USING BEHAVIOR MODIFICATIONS TO TEACH RESPONDING TO JOINT ATTENTION TO PRESCHOOL CHILDREN WITH AUTISM SPECTRUM DISORDER

by
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(Under the Direction of Scott Ardoin)

ABSTRACT

Joint Attention (JA) is defined as the act of sharing an item or experience with another person. This study employed an intervention package created by Whalen and Schreibman (2003) using pivotal response training and discrete trial training to teach responding to JA to preschool age children with autism spectrum disorder. In addition, the current study implemented intervention in the naturalistic setting of the school. Consistent with previous research on JA, the three participants showed low levels of responding to JA in baseline sessions. Two out of three participants successfully acquired the skill of responding to JA in their naturalistic school setting. NOTE: DUE TO COVID-19 THE MAJORITY OF THE DATA ARE FABRICATED AND THUS THIS STUDY SHOULD NOT BE CITED AS PART OF FUTURE RESEARCH PUBLICATIONS.

INDEX WORDS: Joint attention, autism, intervention

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CHAPTER 1

INTRODUCTION

Joint attention (JA), is defined as the act of sharing an item or experience between two people. This skill begins developing when a child is approximately 9-10 months old and continues to develop until they are 12-18 months old (Martins & Harris, 2006). The first topography of JA is responding to a JA bid from a caretaker where the child turns their head or orients their body towards the point or gaze from a caretaker. The child then develops the skill of initiating JA by engaging in coordinated gaze shifting where they look at an object, then to an adult or peer, and then back at the object (Taylor & Hoch, 2008). Oftentimes, JA initiations can be confused with a child tacting an item to receive the respective item, but true JA initiation is a mand for the opportunity to share an item or experience with an adult or peer. JA is a prerequisite for other developmental milestones such as making eye contact, exhibiting affect, imitation, play skills, and perspective taking (Martins & Harris, 2006). Lack of JA skills are deficits associated with a diagnosis of autism spectrum disorder (ASD: Martins & Harris, 2006). In the literature, teaching JA is broken down into two response classes, responding to joint attention (RJA) bids and the more complex skill of initiating joint attention (IJA) bids (Isaksen & Holth, 2009). RJA refers to a child's ability to respond appropriately by turning their head or orienting themselves in the direction of another person's pointing, gaze shifts, or gestures. IJA refers to the ability of the child to engage in pointing, gaze shifts, or gestures to direct the attention of another person towards an object or event (Isaksen & Holth, 2009).

Several early studies were conducted that included neurotypical children as participants in an effort to better understand the effect of JA on language development for children diagnosed with ASD and developmental delays. For example, Tomasello and Farrar (1986) examined the relationship between joint attention and language for neurotypical children. Observational data were collected to examine naturalistic interactions between a mother and a child. Results indicated that during periods of JA focus, both mothers and children talked more and engaged in longer conversations. In addition, they found that the references mothers made to objects inside the JA focus were related to subsequent language development. Following the observational study, experimental procedures were employed to investigate the impact of teaching novel words to 17-month old neurotypical children on word learning and language development. The researchers selected four objects that were unfamiliar to each child and used either a "follow-in condition" or a "direct condition" to teach each word. The follow-in condition involved exposing the child to the name of the object while they were engaged with the object, whereas the direct condition involved saying the name of the object when the child was not engaged with the object. Results indicated that the "follow-in condition" led to greater word learning than the "direct condition". The results provided evidence that when children are engaged with both an object and an adult exposing them to language, there was a greater chance for language acquisition. Overall, Tomasello and Farrar (1986)'s findings demonstrated the importance of teaching preschool age children the JA skills as a prerequisite for language development.

Dawson et al., (2004), conducted a study to examine differences in social orienting and JA between 3 to 4-year old children with ASD, 3 to 4-year olds with

developmental delays, and 12-46 month old neurotypical children. Participants were administered both measures of JA and social orienting, the ability for a child to spontaneously orient to naturally occurring stimuli in their environment. These measures differed from each other because the JA measures included the extra steps of looking at the adult and back at the object whereas, social orienting only involved looking at an object or naturally occurring stimuli. Results revealed that participants with ASD were impaired in the area of social orienting and that they were less likely to orient towards all auditory stimuli, social or nonsocial. In addition, JA and socially orienting measures were predictors of a later autism diagnosis. Ultimately, Dawson et al., (2004) concluded that JA is the earliest predictor of developmental delays and language ability.

Several empirical investigations demonstrated that children with ASD can acquire the skill of RJA and that this behavior can generalize to other settings or individuals and maintain over time (Whalen & Schreibman, 2003; Martins & Harris, 2006). Whalen and Schreibman (2003) conducted the first study to successfully teach young children diagnosed with ASD to engage in RJA and IJA. Specifically, the authors examined the effectiveness of implementing behavior modification techniques such as pivotal response training combined with discrete trial training to teach children with ASD both RJA and IJA skills. Eleven children between the ages of two and four participated in this study (five children with ASD and six neurotypical children). The children with ASD were required to have an official diagnosis of ASD or related disorder (e.g., Pervasive Developmental Disorder, Not Otherwise Specified). A modified multiple baseline design was used to evaluate the effects of intervention on the ASD participants' acquisition of RJA and IJA skills. Intervention was not commenced with subsequent participants until

three sessions of post intervention data were collected on a participant. Although data were not collected on student behavior when intervention was being provided, baseline data collection continued for participants with whom intervention had yet to commence. Three months post-intervention, one follow-up data point was collected for each participant.

The intervention procedures used by Whalen and Schreibman (2003) to teach RJA skills consisted of six intervention levels that decreased in intrusiveness. The levels of this intervention were (a) response to hand on object, (b) response to tapping of object, (c) response to showing the object, (d) eye contact, (e) following a point, and (f) following a gaze. Strategies employed when implementing the intervention to ensure compliance included (a) prompts and prompt fading, (b) interspersing maintenance tasks with acquisition tasks, (c) allowing the child to choose the toys they wanted to play with in order to keep their interest in the task high, and (d) reinforcement for prompted and unprompted correct responding. Whalen and Schreibman trained for RJA and IJA separately and all of their participants successfully acquired the skill of RJA. At the three month follow up, participants maintained these RJA skills.

The procedure Whalen and Schreibman (2003) used to teach IJA skills were divided into two phases, (a) coordinated gaze shifting and (b) protodeclarative pointing. Coordinated gaze shifting was defined as a child looking at their object, looking at an adult, and looking back at their object. Following mastery of this phase, participants were trained to engage in the pointing response towards a novel object to gain the attention of the experimenter to engage in the IJA behavior. Following treatment, four out of their five participants with ASD could successfully engage in IJA to direct an adult's attention

to an object or activity. However, participants did not continue to engage in IJA at the three month follow up. For response training, session length ranged from 18 days to 23 days and for initiation training, session length ranged from six to 16 days. Whalen and Schreibman demonstrated a functional relationship between the RJA and IJA interventions and the percent of opportunities with independent responding. Limitations of this study included not teaching RJA and IJA skills in the natural environment of the child and the failure to collect data during intervention sessions. Unfortunately, findings of this study are limited because data from the intervention was not included, and it is difficult to conclude the rate of acquisition of the RJA skill and to see the effect of each level of intervention.

As an extension of the JA literature, Martins and Harris (2006), trained students to engage in a more naturalistic response by adding a progressive time delay to transfer stimulus control to naturally occurring stimuli. The participants in this study were three children who were three to four-years old and engaged in one to six word utterances with one to two spontaneous greetings. The researchers employed a multiple baseline design across participants with a reversal. Baseline data were first collected on RJA, a child's ability to respond appropriately by turning their head or orienting themselves in the direction of another person's pointing, gaze shifts, or gestures. Martins and Harris collected baseline data on all participants until stable baseline levels were established. Then researchers collected intervention data on phase one, response to hand on object for participant one. Once the first participant reached mastery criterion of phase one, baseline data were again collected on the target RJA response for participant one. After baseline levels were stable, phase two of intervention, responding to tapping of the object, was

implemented and intervention data were collected. Baseline RJA data were again collected, the rotation between baseline and intervention data was implemented for all six intervention phases. Given that a multiple baseline design was employed, phase one of intervention was not implemented with the second participant until the first participant reached mastery criterion for phase one.

Martins and Harris (2006) followed the procedure that included four intervention phases (a) attention-getting phrase (e.g., "Alex") followed by a head turn, a touch of the target object by the researcher, and discriminative stimulus (SD) "look"; (b) attention getting phrase with a head turn and a point to the target object with the SD "look"; (c) attention getting phrase followed by head turn to the object and SD "look at that"; and (d) attention getting phrase followed by a head turn in the direction of the target object with each phase being slightly less intrusive than the previous. In order to transfer stimulus control to a more naturally occurring stimuli, progressive time delay included physically prompting the child to respond to a JA bid until they reached 85% independence for two consecutive sessions at a 0 s delay. Following independence with a 0 s delay, a 2 s delay was introduced before prompting the participant to turn their head in response to the JA bid. This was successful in both training RJA and maintaining it for all participants. IJA was measured as a secondary dependent variable and probes were collected during pre-training and post-intervention. No increases in IJA were recorded following the RJA training. One limitation of this study is not teaching the IJA skill separately from training for RJA. However, unlike previous studies, (Taylor & Hoch, 2008; Whalen & Schreibman, 2003) Martins and Harris (2006) employed single-case design methodology

that examined training of all phases of intervention to show the effectiveness of each phase of intervention and the rate of acquisition of the RJA skill.

The aforementioned studies, (Whalen & Schreibman, 2003; Martins & Harris, 2006) included participants who exhibited a small vocal repertoire that included only one to six word utterances with few spontaneous vocalizations. Taylor and Hoch (2008) extended this line of research by providing intervention to three participants with ASD who had a more extensive and spontaneous vocal repertoire of three to six word sentences. There were three participants in this study, who ranged from age three to age eight, received intensive behavioral intervention, and could tact verbal attributes and mand for tangible items spontaneously. Taylor and Hoch employed four multiple baseline designs across participants in order to separately evaluate each of the following four dependent variables, (a) percentage of trials in which the participant looked in the direction of the therapist's point, (b) percentage of trials that the participant would make an appropriate comment about the item, (c) percentage of trials in which the participant looked back at the instructor within 5 s after making the comment about the item, and (d) number of IJA bids from the participant. The researchers included baseline data and post-intervention probes for each dependent variable. During baseline sessions, the therapist set up an environment with items that were visually enticing or placed out of order. The therapist brought the participant into the room and waited 1 min for the child to engage in IJA. If the child did not initiate, the participant and therapist sat down at a table and engaged with a leisure item. For baseline sessions, the therapist gave the participant an opportunity to RJA every 30 s, then during intervention, the system of least prompts was used to look in the direction of the point, make a comment about the target item, and to

look back at the instructor. This procedure started with a gestural prompt and systematically moved up to a full physical prompt. In the first phase of intervention, teaching RJA, all participants' performance improved. In the second phase, teaching IJA, the researchers used a prompt delay procedure, where the therapist walked the student within 50 cm of the target item and gave the student 5 s to initiate a bid. If they did not engage in IJA, the researchers used most to least prompting to prompt the correct response. Most to least prompting started with a full physical prompt, moving down to a gestural prompt to point to the item. Finally, the therapist provided an echoic verbal prompt to make an appropriate comment about the item. One participant required a textual stimulus (index card) to prompt her to initiate JA bids. Ultimately, all participants' RJA bids increased to 100% independence in the post-intervention probes. In the teaching IJA phase, participants' IJA behavior increased from an average of 0.5 bids per session to 2.7 bids per session. However, one of the limitations of this study is that it was unclear if IJA was a mand for adult attention or simply a tact of the tangible item. Another limitation of this study data were not collected during intervention implementation but rather only post intervention implementation. .

To further extend the JA research, Isaksen and Holth (2009) conditioned social reinforcers to teach both RJA and IJA in a natural environment. Four children with a diagnosis of ASD participated in the study. The participants could vocally imitate four to five word sentences. The intervention included four levels of prompts to teach RJA that decreased in intrusiveness. These levels included (a) moving the child's hand onto the toy, (b) tapping the toy, (c) moving the toy into the child's visual field, and (d) looking at the adult to receive the toy. They also worked on pairing a tangible item with a social

reinforcer to condition the social reinforcer by allowing the child to engage with the tangible item only if the teacher established eye contact with the student and was smiling or nodding. Isaksen and Holth (2009) used a modified multiple baseline design in which scores from the Behavioral Assessment of JA, developed by MacDonald et al. (2006), served as the dependent variable for each participant across 3, 5, or 6 weeks prior to the implementation of intervention. Data were not collected during intervention implementation, but the Behavioral Assessment of JA was administered at post-test and one month after intervention was completed for each participant. All participants in this study scored higher than their baseline levels on the RJA and IJA tests following intervention. Limitations of this study include the design only includes baseline data and post-intervention data. This design did not show that the intervention was responsible for the change in behavior because the researchers did not stagger their multiple baseline design across participants.

It is important to conduct replications in single-case research for many reasons. One limitation of single-case research is the lack of external validity because of the small sample size and limited population. The current study is thus relevant due to the fact that it is a systematic replication of Martins and Harris (2006) and Whalen and Schreibman (2003). Systematic replication establishes the generality of research findings in single-case design to clinical or educational settings. Not only does replication increase the external validity of findings, it also identifies areas for future research. Systematic and direct replications are helpful to extend the literature and remain helpful to continue to expand efficient and effective intervention and instruction (Gast, 2010).

One limitation in past JA literature is the failure of researchers (Whalen and Schreibman, 2003; Taylor & Hoch, 2008; Isaksen & Holth, 2009) to appropriately employ single subject design methodology and thus a failure of the studies to demonstrate experimental control. What Works Clearinghouse recommends using a single-case research design to demonstrate a functional relationship. One previous study (Isaksen & Holth, 2009) used a multiple baseline design, but did not stagger the baseline data points consistently across participants. In some aforementioned studies, (Whalen & Schreibman, 2003; Taylor & Hoch, 2008; Isaksen & Holth, 2009) the researchers did not collect data during intervention implementation and only collected post intervention data. In order to demonstrate experimental control in a multiple baseline design, the researcher must collect baseline data points for all participants who are not going through intervention and other tiers must be held in baseline to show that the behavior systematically changed only when the intervention was introduced. Similarly, a functional relationship is determined if the first participant's behavior changes upon implementation of intervention while the remaining participants' baseline levels remain low and stable prior to their implementation of intervention. Therefore, in previous studies (Taylor & Hoch, 2008; Isaksen & Holth, 2009) experimental control is not established and it is not evident if the intervention in place is responsible for change in RJA or IJA (Kratochwill et al., 2010).

The current study is a systematic replication of Whalen and Schreibman (2003) in the school setting using a multiple baseline across participants with a reversal design similar to that used by Martins and Harris (2006). Baseline sessions were conducted prior to each intervention phase that measured the ultimate target response of RJA intermittent

between teaching phases (Martins, & Harris, 2006). After a participant met mastery criteria in a certain phase of intervention, Martins and Harris (2006) took baseline data on the target response to demonstrate that the intervention was solely responsible for the changes in RJA behavior. In addition, the current study focused on teaching preschool age children with ASD the prerequisite skills of RJA using (a) hand-over-hand, (b) toy-tapping, and (c) a verbal-prompt.

CHAPTER 2

METHODS

Participants

Three participants, two girls and a boy, served as participants in this study. Participants were either diagnosed with ASD or had an ASD educational eligibility. Josh, was 5 years and 1 month old, vocalized in two to three word sentences and mainly communicated through a picture exchange system. Carla was 4 years and 11 months old, vocalized using three to four words, and communicated mostly through gestures. Sally was 3 years and 6 months old, exhibited no vocalizations and communicated mostly through gestures. Both Carla and Sally were being trained to use a picture exchange system.

Setting

All three students were in a preschool classroom at a public elementary school run by undergraduate and graduate students pursuing their degrees in Special Education or Applied Behavioral Analysis at the University of Georgia. The sessions all took place inside the classroom at a small table with two small chairs. Sessions were video recorded to collect interobserver agreement and procedural fidelity data.

Design

A single subject, multiple baseline with a reversal across participants design was used in this study to evaluate the effects of behavior modification procedures on teaching responses to JA. This design included baseline sessions intermittent between teaching phases. This design shows experimental control by continuously taking baseline data on

the participants who are not in intervention. This controls for developmental maturation because in this design, the behavior of participants should not change until they begin intervention.

Dependent Variables

Across all baseline and intervention phases, the percentage of independent trials were measured. In the verbal-prompt phase, responses to JA were scored as independent if the participant (a) looked at the object (b) reached for it within 5 s and (c) engaged with the item for 5 s. Responses were marked independent in the hand-over-hand phase if the participant engaged with the item for 5 s after their hands were placed onto the new object. For the toy-tapping phase, responses were scored as independent if the child engaged with the object being tapped by the therapist for 5 s.

Prior to commencing he study a preference assessment was conducted to determine preferred tangibles and edibles to use during baseline and intervention. Then at least three baseline sessions were conducted for the verbal-prompt phase and the hand-over-hand phase before moving onto the hand-over-hand intervention phase. Once the participant reached mastery criterion for the hand-over-hand intervention phase (3 consecutive sessions at 80% independent), baseline sessions were conducted for the toy-tapping and verbal-prompts phases. Then the participant moved on to the toy-tapping intervention phase and once they met mastery criteria (3 sessions at 80% independent) baseline sessions were conducted for the verbal-prompt phase before beginning the verbal-prompt intervention phase. Once the verbal-prompt intervention phase was mastered, the intervention was completed.

Interobserver Agreement

An independent observer collected interobserver agreement data on the dependent variable during 25% of sessions. Agreement was defined as both observers recording a response as either independent or error. Interobserver agreement was calculated by dividing the number of agreements divided by the sum of the number of agreements and disagreements. The total mean agreement for the present study for all participants was 98.5% (range of 90% to 100%).

Procedures

Preference Assessments. Prior to conducting baseline, multiple stimulus without replacement (MSWO) preference assessments were conducted to determine preferred tangibles that would be used during baseline and intervention sessions and five preferred edibles to be used during intervention sessions. The therapist placed an array of five tangibles or edibles in a line in front of the child within their reach. The therapist then said, "pick one", removed all items that were not picked, and allowed the child to engage with their chosen item for 30 s or consume their chosen edible. Therapist then re-presented the remaining 4 items and allowed the child to engage with their chosen item for 30 s or consume their chosen edible. The therapist continued this procedure until all items were chosen or the participant refused to select another item in the array.

Baseline. Baseline sessions were conducted approximately 4 days a week. Each day consisted of 1-2 sessions per participant and each session lasted approximately 5 min. Across all baseline sessions, the child was brought to a work table where the therapist sat across from the participant and four preferred toys were placed in front of them. The

child was given 2 min to engage with these toys to establish preferences. Two toys were then removed that the child did not engage with frequently or at all. What differed across baseline sessions was the prompt provided by the therapist (descriptions provided below). Reinforcement was not provided for independent responses during any baseline sessions.

To ensure motivation was high, acquisition trials were interspersed on a random basis with maintenance tasks from the child's Individualized Education Program (IEP) on a 1:1 ratio. The order of the trials was randomized before each session began. There were 10 trials total in each session. Interspersing five maintenance tasks with acquisition tasks increased compliance by keeping the child's success rate high and gave them more opportunities to contact reinforcement during intervention.

Verbal-Prompt Baseline Sessions During each verbal-prompt baseline session, the therapist held up 1of 2 toys (the toy the child was not currently engaging with) that the child chose to engage with in the 2 min previous to beginning the baseline session. The therapist gave a verbal-prompt using the child's name and the discriminative stimulus (SD) "look". If the child looked, reached to engage with the object, and engaged with it within 5 s for a minimum of 5 s, the response was marked as independent. If the child did not reach for or engage with the toy within 5 s of the prompt or did not engage with the toy for a minimum of 5 s, the response was marked as an error and the therapist removed all toys before beginning the next trial.

Hand-over-Hand Baseline Sessions. For each hand-over-hand baseline session, the therapist moved the hands of the child onto a new toy. If the child engaged with the new toy for 5 s, the response was marked as independent. If the child did not engage with

the new toy for 5 s, the response was marked as error, the toys were removed, and other preferred toys were presented before the next trial.

Toy-Tapping Baseline Sessions. During toy-tapping baseline sessions, the therapist tapped the toy with which the child was not currently playing. If the child engaged with the toy being tapped within 5 s for 5 s, the response was marked as independent. If the child did not engage with the toy within 5 s for 5 s, the response was marked as error, the toys were removed, and other preferred toys were presented before the next trial.

Training Sessions. Use the same setting as the baseline sessions. The intervention protocol interspersed five maintenance tasks with acquisition tasks, followed the child's lead and allowed them to choose their tangible preferences so they stayed engaged, provided social reinforcement for responding, and edible reinforcement for independent responding.

Phase 1: Hand-over-Hand. The therapist placed the hands of the child onto a different preferred toy. If the child engaged with the newly presented toy within 5 s (kept their hands on it and engaged with it) for
5 s, the response was marked as independent.

If the child did not respond independently (takes their hands off the new object), all toys were removed for 5 s (the timer began once toys were removed), the response was scored as an error, and two new toys were presented. If the child had two incorrect responses within the same trial, the therapist applied a full physical prompt to keep the child's hand on the object for 5 s and scored the response as prompted. The therapist followed the child's lead with regard to their preferred toys, and in order to follow a more

naturalistic procedure all toys did not have to remain the same across the days or sessions.

Phase 2: Toy-Tapping. While the child was playing with a preferred toy, the therapist tapped a different preferred toy. If the child engaged with the toy that was being tapped within 5 s (kept their hands on it and engaged with it) for 5 s, the response was marked as independent.

If the child did not respond independently (does not engage with the toy being tapped), all toys are removed for 5 s (the timer began once toys were removed), the response was scored as an error, and two new toys are presented. If the child had two incorrect responses within the same trial, the therapist applied a full physical prompt to keep the child's hand on the object for 5 s and score the response as prompted.

Phase 3: Verbal-Prompt. For acquisition trials, while the child was playing with a preferred toy, the therapist held up a different toy and gave a prompt using their name and (SD) "look". If the child reached for the new toy within 5 s and engaged with the shown toy, the response was marked as independent.

If the child did not respond independently (does not engage with the toy being shown), all toys are removed for 5 s (the timer began once toys were removed), the response was scored as an error, and two new toys are presented. If the child had two incorrect responses within the same trial, the therapist applied a full physical prompt to keep the child's hand on the object for 5 s and score the response as prompted.

CHAPTER 3

RESULTS

NOTE: ALL DATA COLLECTED POST SESSION 20 ARE FABRICATED DATA. DATA HAD TO BE FABRICATED DUE TO SCHOOL CLOSINGS ON 03/16/2020 AS A RESULT OF THE CORONAVIRUS.

Figure 1 shows baseline JA levels and acquisition of JA responding for all three participants. The intervention was effective for two of the three participants for teaching RJA with a verbal-prompt.

Carla. Correct responses to JA bids during hand-over- hand baseline sessions occurred an average to 20.6% (range 20-40%) of the bids. For verbal-prompt baseline sessions, correct responses to JA bids occurred an average of 6.67% of the time (range 0-20%). She did not complete the hand-over-hand intervention phase. She correctly responded to hand-over-hand intervention an average of 46% (range 0-100%) with highly variable responses.

Sally. During 16 baseline sessions, Sally responded independently to JA bids an average of 20% (range 0-60%) for hand-over-hand baseline sessions and an average of 10% (range 0-40%) for verbal-prompt baseline sessions. All three phases of training were completed in 52 sessions. In order to reach mastery criteria, 10 hand-over-hand sessions were required, seven sessions of toy-tapping intervention, and 10 sessions of verbal-prompt intervention.

During the hand-over-hand intervention, independent responding increased from 20% to 80% in the first six sessions, then dropped off to 40% in the seventh session of

intervention. Following this momentary drop, Sally's responding increased to an average of 87% (range 80-100%) in the final three sessions of hand-over-hand intervention. During this intervention phase, Josh's verbal-prompt baseline levels and hand-over-hand baseline levels remained low, providing some verification that the intervention was responsible for the change in Sally's hand-over-hand response behavior. During the baseline probes following the hand-over-hand intervention, Sally independently responded an average of 32% (range 20-40%) during sessions evaluating her JA to verbal-prompts and an average of 44% (range 40-60%) of responding to toy-tapping. After collecting stable baseline levels, the therapist moved onto the toy-tapping intervention phase with Sally. She responded independently 40% of the time in the first session of intervention and this trend continued to increase to 80% within the first three sessions of the toy-tapping intervention. Following Session 4 of toy-tapping intervention, Sally responded independently to 100% of the JA bids for three consecutive sessions to meet mastery criterion. In addition, Josh's verbal-prompt baseline sessions and toy-tapping baseline sessions remained low while Sally met mastery criterion for the toy-tapping intervention phase. This provided some verification that the intervention was responsible for the change in Sally's toy-tapping response behavior.

During sessions 39 through 42, Sally responded independently 20% (range 0-40%) of the time for verbal-prompt baseline sessions before moving onto the verbal-prompt intervention. During verbal-prompt intervention, independent responding occurred initially at 40% and increased to 100% within six sessions. Sally responded independently an average of 86.7% of the time across the last three sessions of the verbal-prompt intervention to meet mastery criterion and complete the intervention. Once Sally

completed the RJA intervention, Josh's baseline levels remained low and stable and he reached mastery criterion in the hand-over-hand intervention phase and the toy-tapping intervention phase.

Josh. During 25 baseline sessions, Josh responded independently to JA bids an average of 15.29% (range 0-80%) for hand-over-hand baseline sessions and an average of 8.23% (range 0-20%) for verbal-prompt baseline sessions. All three phases of training were completed in 62 sessions. In order to reach mastery criteria, nine hand-over-hand sessions were required, 11 sessions of toy-tapping intervention, and 10 sessions of verbal-prompt intervention.

During the hand-over-hand intervention, independent responding increased from 40% to 80% in the first five sessions, then dropped off to 60% in the sixth session of the hand-over-hand intervention. Josh's responding increased to an average of 87% (range 80-100%) in the final three sessions of the hand-over-hand intervention. During toy-tapping baseline sessions following the hand-over-hand intervention phase, Josh independently responded an average of 30% (range 20-40%) in verbal-prompt baseline sessions and an average of 40% (range 20-60%) in toy-tapping baseline sessions. After collecting stable baseline levels, the therapist moved onto the toy-tapping intervention phase with Josh. He responded independently 40% of the time in the first session of the toy-tapping intervention and this trend continued to increase to 80% within the first six sessions of the toy-tapping intervention phase. Following Session 8of the toy-tapping intervention, Josh responded independently to an average of 93.3% of the JA bids for three consecutive sessions to meet mastery criterion.

During the verbal-prompt baseline sessions, Josh responded independently 33.3% (range 20-40%) of the time for verbal-prompt baseline sessions before moving onto the verbal-prompt intervention phase. During the verbal-prompt intervention, independent responding occurred initially at 60% and increased to 80% within five sessions. Josh responded independently an average of 86.6% of the time across the last three sessions to meet mastery criterion and complete the intervention.

Figure 1

Effects of Behavior Modification Procedures on Teaching Joint Attention Responding

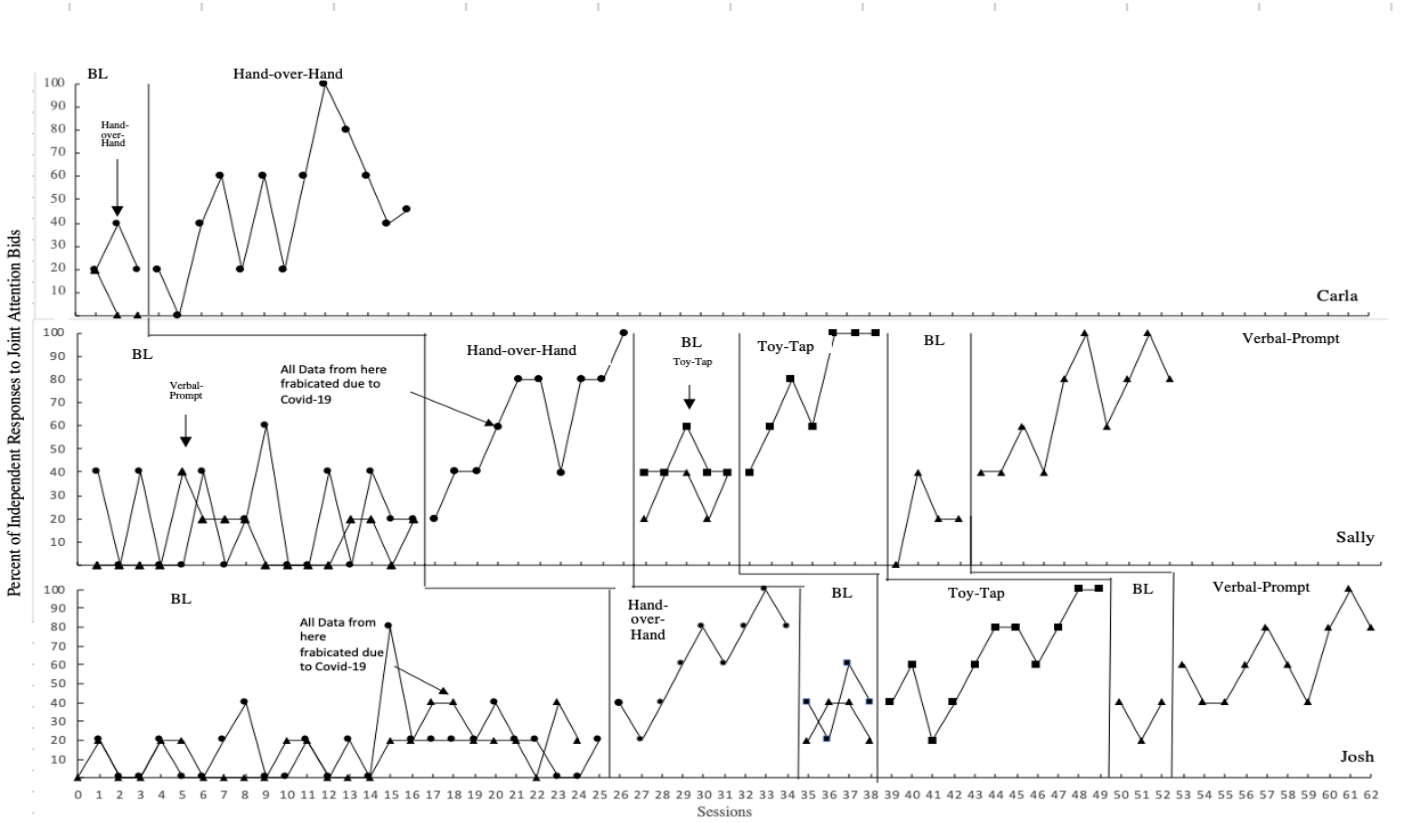

Figure 1. Percent of independent responding to Joint Attention bids

CHAPTER 4

DISCUSSION

NOTE: ALL DATA COLLECTED POST SESSION 20 ARE FABRICATED DATA. DATA HAD TO BE FABRICATED DUE TO SCHOOL CLOSINGS ON 03/16/2020 AS A RESULT OF THE CORONAVIRUS.

The lack of JA ability is identified as one of the earliest predictors of ASD in children. It is a prerequisite for necessary skills such as imitation, language development, and basic social interactions. JA is defined as the experience of sharing an item between two people such as a child and a caretaker or a peer. In the present study, principles of applied behavior analysis were employed to teach prerequisite skills of RJA to preschool children with developmental delays in their naturalistic school setting. RJA skills were taught using discrete trial training where the RJA skill was taught in small steps with mass trials until mastery is reached, interspersing maintenance tasks, and pivotal response training to teach the skill in a naturalistic setting. During baseline, all three participants demonstrated low levels of responding to all three phases of the intervention (hand-over-hand, toy-tapping, and verbal-prompts).

Skill acquisition of RJA was observed for only two of the three participants. Carla never met mastery criterion of the hand-over-hand phase. Following session seven of Carla's intervention, a different set of toys believed to be more highly preferred were assessed and presented to her. She attended to these new tangibles for sessions 10 through 14, but ultimately did not reach mastery criterion in the hand-over-hand intervention phase. Intervention was terminated for Carla following session 14. However,

Sally and Josh both responded favorably to the intervention package and acquired the RJA skills included in this intervention. Consistent with the JA literature, the data from this study demonstrated that children with ASD can acquire the skills necessary to respond independently to JA bids (Whalen & Schreibman, 2003; Kasari et al., 2005; Taylor & Hoch, 2008; Isaksen & Holth, 2009). A multiple baseline design showed the RJA skill did not improve with maturation over a 2-4 week baseline period. This is evident by the fact that baseline levels remained low for all participants who were not in intervention and that behavior change occurred following the start of intervention. Two participants, Sally and Josh, made progress in learning the RJA skill and this was evident by stable baseline levels for Josh when intervention was implemented with Sally. In addition, both participants met mastery criterion for all three intervention phases.

Had the data for this study not been partially fabricated the findings would have important implications, however, there multiple limitations should be considered when interpreting the findings. First, Carla did not attend to the tangibles used in the study despite them having been identified through a preference assessment. Based on observation of Carla's behavior in the classroom she did not typically engage with toys during free operant arrangements, it was hypothesized that tangible items (i.e., toys) did not function as reinforcers for Carla's JA. In addition, according to the diagnostic criteria for ASD, children diagnosed with ASD engage in restricted and repetitive interests. This can be limiting for research that requires toys if they are not in the specific interests of the child. In addition, the present study only includes one verification since Carla did not reach mastery in the hand-over-hand intervention phase. Verification, in this study, occurred when one participant underwent intervention while the next participant's

baseline levels remained low and stable. This occurred twice, once when Sally was in the hand-over-hand intervention and Josh's baseline levels remained low and when Sally was in the verbal-prompt intervention and Josh's baseline levels remained low. Verification did not occur for the toy-tap intervention phase because baseline data were collected not for Josh on the toy-tap phase until Sally had already begun the toy-tap intervention. Ultimately, What Works Clearinghouse standards suggest that there must be three demonstrations of effect and the present study only provides two demonstrations. The biggest limitation to this study was that the participants did not return to school due to Coronavirus and the data following session 20 are fabricated. Future research in this field should examine the effects of using different kinds of preferred reinforcers for children with ASD to teach RJA and IJA skills. In addition, researchers should program RJA skills for generalization and maintenance and take data following the intervention to see if JA skills maintain over time and generalize across settings or people. Another possible extension of this research should examine teaching preschool age children IJA in their naturalistic school setting and potentially examining the effects of intervention in different settings in the classroom.

The current study demonstrated verification with the second participant, Sally because her RJA behavior increased in intervention while Josh's baseline levels remained low prior to intervention. This study also extended the JA research by teaching two participants RJA skills by successfully employing three levels of intervention (a) hand over hand, (b) toy-tapping, and (c) verbal prompt in the naturalistic school setting.

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