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Effects of Using Books and Games in a Modified Incidental Teaching Procedure on the Emergence of Derived Relations in Children with Autism Spectrum Disorder

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by

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Abstract

This study examined the effects of using books and games as a modified incidental teaching procedure (MITP) on the emergence of derived relations in children diagnosed with autism spectrum disorder (ASD). The study was conducted to determine whether presenting language targets in a natural context of reading books and playing games will result in acquisition of listener and speaker responses. Books and games were specifically designed to incorporate all language targets twice. During the acquisition of listener responses, a registered behavior technician (RBT) engaged children in receptive identification of five targets with a test for emergence of speaker responses at the end of each session. During the acquisition of speaker responses, the RBT engaged children in expressive identification of five targets with a test for emergence of a listener responses at the end of each session. The data were collected to see if reading books and playing games was effective in the acquisition of listener and speaker responses in children diagnosed with ASD while providing a natural approach to teaching language and led to emergence of derived responding. The study demonstrated that all three participants exhibited trained responses with 80-100% accuracy after three to seven days of training. Accuracy for emergence of untrained responses was 100% for two out of three participants and 40-60% for the third. Participants selected to play with materials used for games 70% of the time for Participant 1, 87.5% for Participant 2, and 94% for Participant 3. Participant acquired and maintained additional targets of animal sounds and food items animals eat.

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Chapter I: Introduction and Literature Review

The diagnoses of ASD is primarily related to the impairments in language, communication, and social interactions with others (American Psychological Association, 2013). These impairments include delays in comprehension of spoken language and acquisition of receptive and expressive vocabulary, an inability to respond to others, use functional language, and a lack of participation in age appropriate activities such as play (Smith, 2001). With the increase in the prevalence of ASD diagnoses, there has been an emphasis on early developmental screenings starting at nine months of age with a possibility for a diagnosis as early as 18 months (American Academy of Pediatrics, 2015). Research has identified several evidence-based practices to be used during treatment for children with ASD. These practices include, discrete trial teaching (DTT), modeling (MD), naturalistic intervention (NI), and prompting (Wong et al., 2015).

Discrete Trial Teaching

Early research (e.g., Lovaas, 1977) demonstrated the effectiveness of using DTT to improve speech in children diagnosed with autism. DTT consists of teaching children to produce a specific response in the presence of a specific discriminative stimulus (S^D) and providing differential consequences for correct and incorrect responding. DTT is usually conducted at a table with the child and therapist sitting across from each other. The therapist uses short statements to present a demand (“do this”, “touch”, “say”, etc.), that are followed by the child’s response. If the response is correct, the therapist delivers praise, an edible, or access to a tangible item. If the response is incorrect, the therapists prompts a correct response and probes again.

DTT has been proven effective due to the structured approach to teaching and availability of multiple opportunities to learn through repeated presentations of the same targets until mastery.

The use of DTT for language acquisition has been empirically validated across multiple studies (Downs, Downs, Fossum, & Rau, 2008; Smith, 2001). Despite its effectiveness, DTT has multiple limitations. One of the limitations is that DTT is usually conducted in a structured manner that doesn't resemble how behavior develops and maintains in natural settings which might, in turn, hinder generalization of taught skills or leave the child unprepared to acquire new skills in the natural environment. Furthermore, much DTT work relies on contrived reinforcement at rates not seen in the "real world" (Geiger et al., 201; Leaf, Leaf, Cihon, & McEachin, 2016).

Incidental Teaching

To address the above criticism of DTT, other, more natural approaches to teaching have emerged (see Delprato, 2001). One alternative method to DTT is incidental teaching (IT). IT teaches through natural interactions between children and adults while using natural reinforcement. This procedure was developed and documented by Hart and Risley (1968, 1980). They used the arrangement of the environment to their advantage by making objects and activities interesting to children which then required an available adult to help the child produce the response. They implemented modeling and prompting and reinforced behavior by providing access to preferred activities or objects and social praise.

In one of their first studies on the topic, Hart and Risley (1968) observed limited progress made by preschool children on describing objects using the adjective-noun combinations. Children were taught in small groups and had difficulty describing objects using colors outside

of the group setting. Hart and Risley (1968) increased the use of descriptive adjectives in the spontaneous speech of preschools by making access to colorful objects contingent on their identification by color. A variety of toys (balls, cars) and materials of different colors (paint, crayons, colored water) were arranged in a way that they could be seen by children. Children began initiating requests for items of different colors using adjective-noun combinations to gain access to specific items. The skill of using descriptive objects was observed across different materials and objects and not just the ones previously taught in the group setting. Maintenance of the skill was also reported over time.

Hart and Risley (1980) continued to study IT as a method of language acquisition and assessed its effects on compound sentences in children. They demonstrated an increase of compound sentences in speech after incidental teaching was incorporated throughout the naturally structured day for preschool children. The children were also successful in applying the skill to novel sentences in different contexts.

Despite its effectiveness, IT has its limitations and has been criticized for providing a low number of opportunities to practice a certain skill when relying on those opportunities to occur naturally in a particular environment. The need for increased numbers of opportunities has prompted several studies to focus on increasing the number of opportunities by using adult initiations. Rogers-Warren and Warren (1980) increased the number of opportunities for children to mand for items by setting up the environment with multiple objects available upon a mand and by modifying teachers' behavior to initiate presentation of items to children. As a result, the three participants increased and maintained both manding interactions with an adult.

The context of play provided multiple opportunities to practice sight word reading skills for two children diagnosed with autism (McGee, Krantz, & McClannahan, 1986). Charlop-Christy and Carpenter (2000) used modified incidental teaching sessions (MITS) as a combination of pure incidental teaching followed by two instances of adult initiations and concluded with another trial of incidental teaching to increase the number of trials. Their study provided a modification to incidental teaching as well as a comparison of DTT, IT and MITS on increasing spontaneous speech in children diagnosed with autism in the home environment. They discovered that DTT did not lead to any spontaneous speech, limited results were acquired with IT, and better acquisition and generalization were observed using MITS.

Thus, as documented here, IT enhances skill generalization in speech production. Next, I turn to literature on books and games to further promote speech production.

Reading Books

Book reading has been identified as an important activity to develop language and increase vocabulary as well as provide a foundation for development of literacy skills (Wasik, Hindman, & Snell, 2016; Whitehurst & Lonigan, 1998). Book reading has been assessed in a variety of studies. For example, Wasik and Hindman (2014) examined the primary mechanisms that enhance child's learning of vocabulary. They analyzed one of the effective preschool vocabulary building interventions called Exceptional Coaching for Early Language and Literacy (ExCELL). One of the main focuses of ExCELL is to train teachers to use shared book reading to introduce children to new vocabulary. Shared book reading encourages teachers to engage the children in reading by asking questions about illustrations and different concepts, asks to recall information, predict what will happen next or explain by answering a "why" question (Wasik, &

Hindman, 2014). The data from their study of 268 participants supported the hypothesis that engagement of children during reading activities increased vocabulary acquisition beyond those words targeted for intervention. Farrant and Zubrick (2011) used a bioecological approach to children's early vocabulary development using the data from the Longitudinal Study of Australian Children. They concluded that joint attention and parent-child book reading are important facilitators of children's early vocabulary development (Farrant & Zubrick, 2011). Stephens (1989) discussed how books provide models for verbal behavior through demonstrations and functions of connected discourse. He talked about each story presenting a set of structured language that the child can use as models to structure their own (Stephens, 1989). Montag, Jones, and Smith (2015) examined the speech of parents and children as well as the language structure of books. They discovered that without books children were exposed to limited speech and vocabulary, and that books provided more opportunities to encounter novel words and speech patterns that are necessary for language development. A preliminary study to assess effects of shared reading (dialogic reading) for preschoolers diagnosed with ASD was conducted by Fleury, Miramontez, Hudson, and Schwartz (2013). They assessed participation in answering questions, response to prompt types and on-task behavior for three boys with different language skills. The results demonstrated that on-task behavior was high starting with baseline and verbal participation increased for all three children. They also noted that shared (dialogic) reading provided opportunities for children to engage with others, hear language and practice using it in a natural setting. These opportunities are very important to children with ASD, considering their language and social deficits (Fleury et al., 2013).

Next, I turn to current studies on emergence of derived relations, specifically listener and speaker responses, and the relationship of symmetry as it directly relates to the proposed study.

Derived Relations

The procedure to teach stimulus equivalence relations involves the teaching of one or more sets of relations (A-B, B-C) and testing for an emergence of one or more untaught relations (B-A, C-B, A-C) (Hall & Chase, 1991). One of the conditional relations of stimulus equivalence is called symmetry. Symmetry can be described as training an individual to select B in the presence of A (establishing the A-B relation), and then observing the same individual select B in the presence of A (emergence of B-A relation) (Hall & Chase, 1991). Symmetry has been studied in relation to two types of responses; listener response (a child responds to auditory stimulus receptively) and speaker response (a child responds to a visual or verbal stimulus expressively; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005). Michael (1985) identified stimulus-selection-based responding (or listener response) as more complex than speaker responding due to the requirement to scan and engage in conditional discrimination (when hearing the word dog, child has to scan a field of two or more images and discriminate between dog, cat, cow, etc.), while topography-based required a mere point-to-point correspondence (when seeing a dog, child says “dog”). He suggested that emphases on teaching children receptive responses in light of potential deficits should be questioned (Michael, 1985). Greer et al. (2005) discussed naming as a fundamental verbal repertoire that includes both listener and speaker responses and is usually generated form ordinary interactions with caregivers. They considered a listener response to be a prerequisite to a speaker response and conducted a study by training listener responses (A-B relation, where A is an auditory name and B is an image) to

observe the emergence of speaker responses (B-A relations, where B is an image and A is an auditory name) (Greer et al., 2005). In other words, they first taught receptive labels of certain images, and then presented those images to see if subjects were able to label them expressively without being taught to do so.

A similar study was conducted by Rosales, Rehfedt, and Lovetyt (2012). They trained Spanish speaking children to produce listener responses (A-B relations) to English words and then tested for the emergence of derived tacts (B-A relations). Both of these studies used Multiple Exemplar Training (MET) to establish the initial A-B relations; however, one study (Greer et al., 2005) questioned the number of exemplars that would need to be presented and hypothesized that two may be sufficient for some children. Neither one of the studies attempted to use a more natural procedure to teach the initial relations, but one study (Rosales et al., 2012) reported low generalization and maintenance of skill and encouraged future research of a more naturalistic approach (e.g., naming items in a picture book) to assess generalization and maintenance. Neither one of the studies attempted to reverse the trained relations and tested relations and assess the emergence of A-B relations (listener responses) after B-A relations (speaker responses) are taught.

The present study is an extended replication of the study by Greer et al. (2005). It is designed to expand on the current research of derived relations and incidental teaching by combining them and assessing their effectiveness on acquisition of language targets in children diagnosed with ASD. It will seek to answer these questions:

1. Can IT replace MET during the training phase of A-B or B-A relations as a more natural approach to language acquisition?

2. Is there a difference in emergence of derived relations when a speaker response is trained and a listener response is tested vs when a listener response is taught and a speaker response is tested?
3. Can books and games be used during incidental teaching to provide a sufficient number of opportunities to train targeted responses?

Chapter II: Method

Setting

The study took place at a northern Ohio treatment center that specializes in treating children diagnosed with ASD. The study was conducted in a treatment room, which included a table with chairs, a shelving unit for toys and activity materials, a book shelf, and a child-size chair.

Interventionist

The interventionist for this study was the first author, and she was a graduate student with the credential of RBT. The interventionist implemented all components of the study and collected data.

Participants

Participants included three children diagnosed with ASD. Participant 1 (DX) was a seven-year-old male, who communicated with one- to three-word statements limited to trained responses. Participant 2 (LX) was a five-year-old male with deficits in articulation and with delayed echolalia who communicated with one- to five-word sentences. Participant 3 (RY) was a 5-year-old female with one- to three-word trained word statements, and delayed echolalia. All of the participants have been diagnosed prior to the study and had been receiving early behavioral and educational services for a minimum of six months. All participants had limited expressive and receptive language vocabularies. RY had difficulty acquiring and maintaining language targets. All participants received treatment in a restrictive environment with DTT as the primary method of teaching.

Dependent Variable

The dependent variable for this study was the percentage of accurate listener responses (A-B relations) and speaker responses (B-A) relations during the training and post-training probes. A listener response was defined as touching an image corresponding to the auditory stimulus. A speaker response was defined as a vocal-verbal response (tact) in the presence of a visual stimulus with or without an instruction (e.g., "What animal is this?") Criteria to infer the emergence of derived relations in a set was 80-100% correct responses in one trial block.

Interobserver Agreement

Sessions were scored in vivo. On each trial, an agreement was recorded if both observers (interventionist and RBT assigned to participant) recorded a correct or incorrect response; otherwise, a disagreement was recorded. IOA calculation was not needed as there was 100% agreement, and when appropriate IOA sessions are noted in figures.

Social Validity

Social validity was collected using a written survey (see Appendix A). It included several questions on level of difficulty of the procedure, training, benefit to individual's treatment, and acceptability. Social validity was completed by the primary RBT who worked with the child at the center. The primary RBT was present during 69% of sessions for DX and 100% for LX and RY. Study sessions for DX were scheduled 15 minutes prior to the treatment sessions at the center, this prevented the primary RBT to be present during all of the sessions.

Materials

Baseline set (Set 1) contained images of 10 farm animals and 13 zoo animals. These images were similar but not identical to the stimuli used during training. This set was used only during baseline for the purpose of identifying targets that required training.

Books were designed in Microsoft Word and printed on a colored printer (see Appendix B). The books contained a story of a child who was going to the zoo/farm because he/she liked animals and often played farm/zoo with his/her own toy animals. The storyline allowed participants to contact the targeted stimuli twice—once as toy animals and the second time as "real" animals. Each page of the book contained questions or statements that could be used to engage the child in reading. They served as visual prompts for the interventionist and were typed in a smaller font on the bottom of each page (see Appendix B). Each page contained one to three statements or questions and the interventionist used just one that reflected the participant's ability to provide a vocal or non-vocal response. For example, the first page of *Connor Goes to the Zoo* had two questions ("What color is Connor's shirt?", "How does he feel?") and one statement "Show me Connor." Because the child was familiar with colors and could identify them, the interventionist used the question about the color to engage the child when reading Page 1. The pages with the targeted stimuli had just one statement "show me x" for training listener responses and "what animal says x?" for training speaker responses. All questions and statements were identified prior to session.

Game pieces (see Appendix C) were made of images of farm/zoo animals, corresponding to the illustrations in the books. Book illustrations were approximately two inches high,

laminated, cut out, and placed in the opening of a binder clip or taped to Lego blocks in order to resemble game pieces.

Stimulus boards (see Appendix D) were made of targeted stimuli in circle frames, randomly arranged on a piece of paper in a quincunx and laminated.

Generalization set (see Appendix E) contained small toy animals and was used to test for ability to generalize from 2D images to 3D representations of the animals.

Additional materials contained: a set of plastic/wooden blocks, two cardboard boxes, and a cup, images of buckets (laminated, cut out and attached to Lego blocks using tape), and food items (laminated and cut out).

Experimental Design

An A-B probe design with generalization and maintenance probes was used (Horner & Baer, 1978). To control for bias, participants were randomly assigned to start with either A-B or B-A training first (see Kratochwill & Levin, 2010). This was accomplished by placing four cards in a hat: two with “A-B” and two with “B-A” written on it. The three participants were arranged by alphabetical ordering of first name (DX as Participant 1, LX as Participant 2, and RY as Participant 3), and the first card drawn was assigned to the first participant. This continued for the next two participants. DX was assigned to start with A-B (listener training) first and B-A (speaker training) second. LX was assigned to start with B-A (speaker training) first and A-B (listener training) second. RY was assigned to start with B-A (speaker training) first and A-B (listener training) second.

Procedure

Baseline

Targeted animals were selected based on the early language assessments (EOWPVT-4, ROWPVT-4, BBCS-3:R, and BBCS:E) and expanded to include additional animals. Participants were first assessed on the ability to pronounce all to-be trained stimuli via echoic responses without an accompanying image. The interventionist gave a familiar instruction "say x," where x was the name of the animal, and waited 10 s for a response. If the participant failed to produce the correct echoic, that animal was replaced with another animal for which the echoic could be produced. Following a break, all of the listener and speaker responses were assessed using the baseline set of stimuli (images of animals) under probe conditions. Presentation of images was randomized for each trial by different distractor images presented with targeted image and by changing the target image's position. Each image was presented twice and counterbalanced to prevent correct responses by echoing. This was accomplished by assessing speaker responses first. Each of the stimuli was presented in isolation with the question: "what animal is this?" Listener responses were assessed with a stimulus board of all five images and an instruction "show me x." Only the first response within 10 s. was scored. No reinforcement or correction was provided during baseline. Participants received specific social praise, e.g.: "I like how you are sitting" and "great job looking at the pictures" for sitting and attending.

Due to previous exposure to animals during treatment, the first baseline failed to identify a sufficient number of farm animal targets to train for all three participants and zoo animal targets for one participant.

The second baseline data for farm animals were collected with the same baseline set of 10 stimuli but included the sounds animals made. Data were collected only on speaker and listener responses because echoic responses were assessed in the first baseline. Participants were first asked: “What animals says x?” to assess speaker responses and then presented with a field of five stimuli and asked “Show me animal that say x” for listener responses.

Second baseline data for zoo animals were collected with the same baseline set of stimuli but included the foods animals eat. One food item was identified per animal based on the google search for foods animals are fed at the zoo. Baseline data were collected the same way, but for speaker responses, participant was presented only with the demand: “What animals likes to eat x?” and for listener responses, participant was presented with a field of five animals, and asked: “Show me animal that likes x.” The baseline set was decreased from 13 to 10 targets due to several animals having the same food items in their diet (e.g., meat for tiger and lion).

A-B Training with B-A Testing

Listener Response (A-B Relation) Training

The session began with the interventionist sitting next to the participant and saying, “Let’s read a book and talk about animals.” The training began with reading *Connor goes to the Zoo*. The interventionist read the book, pausing on each page to ask the participant a question about an illustration or to give a directive (e.g., “show me x” to train for the listener response). If the participant responded by touching the appropriate illustration, the interventionist praised the participant (e.g., “You are right, that’s x,” or “great job touching x”). If the participant did not respond correctly or failed to produce a response within 5 s, the interventionist re-presented the directive and used least to most intrusive prompts to encourage correct responding. After

prompting a correct response following an incorrect response or the absence of response, another probe was presented.

After reading the book, the interventionist began an additional trial block of training listener responses and collecting data on responses. The interventionist made a statement: “Let’s look at all the zoo animals,” when presenting the stimulus board for the first time, followed by the directive: “Show me x.” Data were documented on the first response only using a simple data collection form (see Appendix F). Praise was provided following each correct response, and a prompt (using least to most prompt sequence) was provided after an incorrect or absence of response within 5 s. Each incorrect response or absence of response were followed by another probe.

The participant was then directed to the table to play the game *Animal Parade* by the interventionist saying: “Let’s play a game.” An open bottom box, with an opening on one side, and the word “zoo” written on it was also present on the table. The interventionist lined up the game pieces and began training and collecting data on the listener responses by giving a directive “Show me x.” Any response of touching, picking up, or handing the correct game piece to the interventionist was counted as correct. If the child correctly answered, he was allowed to play with the animal for 3-10 s. Failing to respond within 1-3 s was met with the interventionist modeling simple engagement by moving it around the table, walking up participants arm, or tickling while saying, for example, “here comes the zebra,” “the zebra is walking on the table,” and “the zebra is going to tickle you.” Following the model, the interventionist allowed the child to play with the toy for 10 s. If the child did not play with the toy, a new trial was started for a

listener response to a different animal. Animals were rearranged by being moved to the right or left after each trial.

Speaker Responses (B-A Relations) Test

The emergence of a speaker response was tested immediately after the last probe for a listener response. The first trial began with the interventionist saying: “Let’s play another game.” The interventionist placed all the animals under the box with word “zoo” and said: “The animals are hiding at the zoo. Let’s see what animals are there.” The interventionist removed each of the animals from under the box one at a time and asked: “What animal is this?” and pausing for 5 s. No consequence was provided following a participant’s response.

After the last trial the participant was praised for playing the game and was given access to the game pieces for up to 3 minutes. During this time, the interventionist modeled placing animals in the box zoo and moving them on table. The interventionist did not provide any statements during this interval of play. If participant did not play with the zoo animals within 10 s or stopped playing for 10 s, he was directed to leave the room. Data were collected on this last opportunity to engage with materials as a demonstration of preference and as a measure of social validity with the participants. This concluded the session.

The following three sessions were conducted the exact same way, but the book *Connor Goes to the Zoo* was alternated with the book *Mary goes to the Zoo* and new sets of game pieces and stimulus boards, corresponding to the illustrations in the book, were used.

Generalization probes. The fifth session was conducted differently and was used to collect data on generalization probes. This session used set five (toy animals) as the stimuli. All of the toy animals were placed in a closed box with the word “zoo” written on it. The

interventionist began session by saying: “Let’s play a game.” The same game played during speaker and listener training, *Who is at the Zoo*, was played with toy animals. The interventionist said: “Let’s see what animals are at the zoo” and took each animal out one at a time. The interventionist asked, “What animal is this?” and allowed up to 5 s to respond. No reinforcement or correction was provided.

Immediately after the last test trial for generalization of a speaker response, the child was directed to the table and another game *Let’s Build a Zoo* was started. The interventionist positioned blocks in front of the child and said: “Let’s build a zoo.” The interventionist worked with the participant to arrange blocks in a circle to represent the zoo just like in the books. Once the structure was built the interventionist lined up the animals in front of the child and said: “We need animals in the zoo. Show me x.” The remaining animals were rearranged after one was selected. No correction or reinforcement was provided, but access to the toys was given immediately after the last probe for up to 3 minutes. The interventionist remained with participant and engaged with simple word statements about the child’s game, such as: “I like how you put the animals in the zoo,” “I see zebra in the zoo,” “you put bear next to bird,” and “your zoo is full of animals.” If the participant did not respond within 10 s or stopped engaging for 10s, he was directed to leave the room. Data were collected on this last opportunity to engage with materials as a demonstration of preference and as a measure of social validity with the participants.

B-A Training with A-B Testing

Speaker Responses (B-A Relation) Training

Baseline data were collected prior to the first training session. The session began with the interventionist sitting next to the child and making a statement: “Let’s read a book and talk about animals.” The training began with reading *Alex goes to the Farm*. Each page of the book contained questions or statements in smaller font at the bottom of each page that the interventionist used to engage the child in reading. Interventionist read the book, asking: “What animal is this?” on pages that displayed animals to train the speaker’s response. If the participant responded by tacting the illustration, the interventionist praised child with a statement: “You are right, that’s x,” or “great job telling me, it’s x.” If the child responded incorrectly, the interventionist presented the request again and used and verbally prompted the correct response. The incorrect response was followed by another probe to allow child to produce the correct tact.

After reading the book, the interventionist began an additional trial block of training speaker responses and collecting data using game pieces. All animals were inside a box with the word “farm” written on it. Interventionist began the set of trials by placing the box in front of the participant and saying: “Let’s see what animals are on my farm.” The interventionist took each of the animals out of box one at a time and asked the participant: “What animal is this?” The interventionist praised for correct response and allowed the participant to gain access to the animal piece for 30 s. If the child did not initiate engagement with the animal within 1-3 s, interventionist modeled simple engagement by moving it around and making animal sounds, walking up participants arm or engaging in tickling with verbal statements like: “here comes the cow, moo-moo,” “the dog is here, woof-woof,” “the cat is going to tickle you, meow.” If the

participant did not produce a response or the response was incorrect, interventionist asked the question again and prompted the correct response using a verbal prompt. Data were documented on the first response only. The same game was played again to allow an extra opportunity for training a speaker response. This time interventionist handed the empty box to the participant and said: “Now you have a farm and we are going to see what animals you have.” The interventionist then presented animals one by one and asked: “What animal is this?” Praise and access to the animal were given contingent on a correct response. Incorrect responses were corrected by presenting the question with a verbal prompt, and then repeating the probe again.

Listener Response (A-B Relation) Test

The emergence of a listener response was tested immediately after the last probe for a speaker response. The first trial began with the interventionist saying: “Let’s play another game at the table.” The participant was then directed to the table to play the game *Find an Animal*. This game used laminated stimulus boards to simplify presentation and data collection. The interventionist made a statement: “Some animals are hiding. Let’s find them,” when presenting the stimulus board for the first time, followed by the request: “Where is x?” Interventionist collected data on listener responses for each of the animals. Data were documented on the first response only. No consequence was provided following a response from the participant.

After the last trial, the participant was praised for playing the game and was given access to the game pieces used for the speaker response training for up to 3 minutes. The interventionist remained with participant and engaged in playing by modeling placing animals in the box farm and moving them on. The interventionist did not provide any statements during this interval of play. If participant did not begin engagement within 10 s or stopped engaging for 10s, he was

directed to leave the room. Data were collected on this last opportunity to engage with materials as a demonstration of preference and as a measure of social validity with the participants. If participant engaged, interventionist documented engagement. This concluded the session.

The following three sessions were conducted the exact same way, but the book *Alex Goes to the Farm* was alternated with the book *Lana Goes to the Farm* and corresponding sets of stimuli were used.

Generalization probes. The fifth session was conducted differently and was used to collect data on generalization probes. This session used toy animals as the stimuli and blocks that were arranged in a circle to make an enclosure for the animals. Interventionist engaged the participant in building the structure by modeling and using partial physical prompts. Once the structure was built, toy animals were placed inside, and the same game *Find an Animal* was played. Data were collected on the first response made and no consequence was provided.

Immediately after the last test trial for generalization of a listener response, the interventionist began the test for speaker responses by picking up animals and asking, “What animal is this?” The interventionist documented speaker responses made within 5 s. No consequence was provided. This concluded the generalization probes.

Access to the toys was then given for up to 3 minutes. Interventionist remained with participant and engaged with simple word statements about the child’s game, such as: “I like how you put the animals on the farm,” “I see the dog,” “you put cat next to cow,” “your farm is full of animals.” If participant did not begin engagement within 10 s or stopped engaging for 10s, he was directed to leave the room. Data were collected on this last opportunity to engage with materials.

Maintenance probes. Maintenance probes were conducted at least one month after training and testing were completed. Maintenance probes were conducted in the same format as baseline using one of the stimuli sets. Maintenance probes were conducted on both the speaker responses and listener responses, with the speaker response being assessed first.

Chapter III: Results

DX - Listener Response (A-B Relation) Training

Results for DX are presented in Figure 1. Baseline data were collected on 13 zoo animals. DX was able to produce an echoic response for all 13 targets. DX was able to give an accurate listener response for 8/13 targets and speaker response for 3/13 targets. Baseline data for the zoo set identified five targets (zebra, gorilla, bird, deer, and hippo) for both the listener and the speaker responses. Level of accuracy for these targets was at 0% during baseline. After four days of listener response training, DX demonstrated an increase in accuracy to 80% across both book-boards and game. The training was extended an additional day to see if 100% of accuracy could be achieved across the training conditions. The desired accuracy was achieved only in the game condition but was not maintained during the generalization and maintenance probes. The test for the emergence of speaker responses demonstrated a range of accuracy between 20 to 100% with a mean of 56%. DX was able to produce an accurate speaker response for all five targets during the generalization probe and for four targets during the maintenance probe.

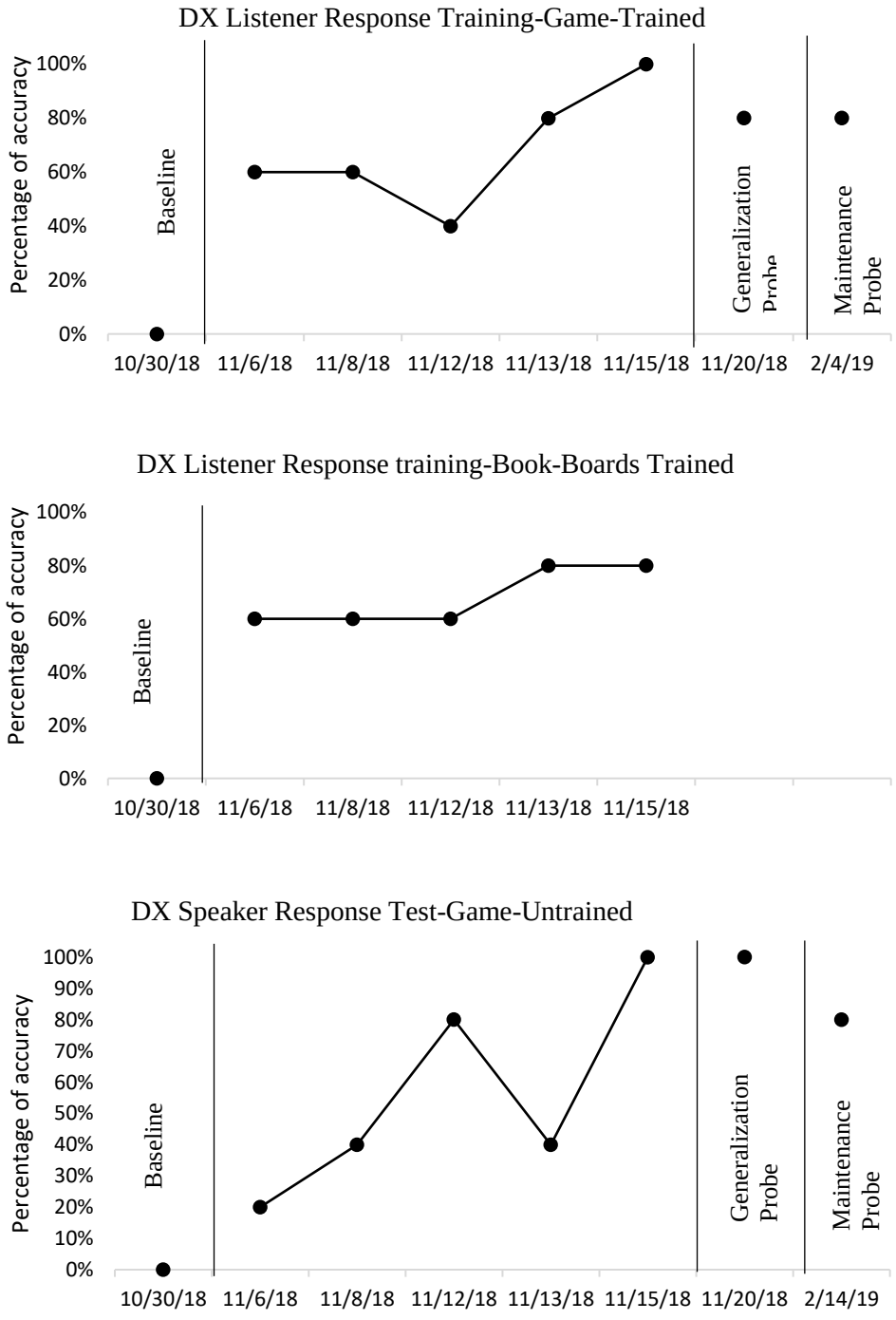


Figure 1. The Percentage of Accuracy of Responding for DX in Baseline, During Listener Response Training in Two Conditions, and the Test for Speaker Response Emergence.

DX – Speaker Response (B-A Relation) Training

Results for DX are presented in Figure 2. Baseline data were collected on 10 farm animals. DX could produce an echoic response for all 10 targets. DX accurately identified 8/10 targets with listener responses and 6/10 targets speaker responses. These data did not identify the sufficient number of targets to be trained. Baseline data were collected again to include the sounds animals made. Baseline data were collected the same way, but for speaker responses, DX was asked: "What animals says x?" and for listener responses: "Show me animal that say x." DX was able to give an accurate listener response for 6/10 targets but wasn't able to give an accurate speaker response for any of the targets. These baseline data identified four targets (horse, sheep, rooster, turkey) for both the speaker and listener responses. Level of accuracy for these targets was at 0% during baseline. Speaker response training was modified to include the sounds animals made. The book included animal sounds and the pages that had one of the targeted animals had the statement "What animal says x?" to train the speaker's responses. The response of tacting the animal with one word remained the same. The game was changed to *Hide and Seek on the Farm*. It included a cup for hiding an animal. The game began with all of the animals out of sight and the statement of: "Animals are hiding on the farm." One of the targeted animals was then placed under a cup with the statement/question: "I hear an animal say x. What animal says x?" and a 5 s pause to allow DX to respond. An absence of response or an incorrect response was followed by a verbal prompt and a new opportunity to respond independently. Data collection remained the same. Data were also collected on ability to make animal sounds to see if additional language of making animal sounds would be acquired. The child was then asked, "What does x say?" incidentally during the game. After four days of speaker response training,

DX demonstrated an increase in accuracy to 100% and maintained it during the generalization probe. Maintenance probe was at 75% with one of the targets not identified accurately. Data on animal sounds demonstrated a range in accuracy between 0-25% during training, and 100% during both the generalization and maintenance probes. The test for the emergence of listener responses demonstrated a range of accuracy between 25 to 100% with a mean of 69%. DX maintained 100% accuracy for listener responses during the generalization and maintenance probes.

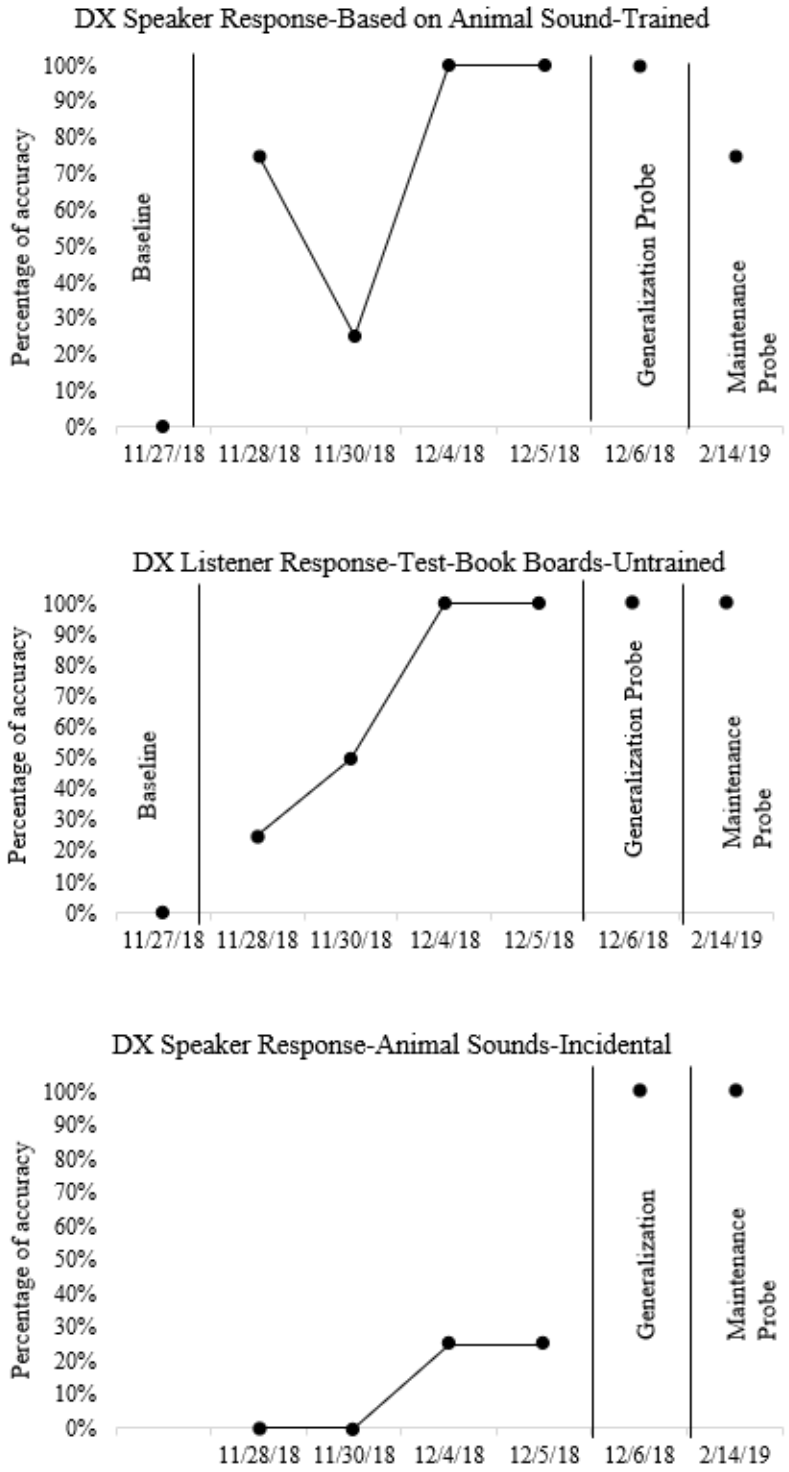


Figure 2. The Percentage of Accuracy of Responding for DX in Baseline, During Speaker Response Training, the Test for Listener Response Emergence, and the Additional Incidental Targets of Animal Sounds.

LX – Speaker Response (B-A Relation) Training

Results for LX are presented in Figure 3. Baseline data were collected on 10 farm animals. LX was able to produce an echoic response for all 10 targets. LX was able to give an accurate listener response for 8/10 targets and speaker response for 8/10 targets. These data did not identify a sufficient number of targets to be trained. Baseline data were collected again to include the sounds animals made. Baseline data was collected the same way, but for speaker responses, LX was asked: "What animals says x?" and for listener responses: "Show me animal that say x." LX was able to give accurate listener and speaker responses for 4/10 targets. These baseline data identified three targets (horse, goat, rooster) for both the speaker and listener responses. Additional two targets that did not result in an accurate listener response were selected (cow and duck) to test whether they will emerge during the untrained listener response test after the training. Level of accuracy for these targets was at 40% during baseline for speaker responses and 0% for listener responses. Speaker response training was modified to include the sounds animals made. The book included animal sounds and the pages that had one of the targeted animals had the statement "What animal says x?" to train the speaker's responses. The response of tacting the animal with one word remained the same. The game was changed to *Hide and Seek on the Farm*. It included a cup for hiding an animal. The game began with all of the animals out of sight and the statement of: "Animals are hiding on the farm." One of the targeted animals was then placed under a cup with the statement/question: "I hear an animal say x. What animal says x?" and a 5 s pause to allow LX to respond. An absence of response or an incorrect response were followed by a verbal prompt and a new opportunity to respond independently. Data collection remained the same. Data was also collected on ability to make animal sounds to

see if additional language of making animal sounds would be acquired. A simple question of: "What does x say?" was asked incidentally during the game. LX demonstrated 100% accuracy on the first day of training and maintained it for the next three days. Training was discontinued after three days due to such a rapid acquisition of targets. LX had a decrease in accuracy by 20% during the generalization probe, with another decrease in the maintenance probe. Data on animal sounds demonstrated a range in accuracy between 0-100% during training, 80% during the generalization, and 100% for the maintenance probes. The test for the emergence of listener responses demonstrated a range of accuracy between 40 to 100% with a mean of 80%. LX maintained 80% accuracy for listener responses during the generalization and 100% during maintenance probe.

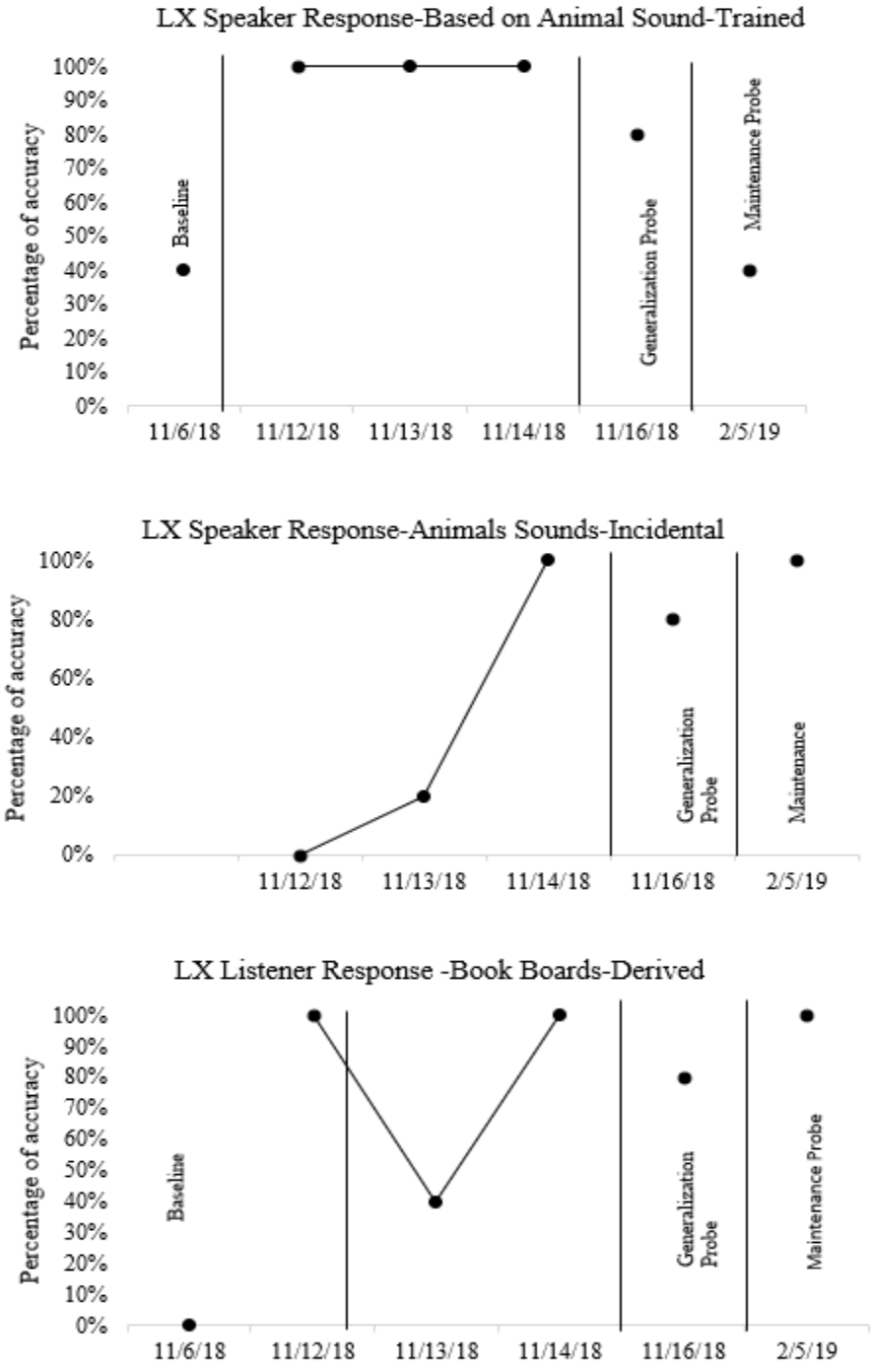
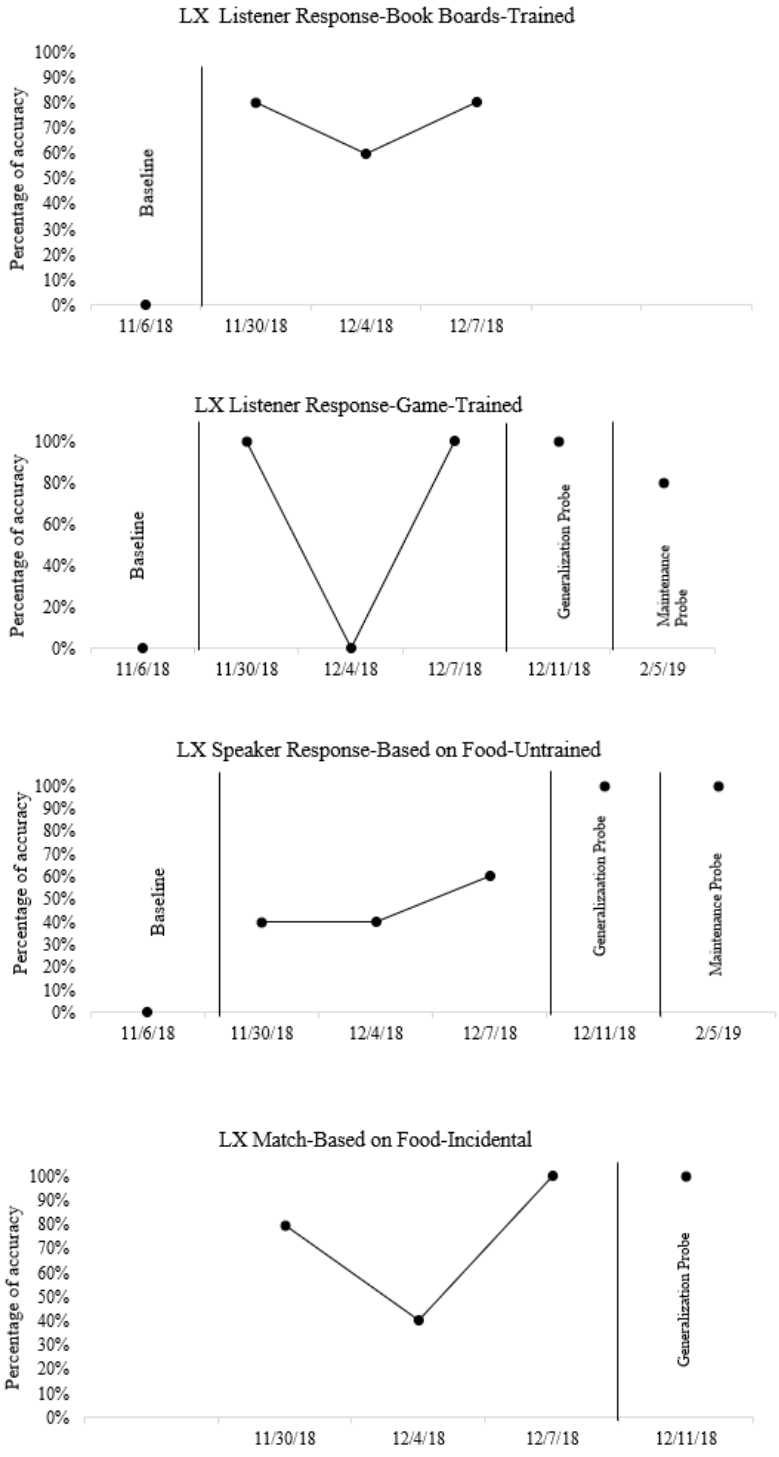


Figure 3. The Percentage of Accuracy of Responding for LX in Baseline, During Speaker Response Training, the Test for Listener Response Emergence, and the Additional Incidental Targets of Animal Sounds.

LX - Listener Response (A-B Relation) Training

Results for LX are presented in Figure 4. Baseline data were collected on 13 zoo animals. LX was able to produce an echoic response for all 13 targets. LX was able to give an accurate listener response for all 13 targets and speaker response for 9/13 targets. Baseline data for the zoo set did not identified a sufficient number of targets for training. LX was able to give accurate listener responses for 2/10 targets and speaker responses for 0/10 targets. Based on the baseline data five targets were selected (zebra, lion, penguin, parrot, deer) for both the speaker and listener responses. Three of these targets (parrot, zebra, and penguin) were also the ones that LX did not identify accurately during the original baseline data collection for speaker responses. Listener response training was modified to include the foods animals like to eat. The book included a play scenario of an animal party. The pages had one of the targeted animals as well as the picture of the food had the statements: “The toy x is coming to the party. X likes x. Show me x (for both animal and food)” to train the listener responses. The response of touching the animal remained the same. The game was changed *to Let’s Feed the Animals*. It included pictures of animals and food connected to Lego blocks. All of the animals were lined up in a row on a Lego board. The game began with the statement: “I have x, what animal likes x?” Any response of touching, picking up the animal or giving the animal were accepted. An absence of response or an incorrect response were followed by a gestural prompt and a new opportunity to respond independently. Data collection remained the same. Data was also collected on ability to match food to the right animal when given a directive: “feed the animals” to see if the additional skill of matching food items to animals would be acquired. The test for speaker responses was done during *a Hide-and-Seek* game. With all of the animals out of sight, one animal was placed under

a cup followed by a statement: “The animal is eating x. What animal likes x?” LX demonstrated variability in accuracy between 0-100% during the three days of training across book and game conditions. LX was able to generalize responses at 100% with a slight decrease to 80% during the maintenance probe. Data on matching demonstrated a range in accuracy between 40-100% during training but dropped increased to 100% during generalization. The test for the emergence of speaker responses demonstrated a range of accuracy between 40 to 60% with a mean of 46%. However, LX increased accuracy to 100% during the generalization and maintenance probes.



F*igure 4.* The Percentage of Accuracy of Responding for LX in Baseline, During Listener Response Training, the Test for Speaker Response Emergence, and the Additional Incidental Targets of Matching Animals to Food Items.

RY – Speaker Response (B-A Relation) Training

Results for RY are presented in Figure 5. Baseline data was collected on 10 farm animals. RY was able to produce an echoic response for all 10 targets. RY was able to give an accurate listener response for 8/10 targets and speaker response for 7/10 targets. These data did not identify a sufficient number of targets to be trained. Baseline data was collected again to include the sounds animals made. Baseline data was collected the same way, but for speaker responses, RY was asked: "What animals says x?" and for listener responses: "Show me animal that say x." RY was able to give accurate listener responses for 3/10 targets and speaker responses for 0/10 targets. Based on the data five targets were identified (cow, horse, goat, pig, cat). Level of accuracy for these targets was at 0% during baseline. Speaker response training was modified to include the sounds animals made. The book included animal sounds and the pages that had one of the targeted animals had the statement "What animal says x?" to train the speaker's responses. The response of tacting the animal with one word remained the same. The game was changed to *Hide and Seek on the Farm*. It included a cup for hiding an animal. The game began with all of the animals out of sight and the statement of: "Animals are hiding on the farm." One of the targeted animals was then placed under a cup with the statement/question: "I hear an animal say x. What animal says x?" and a 5 s pause to allow RY to respond. An absence of response or an incorrect response were followed by a verbal prompt and a new opportunity to respond independently. Data collection remained the same. Data was also collected on ability to make animal sounds to see if additional language of making animal sounds would be acquired. A simple question of: "What does x say?" was asked incidentally during the game. RY demonstrated 0% accuracy for the first three days with a slight increase of 20% on the fourth.

Training was extended an additional three days until RY demonstrated an accuracy of 80% during the speaker response training. RY maintained accuracy of 80% during the generalization probe and 60% during maintenance probe. Data on animal sounds demonstrated a range in accuracy between 0-100% during training, 100% during the generalization, and 80% for the maintenance probes. The test for the emergence of listener responses demonstrated a range of accuracy between 0-80% with a mean of 40%. RY's accuracy for listener responses decreased to 40% during the generalization but increased to 60 during maintenance probe.

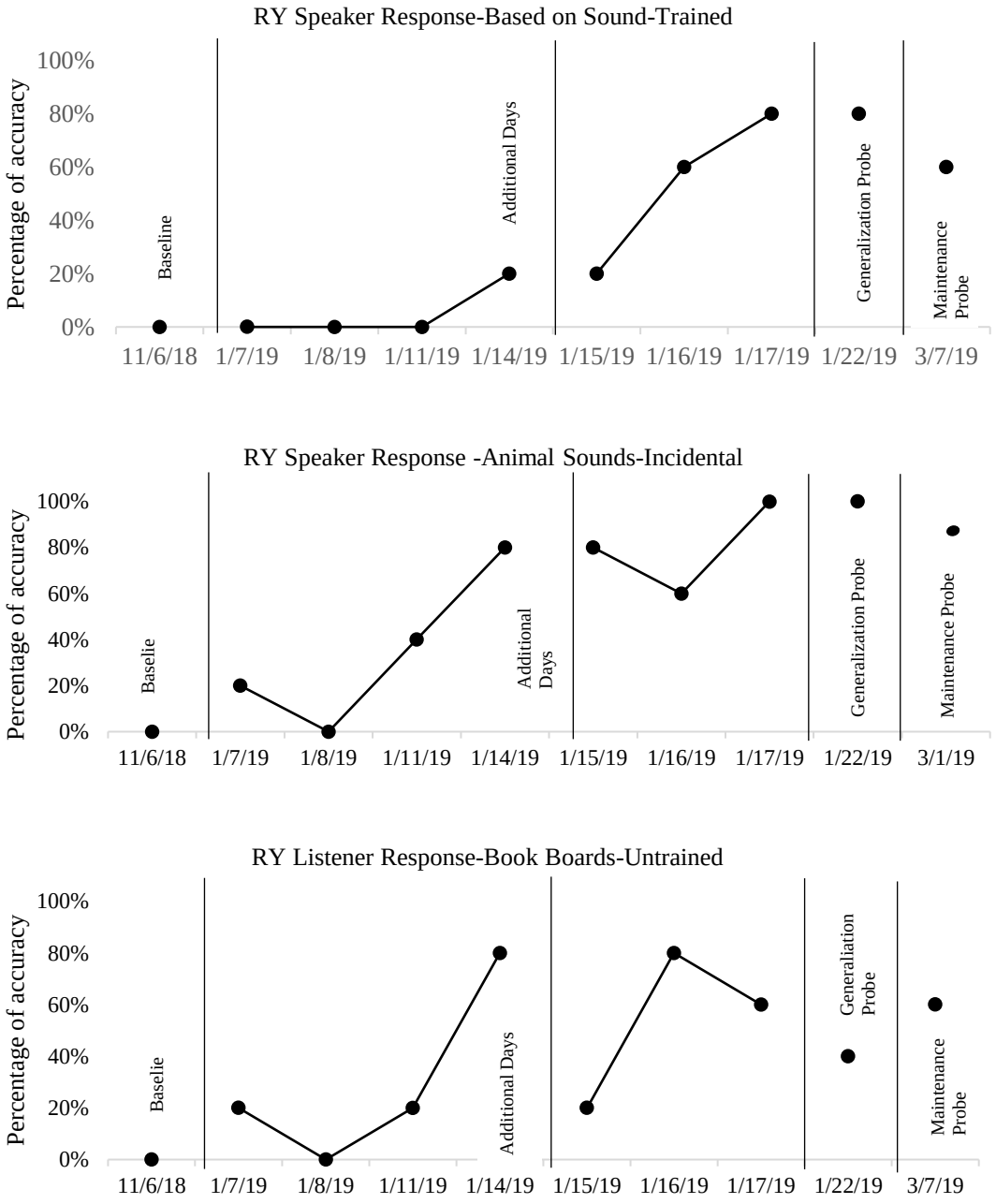


Figure 5. The Percentage of Accuracy of Responding for RY in Baseline, During Speaker Response Training, the Test for Listener Response Emergence, and the Additional Incidental Targets of Animal Sounds.

RY - Listener Response (A-B Relation) Training

Results for RY are presented in Figure 6. Baseline data was collected on 13 zoo animals. RY was able to produce an echoic response for all 13 targets. RY was able to give an accurate listener response for 7/13 targets and speaker response for 4/13 targets. Baseline data for the zoo identified five targets for training (gorilla, deer, tiger, elephant, snake). RY demonstrated 40% accuracy in accuracy during the three days of training across book-boards and 20% during game conditions. RY increased accuracy to 60% for both conditions on the 4th day. Training was extended an additional 3 days to ensure 80% of accuracy was achieved. RY was able to generalize responses at 100% with 80% during the maintenance probe. The test for the emergence of speaker responses demonstrated a range of accuracy between 0 - 40% with a mean of 34%. However, RY increased accuracy to 60% during the generalization and 80% during maintenance probes.

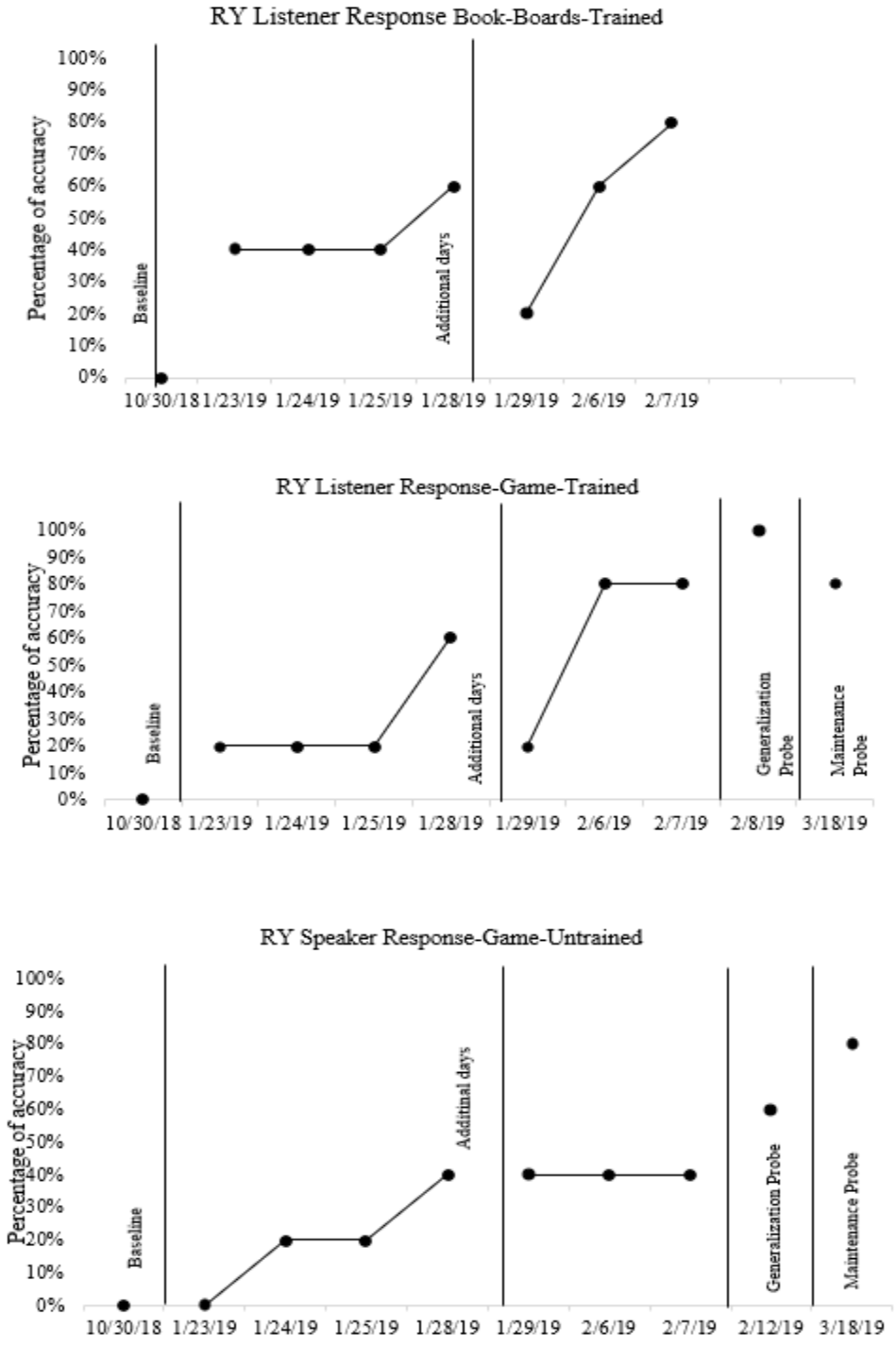


Figure 6. The Percentage of Accuracy of Responding for RY in Baseline, During Listener Response Training and the Test for Speaker Response Emergence.

Social Validity Results

In response to Question 1 (How difficult was this procedure to implement?), two out of three RBTs rated it at 1, while the other one rated it at 2 (with 1 being very easy and 5 – very difficult. In response to Question 2 (How enjoyable was this procedure?), all three rated it at 5. In response to Question 3 (How enjoyable was this procedure to the participant?), all three rated it at 5. In response to Question 4 (How beneficial was this procedure to the participant?), two RBTs rated it at 4, and 1 rated it at 5. In response to Question 5 (Would you repeat this procedure with another client?), all 3 RBTs rated it at 5.

In addition to the social validity questions, RBT for Participant 3 reported participant drawing and naming all of the animals in the natural environment, as well as responding to questions about animal sounds during group with peers. Participant 2 made several requests to learn about animals when meeting interventionist in the hall. Participant 1 did not engage in any problematic behavior during session.

IOA

Interobserver agreement data were collected for trained/untrained responses, participation in play and additional responses. Additional responses included: animal sounds for all three participants, foods animals eat, and matching foods to animals for LX. Agreement data were obtained for all baseline sessions and were 100% across the three participants. Agreement for DX was collected during 61% of sessions, 60% of sessions for LX, and 73% for RY. Mean interobserver agreement values were 100% for DX, 98% for LX, and 100% for RY.

Table 1

Interobserver Agreement

DX				LX				RY			
Date	IOA	Date	IOA	Date	IOA	Date	IOA	Date	IOA	Date	IOA
11/6	100%	11/28		11/12	86%	11/30		1/7	100%	1/23	100%
11/8	100%	11/30		11/13	100%	12/4		1/8		1/24	
11/12	100%	12/4	100%	11/14		12/7	100%	1/11	100%	1/25	100%
11/13	100%	12/5	100%	11/16		12/11	100%	1/14	100%	1/28	100%
11/15		12/6		2/5	100%	2/5	100%	1/15		1/29	100%
11/20		2/14	100%					1/16	100%	2/6	100%
2/14	100%							1/17		2/7	100%
								1/22	100%	2/8	100%
								3/7	100%	2/12	100%
										3/18	100%

Chapter IV: Discussion

Target Acquisition

All participants responded to the presentation of the book by answering questions and completing directives. All participants participated in sessions without engaging in problematic behavior or protesting. DX had one session with frequent requests for food and LX had one session with crying that was carried over from an experience prior to session. Each participant was exposed to five targets simultaneously (Participant 1 had only four targets during speaker response training) and met criterion of 80-100% accuracy for all targets after just five days of training for DX, three days for LX, and seven days for RY. All participants responded to a variety of directives that required the same response (e.g., touch, show me, where is? What animal says x?), with some that consisted of two sentences (ex: I have grapes. What animals likes grapes?). Target acquisition occurred without the use of edibles or tokens as reinforcement; instead, typical reinforcement was used, including praise, social interaction with the interventionist, and access to game pieces was used during all sessions.

Incidental Targets

All participants were exposed to additional language such as animal sounds for all three participants and food items for LX. Data were collected on acquisition of these targets, but no criterion or specific training was provided. All three participants had demonstrated responding limited to only trained responses. In this study, we addressed multiple targets incidentally with no primary reinforcement or tokens. DX demonstrated acquisition of animal sounds at 20% during training, and 100% during generalization and maintenance. RY demonstrated 100% of accuracy for animal sounds during training, maintaining the same level of accuracy during

generalization, with a decrease to 80% during maintenance probe. LX demonstrated 100% accuracy for animal sounds during training and maintenance, and 80% during generalization. An accuracy of 100% was achieved by LX on matching food items to animals during training, generalization, and maintenance. This was a novel skill of matching items by association that has never been addressed with LX before.

Test for Emergence of Untrained Responses

Criterion for the emergence of untrained responses was set for 80-100% accuracy. DX met the criterion for both untrained speaker and listener responses during training, generalization, and maintenance. LX met criterion for untrained listener responses during training, generalization, and maintenance. LX met criterion for speaker responses during generalization and maintenance but not training. RY met criterion for untrained listener responses on two out of seven training sessions and could not demonstrate the same accuracy during generalization and maintenance. RY did not meet criterion for untrained speaker responses at any point during the procedure except when maintenance probe was conducted a month later, when RY received a score of 80%.

Play

All participants selected to play with materials used for games. DX selected to play 70.0% of the sessions (one session play was not selected due to requests for food). DX's play wasn't functional. He rotated game pieces between fingers. LX elected to play 87.5% of the sessions (one session play wasn't selected due to crying that carried over from an experience prior to session). LX enjoyed holding game pieces and placing them on the chair and in his lap. RY selected play to 94.0% of all sessions RY enjoyed placing marker caps on own fingers, so

game pieces were taped to marker caps instead of Lego blocks or binder clips. RY enjoyed placing game pieces on the fingers and singing a song (family finger song; e.g., *Daddy finger where are you, here I am, how do you do*) No participant reproduced play from a brief model of the interventionist moving game pieces/toy animals, pretending that they were animals.

Limitations

A limitation of this study is that all of the sessions were conducted by one interventionist. It is possible that the interventionist was a variable affecting treatment results. The interventionist's prior education, experience working with children, and skills may have positively affected the acquisition of targets by the participants. The interventionist had a vested interest in results of the study as it was a part of the thesis for a graduate program.

Another limitation could be the lack of reliability assessment of the procedures. Even though IOA was collected during 60-73% of the sessions, reliability was never assessed.

Another limitation was the lack of data on the duration of play. Play was recorded as a choice made at the end of the sessions as a measure of social validity for the participants, however the duration of engagement with game pieces would have demonstrated a true interest in materials used for the session.

An additional limitation is that the effects of books and of games were not assessed individually and were a part of the intervention package. It is not clear what effect each one of these had on the acquisition of targets and whether one was more effective than the other.

The final limitation was that criterion for the emergence of untrained responses was only met by 2/3 participants. Even though it is possible that different data could have presented a more accurate representation of acquisition of language targets and emergence of untrained

responses, it is also possible that using books and games is not an effective method for all children with ASD.

Future Research

Future research should examine effects of individualizing this method based on child's interests and rate of acquisition. Some individualization of game pieces was attempted during this study, but it was only addressed when individual failed to make expected progress. Individualization can be achieved by examining items that are used as functional reinforcement and identifying certain features that could be used to increase motivation and interest. It would also be beneficial to test the use of songs as another opportunity for training selected targets.

Future research should identify the best training procedure for professionals in the field as well as family members to be able to use this method independently. It may be beneficial to assess if treatment fidelity is crucial for implementing this method, and whether naturally occurring variables (formulation of directives, order of presentation, environment sounds/distractions) in the presentation of trials are opportunities for generalizing the skill and developing ability to respond under natural environment conditions.

Future research could also focus on examining effects of this procedure in the home environment, administered by the parent. So many of the procedures used with children with ASD rely on a strict environment and trained professionals, while typically developing children learn from their parents and other individuals in different naturally set up environments. Previous research has demonstrated increased effects of treatments when the parent was a part of the treatment. It is possible that this procedure may require minimum training and could be easily replicated in the home or other natural environments like a preschool or grandma's house.

Children with ASD may benefit from increased social interactions and demonstrate ability to generalize targeted and novel skills to different environments.

It may be beneficial to compare effects of using this procedure to the effects of DTT on acquisition of language and other skills. DTT has been identified as a research-based procedure that is effective in addressing a variety of deficits. This study set a goal to examine effects of a different procedure and has demonstrated promising results. Contingent on replication of this study across multiple participants with similar results, it may be beneficial to examine effects of a procedure that combines both DTT and incidental teaching using books and games.

Future research could identify and examine other application of this procedure (using books and games) in acquisition of more complex language skills (sentence structure, idioms, sarcasm), play skills, social skills, and adaptive skills.

A final area of research would be to examine and identify data collection system that would be able to capture both progress and struggles in acquisition of targeted skills in the natural environments, where variables such as sounds, movement of others, and other distractors cannot be controlled.

References

American Academy of Pediatrics. (2015). *Caring for your baby and young child: Birth to age five* (6th ed.). New York, NY: Bantam.

American Psychological Association. (2013). *The American Psychiatric Association's diagnostic and statistical manual* (5th ed.). Washington, DC: Author.

Charlop-Christy, M. H., & Carpenter, M. H. (2000). Modified incidental teaching sessions: A procedure for parents to increase spontaneous speech in their children with autism. *Journal of Positive Behavior Interventions, 2*, 98-112.

Delprato, D. J. (2001). Comparison of discrete-trial and normalized behavioral language intervention for young children with autism. *Journal of Autism and Developmental Disorders, 3*, 315-325

Downs, A., Downs, R. C., Fossum, M., & Rau K. (2008). Effectiveness of discrete trial teaching with preschool students with developmental disabilities. *Education and Training in Developmental Disabilities, 43*(4), 443-453

Farrant, B. M., & Zubrick, S. R. (2011). Early vocabulary development: The importance of joint attention and parent-child book reading. *First Language*, 1-22.

Fleury, V., Miramontez, S. H., Hudson, R. F., & Schwartz, I. S. (2013). Promoting active participation in book reading for preschoolers with autism spectrum disorder: A preliminary study. *Child Language Teaching and Therapy*, *0*, 1-16.

Geiger, K. B., Carr, J. E., LeBlanc, L. A., Hanney, N. M., Polick, A. S., & Heinicke, M. R. (2012). Teaching receptive discrimination to children with autism: a comparison of traditional and embedded discrete trial teaching. *Behavior Analysis in Practice, 5*, 49-59

Greer, R. D., Stolfi, L., Chavez-Brown, M., & Rivera-Valdes, C. (2005). The emergence of the listener to speaker component of naming in children as a function of multiple exemplar instruction. *The Analysis of Verbal Behavior*, *21*, 123-134.

Hall, G. A., & Chase, P. N. (1991). The relationship between stimulus equivalence and verbal behavior. *The Analysis of Verbal Behavior*, 9, 107-119

Hart, B. M., & Risley, T. R. (1968). Establishing use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. *Journal of Applied Behavior Analysis, 1*, 109-120.

Hart, B. M., & Risley, T. R. (1980). In vivo language intervention: Unanticipated general effects. *Journal of Applied Behavior Analysis,13*, 407-432.

Horner, R. D., & Baer, D. (1978). Multiple-probe technique: a variation of the multiple baseline. *Journal of Applied Behavior Analysis, 11*, 189-196.

Kratochwill, T. R., & Levin, J. R. (2010). Enhancing the scientific credibility of single-case intervention research: Randomization to the rescue. *Psychological Methods, 15*, 2. doi: 10.1037/10017736

Leaf, J. B., Leaf, R., Cihon, J. H., & McEachin, J. (2016). A progressive approach to discrete trial teaching: Some current guidelines. *International Electronic journal of Elementary Education*, *9*, 361-372

Lovaas, O. I. (1977). *The autistic child: Language training through behavior modification*. New York: Irvington.

McGee, G. G., Krantz, P. J., & McClannahan L. E. (1986). An extension of incidental teaching procedures to reading instruction for autistic children. *Journal of Applied Behavior Analysis*, *19*, 147-157.

Michael, J. (1985). Two kinds of verbal behavior plus a possible third. *The Analysis of Verbal Behavior*, *3*, 1-4.

Montag, J. L., Jones, M. N., & Smith, L. B. (2015). The words children hear: Picture books and the statistics for language learning. *Psychological Science*, 1-8.

Rogers-Warren, A., & Warren, S. F. (1980). Mands for verbalization. Facilitating the display of newly trained language in children. *Behavior Modification*, *3*, 361-382.

Rosales, R., Rehfeldt, R. A., & Huffman, N. (2012). Examining the utility of the stimulus pairing observation procedure with preschool children learning a second language. *Journal of Applied Behavior Analysis*, *45*, 173-177.

Smith, T. (2001). Discrete trial training in the treatment of autism. *Focus on Autism and other Developmental Disabilities*, *16*, 86-92.

Stephens, J. (1989). Language, discourse, and picture books. *Children's Literature Association Quarterly*, *14*, 106-110.

Wasik, B. A., Hindman, A. H., & Snell, E. K. (2016). Book reading and vocabulary development: A systematic review. *Early Childhood Research Quarterly*, *37*, 39-57.

Wasik, B. A., & Hindman, A. H. (2014). Understanding the active ingredients in an effective preschool vocabulary intervention: An exploratory study of teacher and child talk during book reading. *Early Childhood and Development*, *25*, 1035-1056.

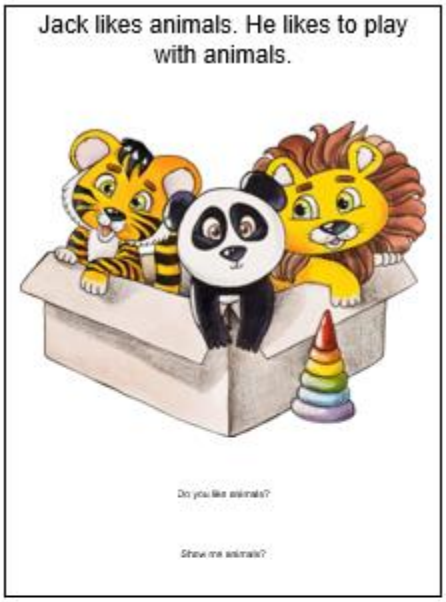
Whitehurst, G. J., & Lonigan, C.J. (1998). Child development and emergent literacy. *Child Development*, *69*, 848-872.

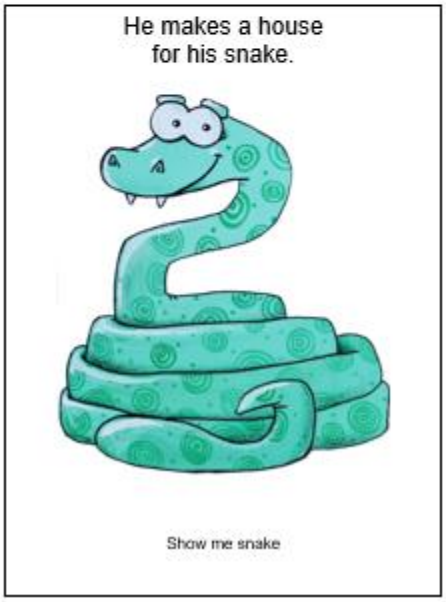
Wong, C., Odom, S. L., Hume, K. A., Cox, a. W., Fettig, A., Kucharczyk, A., . . . Schultz, T. R. (2015). Evidence-based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. *Journal of Autism Development Disorder, 45*, 1951-1966

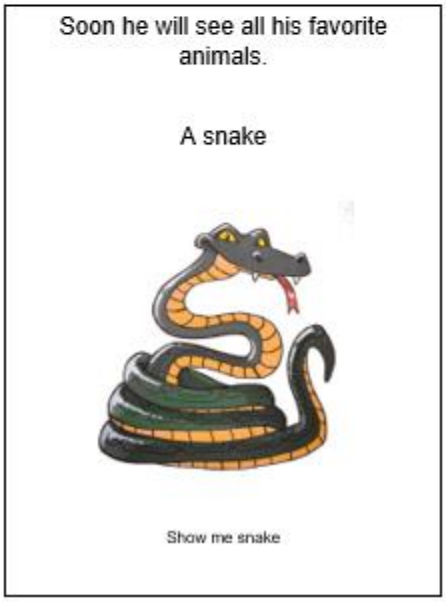
Appendix A: Social Validity Survey

	Rating Scale 1-5				
1. How difficult was this procedure to implement?	1	2	3	4	5
2. How enjoyable was this procedure?	1	2	3	4	5
3. How enjoyable was this procedure to the participant?	1	2	3	4	5
4. How beneficial was this procedure to the participant?	1	2	3	4	5
5. Would you repeat this procedure with another client?	1	2	3	4	5

Appendix B: Book Pages Used for Training Targeted Responses

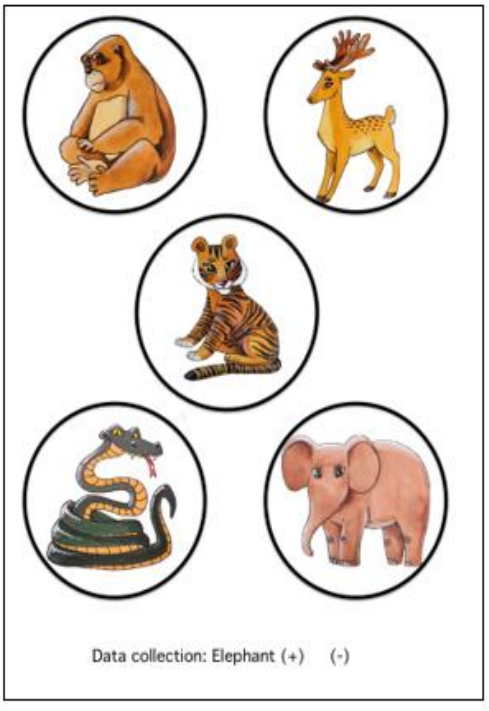






Appendix C: Game Pieces Used for Training/Testing Targeted Responses

Appendix D: Book Boards Used for Training/Testing Listener Responses



Appendix E: Toys Used to Generalize Targets

Appendix F: Data Collection Forms

Speaker responses
Participant LX
Data Collector_____
Date _____

Book BOARDS - Receptive

Zebra	+ -
Lion	+ -
Parrot	+ -
Penguin	+ -
Deer	+ -

Game I have grapes, I need an animal that likes grapes -Receptive

Zebra	+ -
Lion	+ -
Parrot	+ -
Penguin	+ -
Deer	+ -

Game WHO IS Eating-Animal under container. This animal is eating grapes. What animal likes grapes. Expressive

Zebra	+ -
Lion	+ -
Parrot	+ -
Penguin	+ -
Deer	+ -

Game FEED THE ANIMALS. I have grapes, feed the animal - Receptive

Zebra	+ -
Lion	+ -
Parrot	+ -
Penguin	+ -
Deer	+ -

Played 3 minutes at the end of session

YES	NO

Participant LK
Data Collector_____

Date _____

GENERALIZATION
Animals are hiding on the farm.
I hear an animal say X.
What animals says X

Cow	+ -
Horse	+ -
Rooster	+ -
Goat	+ -
Duck	+ -

GENERALIZATION
Let's build a farm. We need an animal that says x

Cow	+ -
Horse	+ -
Rooster	+ -
Goat	+ -
Duck	+ -

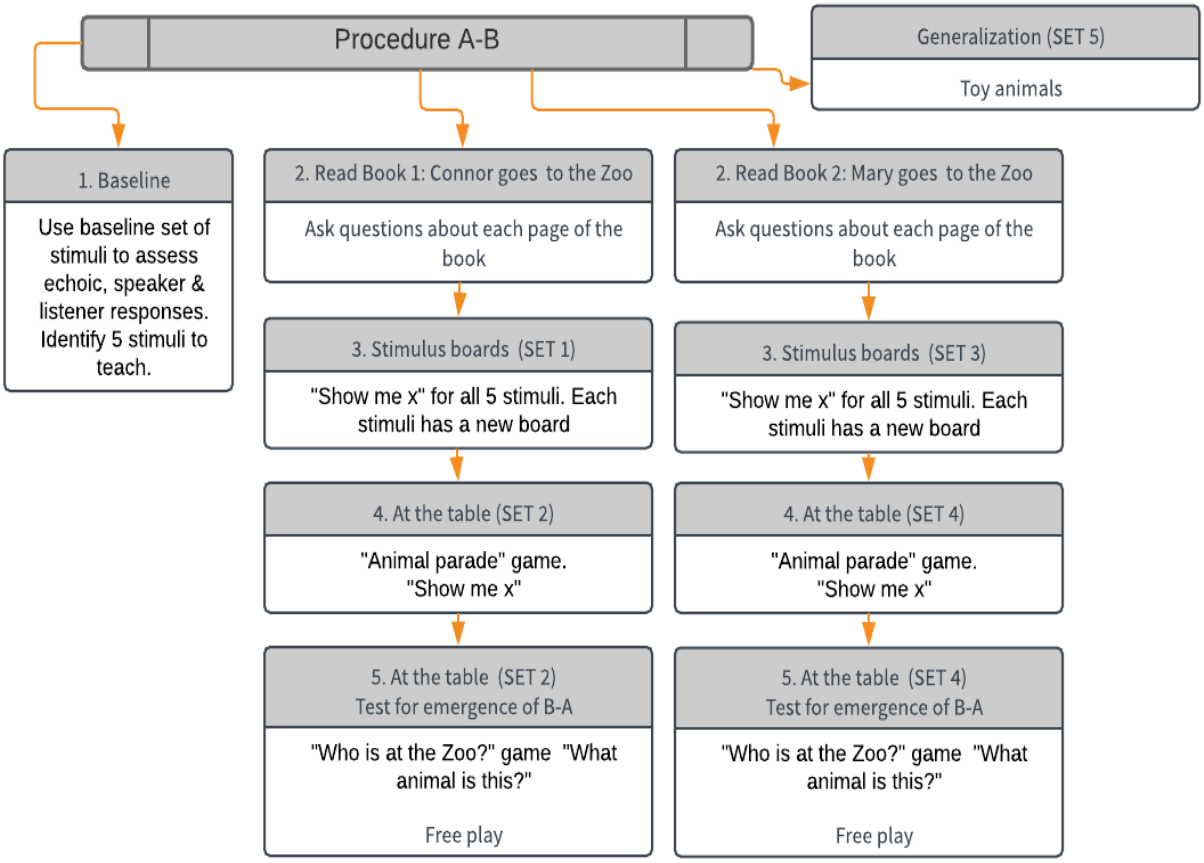
GENERALIZATION
Look at the animals. What does the x say?

Cow	+ -
Horse	+ -
Rooster	+ -
Goat	+ -
Duck	+ -

Played 3 minutes at the end of session

YES	NO

Appendix G: Flow Chart to Illustrate Procedure for Condition 1: A-B to B-A Relations



Appendix H: Flow Chart to Illustrate Procedure for Condition 2: B-A to A-B Relations