
4. *Have you learned anything about the Aided Language Modeling strategy? If so, what?*
5. *Are you satisfied with the outcomes of this study? If so, in what ways? If not, why?*
6. *What aspects of the study were most beneficial to you and your family?*
7. *What aspects of this study would you have changed?*
8. *Would you be interested in being trained and coached on how to use ALM with [child]?*
9. *Is there anything else you would like to share with us?*
10. *Are you satisfied with the outcomes of this study? If so, in what ways? If not, why?*
11. *What aspects of the study were most beneficial to you and your family?*
12. *What aspects of this study would you have changed?*
13. *Would you be interested in being trained and coached on how to use ALM with [child]?*
14. *Is there anything else you would like to share with us?*

Other Household Member Script- Sibling

Thank you for participating in this study, we would know to know about the outcomes and experiences about the study.

(If the interviewee is under the age of 18, I will include assent. Example: *Your siblings* (names) *recently participated in a study, would you be willing to answer a few questions for me?*)

1. *Have you observed changes in [sibling]'s interactions with* [child] *since we started the study? If so, describe. [sibling's] and [child]'s? If so, describe.*

2. *Have you observed changes in* [child]'s *communication since we started this study? If so, describe.*
3. *Have interactions changed between others who were not involved in the study (siblings or you)? If so, describe.*
4. *Have you learned anything about the Aided Language Modeling strategy? If so, what?*
5. *Are you satisfied with the outcomes of this study? If so, in what ways? If not, why?*
6. *What aspects of the study were most beneficial to you and your family?*
7. *What aspects of this study would you have changed?*
8. *Would you be interested in being trained and coached on how to use ALM with [child]?*
9. *Is there anything else you would like to share with us?*