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Effect of the SO(A)R Intervention on the Communication Functions of Children with Autism using AAC

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ABSTRACT

Augmentative and alternative communication (AAC) provides individuals with autism spectrum disorder (ASD) who have minimal verbal output with access to communication. Individuals learning to use AAC must be provided with practice opportunities and exposure to this type of communication; therefore, training for communication partners is a crucial aspect of AAC intervention. The following thesis is a post-secondary analysis using data from a primary study, Wendelken (2022), through which an asynchronous online training for caregivers of children with ASD using AAC was developed to teach caregivers an AAC-specific strategy to support communication. Wendelken (2022) demonstrated the efficacy of asynchronous remote trainings in assisting caregivers in supporting their child in learning AAC. This thesis analyzes the effects of asynchronous training on child responsivity. The children's responses to the caregivers' use of different prompting behaviors were measured. The results revealed an increase in the responsivity of children with ASD who are learning to use AAC following completion of remote training by caregivers, showing that asynchronous trainings can impact caregiver prompting and simultaneously provide benefits regarding child responsivity.

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Chapter 1: Introduction

Autism Spectrum Disorder (ASD)

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication, such as within social reciprocity, nonverbal communication, and abilities to establish and maintain friendships. The presence of repetitive and restrictive behaviors is also a requirement for an ASD diagnosis. Individuals with ASD may also demonstrate language deficits, which can manifest as overly literal language, low speech comprehension, echolalic speech, or a complete lack of speech. These criteria can manifest through a variety of ways due to internal factors such as the individual's age, intellectual levels, language skills, and prior treatment experiences (American Psychiatric Association, 2022).

ASD and Communication

Communication can be defined as having four main purposes: to express wants/needs, to establish social relations, to transfer information, and to perform social etiquette (Light, 1988). For individuals who have access to verbal communication, these purposes emerge in infancy, continue to evolve throughout the lifespan, and are easily met (Light, 1997). Typically developing (TD) children use a variety of communication functions before they can produce spoken language. Meanwhile, children with ASD do not demonstrate the same behaviors; specifically, early communicative actions such as social greetings, acknowledgments, and commenting are limited for children with ASD (Wetherby, 1986).

In a study meant to compare the use of spontaneous communication between children with ASD and TD counterparts at similar stages of language development, Wetherby and

Prutting (1984) found that ASD participants consistently demonstrated a limited quantity as well as limited variety of communication functions. All participants with ASD engaged in a high proportion of interactions related to communicating a want/need, but rarely used interactive acts related to a social consequence, such as requesting information or acknowledging communication partners (Wetherby & Prutting, 1984). Additional studies have found that on the occasion that children with ASD engage in behaviors which may be perceived as communicative, such as vocal or gestural acts, the child does not have the goal of conveying a message. These behaviors are different than the behaviors of TD children because they lack intentionality, awareness, and the understanding that language can be used to pass a message to other individuals (Wetherby, 1986).

Engaging in social interactions is a crucial aspect of acquiring language; these interactions allow for increased language exposure and feedback from communication partners regarding expressive language abilities (Beukelman & Light, 2020). However, communication partners typically perceive individuals with autism as lacking desire to converse and interact socially due to these differences in behaviors. This results in individuals with ASD having limited opportunity to engage in interactions and learn language (Jaswal & Akhtar, 2019).

Augmentative and Alternative Communication (AAC)

Augmentative and alternative communication (AAC) refers to all forms of communication that an individual may use instead of speech. Augmentative communication adds to verbal communication, while alternative communication is a replacement for speech. AAC can be very beneficial for individuals of all ages who experience challenges with speech or language, such as individuals with ASD. AAC comes in many different forms and can be divided

into the two main categories of low-tech and high-tech. Low-tech AAC may include facial expressions, writing, or gesturing/pointing, while high-tech AAC may include an app on an iPad or a speech-generating device (ASHA, n.d.)

Individuals who communicate using AAC are typically denied the opportunity to learn to effectively use all four communication functions (wants/needs, social connectivity, transfer of information, social etiquette) (Light, 1988). Interventions usually only focus on teaching people who use AAC to express their wants and needs. Beyond that, the other communication purposes (especially social closeness) tend to be ignored (Casenhiser et al., 2014). However, people with AAC usually consider social closeness as a priority within their lives (Light, 1997). This mismatch is a major problem within the current use of AAC interventions. Individuals with AAC have a right to all four goals of communication, and interventions should be designed to support this. Therefore, it is essential that the AAC interventions designed for children with autism have an increased frequency in using communication for the purposes of social interaction and joint attention. Children with ASD are more likely to reap greater benefits across social and educational environments if their intervention focuses on variety of communicative functions, rather than just on requesting (Logan et al., 2017). Children with ASD need more skills than simply labelling items; labelling items without the intent to communicate with a partner about the item is not the same as language (Casenhiser et al., 2015).

Communication Partners

The meta-analysis of the effects of communication partner intervention for children using AAC conducted by Kent-Walsh et al. (2010) demonstrates that individual's learning to use AAC are far more successful when supported by the instruction of a communication partner.

Additionally, when caregivers have positive expectations that their child will learn literacy skills, their behaviors regarding literacy activities with their child is different. It is significant that caregivers take time at home to guide and encourage their children in developing these skills because children will have greater success rates under supportive conditions (Light & McNaughton, 1993).

However, communication competence is not a skill that humans have intuitively; it requires work (Light, 1997). Therefore, in the same way that TD children are provided exposure to spoken language before they are expected to produce their own language, children learning to use an AAC device need experience with augmented input. A child will not understand how to use the AAC device on their own; they must become used to the language mode through having it modelled for them (Romski et al., 2010). This responsibility does not fall solely onto the person communicating with an AAC device, but also onto communication partners: parents, caregivers, therapists, teachers (Light, 1997). Children learning to use AAC need multiple opportunities to see other individuals use AAC systems to communicate (Kent-Walsh et al., 2010).

Planning and instruction for communication partners is necessary for children to be successful in learning to use their AAC device (Biggs et al., 2019). Communication partners need guidance in order to effectively facilitate an interaction with an AAC device. Without proper training, communication partners may limit interactions in an attempt to support the individual with CCN. For instance, communication partners may fail to provide ample communication opportunities, take too many turns, or elicit too many yes/no responses instead of more natural conversation (Kent-Walsh, et al., 2010). Other ways communication partners

unintentionally restrict interactions with AAC device include anticipating their child's needs or accidentally missing the child's attempt to communicate (Douglas et al., 2017). Communication partner training is effective to promote behaviors which support social interactions rather than restrict them (Kent-Walsh, et al., 2010). Therefore, it is an integral aspect of AAC intervention.

Asynchronous Training for Caregivers of Individuals Learning AAC

Although training for communication partners has been shown to be a crucial aspect of AAC intervention, most parents, educators, and peers lack the necessary training to support communication for children using AAC (Biggs et al., 2019). There are significant barriers that prevent caregivers from accessing such services, including a lack of trained professionals, limited financial resources, difficulty accessing necessary transportation, inability to find childcare, geographic concerns, or inconveniences allocating time to such programs (Wainer & Ingersoll, 2015). Therefore, asynchronous, self-paced trainings have been developed to mitigate these potential issues. Through these programs, parents have the opportunity to engage in material at their own pace a time that is convenient for them. This type of training has been suggested for caregivers of children with CCN to support their child in learning to communicate via AAC (Suppo & Floyd, 2012).

Storybook Reading Intervention

One of the main exposures that TD children have to literacy and language is storybook reading and early reading experiences guided by caregivers and teachers. However, while parents of children without disabilities consider storybook reading with their child to be a high priority, this is not the case for parents of children with disabilities. The early literacy experiences of

children who use AAC in comparison to TD children is vastly different; children who use AAC have much lower frequency of participation in activities surrounding reading (Light & McNaughton, 1993).

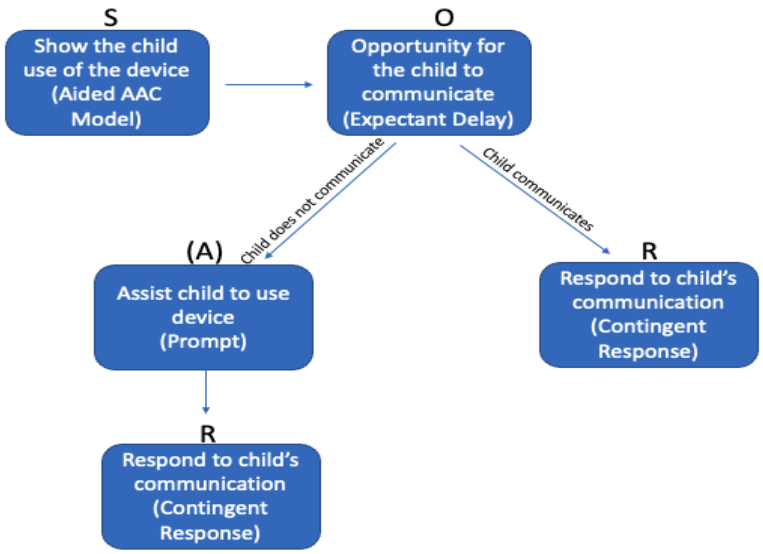
Storybook reading is a very beneficial activity for children who use AAC because the focus of the activity is on communication. Other activities, such as art or sports, include extraneous motor requirements. Storybook reading eliminates those demands; the sole focus of the activity is communication. Therefore, this activity presents an ideal opportunity for caregivers to work with their children using AAC to develop communication skills. For parents, storybooks provide context and follow a predictable pattern, making it easier to provide examples of modelling. This context and predictable nature of storybook reading also allows children learning to use AAC with ample and understandable opportunities to learn to communicate (Kent-Walsh et al., 2010). Further, storybook reading introduces children to the ideas of decontextualized language and reflective thought, which are highly relevant within classroom learning and literacy development (Light et al., 1994).

The SO(A)R Strategy

The SO(A)R strategy is an asynchronous, remote training for caregivers of children with ASD learning AAC to provide caregivers with tools to better support their child, developed by Wendelken (2022). This training was created to increase social communication between caregivers and their children through reciprocal interactions, as well as enhance the use of language for social communication functions for children with ASD. Skills taught to caregivers via this training included a set order of behaviors (modelling, expectant delay, prompting, contingent response), as represented by the acronym SO(A)R (Show, Opportunity, Assist,

Respond). Caregivers can assist their child through either a pointing prompt or a manual hand-over-hand (HOH) prompt, but assisting is only to be integrated if the child does not respond to either modelling or an expectant delay first. Further information about the steps, as well as the creation of the SO(A)R strategy, can be found in Wendelken (2022). Figure 1 shows a visual representation of the SO(A)R strategy (Wendelken, 2022).

Figure 1: Number of Child Responses to SO(A)R Behaviors by Parents during Baseline vs Post-Intervention



Chapter 2: Methods

This study is a secondary analysis using data from a primary study, Wendelken (2022). The primary study can provide further information regarding the methodology, design, and analysis of this project.

Participants

Approval from the Pennsylvania State University Institutional Review Board was received prior to Wendelken (2022). Recruitment for participation included personal contact and a flyer shared via social media platforms. To identify parents as eligible for the study, inclusion criteria included (a) being a caregiver to a child who has been diagnosed with AAC, (b) possessing accessibility to technology that could be used to engage in virtual online training, (c) no presence of a speech, hearing, or language impairment, (d) education level of at least a high school diploma, and (e) speaking English as a first language. There was also inclusion criteria applied to determine eligibility for child participants, which included (a) an official ASD diagnosis from a professional, (b) no visual impairments, hearing impairments, or genetic disorders, (c) little to no functional speech, (d) motor abilities which would allow for selection of buttons on AAC device, (e) minimum of 3 years of age, (f) the ability to engage in a storybook reading activity for 10 minutes. Further information regarding participant data can be found in Wendelken (2022). Details of the demographics for the child participants are provided in Table 1. Details of the demographics for the parents/caregivers are provided in Table 2.

Table 1: Child Participant Demographics

Participant	Age	Language Assessment Scores	ASD Assessment Scores	AAC System
Dyad 1	4;10	PLS-5 Auditory Comprehension (SS=50) Expressive Communication (SS=50) Total Communication (SS=50) **December 2020*	CARS-II: Raw score: 47 **November 2021*	PECS Phase I/II
Dyad 2	5;9	BRIGANCE Screening-III Lang. Dev. Score: 1.0 AE: <9 mos. **April 2017* Capute Scales Comm. Skills 6-8 month range **June 2017*	STAT: Score of 4 **June 2017*	LAMP Words for Life (~20-25 button grid)
Dyad 3	8;2	CELF-5 administered; all subtests discontinued due to consistently scoring 0 **June 2018*	*Obtainment of test scores in progress*	LAMP Words for Life (~25 button grid)
Dyad 4	11;6	TECEL Raw score: 55 AE: 21 mos, 30 days **March 2019* ROWPVT SS: <55 PR: <1 **February 2019*	CARS-2 T-score: 41 PR: 19 **October 2019*	TouchChat (~25 button grid)
Dyad 5	11;4	OWLS-II SS: 40 AE: 3;1 PR: <0.1 **February 2020* PPVT-5 SS: 40 AE: 2;6 PR: <0.1	CARS-2 T-score: 66 PR: 95 **January 2020*	TouchChat (~25 button grid)

**January 2020*

(Wendelken, 2022)

Table 2: Parent/Caregiver Participant Demographics

Participant	Age	Ethnicity	Location	Caregiver Role	Previous AAC Training	Employment Status	Highest Education Achieved
Dyad 1	49 years	White	South Carolina	Grandmother	None	Unemployed	Associate's degree
Dyad 2	30 years	White	Virginia	Father	None	Full-time (≥40 hrs/wk)	Master's degree
Dyad 3	39 years	White	Virginia	Mother	Some information received from SLP & ABA provider	Worked 3 jobs (≥50-55 hrs/wk)	Master's degree
Dyad 4	41 years	Black	New York	Mother	None	Full-time (>40 hrs/wk)	Master's degree
Dyad 5	38 years	White	New York	Mother	None	Part-time (25-30 hrs/wk) + Enrolled as part-time nursing student (7 credits)	Associate's degree

(Wendelken, 2022)

Materials

A laminated page with a visual representation of the SO(A)R strategy was mailed to all participants prior to the intervention phase of the study. Parents were instructed to have this resource readily available while engaging in storybook reading with their child using AAC to ensure that the proper steps are being implemented to best support their child (Wendelken, 2022).

Additionally, participants received ten books related to personal interests of each child. The child's interests were incorporated into the activity in order to increase the child's motivation to partake in the activity. Books included colorful images of target vocabulary, text in the child's area of proximal development for comprehension, high interest and appropriate vocabulary, and simple language. Pictello, an educational iPad application for creating electronic books with personalized images and writing, was used to create these books. Participants also received funding for Pictello and were given the option to access the books electronically via Pictello. All participants chose to use the hard copy of the book instead (Wendelken, 2022).

Prior to the study, the investigator pre-programmed the TouchChat application onto iPads to be used in the study. The investigator programmed one vocabulary page (25-button grid size) with vocabulary words that corresponded to each of the individualized books in the study. The words on the vocabulary pages included relevant names, objects, locations, adjectives, and actions. Participants each were provided with 10 vocabulary pages included 25 buttons. Further information about the materials in this study can be found in Wendelken (2022).

Procedure

All data in this study was video recorded. During the baseline phase, caregivers were directed to read the books they received with their child with the AAC device present, as well as to normally interact with their child. After baseline measurements were recorded, caregivers were sent the link to the online SO(A)R training and were directed to complete the training and send proof of the completion certificate. Following the same procedure as baseline, post-intervention measures were recorded through instructing caregivers to guide their children through the books prepared for the study. During these sessions, caregivers were instructed to use the SO(A)R strategy during the story-telling activity. This data was also collected via video recordings (Wendelken, 2020). Further information of study procedures can be found in Wendelken (2020).

Data Analysis

Variables

The independent variable in this study is the SO(A)R training videos which parents watched. The data of parents engaging in storybook reading with their children were recorded at baseline before parents engaged in SO(A)R training, as well as at a post-intervention phase, after parents completed the SO(A)R training.

The dependent variables of interest in the original Wendelken (2022) study included the parent use of skills taught within the SO(A)R strategy: modelling, expectant delay, pointing, hand-over-hand (HOH) prompting, and contingent responding. Dependent variables for the current study included those, as well as child responses to each behavior. Additionally, the current study included nine additional caregiver prompting behaviors (“WH” questions, “WH”

questions + point, “WH” questions + HOH, spoken directives, spoken directives + point, spoken directives + HOH, “other” spoken prompts, “other” spoken prompts + point, “other” spoken prompts + HOH) and child responses to these prompting behaviors. Implementation of the SO(A)R strategy accounts for any changes recorded in these dependent variables; the training influenced parent prompting which consequently influenced child responsivity.

Transcriptions

Transcriptions were created for all data videos in Wendelken (2022). Behaviors related to the activity for both the caregivers and the children were written into the transcription, including speech, AAC button selections, pointing to the book or device, or any manual prompting. Inter-observer agreement checks were completed by two research assistants to confirm accuracy of the transcription content. Further information on the development of transcriptions for video data can be found in Wendelken (2022).

Data Coding

Coding was completed directly on the transcripts for the dependent variables. Thirteen caregiver prompting behaviors were coded in the transcripts, as well as child responses to each specific prompting behaviors. The four behaviors included were those taught to parent by the SO(A)R strategy: modelling, expectant delay, pointing, and hand-over-hand assistance. The additional nine behaviors were prompting behaviors which were not included in the SO(A)R strategy but were used frequently by parents to elicit a response from their child using the AAC device.

These nine prompting behaviors which were coded but were not taught to parents in the SO(A)R strategy were “WH” questions, “WH” questions combined with a point prompt, “WH”

questions combined with hand-over-hand prompting, spoken directives, spoken directives combined with a point prompt, spoken directives combined with hand-over-hand prompting, “other” spoken prompts, “other” spoken prompts combined with a point prompt, and “other” spoken prompts combined with hand-over-hand prompting. The category of “other” spoken prompts was created because these behaviors were used by caregivers to elicit a response from their child, but were not implemented frequently enough to given an individual category. Four specific behaviors were classified in the “other” category: yes/no questions, cloze sentences, spoken models, and choice questions. The operational definitions for each of the thirteen parent prompting behaviors and for the child response to each behavior can be found in Table 3.

On the same sheet as the operationalized definitions for the thirteen prompting behaviors, five notes about how to accurately code the videos were included. These notes were: 1) All child communication behaviors are counted as in response to the parent behavior that occurred DIRECTLY BEFORE. For example, if the parent engages in 5 communicative behaviors in a row and then the child communicates, the child's response is a direct result of the parent's FIFTH communicative behavior. Exceptions to this rule are only made in the event that a parent behavior follows the pattern of Spoken Behavior (wh, spoken, or other) and then Expectant Delay/Opportunity; 2) All behaviors are only to be recorded DURING the storytelling activity. Side conversations, or the parent trying to get the child's attention do NOT count as communication behaviors - only code while they are engaged in reading the story. Also NOT counting any rhetoric, playful questions ("who's a smarty pants?"); 3) ONLY include child communication using the device. NO spoken utterances from the child are included; 4) If a child communicates the same button over and over, only ONE button press is counted. If the parent engages in HOH prompt but accidentally presses multiple buttons while guiding the child to the

correct button, only the CORRECT button is counted; 5) If the child communicates but it is NOT in response to one of the parent behaviors, this does not count as a response. For example, if the parent reads from the book and does not model but the child communicates, this is NOT counted as a child response. Child communication is only coded when it is a response to the caregiver.

Table 3: Operational Definitions for Parent and Child Communication Behavior

Behavior	Parent Communication Behavior	Child Response
Modelling	Parent models use of device to PROMOTE child response. The parent pressing a button while reading is modelling. The parent CONFIRMING/RESPONDING to a child's button press (parent uses the device after the child, not meant to prompt more communication from the child) is NOT Modelling behavior.	Child communicates using AAC immediately after parent models use of the device.
Expectant Delay/Opportunity	Any parent pausing/waiting during STORYTELLING activity for a minimum of 3 seconds.	THIS ONLY COUNTS FOLLOWING A MANUAL PROMPT WITHOUT SPEAKING *(modelling, prompt, HOH)*. If the parent uses a MANUAL PROMPT, pauses for a minimum of 3 seconds, and THEN the child responds, the child's response is a result of the expectant delay. IF THERE IS ANY PAUSE FOLLOWING A SPOKEN PROMPT (*wh question, spoken directive, "other" category question)*, the child's response is a result of the spoken prompt, NOT THE EXPECTANT DELAY. parent speaks + waits, child response = to the speech. parent prompts WITHOUT speech + waits, child response = to the delay

Prompt (Point)	Parent prompts child to communicate using the device through pointing to a specific button on the device	Child communicates with device after parent points to device
Prompt (HOH/Manual)	Parent physically moves child's hand/arm to press a button on the device	Child presses button as a result of being physically prompted by parent
"WH" Question	Parent asks child a "wh" question during storytelling activity. Examples: "Where's mom?," "Who's that?," "What color?"	Child presses a button on the device in a direct response to the parent asking a "wh" question
"WH" Question + Point	Parent asks child a "wh" question during storytelling activity WHILE pointing to the device	Child communicates with device immediately after parent uses combination of a spoken "WH" question and a pointing prompt
"WH" Question + HOH	Parent asks child a "wh" question during storytelling activity WHILE moving the child's hand/arm to the device	Child communicates with device immediately after parent uses combination of a spoken "WH" question and a HOH prompt
Spoken Directive	Parent promotes child communication through VERBALLY DIRECTING the child to respond using the device. "show me on here," "press mom"	Child communicates with the device as a direct result of parent VERBALLY DIRECTING child to press a button the device
Spoken Directive + Point	Parent promotes child communication through VERBALLY DIRECTING the child to respond using the device. "show me on here," "press mom" AND physically prompting the child by POINTING	Child communicates after the parent VERBALLY DIRECTING the child to respond using the device. "show me on here," "press mom" AND physically prompting the child by POINTING

Spoken Directive + HOH	Parent promotes child communication through VERBALLY DIRECTING the child to respond using the device. "show me on here," "press mom" AND physically prompting the child by HOH PROMPT (making contact with	Child communicates after the parent VERBALLY DIRECTS the child to respond using the device. "show me on here," "press mom" AND physically prompting the child by HOH PROMPT (making contact with the child's hand)
Other Spoken Prompt	OTHER BEHAVIORS INCLUDE: yes/no questions ("do you see mom?", "can you show me mom?"), clozed sentences (parent begins a sentence and then trails off, promoting the child to complete the sentence), spoken model (parent produces target word in ISOLATION to try and get the child to respond using the device), and choice questions ("do you want ____ or _____"). ALL of these behaviors are considered "other" - do not have to indicate in final totals.	Child presses a button on the device in a direct response to the parent asking one of the questions categorized as "other" (yes/no questions, clozed sentences, spoken model, choice questions). Do not have to indicate type of "other" question in final totals.
Other Spoken Prompt + Point	Parent promotes child communication through using one of the "other" questions AND physically prompting the child by POINTING to the device/ a button	Child communicates with the device as a direct result of parent using a spoken directive categorized as "other" and pointing

Other Spoken Prompt + HOH	Parent promotes child communication through using one of the "other" questions AND physically prompting the child with a HOH Prompt.	Child communicates with the device as a direct result of parent using a spoken directive categorized as "other" and a HOH Prompt.

The transcripts were coded using a color-coding scheme. Each of the parent prompting behaviors were assigned a specific color and the corresponding child response to the prompt was assigned a lighter shade of the color. Each line in the transcript where a defined prompting behavior or child response occurred was highlighted in the corresponding color. For instance, caregiver "WH" questions were coded in dark green, child responses to "WH" questions were coded in light green, caregiver pointing was coded in pink, and child responses to pointing were coded in pink. For the combination prompts which included a spoken prompt as well as a physical prompt, the row was highlighted in the color of the spoken prompt and the text was changed to the color of the physical prompt. Therefore, if a parent used the "WH" prompt and pointing combination, the coding for this row would be highlighting the whole row in dark green and changing the text to pink. A child response to the "WH" prompt and pointing combination would be highlighting the row in light green and making the text light pink. Once a transcript was completely color-coded for all behaviors, the totals for each prompting behavior and response were calculated below the transcription.

Reliability Coding

Two research assistants were trained to complete inter-observer coding. Both research assistants were given access to an Excel sheet with the operationalized definitions for behaviors, the color-coding scheme, and the additional notes about coding. The primary investigator met individually with both research assistants to explain the operationalized definitions, as well as to provide video examples of about 10 seconds to demonstrate the behaviors in the videos.

Research assistants also completed coding for three training videos, which were shortened clips of video data, averaging 2:28 each. These videos were selected because they had a high quantity of prompting behaviors and would give research assistants an opportunity to

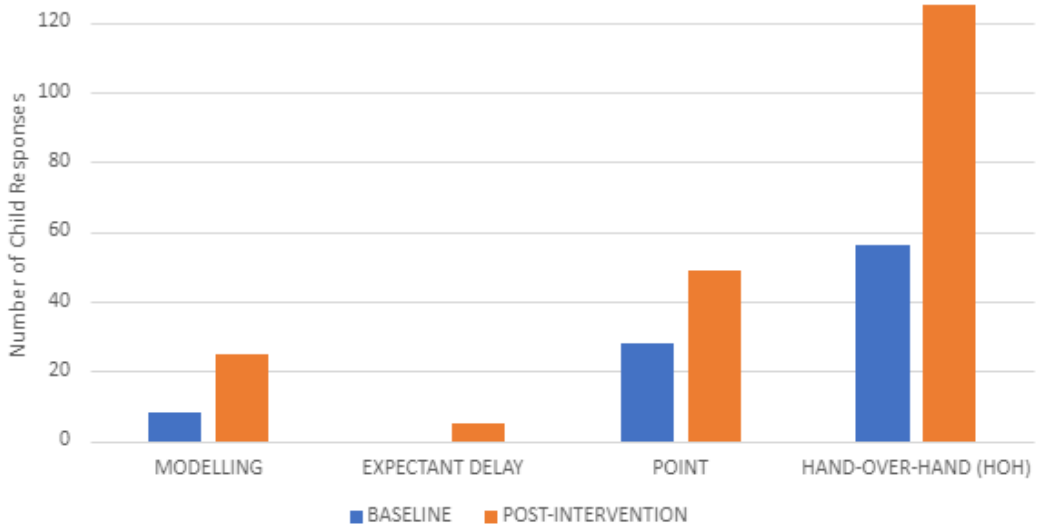
work with these videos and transcripts before coding information data to be included in the final study. Research assistants were instructed to have the operationalized definitions available while completing this coding. Research assistants completed the training videos with an initial agreement of 90%. After discussion, a 100% agreement was reached between both research assistants and the primary investigator. Additional meetings were held to review reasons for discrepancies on the training videos.

Research assistants completed inter-observer agreement checks for coding parent prompts and child responses for 20% of videos recorded at baseline and 20% of videos recorded at post-intervention. Videos were selected and assigned randomly. Twenty-eight videos were recorded across all 5 dyads at baseline; 6 of these videos were coded by research assistants. Thirty-three videos were recorded across 5 dyads at post-intervention; 7 of these videos were coded by research assistants. Similarly to the procedure for the training videos, research assistants were instructed to have the operationalized definitions for behaviors accessible while completing the coding. Reliability coders completed the coding with an initial agreement of 95%, which became a 100% agreement upon discussion

Chapter 3: Results

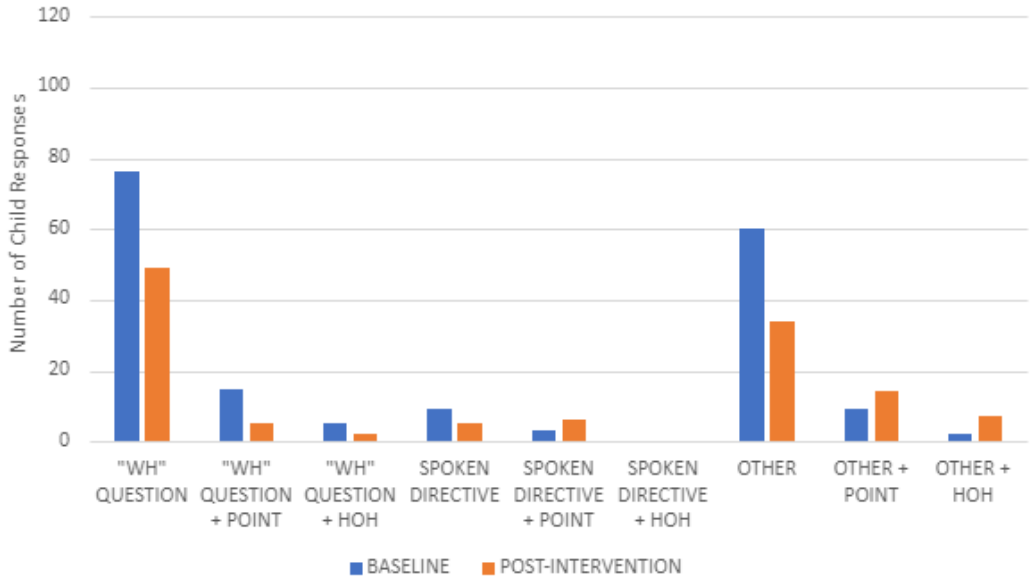
When examining the combined number of responses for all five child participants, child response rates to all four behaviors taught by the SO(A)R strategy (modelling, expectant delay, pointing, and hand-over-hand) increased from baseline to post-intervention. Therefore, after caregivers completed the SO(A)R training, children responded to a higher quantity of these specific prompting behaviors. The combined data of all five child participants shows that children responded to 8 models, 0 expectant delays, 28 points, and 56 hand-over-hand prompts at baseline. At post-intervention, however, these quantities increased to responses to 25 models, 5 expectant delays, 49 point prompts, and 121 hand-over-hand prompts. The results of child responses to SO(A)R behaviors by parents during baseline as compared to post-intervention are summarized in Figure 2, where the sum of child responses to these behaviors across all 5 child participants are recorded.

Figure 2: Number of Child Responses to SO(A)R Behaviors by Parents during Baseline vs Post-Intervention



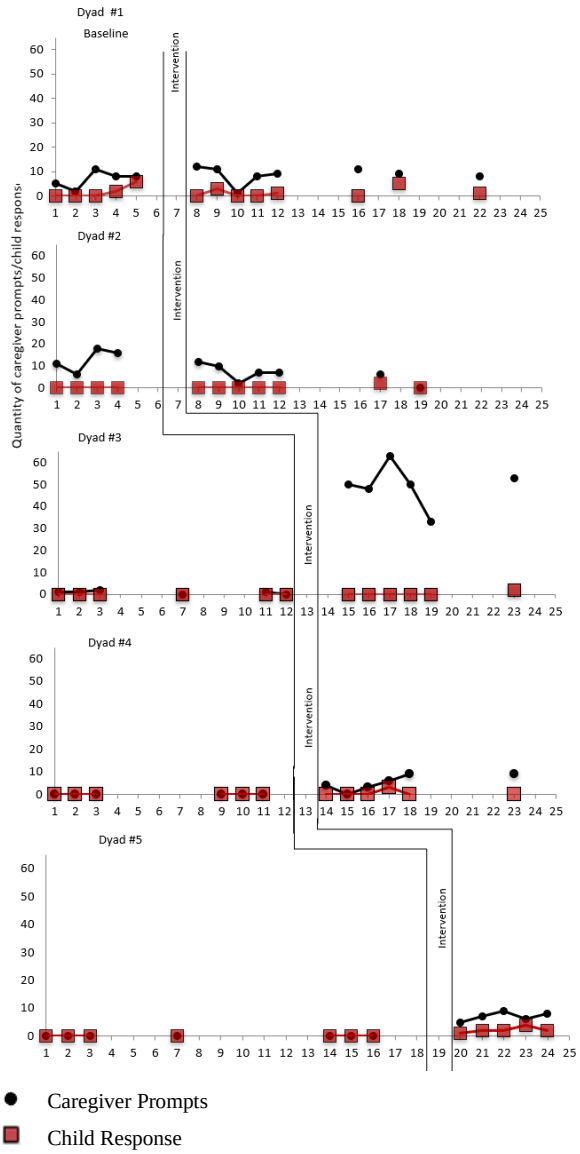
Child responses to the nine caregiver prompting behaviors that caregivers were not taught by the SO(A)R strategy can also be compared at baseline and post-intervention. When examining the sum of child responses across all 5 child participants, there was a decrease in the quantity of child responses to all “WH” questions, including “WH” questions asked without any physical prompt, “WH” questions asked with a pointing prompt, and “WH” asked with a hand-over-hand prompt following intervention. Data also shows that children responses to spoken directives given in isolation decreased following intervention, while child responses to spoken directives combined with a point prompt increased following intervention. There was no change for child responses to the combination of a spoken prompt and a hand-over-hand prompt; all children in this study responded to this prompt zero times across baseline and post-intervention measures. Child responses to the “other” spoken prompts operationalized in this study decreased following intervention, while child responses to “other” spoken prompts combined with pointing, as well as “other” spoken prompts combined with a hand-over-hand prompt decreased following intervention. Figure 3 summarizes the quantity of child responses to the non-SO(A)R behaviors; the sum of child responses across all 5 child participants are recorded here.

Figure 3: Number of Child Responses to Non - SO(A)R Behaviors by Parents during Baseline vs Post-Intervention



The caregiver participants in Dyads 1 and 2 used a consistent amount of modelling at baseline and post-intervention. There was no change observed in the quantity of responses to modelling from baseline to post-intervention for the child participant in Dyad 1. The child participant in Dyad 2 responded to 0 modelling prompts during every session, except for one post-intervention session, where this child responded to 2/6 modelling prompts. The caregiver participants in Dyads 3, 4, and 5 demonstrated an increase in modelling from baseline to post-intervention. The largest increase was in Dyad 3; the caregiver used modelling an average of 0.8 times per session at baseline and an average of 49.5 times per session following intervention. Child participants in Dyads 3, 4, and 5 did not respond to any modelling prompts at baseline and all demonstrated an increase in responses during post-intervention. Figure 4 shows the number of times parents used modelling during session and the number of times children responded to modelling during baseline as compared to post-intervention.

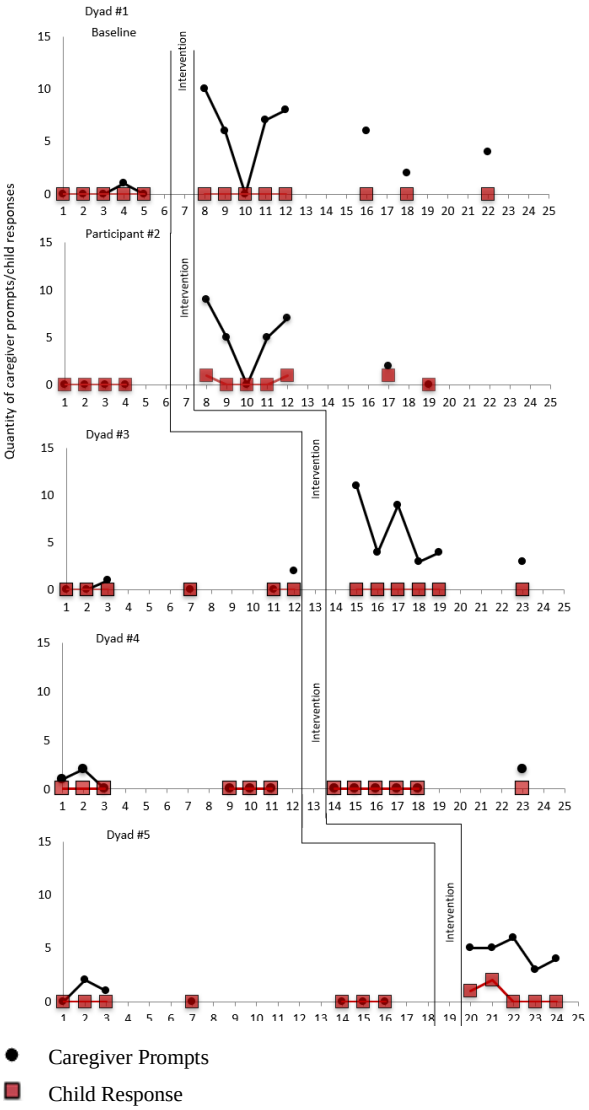
Figure 4: Number of times caregivers used modelling and children responded to modelling



The amount of expectant delays used by caregivers and the amount of child responses to expectant delays during baseline and post-intervention are shown in Figure 4. The caregiver participants in Dyads 1, 2, 3, 5 increased the number of expectant delays provided during sessions at post-intervention than at baseline. Children in Dyads 1 and 5 responded to more expectant delays at post-intervention than at baseline, while children in Dyads in 2 and 3

demonstrated no change in the quantity of responses to expectant delay. In Dyad 4, caregiver integration of expectant delays decreased from baseline to post-intervention and the child in this dyad never responded to any expectant delays.

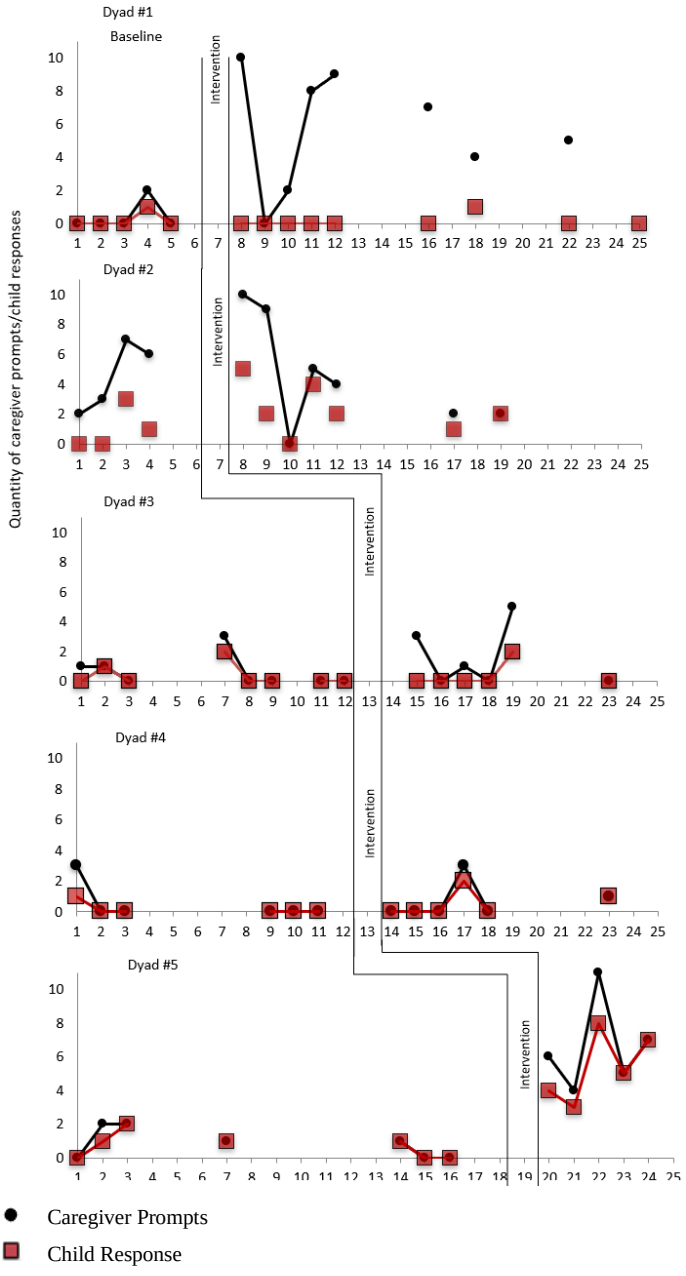
Figure 5: Number of times caregivers used expectant delays and children responded to expectant delays



Across all five caregiver participants, there was an increase in pointing behavior from baseline to post-intervention. Child participants also demonstrated an increase in responses to pointing from baseline to post-intervention, except for the child participant in Dyad 1, who

showed no change in the number of responses to parent pointing. Results of parent pointing and child response to pointing at baseline and post-intervention are shown in Figure 6.

Figure 6: Number of times caregivers used pointing prompt and children responded to point prompt

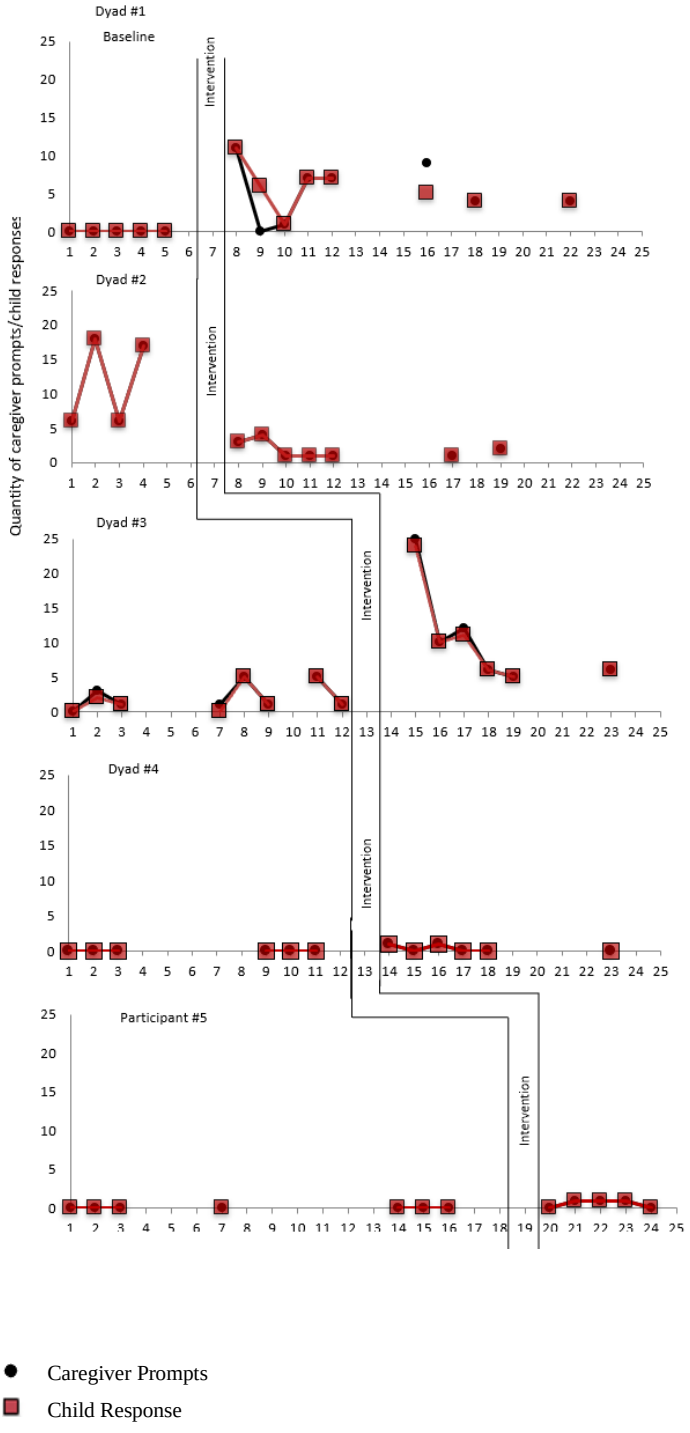


For caregivers and children in Dyads 1, 3, 4, and 5, there was an increase in hand-over-hand prompting by caregivers and responses to hand-over-hand by children from baseline to

post-intervention. There was a decrease in the amount of hand-over-hand prompting from baseline to post-intervention used by the caregiver in Dyad 2 as well as a simultaneous decrease in child responses to hand-over-hand prompting. The quantity of caregiver hand-over-hand prompting and child responses to hand-over-hand prompting at baseline and at post-intervention are summarized in Figure 7.

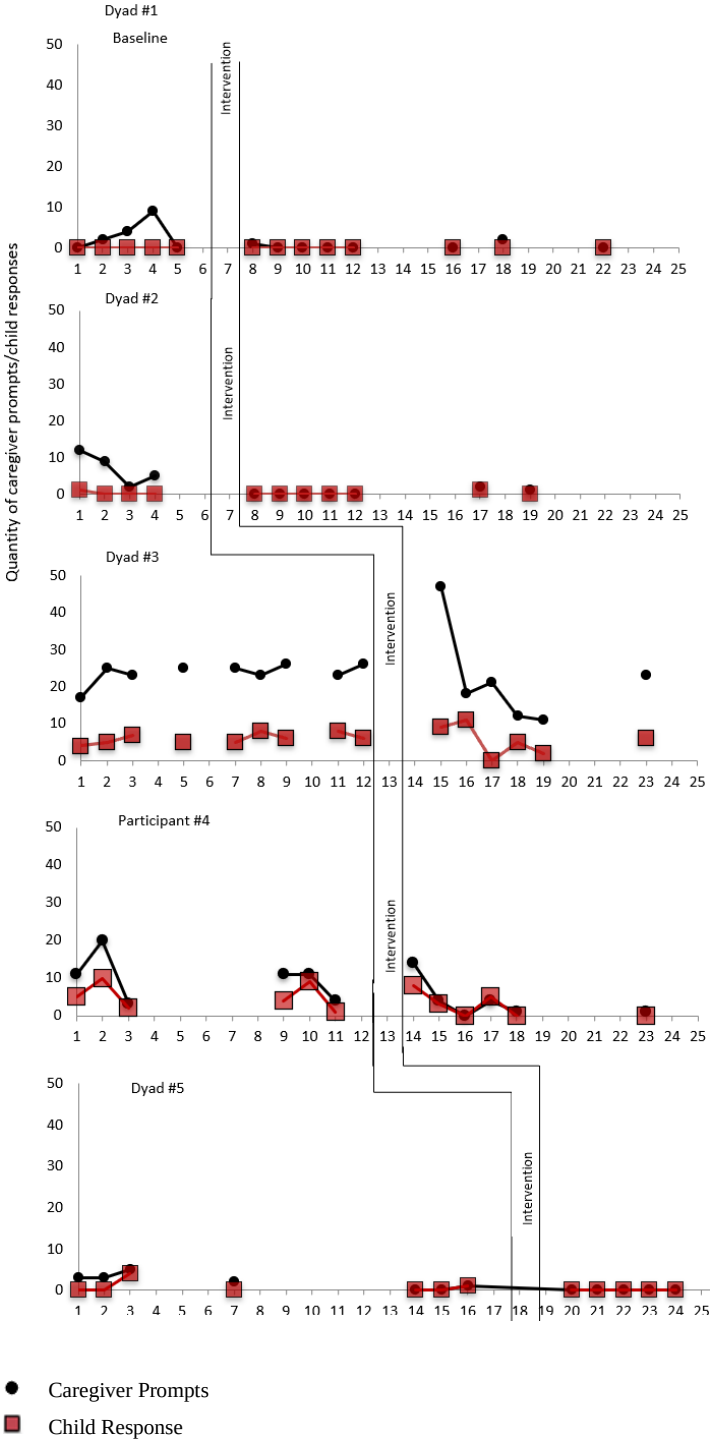
In a majority of the instances where a caregiver used a hand-over-hand prompt, the child responded to the hand-over-hand prompt. This is due to the nature of this type of manual prompt; the caregiver would physically guide the child's hand towards a button press. However, this pattern of prompt and response deviated in a few instances. For instance, the child would sometimes pull away from their caregiver's hand-over-hand prompt. This is visually represented by data such as in Session 9 for Dyad 1. On other occasions, the parent would use one prompt to bring the child's hand towards two buttons. This would lead to a higher amount of child responses than parent prompts, as graphically demonstrated in Session 16 for Dyad 1.

Figure 7: Number of times caregivers used hand-over-hand prompting and children responded to hand-over-hand prompting



The caregivers in Dyads 1, 2, 3, and 5 asked their child less “WH” questions during storybook reading at post-intervention sessions than at baseline sessions. Therefore, the children in these four dyads responded to a decreased amount of WH” questions at post-intervention than during baseline. The caregiver in Dyad 4 also asked a decreased amount of “WH” questions at post-intervention as compared to baseline, with the exception of one post-intervention session. At baseline, this caregiver asked an average of 10 “WH” questions per session. This average decreased to about 4 “WH” questions at post-intervention, but this caregiver asked 14 “WH” questions during the first post-intervention sessions, making these results different than that of the other four dyads. There was no change in the number of “WH” questions that the child participant in Dyad 4 responded to. The number of caregiver “WH” questions and child responses to “WH” questions at baseline and at post-intervention are summarized in Figure 8.

Figure 8: Number of times caregivers used "WH" Questions and children responded to "WH" Questions



The combination prompt of "WH" questions and pointing, as well as the combination prompt of "WH" questions and hand-over-hand prompting were also defined as dependent variables of this study. Minimally significant results were recorded for both of these behaviors because caregivers typically did not integrate these prompting behaviors. The greatest amount of "WH" questions and pointing used by a caregiver during a single session was 5 times and the greatest amount of "WH" questions and hand-over-hand prompting used by a caregiver during a single session was 3 times. Therefore, children did not have many opportunities to respond to these behaviors.

For "WH" questions and pointing, there was a decrease in the amount of times caregivers integrated this prompt from baseline to post-intervention for the caregiver participants in Dyads 1, 2, and 5. These caregivers use this prompt a few times as baseline and then eliminated it following intervention. The child in Dyad 1 did not respond to this prompt during any session and the children in Dyads 2 and 5 showed a decrease in response to this prompt at post-intervention. Caregivers in Dyads 3 and 4 used this prompt a few times at both baseline and intervention. The child in Dyad 3 did not demonstrate any change in the number of responses to this prompt throughout sessions. The child in Dyad 4 demonstrated a decrease in the number of responses to the combination prompt of "WH" questions and pointing. The results for parent use of "WH" questions and pointing and the child responses to this behavior at baseline and post-intervention are demonstrated in Figure 9.

The caregivers in Dyads 4 and 5 did not use "WH" question and hand-over-hand prompting together during any session; therefore, child participants in these dyads never had the opportunity to respond to this prompt. Caregivers in Dyads 2 and 3 used this combination prompt a few times at baseline but did not use it at all during post-intervention. Child responses for these

two dyads simultaneously decreased. The caregiver in Dyad 1 demonstrated a slight increase of this behavior from not using at all during baseline to using it once during three post-interventions sessions. Responses from the child in this dyad also increased. Figure 10 depicts the results for the combination of “WH” question and HOH prompting.

Figure 9: Number of times caregivers used combination prompt of "WH" Questions and pointing and children responded to combination prompt of "WH" Questions and pointing

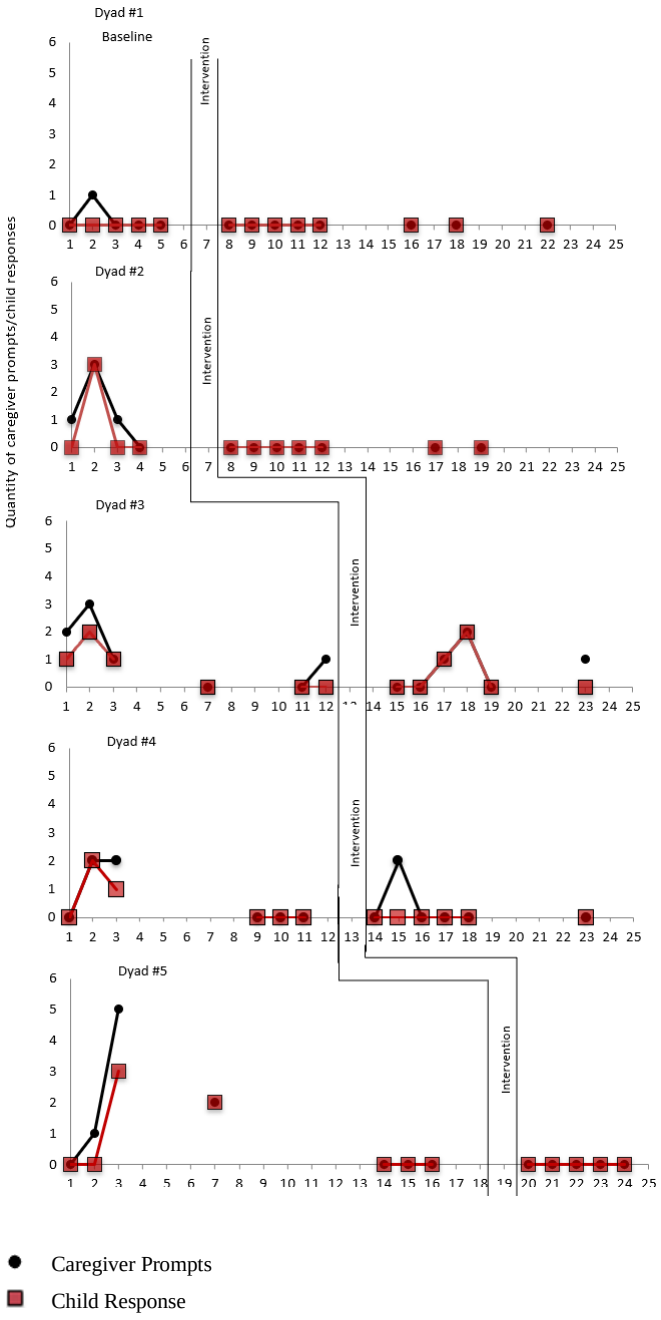
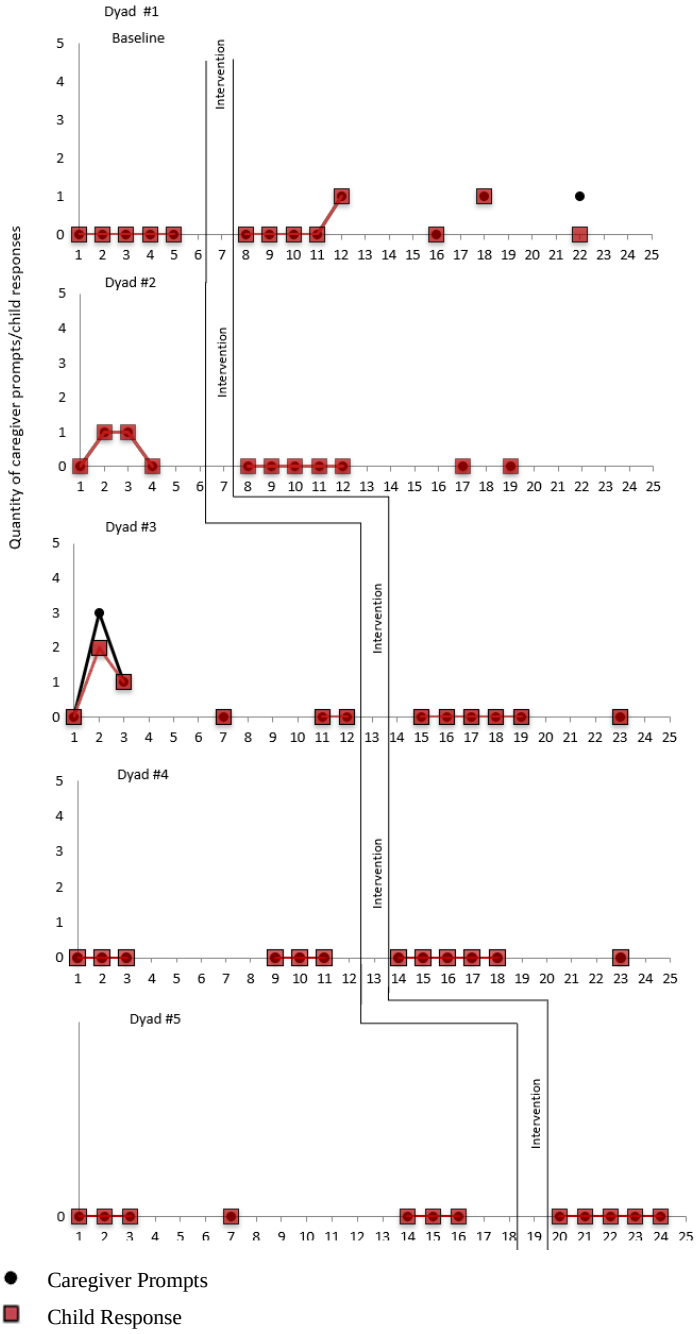


Figure 10: Number of times caregivers used combination prompt of "WH" Questions and HOH and children responded to combination prompt of "WH" Questions and HOH

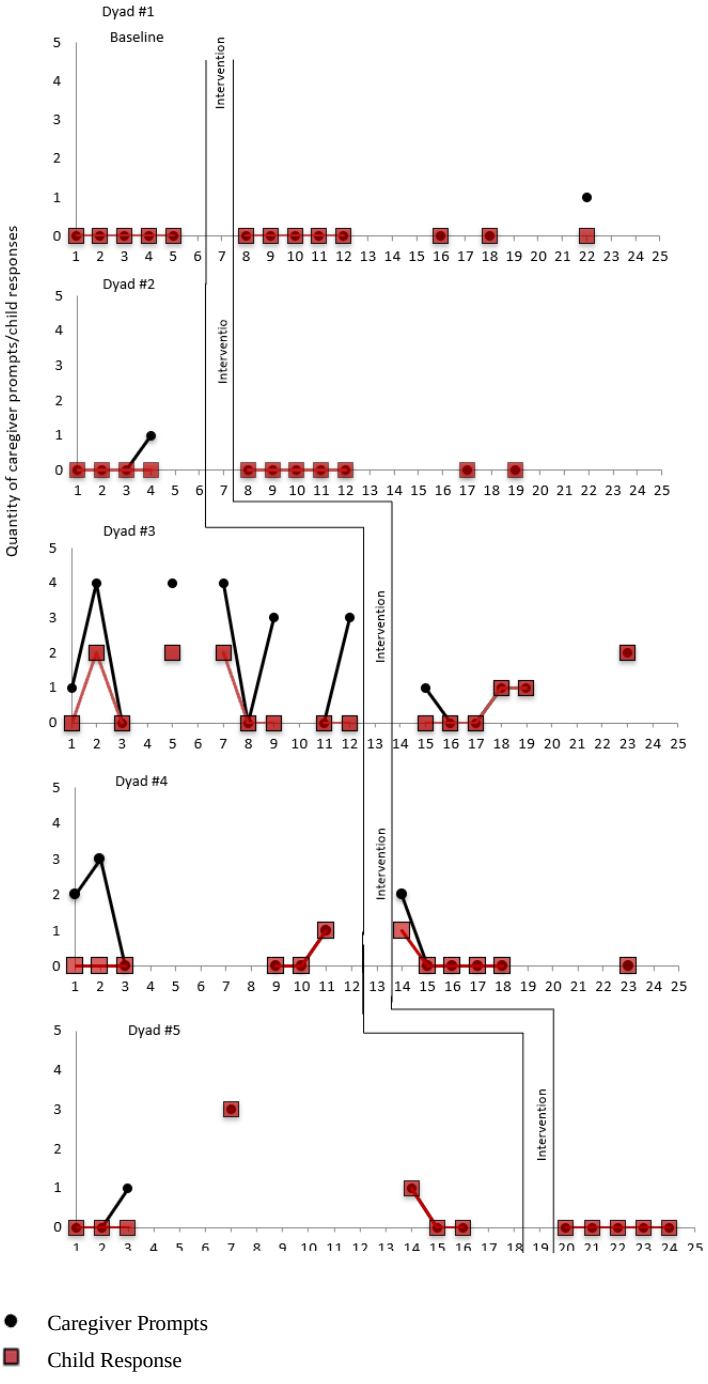


Spoken directives were used the least by caregivers out of all other spoken prompts operationalized by this study, including when combined with a point or a hand-over-hand

prompt. Spoken directives used in isolation increased from baseline to post-intervention for the caregiver participant in Dyad 1 and decreased for the other four caregiver participants. Two child participants (Dyads 1 and 2) never responded to this prompt, two child participants (Dyads 3 and 4) demonstrated no change in the number of responses to this prompt from baseline to post-intervention, and one child participant (Dyad 5) responded to this prompt a few times at baseline, but did not have any opportunities following intervention. The results for spoken directives used in isolation are not highly significant; the highest quantity of spoken directives during one session was 4 times. Figure 11 demonstrates the results for spoken directives by caregiver and child participants at baseline and post-intervention.

The combination of spoken prompts and pointing did not lead to any significant results; the maximum amount of times that a caregiver used this prompt during a session was 2. There are also no significant findings for the combination prompt of spoken directive and hand-over-hand prompting; none of the caregiver participants ever integrated this combination prompt.

Figure 11: Number of times caregivers used spoken directives and children responded to spoken directives



Across four caregiver participants (Dyads 1, 2, 3, 4), prompting behaviors operationalized as “other” spoken prompts were used consistently before and after intervention. The caregiver in Dyad 5 used these behaviors slightly less at post-intervention than at baseline. All five child participants did not demonstrate any change in quantity of responses to “other” spoken prompts when provided the opportunity. Four child participants (Dyads 2, 3, 4, 5) responded relatively consistently to these prompts, while one child participant (Dyad 1) never responded to “other” spoken prompts. See Figure 12 for the results of caregiver use and child response to “other” spoken prompts before and after intervention.

Caregivers in three dyads (Dyads 1, 2, and 4) used the combination prompt of “other” spoken prompts and pointing at an increased rate following intervention and their child participants demonstrated an increase in response to this prompt. In the other two dyads (3 and 5), caregivers used this combination prompt less and child responses to this prompt decline. Figure 13 shows the caregiver use of the combination prompt of “other” spoken prompts and pointing and the child response to these behavior at baseline and post-intervention.

Caregivers in Dyads 3, 4, and 5 did not use the combination of “other” spoken prompts and HOH prompting during any session. The caregiver in Dyad 2 used this combination prompt consistently throughout sessions. The caregiver in Dyad 1 did not use this combination prompt at baseline but did integrate this combination from following intervention. Child responsivity followed the same pattern as caregiver integration due to the manual nature of this prompt. Results for caregiver use and child response to the “other” spoken prompt and HOH combination are summarized in Figure 14.

Figure 12: Number of times caregivers used “other” spoken prompt and children responded to other spoken prompt

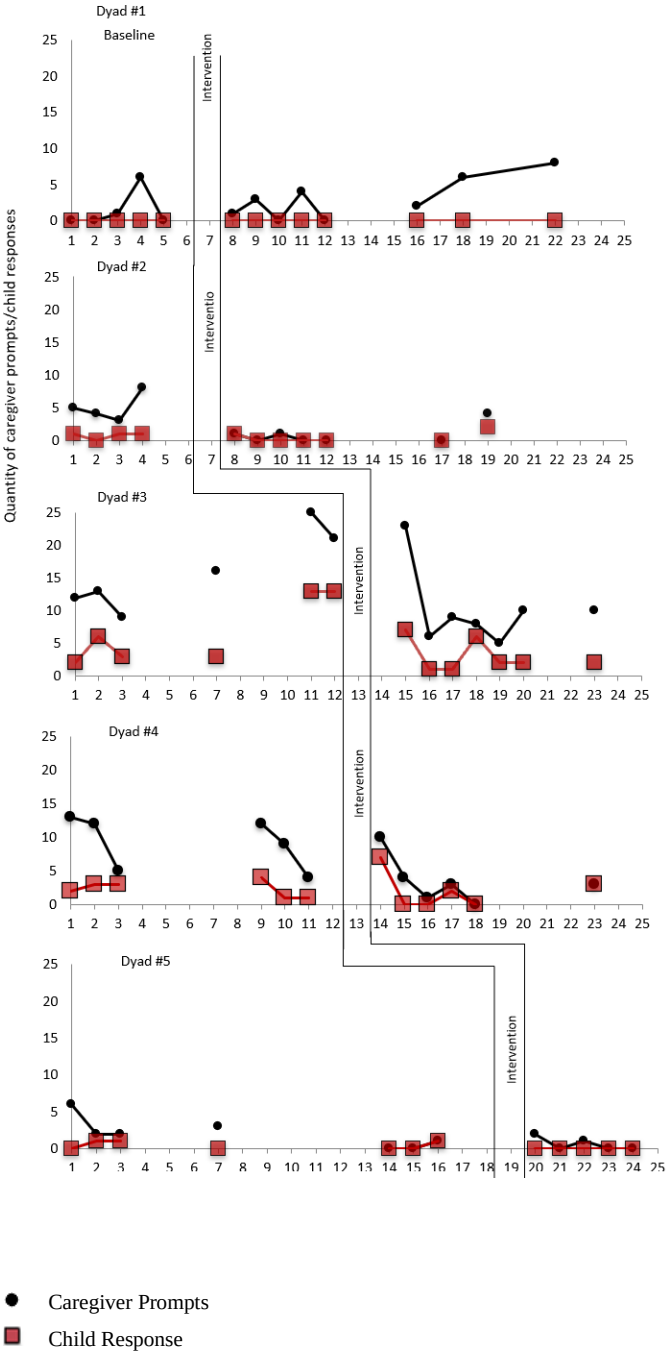


Figure 13: Number of times caregivers used combination prompt of "other" spoken prompt and pointing and children responded to combination prompt of "other" spoken prompt and pointing

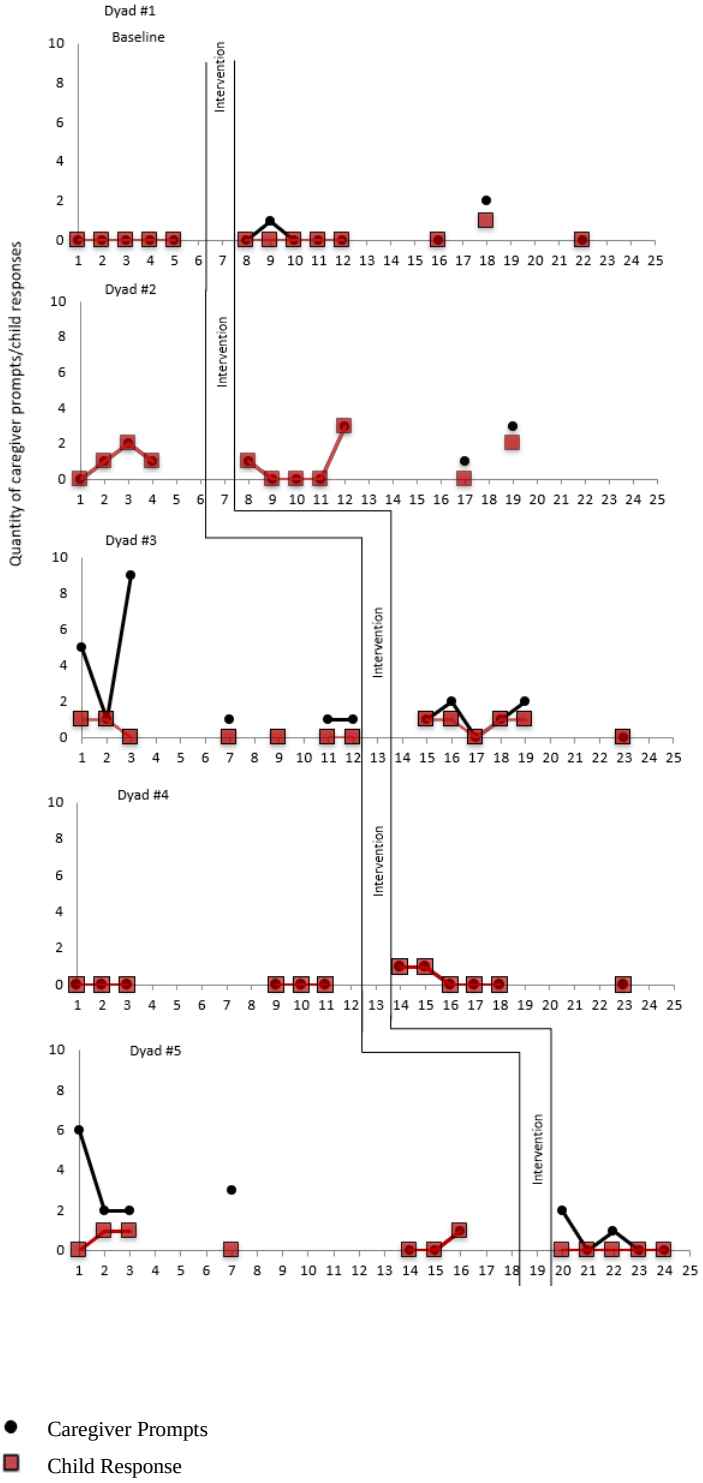
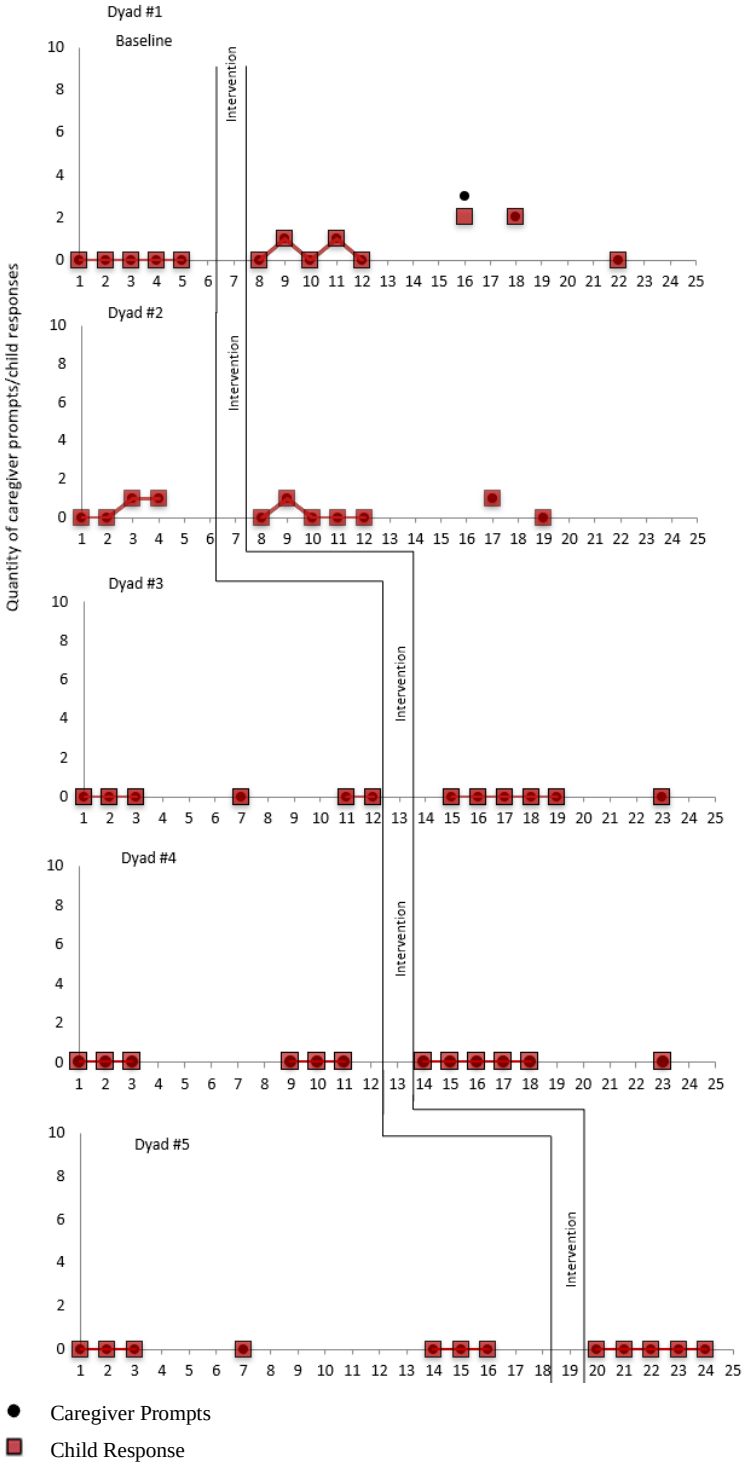
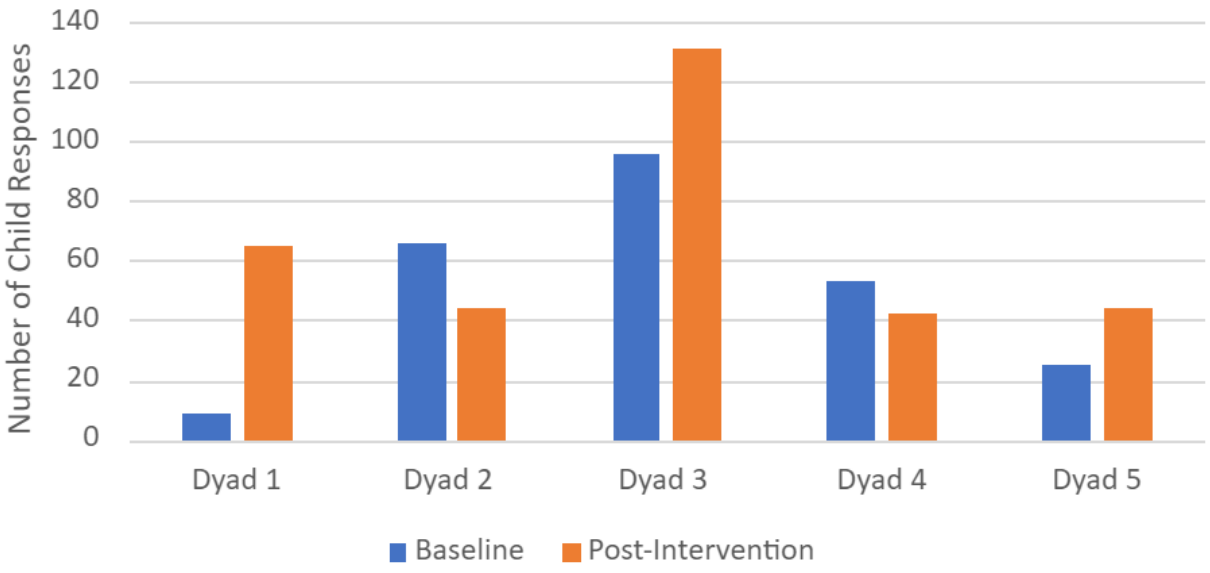


Figure 14: Number of times caregivers used combination prompt of "other" spoken prompt and HOH prompting and children responded to combination prompt of "other" spoken prompt and HOH prompting



When comparing overall response rates before intervention and after intervention across all thirteen prompting behaviors operationalized by this study, three out of five child participants (Dyads 1, 3, and 5) responded to more prompts after intervention. The child participants in Dyads 2 and 4 demonstrated a decrease in response to caregiver prompting. The greatest change in child responsivity from baseline to post-intervention was observed in the child in Dyad 1, who responded to a total of 9 prompts during baseline and a total of 65 prompts during post-intervention sessions. The results for the changes in response to prompting for each child participant from baseline to post-intervention are shown in Figure 15.

Figure 15: Quantity of Child Responses at Baseline vs Post- Intervention Across all Prompting Behaviors



Chapter 4: Discussion

Changes in Child Responsivity

Majority of the child participants in this study responded to more prompting behaviors following intervention, providing evidence that the SO(A)R strategy is effective in increasing child communication of children with ASD learning to use AAC. Two child participants in this study, Dyad 2 and 4, however, responded to less prompts at post-intervention than at baseline.

The decrease in quantity of responses for the child participant in Dyad 2 is most likely related to a decrease in use of the hand-over-hand prompt by the caregiver following intervention. When accurately implementing the SO(A)R strategy, hand-over-hand prompting is to be used as the final prompting behavior to elicit child communication, after modelling, pausing, and pointing. The caregiver in Dyad 2 used a lot of hand-over-hand prompting at baseline, especially during sessions 2 and 4, but this was reduced at post-intervention. The child in this dyad responded to every hand-over-hand prompt and never pulled away from this manual prompt. Therefore, the decrease in responses from the child in Dyad 2 from baseline to post-intervention is most likely a result of the parent properly integrating the SO(A)R strategy and is not an indicator that this participant's communication skills decreased. Additionally, the child in this dyad also communicated spontaneously with the device during sessions. This study is focused only on child response to explicitly defined parent prompting; independent communication is not included. By reducing the number of manual hand-over-hands, the caregiver in Dyad 2 potentially gave the child more opportunities to communication spontaneously, which leads to benefits regarding this child's communication. Therefore, the decrease recorded in this child's quantity of responses to caregiver prompting from baseline to

post-intervention is due to beneficial changes within the interactions between this child and caregiver.

The child participant in Dyad 4 was the only other child who responded to less prompts following intervention. In addition to having a decrease from baseline to intervention in terms of response rate, the changes in this child's quantity of responses were less than that of all other child participants. The child in Dyad 2 responded to 53 prompts at baseline and 42 prompts at post-intervention; this change is lower than that of all other child participants. The decrease in responses for the child in Dyad 2, as well as the minimal change in responsivity following intervention, can be explained by the prompting opportunities provided by the caregiver. Compared to the other four caregiver participants, the caregiver in Dyad 4 implemented the lowest quantity of all four SO(A)R behaviors (models, expectant delays, pointing, hand-over-hand prompts) across baseline and post-intervention sessions. Therefore, the results regarding this child's quantity of responses is most likely due to a lack of opportunities to respond. Additionally, according to Wendelken's (2022) results, this caregiver responded to child's communications attempts less often than the other caregivers following intervention. This could be another reason for the decrease and minimal change in responses for the child in Dyad 4; this child was being responded to less and potentially did not have the opportunity to learn that his communication via AAC was meaningful.

Prompting Behaviors

The only independent variable in this study is the asynchronous online training to teach the SO(A)R strategy. Therefore, all changes recorded in the dependent variables (quantity of caregiver prompting and quantity of child responses to prompting) from baseline to post-

intervention are related to introduction of the SO(A)R strategy. When examining the sum of responses from all child participants in this study, there is a clear increase to the prompting behaviors taught to caregivers by the SO(A)R strategy, as shown in Figure 1. Therefore, caregiver engagement in the SO(A)R strategy is effective in increasing the quantity of responses of children with ASD learning to use AAC. This increase in child responses to all four SO(A)R behaviors is most likely a result of parents integrating these specific behaviors more often, allowing child participants to have increased opportunities to these behaviors. Other potential explanations for the increase in child responses to all four SO(A)R behaviors during post-intervention are that constant caregiver integration of SO(A)R behaviors supported child participants in understanding how to use their AAC device, as well as that their communication via AAC is meaningful. One aspect of the SO(A)R strategy was caregiver response to all child communication, through either confirming (pressing the same button) or expanding (2-button press) the child's message. This was meant to demonstrate to child participants that their communication was meaningful and to encourage further child responses. This behavior could have played a role in increasing child responses to SO(A)R behaviors following intervention.

When examining the combined sum for child responses to each caregiver prompting behavior at baseline, children responded the most to "WH" questions. At baseline, there were 76 child responses to "WH" questions. This statistic is even higher than the combined responses for all child participants at baseline to HOH, as child responded to 56 HOH prompts at baseline. This points to the efficacy of "WH" questions being asked in isolation in increasing child responsivity rates. However, the SO(A)R strategy did not include "WH" questions. Therefore, all caregivers (excluding Dyad 3) asked less "WH" questions from baseline to post-intervention. This decrease in opportunity to respond to "WH" questions led to a decrease in child responses

to “WH” questions. A decrease was also observed in child responsivity to “WH” questions combined with a point or with a HOH prompt for similar reasons of the parent decreasing use of this prompt.

As sessions progressed, the caregiver in Dyad 1 used an increased amount of “other” spoken behaviors, in isolation, when combined with a point prompt, and when combined with a HOH. All other caregivers used this behavior at a consistent or decreased rate as sessions progressed. Upon further analysis of the video data, the caregiver in this dyad mostly used yes/no questions, rather than the three other behaviors included in the “other” category. The child in Dyad 1 had the largest increase in responsivity from baseline to post-intervention, which could potentially be accredited to this caregiver’s use of “other” prompts, specifically yes/no questions. However, yes/no questions only allow for limited responses (yes or no) and are not highly supportive in leading to spontaneous and independent communication. Therefore, although yes/no questions led to higher responsivity for this particular participant during storybook reading, this may not always be an effective prompting behavior to increase child responsivity.

Limitations & Future Directions

Caregivers were to complete the SO(A)R training during the intervention phase of this study; comparisons between baseline and post-intervention are inaccurate if this intervention phase was completed inaccurately. Although participants were required to send a screenshot of their completion certificate to provide evidence of finishing the training, the software platform provided participants with the opportunity to fast-forward videos (this feature could not removed). This training was completed asynchronously and virtually because of the nature of the study; there is no evidence that participants did not use this feature. These sessions were not

proctored – which is beneficial as it provides caregivers with the opportunity to learn and practice at their own rates – however, completion of these trainings is based entirely on the integrity of participants. Additionally, completion of these trainings was entirely based on the integrity of participants. It is possible that caregivers did not fully engage with material or were distracted, which could influent the data and findings of this study (Wendelken, 2020).

Caregivers also had the ability engage in the training at their own time and could have potentially gone back to the training in between post-intervention sessions. This is a limitation of this study. There is no way of knowing how much time caregivers engaged in the training; this may have led to some differences within results in caregiver integration of SO(A)R behaviors, also consequently impacting child responsivity. A potential future direction could be instructing to caregiver's to review the training and then conducting more storybook reading sessions to see if this has further impact on child responsivity.

The findings of this study demonstrate the efficacy of "WH" questions being asked in isolation increase child responsivity rates. Therefore, future studies could potentially also incorporate "WH" questions and analyze if strategically including these types of questions into interactions with children learning to use AAC has any positive impact on communication rates. Caregivers were taught to use behaviors other than "WH" questions through SO(A)R, but future studies could examine the changes in quantity of child responses when caregivers are also taught to strategically integrate more "WH" questions into their interactions with their child with ASD learning to use AAC.

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ACADEMIC VITA

JULIA SULTANA

EDUCATION

Pennsylvania State University, Schreyer Honors College University Park, PA

- B.S. in Communication Sciences and Disorders Anticipated graduation: May 2023
- Minors: Psychology, Human Development and Family Studies

PENN STATE RESEARCH EXPERIENCE

Cognition and Language Learning Laboratory

Undergraduate Researcher – Honors Thesis August 2022 – Present

- Develop honors thesis project focused on connectiveness of caregiver communicative behaviors and communication of children with autism (ASD) using augmentative and alternative communication (AAC).
- Train and meet with undergraduate research assistants to create reliability coding.
- Meet weekly with supervisors to review project status.
- Attend and engage in weekly lab meetings focused on current projects and presentations.

Undergraduate Research Assistant January 2021 – August 2022

- Created reliability coding in project analyzing the effectiveness of asynchronous training in guiding caregivers to support children with ASD in using AAC devices during storybook reading activity.

Speech, Language, and Cognition Laboratory: Undergraduate Research Assistant Sept. 2021 – Dec. 2021

- Recorded acoustic analysis data of audio recordings of speakers with and without dysarthria secondary to amyotrophic lateral sclerosis in collaborative project with Penn State's Speech Production Laboratory.

Cole Emotional Regulation Laboratory: Undergraduate Research Assistant January 2020 – June 2021

- Collaborated on project analyzing emotional self-regulation of preschool-aged children and parents.
- Proficiently operated Continuous Affect Rating and Media Annotation (CARMA) software to develop ratings for 4 emotions across 84 videos, as well as participated in weekly consensus coding meetings.
- Created annotated bibliography of 37 relevant publications on childhood emotion and physiology.

WORK EXPERIENCE

Classroom & Job Exploration Assistant August 2022 – Present

Penn State WorkLink – State College, PA

- Support students with intellectual disabilities participating in postsecondary education through facilitating lessons on relevant topics, including self-advocacy, independent living, and interview etiquette.
- Serve as Job Coach to provide individualized support for students beginning on-campus internship positions.

Assistant Teacher/Program Support March 2022 – May 2022

The Goddard School – State College, PA

- Encouraged positive learning for children aged 6 months to 5 years while promoting classroom safety.
- Provided support for classroom teacher through supervising and leading activities.
- Recorded vital information about children's daily activities to be shared with caregivers through iPad system.

Residential Camp Counselor June 2021 – August 2021

Camp Sequoia – Pennsburg, PA

- Promoted successful emotional regulation and social development at a 6-week residential program for 7-17-year-old boys with ADHD, autism, social anxiety, and/or general learning differences.
- Served as a Program Lead during weekday routines, which involved planning and facilitating daily activities.
- Actively engaged in 2-week training on frustration tolerance and social cognition prior to camper arrival.

Pool Club Management Representative June 2020 – August 2020

Elite Management – Bayside, NY

- Engaged in hospitality at a pool club while implementing COVID-19 safety guidelines.

CAMPUS INVOLVEMENT

Harmony

Rehearsal Chair May 2022 – Present

- Provide individualized support to students with disabilities during inclusive theater rehearsals.
- Assign pairings between Harmony students and Penn State volunteers who will work well together.
- Professionally communicate with families to address any concerns and to ensure needs are being met.

Volunteer January 2020 – May 2022

- Promoted accessibility through engaging in inclusive theater organization for students with disabilities.

Penn State National Student Speech Language Hearing Association (NSSLHA)

Diversity Liaison May 2021 – Present

- Encourage attendance of NSSLHA members in volunteer opportunities which promote diversity, equity, and inclusion within Communication Sciences and Disorders (CSD), as well as share relevant resources.
- Plan at least one meeting per semester focused on diversity within our field, including inviting guest speakers.
- Administer mandatory implicit bias test to all members and document completion.
- Assist Penn State's CSD Department in initiatives related to diversity.

Member September 2019 – May 2021

- Engaged in volunteer experiences and pre-professional development within CSD.

Penn State THON

Family Relations Captain: Public Relations Liaison 2022 – Present

- Work closely with families impacted by pediatric cancer in sharing their unique voices and stories, while respecting their privacy and best interests.
- Collaborate with Public Relations team on projects which share family's stories, including videos, social media projects, and interviews with external media outlets.

Special Events Committee Member: Family Relations Liaison 2021 – 2022

- Volunteered during events throughout the year for families served.

Dancer Relations Committee Member 2020 – 2021

- Implemented safety strategies to best support volunteers who stood for 46-hour dance marathon.

Penn State Sign Language Organization August 2019 – Present

- Attend weekly meetings and events to expand American Sign Language knowledge, communicate with other learners or native speakers in the language, and spread awareness of Deaf Culture throughout campus.

Penn State Teaching Assistant: Clinical Phonetics August 2021 – December 2021

- Aided student learning in phonetics course through grading assignments and hosting 3 office hours per week.

LifeLink Mentor August 2021 – December 2021

- Spent an hour each week accompanying a student with disabilities during lunch break on campus.

SCHOLARSHIPS AND AWARDS

Penn State Department of Communication Sciences and Disorders Student Marshal, Dean's List, Provost Award, President's Freshman Award, Jane B. Slep Honors Scholarship, New York City Council Citation Speaker's Achievement Award