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Increasing "Object-Substitution" Symbolic Play in Young Children with Autism Spectrum Disorders

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Abstract

Children with autism spectrum disorders (ASD) may not develop symbolic play skills so such skills need to be taught specifically. We report an experiment regarding a procedure targeting "object-substitution" symbolic play skills. The "object-substitution" symbolic play behavior occurred when the child labeled a common object with the name of a substitute and used the object to perform a play action (e.g., As she put a bowl on her head, she called it a hat). A multiple probe across behaviors design was employed with five children (four boys and one girl, aged 3 to 6) with ASD. All children had verbal communication and demonstrated functional play and generalized imitation, but no symbolic play skills prior to the study. The instruction consisted of intraverbal training, picture prompts, and modeling of play actions. All children demonstrated object-substitution symbolic play skills after the instruction. The occurrences of response generalization were also discussed.

Keywords: symbolic play, object substitutions, functional play, autism.

Increasing "Object-Substitution" Symbolic Play in Young Children with Autism Spectrum Disorders

Individuals who meet the diagnostic criteria for autism spectrum disorders (ASD) display core deficits in social communication and restrictive/ repetitive patterns of movements, interests, and activities (American Psychiatric Association, 2013). As a result, affected individuals are more likely to experience social isolation and anxiety in social situations (Bellini, 2006). It is commonly observed that young children with ASD often engage in solitary, repetitive play activities and lack appropriate play repertoires. Thus, appropriate play behavior is typically a focus in early intervention programs for children with ASD.

Symbolic play is one play behavior commonly observed in young children and has long been recognized as one of the most important foundational skills due to its correlation with future cognitive, social, and emotional development (Copple, Bredekamp, & National Association for the Education of Young Children, 2009; McCune, 2010; Piaget, 1962; Vygotsky, 1967). Typically, children develop symbolic play during their first two to three years. However, symbolic play is usually absent in children with ASD (Baron-Cohen, 1987; Charman et al., 1997) and it has been used as one of the diagnostic criteria for ASD (Lord et al., 2012). In the skill-based behavior assessments, such as *The Assessment of Basic Language and Learning Skills-Revised* (ABLLS-R; Partington, 2010) and *Verbal Behavior Milestones Assessment and Placement Program* (VB-MAPP; Sundberg, 2008), symbolic play behaviors are listed as test items (i.e., playing with common objects in creative ways; engaging in pretend or imaginary play), suggesting that symbolic play is an important play skill to teach in early intervention programs.

Developmental psychologist Leslie (1987) categorized play into functional play and three forms of symbolic play (i.e., object substitutions, attribution of pretend properties, and

imaginary objects). Functional play refers to use of objects in a conventional manner (e.g., using a cup to drink), while symbolic play involves "pretending" one object is another. Leslie's (1987) arguments focused on the underlying mental process of whether a child accurately discriminates the actual functions of objects and their associated events with the pretend functions or events reflected in their play behavior. However, the behavioral processes and the contextual variables affecting the acquisition of "pretense" reflected in children's play behavior are largely overlooked.

Object-substitution is one form of children's symbolic play and it consists of using an object in ways beyond its conventional function. The analysis of behavioral processes involved in intraverbal naming may be particularly relevant to the development object-substitution symbolic play in young children. In intraverbal naming, different stimuli may be related to form a stimulus class through intraverbal behavior (Horne & Lowe, 1996; Miguel, 2016). Research suggests that tact training and intraverbal training linking different stimuli established an equivalence class and the emergence of novel intraverbal relations in verbally capable adults (Jennings & Miguel, 2017; Ma, Miguel, & Jennings, 2016; Santos, Ma, & Miguel, 2015). In their seminal paper, Horne and Lowe (1996) provided an example of a caregiver-child interaction to illustrate how intraverbal behavior may establish different stimuli as members in a naming relation. (See Horne & Lowe, 1996, p 213). Here, we use their example to describe how a child may acquire object-substitution symbolic play via intraverbal naming. A child initially learned the names of bowls and boats and observed how they function on separate occasions (e.g., bowls hold food on the table; boats hold people on the water). Now the caregiver tells the child that the toy bowl is a boat, and thus, the child's play behavior toward the bowl includes all those applicable to toy boats. Such an intraverbal relation establishes equivalence between these two initially separate stimuli (e.g., "This bowl is a boat"). Further, the new name for the bowl (e.g., boat) may function as a discriminative

stimulus to evoke the derived new play behavior (e.g., pushing a bowl in a bathtub filled with water) without additional training. Similarly, if other new names are given to the bowl (e.g., "The bowl is a hat"), the bowl will evoke different play behaviors based on the names and their associated functions (e.g., putting the bowl on head). The equivalence class formation in intraverbal naming provides a prototype of instruction for children with ASD who have tact and intraverbal behavior yet lack symbolic play in their repertoire.

Interventions in play behavior for children with ASD rarely target symbolic play, probably due to its complexity (Kasari, Freeman, & Paparella, 2006). Currently, interventions targeting play skills focus on teaching appropriate play to children with ASD or developmental disabilities with instructional strategies, such as discrete trials, video or live modeling with verbal scripts or matrix training, reciprocal imitation training, pivotal response training, as well as combined behavioral and milieu teaching (Jung & Sainato, 2013; Stahmer, Ingersoll, & Carter, 2003).

Video modeling showing play actions and verbal statements with toy items was effective in increasing appropriate toy play without external reinforcement for children with ASD (D'Ateno, Mangiapanello, & Taylor, 2003; MacDonald, Clark, Garrigan, & Vangala, 2005; MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009; Paterson & Arco, 2007; Reagon, Higbee, & Endicott, 2006). In spite of rapid increases of imitative toy play via video modeling, generalization to new toy items, unscripted verbal statements or play actions was limited unless multiple exemplar training (Dupere, MacDonald, & Ahearn, 2013) or matrix training was incorporated as part of the instruction (Dauphin, Kinney, Stromer, & Koegel, 2004; MacManus, MacDonald, & Ahearn, 2015). Thus, generalization must be programmed into the instruction of play behavior for children with ASD.

Besides video-based instruction, Ingersoll and Schreibman (2006) taught reciprocal imitation skills to children with ASD and found their spontaneous pretend play increased as a

result. Using visual support as in activity schedules also facilitated appropriate toy play for children with ASD (DiCarlo & Reid, 2004; Morrison, Sainato, Benchaaban, & Endo, 2002). The above studies included play activities consisting of both functional and symbolic play behaviors, mostly using toy figurines to engage in play actions with relevant verbal responses described as pretend play in general. The distinction between different types of symbolic play was not clear in the pretend play activities in these studies.

Kasari and her colleagues (2006) used a combination of discrete trials instruction and naturalistic teaching in free play settings to teach symbolic play skills to children with ASD. They reported that the children's scores on the play skills assessment were significantly higher in the symbolic play group than in the control group. In a subsequent follow-up study, the researchers reported that children with ASD who displayed more diverse and complex play skills at the age of 3 to 4 years predicted later functional expressive language at 8 years old (Kasari, Gulsrud, Freeman, Paparella, & Hellemann, 2012). Stahmer (1995) used pivotal response training to target both language and symbolic play skills and reported that children's play skills did not change after language training but were improved following symbolic play training. The results of these studies indicated that it is possible for children with ASD and developmental disabilities to advance their play repertoire to include symbolic play, but specific instructions were needed.

Despite the emphasis on symbolic play skills in Kasari et al. (2006; 2012) and Stahmer (1995), the researchers used play skills assessments, including both functional and symbolic play, as dependent measures. The children's overall play skill levels were improved after the interventions; however, it is not clear how much and what types of symbolic play the children acquired. Due to the complexity inherent in children's play behavior, it is necessary to identify a specific type of symbolic play and evaluate whether such play behavior is acquired in an intervention.

The developmental sequence suggests that functional play may be one of the prerequisite skills for symbolic play and needs to be taken into consideration when planning early intervention (Lifter, Sulzer-Azaroff, Anderson, & Cowdery, 1993). It is observed that children demonstrate their ability to tact objects and associated events in their play behavior categorized as functional play. Thus, functional play skills may be required before targeting intervention for symbolic play. Given the relevance of intraverbal naming to symbolic play, the intervention may include intraverbal training to relate various common objects to facilitate object substitutions. Additionally, one important consideration in intervention for children with ASD concerns diversity in their responses due to the deficit of restrictive interests and repetitive behavioral patterns (Rodriguez & Thompson, 2015; Wolfe, Slocum, & Kunnavatana, 2014). Thus, varied response patterns should be taken into consideration in the intervention.

Response diversity occurs when a stimulus evokes varied multiple responses. It may involve response generalization as well as divergent multiple control in intraverbal relations (Michael, Palmer, & Sundberg, 2011). Response diversity can be taught via several instructional tactics, such as positive reinforcement (Goetz & Baer, 1973), picture prompts (Miguel, Petursdottir, & Carr, 2005) and visual imaging (Kisamore, Carr, & LeBlanc, 2011) for typical children; lag reinforcement schedule (Lee, McComas, & Jawor, 2002; Susa & Schlinger, 2012), picture prompts (Feng, Chou, & Lee, 2017), and instructor feedback with novel responses (Carroll & Kodak, 2015) for children with ASD. In these studies, varied and multiple responses to single stimuli were increased as a result of instruction targeting response diversity while avoiding the problem of undesired rote responding commonly observed in children with ASD (e.g., the same responses with the same order without attending to the antecedent stimuli).

Extending the conceptual analysis of intraverbal naming in Horne and Lowe (1996), we speculate one way that a child demonstrates object-substitution symbolic play with the following skills. The child has to a) tact the names and functions of common objects (e.g., a bowl is to hold food), b) tact the name and function of substitute objects (a boat is to hold people on the water), c) demonstrate common use of objects in play activities (e.g., a functional play action using a bowl to hold food or to eat with), d) associate an object with a new name (e.g., a bowl is a hat), and d) use the object to perform a new play action based on its new name (e.g., put a bowl on head). Therefore, prior to teaching object-substitution play behavior, the child has to name the object and its function as well as demonstrate the functional use of objects (functional play) as a prerequisite skill. Further, a response class consisting of multiple members is established via divergent multiple control in intraverbal relations for response diversity in the play repertoire. That is, the child learns to add new names in the response class and use the same object to perform novel play actions.

Taken together, the behavioral process of intraverbal naming suggests that object-substitution symbolic play can possibly be acquired in a process similar to intraverbal naming via the interactions between a child and her caregiver. However, whether an instruction resembles such an acquisition process is effective to teach symbolic play to children with ASD is unknown. The review of the literature in play interventions suggest the possibility of incorporating visual supports, modeling with multiple exemplars, and appropriate prompts to teach play skills to children with ASD and other developmental disabilities (Jung & Sainato, 2013; Stahmer et al., 2003). Therefore, it is necessary to incorporate some of these strategies in the symbolic play instruction and evaluate the procedure empirically. Previous research targeting pretend play skills often include functional play and various types of symbolic play without a procedure specifically designed to teach and measure object-substitution symbolic

play (DiCarlo & Reid, 2004; Ingersoll & Schreibman, 2006; Kasari et al., 2006; Morrison, Sainato, Benchaaban, & Endo, 2002; Stahmer, 1995).

In response to the gaps in the literature, the present study sought to apply intraverbal naming to teach object-substitution symbolic play behavior to children with ASD and developmental disabilities. We developed the instructional procedure based on Horne and Lowe's analysis of intraverbal naming and incorporated effective strategies to increase play skills in the procedure. We also aimed at teaching multiple varied play responses for each common object. Specifically, the children were taught to vocally respond to with multiple substitutes of four or five common objects (after a verbal antecedent question with the presence of the target object) and use these objects to perform their substitute functions. The purpose of the study was to evaluate whether the instruction increased the number of substitutes and their associated play actions in object-substitution symbolic play. The procedure primarily involved intraverbal training combined with picture prompts with multiple exemplars to transfer tact to intraverbal, modeling of play actions, verbal praises, and token reinforcement. The primary dependent variable was the number of substitutes and play actions for each common object. The number of novel substitutes without training was evaluated as a collateral effect of the instruction.

The following research questions are addressed. First, whether the object-substitution symbolic play instruction increased the total number of vocal responses of substitutes and their associated play actions for each target object. Second, whether the instruction increased the number of untaught vocal responses of substitutes and their associated play actions for each object. Third, whether the acquired skill was maintained 10 months after the instruction was completed in two of the five children.

Method

Participants

Four boys (Yu, Ray, Cheng, and Yan) and one girl (Xuan) participated in this study. At the time of the study, Yu and Cheng were both 3 years old with the diagnosis of ASD. Ray was 6 years old diagnosed with Asperger's Syndrome. Xuan was a 4-year-old girl, and Yan was a 6-year-old boy. They were also diagnosed with ASD. All children were diagnosed with Autism Diagnostic Observation Schedule, Second edition (ADOS-2; Lord et al., 2012) and Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5) (American Psychiatric Association, 2013), except Ray was diagnosed with ADOS-2 and DSM-IV (American Psychiatric Association, 1994).

All participants attended regular preschools in the morning and received center-based applied behavior analysis (ABA) services for one hour per day, four days per week. The center-based ABA intervention included one-on-one instruction in both structured and natural settings as well as group instruction (i.e., circle time, music, and gym class).

Initial screening. The initial screening consisted of examining each child's individualized programs. All participants demonstrated attending and direction following skills, requesting preferred items/activities with full sentences (e.g., "I want _____."), generalized imitation skills, naming more than 50 common objects and their functions, and answering "Wh" questions.

Instructions related to play skills for each child before the study are described as follows. Yu was taught to take turns with peers and to follow directions in group activities. Ray's play skills instruction included appropriate toy play (e.g., playing with a ball) and functional play with toy items (e.g., cooking on a toy range). Cheng also had the same instruction on functional play as Ray and following directions in a group. Xuan learned to wait for her turn, imitate block building patterns, appropriate toy play, and functional play with toys. Yan was taught to follow directions in group activities.

Play skills assessments. After the initial screening, each child was assessed with functional and object-substitution symbolic play skills (Feng & Sun, 2017). The play skills assessments were conducted in the play area with various types of toys on the shelves. The toys were not freely available to the child during assessment.

During functional play skills assessment, the assessor first gave the child a ball and said, “Try to play with it.” The assessor then let the child play with the ball for about a minute and asked the child to give the ball back to the assessor. The same procedure was repeated for a toy car and a drum, one at a time.

An instance of functional play was defined as the child played with an object with its intended function (e.g., beating the drum). Any inappropriate play included mouthing, banging, lining up, flipping, throwing objects, or manipulating a particular part of a toy repeatedly. The child’s functional play skill was scored “0” if s/he did not play with the toy or engage in inappropriate play, “1” if s/he played appropriately with one or two of the three items, and “2” if s/he played appropriately with all three items. This assessment took approximately 5 minutes to complete.

The object-substitution symbolic play assessment was conducted in the following steps. Step 1: six common objects were prepared, three for the child (i.e., a frisbee, a stack ring, and a pen) and three for the assessor (i.e., a block, a bowl, and a ball). Step 2: the assessor presented the block as a comb to comb her hair and said, “I am combing my hair.” Step 3: the assessor then presented a frisbee and gave it to the child and said, “Now you play.” Step 4: if the child engaged in play actions with the frisbee, the assessor asked questions (e.g., “What are you doing?”) for the child to clarify or explain his/her play actions and concluded this trial. This trial was also concluded if the child did not play with the frisbee within 10 seconds. Step 5: the assessor moved the bowl in the air as if it were a bird flying and said, “The bird is flying,” and gave the child a stack ring to play with. Step 4 was

repeated with a stack ring. Step 6: the assessor held a ball and said, “This is an apple,” and opened mouth pretending to eat it. The child was then given a pen to play with. Step 4 was repeated with a pen. Finally, the assessment was complete after the third item was assessed.

An instance of object-substitution symbolic play was defined as the child played with a common object with a substitute function (e.g., using a pen as a microphone for signing). If the child imitated the assessor with the given object (e.g., imitating the assessor’s hair combing action using a frisbee), it is not considered as symbolic play. Any inappropriate play, no response, or functional play was scored “0”; object-substitution symbolic play with one or two of the three items “1”; all three items “2.” This assessment took approximately 5 to 10 minutes.

The purpose for the assessor to provide an object-substitution play sample for each item was to model using an ordinary object with a substitute function. The child was given a different item from the assessor’s model item in order to avoid imitation of the same symbolic play action. All children who participated in this study scored “2” in functional play and “0” in the object-substitution symbolic play assessment. Yan was observed to engage in inappropriate play behaviors (i.e., banging toy items) in two occasions while other children did not have any inappropriate play behaviors during the assessment.

Setting and Materials

The study took place in a university affiliated autism center of a major city located in central China. All treatment programs were delivered in Mandarin. All sessions were conducted in the individual therapy rooms (about 2.5m by 2.5m, and 3m from floor to ceiling). Each therapy room also contained a play area with toys and books on shelves, one child-sized table with two chairs for treatment sessions, and a video camera for recording all sessions. Each room had a two-way mirror window for observations from outside. All

sessions were conducted in a one-on-one format either at the table or in the play area of the room.

Selection of instructional goals. The materials used in this study as target objects consisted of common objects either in the form of children-sized toys or regular items of daily use. Each target object had five substitutes as instructional goals. The instructors first created a table with four to five potential target objects and five potential substitutes for each object. These tentative target objects and substitutes were selected based on a) the children's instructional history of mastered tacted items and b) the symbolic play target objects and substitutes used in previous individual cases not included in this study.

Each child was tested that they could tact the name and its conventional function for each item in the table (i.e., presenting a picture and asking, "What's this?" "What do you do with it?"). Whether they could use the target objects and substitutes in functional play was not tested. The target selection included only items each child accurately tacted the name and its conventional function. If the child could not tact the name and function of an item, that item was replaced with another item and tested with the same procedure. The final target lists consisted of four or five target objects and five substitutes for each object (See Table 1 and 2 for target objects, their substitutes, and play actions for each child).

The substitutes used for instruction were presented in the form of pictures as prompts. Each picture-prompt card (4 cm x 6 cm) contained a picture of a substitute similar primarily in shape as the target object in order to prompt for an object substitution (e.g., a "hat" picture as a prompt to substitute for the target object "bowl").

Experimental Design

A multiple probe across behaviors design (Gast, Lloyd, & Ledford, 2014) was used to investigate the functional relationship between the symbolic play instruction and the acquisition of object-substitution symbolic play behaviors. The sequence of the study

contains a) baseline, b) instruction, c) one-week follow-up maintenance, and d) 10-month follow-up for Xuan and Yan. After baseline, the instruction for the first target was introduced. A probe trial for the target object under the instruction condition was conducted prior to the implementation of instruction each day. When the child provided at least one response to the first target object during a probe trial, the instruction was introduced to the second target object. The instruction was introduced to the subsequent target object when the child provided at least two responses to the previous target during a probe trial. The order of target objects introduced to Xuan and Yan was reversed to control for the order effect.

Dependent Measures and Response Definitions

The dependent measures consisted of a) the number of correct object-substitution symbolic play responses and b) the number of novel object-substitution symbolic play responses demonstrated during probe trials across all conditions. Each instance of correct object-substitution symbolic play was defined as, when presented with a target object, the child verbally labeled it with the name of a substitute and used it to perform a play action (e.g., putting a bowl on her head and calling it a hat). The child was encouraged to provide as many substitutes (out of one target object) as possible in response to the question, "What can you pretend with this (target object)?" There was no limit on how many substitutes from one target object. The instructor waited for the child to provide multiple responses until the child paused and then asked, "Anything else?" to ensure that the child had no more responses (e.g., "No more.").

An instance of novel object-substitution symbolic play was defined as an object substitution, including naming the substitute and performing its associated play action, not taught in the instruction and had not been emitted previously. In other words, if a child provided an untaught substitute and its play action for the first time, it was coded as a novel response, but if the same response appeared the second time in a later trial, it was not

considered a novel response. The correct responses of substitutes provided during baseline probe trials prior to the introduction of the instruction were also counted as novel responses because these responses were not taught. An incorrect response was defined that the child's play action did not match the name of substitute s/he provided or the child only provided the name of substitute without a play action. The children did not emit any incorrect responses during the study; they either paused or said, "No more" or "I don't know," when they did not have any more substitutes.

Procedure

Probe Procedure. The sequence of the conditions consisted of baseline, symbolic play instruction, and the follow-up conditions. The probe trials for each target was conducted across baseline, instruction, and follow-up conditions. Each child's responses during probe trials were graphed in figures across conditions. Probe trials conducted under the instruction condition was also counted toward criterion to determine the completion of the instruction.

The probe trials during baseline were delivered as follows. The instructor presented a target object and asked, "What is this?" and "What is this for?" Or "How do you use this?" If the child answered these questions accurately within 3 s, the instructor provided praise and immediately asked, "What can you pretend with this thing? "Can you show me, as many as you can?" The child's correct responses (the names of substitute and play actions) were reinforced with praise and the instructor imitating the child's play actions. The child's incorrect responses were ignored but the instructor provided praise for their good attending or cooperative behaviors (e.g., "Nice playing" or "Thanks for your answers"). If the child did not provide any response within 3 s, the instructor asked again, "Any more you can think of?" A probe trial concluded when the child responded by saying "no more" or "I don't know."

Baseline. During baseline, probe trials for target objects under the baseline condition were conducted once per day with the procedure described above.

Symbolic play instruction. Under the instruction condition, probe trials for target objects were conducted once per day prior to instructional sessions. The instruction continued each day until the child achieved mastery criterion determined by his/her performance during probe trials.

The symbolic play instruction was delivered in the following sequence. Step 1: The instructor first presented the target object (e.g., bowl) and asked, "What is this? What do you do with it?" The child answered with the name and the conventional function of the object (e.g., "It's a bowl. I use it to hold food"). Step 2: The instructor then asked, "What can you pretend with the bowl? Can you show me, as many as you can?" Step 3: The instructor waited for 3 s for the child to respond. If the child provided correct symbolic play responses, the instructor allowed the child to respond with multiple answers until no more responses were given, and provided praise plus a token for each instance of symbolic play. The session was complete if the child provided more than five substitutes and their play actions to the target object. Step 4: If the child provided fewer than five substitutes, the instructor set aside of the substitute pictures said by the child in Step 3 and presented one of the remaining substitute pictures the child omitted in Step 3 to prompt for another symbolic play. If the child responded correctly to each picture prompt, the instructor provided praise and immediately presented one picture at a time until all remaining substitute pictures were presented. The instructional session was complete. Step 5: If no response to the Step 2 question after 3 s, the instructor randomly selected one of the five pictures of substitutes and presented it as a prompt to the child. Step 6: The instructor then waited for 3 s for the child to respond. If the child responded correctly, the instructor provided praise and presented the remaining substitute pictures, one at a time, until all substitute pictures were presented to conclude this session. Step 7: If no responses are given to a picture prompt, the instructor then said, "You can pretend the bowl is a hat" and modeled the action of putting the bowl on

her own head at the same time. Step 8: The instructor required the child to say the name of substitute and imitate the play action by saying, “Now you do it.” After the child said the name of the substitute and completed the play action, the instructor provided praise to reinforce the child’s play behavior (e.g., “This is fun!”). The instructor repeated Step 5 to Step 8 with one substitute at a time, until all five substitute pictures were presented to conclude the instructional session.

At any point of the above sequence, each of the child’s correct responses was followed with the instructor’s praise. The instructor delivered a token only when the child independently provided a correct vocal response along with its play action to the antecedent question in Step 2, “What can you pretend with a ___? Show me as many as you can.” All children in the study were accustomed to the token economy system and had his/her own individualized token board used across all instruction programs with backup reinforcers exchanged at the end of the day.

An instructional session was concluded when all five substitutes were presented or said by the child. Three instructional sessions for one target object were conducted each day. The picture of a substitute was removed from instructional sessions if the child independently provided the name of substitute and its play action in response to the question in Step 2 for two consecutive probe trials. The mastery criterion for each target object was achieved when the child independently provided at least five different names of substitutes (either taught or novel) and performed their play actions for three consecutive probe trials conducted prior to instructional sessions. The entire instruction was completed when the child achieved criterion performance for all target objects.

We attempted to avoid the occurrences of undesired rote responding during instruction with the following procedures. First, each instructional trial of symbolic play instruction was randomly rotated with other instructional programs. Second, the instructor

presented the picture prompts, one at a time, in a random order. The above two procedures were consistent across all children. Third, when a child provided the same answers with the same order for two consecutive instructional sessions, the instructor immediately interrupted the sequence after the antecedent question. For example, if the child always responded to the "bowl" with "hat" as the first response, the instructor immediately said, "A hat and what else?" or "Tell me something other than a hat?" after delivering the antecedent, "What can you pretend with this bowl?" The anecdotal notes written by the instructor indicated three of the five children in this study were observed to engage in such undesired rote responding during initial instructional sessions for the first target object. Such a rote pattern was eliminated after the instructor interrupted their first response immediately after the antecedent question for two or three instructional trials.

Follow-up. Probe trials were conducted one week after the mastery criterion was achieved for each target object for all five children. Additional follow-up probe trials were conducted 10 months after the completion of the instruction for Xuan and Yan. These probe trials were conducted in the same manner as described above.

Interobserver Agreement and Procedural Integrity

All sessions were videotaped for the purposes of data collection, interobserver agreement, and procedural integrity. To assess interobserver agreement and procedural integrity, a second observer (a graduate student) who was naïve to the purpose of the study was trained to record data from the videotapes independently and separately from the experimenters. The data of interobserver agreement and procedural integrity were collected for 30% of the total sessions from each condition. Data of agreement and integrity was recorded using a table with specified antecedent, student response, and consequence for each trial (Table 3). The observer recorded a "+" for a correct student response or a correct instructor implementation, and a "-" for an incorrect student response or an incorrect

instructor implementation. The percentage of agreement was obtained by comparing the experimenter's and the observer's recording forms. The percentage of procedural integrity was calculated by dividing the number of correct implementations (i.e., antecedents, reinforcement, or correction) by the total number of implementations. The point-to-point agreement procedure was implemented to collect data on interobserver agreement by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The agreement averaged 98% with a range of 90% to 100%, and the procedural integrity was 100% across all sessions observed.

Results

The figures depict the number of previously emitted and novel responses of object-substitution symbolic play for the target objects during probe trials across all conditions. Table 4 and 5 present novel substitutes and play actions provided by each child across conditions.

For Yu, Ray, and Cheng, their first three target objects were "bowl," "chopsticks," and "towel," and the fourth target object varied. Figure 1 presents Yu's responses for four target objects during probe trials across conditions. During baseline, Yu did not provide any response for the first three target objects but had two responses for the fourth target object. As the instruction was introduced, the number of responses for each target object per probe trial gradually and steadily increased from a low level to a total number of five or six responses per trial for the first three target objects. He also provided a total of three novel responses for "bowl," "chopsticks," and "towel" during probe trials under the instruction condition. As the instruction was introduced to the fourth target object, Yu immediately provided three correct responses in the first probe trial and steadily increased five or six responses per trial. He had one novel response for "cracker" under the instruction condition.

He maintained at five previously taught/emitted responses per trial without any novel response during one-week follow probes.

Figure 2 and 3 depict previously taught/emitted and novel responses in each probe trial for Ray and Cheng, respectively. During baseline, Ray did not emit any response for the first and third target objects but provided three responses for the second and the fourth target objects. His total responses started at a low level and gradually increased to a relatively high level with five or six responses and achieved the criterion in eight days under the instruction condition for the first target object. His taught or previously emitted responses for the subsequent targets immediately increased to relatively high level once the instruction was introduced. The number of novel responses under the instruction condition was three for "bowl," one for "chopsticks," two for "towel," and one for "eraser." During follow-up probes, he continued providing five previously taught/emitted responses per trial without novel responses for each target. Cheng's responses also followed a similar pattern. He did not emit any responses until the fourth target object during baseline, had gradual increases of responses for all targets during instruction, and maintained acquired responses at a relatively high level. Cheng provided two novel responses for "bowl" and one novel response for "towel" and "scotch tape" during the probe trials under the instruction condition. He provided one novel response during a follow-up probe trial for "towel."

Figure 4 and 5 depict the number of previously taught/emitted and novel responses during probe trials across all target objects under baseline, instruction and follow-up conditions for Xuan and Yan, respectively. The target objects used were "clip," "block," "cup," "bowl," and "pencil" with the order of target objects reversed for Xuan and Yan. Both children did not demonstrate symbolic play for any target object during baseline probe trials. Similar with the other three children, their taught or previously emitted responses gradually increased from zero or one to five or six responses for each target object under the instruction

condition. Xuan emitted 1 novel response for the first target object, 2 novel responses for the second target object, 3 novel responses for the third and fourth target objects, and no novel response for the fifth target object under the instruction condition. Yan had no novel response for the first three target objects and one novel response for the fourth and fifth target objects under the instruction condition.

Both children maintained four to six previously emitted responses per trial for each target object but did not provide any novel responses for all target objects during one-week follow-up probe trials. For the10-month follow-up, Xuan provided one previously emitted response for the first target, one previously taught/emitted and one novel response for the second target, two novel responses for the third target, one previously taught/emitted and five novel responses for the fourth target, and one previously taught/emitted and three novel responses for the fifth target. Similarly, Yan had four novel responses for the first target, two novel responses for the second target, one previously emitted and two novel responses for the third target, one previously taught/emitted and one novel response for the fourth target, and two previously taught/emitted and seven novel responses for the fifth target.

Discussion

Results of the study provided empirical support for the instruction to increase the responses of object-substitution symbolic play in five children with ASD. All children provided zero or a low level of responses prior to the instruction but increased to at least five substitutes for each target object under the instruction condition and maintained at a high level during one-week follow-up probe trials. All children also provided novel responses during the probe trials under the instruction condition, indicating the occurrence of response generalization as a result of instruction. All children maintained acquired responses at a relatively high level during one-week follow-up probe trials. The two children who were tested 10 months after the completion of the instruction provided more novel responses than

previously taught/emitted responses for each target, suggesting the possibility of short-term maintenance of acquired responses and long-term response generalization. This study extended current literature by using intraverbal training in conjunction with effective teaching strategies to increase object-substitution symbolic play behavior and the diversity of their play actions.

The results of the study were consistent with previous research that children with ASD could acquire symbolic play skills with specific instruction (Kasari et al., 2006; Lang et al., 2009; Stahmer, 1995). Besides acquiring specific symbolic play skills in object substitution, all children also showed diverse play actions and novel play actions for each target object. It was clear that all children did not demonstrate divergent control (responding to a single stimulus with multiple responses) and only provided one answer each time the target question was asked during baseline. The only exception was that Ray provided two responses to the question during one baseline probe trial for the fourth target object. The divergent control began to emerge and was established under the instruction condition for each target in all children. As shown in previous studies, divergent control was established via instructional tactics, such as picture prompts (Feng et al., 2017; Miguel et al., 2005) and positive reinforcement (Goetz & Baer, 1973). We also used picture prompts to transfer the stimulus control from tact to intraverbal to facilitate the divergent multiple control in children's vocal responses and play actions. The pictures provided visual stimuli for children to recognize the formal similarity between the target objects and their substitutes.

The acquisition processes of object-substitution may be explained by intraverbal naming (Horne & Lowe, 1996; Miguel, 2016), through which each target object is intraverbally related to its substitutes to derive new play actions associated with the substitutes. Specifically, the acquisition process of symbolic play in this instruction may involve a) the verbal antecedent indicating that each target object can also be many other

different things (i.e., “What can you pretend with this? Tell me as many as you can.”), b) the presentation of the picture to evoke a tact response (the name of the substitute) following the verbal antecedent (i.e., transferring from tact to intraverbal), c) the association of the instructor-modeled substitute play actions with the target object, d) adding new members in the response class of substitutes (five multiple examples for each target object), and e) derived new names and their related play actions with the target object. That is, the picture/name of a substitute (e.g., hat) was presented following the verbal antecedent and the target object (e.g., bowl) in conjunction with the instructor-modeled play action (e.g., putting the bowl on their head) to form an equivalence class in the intraverbal relation (e.g., bowl = hat). The different examples function to expand the response class (e.g., bowl = hat; bowl = bathtub; bowl = boat….) and the derived play actions based on new names of the target object (e.g., putting doll in bowl; wash doll in bowl). Although it is possible that the verbal antecedent may facilitate the association process, we did not test whether the children could describe “pretend” or to discriminate the differences between pretense and facts. On the other hand, the intraverbal behavior may not be necessary in this acquisition process, and the associative learning may be sufficient to acquire the target skills as well as the derived new play actions (Hayes, Barnes-Holmes, & Roche, 2001). Future research needs to examine the role of intraverbal behavior in the acquisition process of object-substitution symbolic play.

Providing multiple exemplars of substitutes for each target object may facilitate response generalization as well as some level of generalized symbolic play for untaught objects. Response generalization was evident that all children provided novel responses for the target objects during probe trials after the instruction was introduced. This finding was also consistent with previous studies, where generalization training with multiple exemplars was incorporated in the modeling procedure (Dauphin et al., 2004; Dupere et al., 2013; MacManus et al., 2015).

However, novel responses for other target objects (generalized object-substitution symbolic play) began to emerge during the baseline probes following the mastery of the previous target objects only for three children (Yu, Ray, and Cheng). Two (Yu and Cheng) of the three children's novel response across different target object did not emerge until the fourth target object. While the generalized symbolic play emerged for the three children, the number of responses remained one or two, suggesting the divergent control was absent or weak. This finding suggests that training multiple target objects to mastery was important for some children to demonstrate symbolic play skills across various objects. Nonetheless, such generalization did not occur for Xuan and Yan after mastering four target objects. Generalization of symbolic play skills across various objects remains a challenge for children with ASD and warrants future research.

All children maintained the acquired responses one week after the completion of the instruction. For the two children tested after 10 months, the number of previously taught/emitted responses decreased for all target objects. Yet, both children provided more novel responses than previously taught/emitted responses for almost all targets, suggesting the long-term effect of response generalization. During the 10-month period, both children continued to receive 4 hours per week of ABA intervention in the center following the completion of this study. Their individualized instructional programs included intraverbal skills (e.g., asking "wh" question, initiating a conversation), tacting antecedents of emotions within context (e.g., He is angry because his sister took his toys), imaginary-object symbolic play, and group gym activities. The imaginary-object symbolic play pertained to pretend play without using any objects (e.g., pantomime) and the children were taught to perform play actions without objects and to describe their actions at the same time. It is probable that imaginary-object instruction maintained "pretense" in their play activities and thus indirectly promoted response generalization of object substitution.

As discussed previously, we designed the instruction to simulate natural interactions between the caregiver and the child in order to maintain and generalized acquired skills. Although we did not continue the instruction, the children's symbolic play may be affected through natural interactions with others during free play. We believe that the response generalization observed during 10-month follow-up trials for Xuan and Yan was also under the influence of natural interactions in play activities. That is, the acquired object-substitution symbolic play on the target objects was likely to be maintained and generalized through the combination of imaginary-object instruction and natural contingencies.

The limitations of this present study included insufficient data points collected for all children during the first and/or second targets and the lack of maintenance data beyond one week following mastery for Yu, Ray, and Cheng. Another potential limitation of the procedure is that the instruction targeted "responding" but not spontaneously "initiating" symbolic play activities in solitary play or interactive play. Although this response-focused procedure may facilitate response generalization, it may also explain the limited occurrence of generalization to subsequent untaught objects in all five children under the study. With the absence of or weak generalization across untaught objects, the children may or may not engage in symbolic play behaviors with any other objects outside of the instruction. Further investigations should test the effects of this teaching procedure on children's spontaneous engagement of symbolic play activities (i.e., responding or initiation) by themselves as well as with their peers or other adults in natural free play settings. Alternately, other initiation-focused procedures to teach symbolic play behaviors can be developed and evaluated empirically.

During instruction, we observed that three of the children engaged in undesired rote responding in the beginning instructional sessions and implemented an additional response interruption procedure to suppress the rote pattern. However, the number and pattern of rote

responses were not recorded and the procedure was not evaluated with procedural integrity. This can potentially limit the interpretation of the results. It is necessary to examine data of undesired rote responding and systematically evaluate the effects of adding such a response interruption procedure on the occurrences of undesired rote responding in future studies.

In addition, the pre-experimental assessment of object-substitution symbolic play presented in a format similar to discrete trials with assessor-modeled play actions may evoke imitation in children who had an instructional history in behavioral intervention. Such a possibility was minimized by giving the child a different item, and symbolic play was not scored, if the child imitated the assessor's play action with a different item. Future researchers can consider assessing children's symbolic play via observations or natural interactions in a play setting.

The present study targeted object-substitution symbolic play but not any other forms of symbolic play. Future researchers can design teaching procedures targeting other forms of symbolic play and examine their effectiveness. Additionally, this study applies to young children with ASD who have basic verbal communications and demonstrated functional play with generalized imitation but not symbolic play. For children who do not have verbal communication but demonstrate functional play skills, the teaching procedure has to be modified and then empirically verified. For example, the instructor can ask the child to perform the actions of the ordinary function (e.g., offering a cup to the child and ask, "Show me how you use this cup") and then the actions of object substitutions (e.g., "Show me it is something else!") without requiring the child to verbally label the name and function of the target objects. The instructor can also provide modeling of symbolic play actions along with verbal labeling in the beginning (e.g., "I would like to pretend the cup is a submarine." "Now, you do it.")

Despite some limitations, the present study demonstrated the short- and long-term maintenance and response generalization effects of object-substitution symbolic play instruction. Therefore, the study has important implications in teaching object-substitution symbolic play to children with ASD. It also provides a model of instruction simulating natural interactions between child and caregiver that can be easily implemented in any applied settings.

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Table 1. *Target objects, their substitutes, and instructor-modeled play actions used during instruction for Ray, Yu, and Cheng*

Yu, Ray, and Cheng			
Object	Function	Substitute object (picture)	Instructor-modeled substitute actions (with verbal sound effects or explanations)
bowl	to hold food	1-1 hat 1-2 flowerpot 1-3 pot cover 1-4 bun 1-5 turtle shell	place bowl on head place flowers in bowl cover pot with bowl put close to mouth move bowl slowly
chopstick	to pick up food	1-1 pencil 1-2 wand 1-3 cane 1-4 tele-pole 1-5 microphone	hold chopsticks to write hold chopsticks to point hold chopsticks to walk sticks chopsticks next to toy house hold chopsticks to sing
towel	to dry body	1-1 scarf 1-2 blanket 1-3 flag 1-4 sponge 1-5 cushion	place towel around neck cover body with towel open up towel wipe table with towel sit on folded towel
cracker (4th target for Yu)	as food, snacks	1-1 soap 1-2 pillow 1-3 smartphone 1-4 frisbee 1-5 plate	wash doll's body with cracker place doll's head on cracker hold cracker close to ear toss cracker put food on cracker
eraser (4th target for Ray)	to erase	1-1 smartphone 1-2 remote 1-3 bed 1-4 block 1-5 train	hold eraser close to ear hold eraser toward TV and press place doll on eraser stack erasers move eraser on table
scotch tape (4th target for Cheng)	to tape things	1-1 wristband 1-2 watch 1-3 magnifier 1-4 wheel 1-5 hat	put tape on doll's wrist put tape on wrist and tell time hold tape close to eye roll tape on table Put tape on head

Table 2. *Target objects, their substitutes, and instructor-modeled play actions used during instruction for Xuan and Yan*

Xuan and Yan			
Object	Function	Substitute object (picture)	Instructor-modeled substitute actions (with verbal sound effects or explanations)
pencil	to write, draw	1-1 rocket 1-2 lollipop 1-3 thermometer 1-4 needle 1-5 tele-pole	move pencil upward place lollipop close to tongue place thermometer underarm sewing action stick pencil next to toy house
bowl	to hold food	1-1 hat 1-2 boat 1-3 bath tub 1-4 flowerpot 1-5 cake	place bowl on head put doll in bowl, move bowl put doll in bowl place flowers in bowl place bowl upside down and open mouth
cup	to hold liquid	1-1 pen case 1-2 trash can 1-3 telescope 1-4 vase 1-5 cover	place pens in cup place trash in cup place cup close to eye put flowers in cup cover small object (peekaboo!)
block	to stack, make patterns	1-1 pillow 1-2 phone 1-3 car 1-4 bridge 1-5 comb	place doll's head on block place phone close to ear place doll in block and move block move car/doll across block move block on hair
clip	to hold papers or things together	1-1 bird 1-2 clam 1-3 aircraft 1-4 book 1-5 pocketbook	move clip in air press clip move clip in air place clip on table in front put clip on doll's shoulder

Table 3. *Interobserver agreement and procedural integrity data collection form.*

Phases	ABC	Trials (+ correct; - incorrect)									
		1	2	3	4	5	6	7	8	9	10
Probe trials	SD：What's this? What do you do with it? What can you pretend with this? No prompts.										
	Student responses										
	Consequence (Praise for correct responses or attending or cooperative behaviors)										
Instruction procedure	SD：What's this? What do you do with it? What can you pretend with it? Prompt delay, prompt hierarchy										
	Student responses (name and play action)										
	Consequence (Praise + Token for independent correct responses, praise for prompted correct responses, or correction for incorrect responses)										
Prompt delay: 3 sec Prompt hierarchy: 1) a picture prompt, 2) an echoic prompt and modeling the play action. 3) repeat 1) and 2) with another picture until all substitute pictures are done.											

Note. The SD and consequence codes were used to calculate the percentage of accurate implementations. The student response codes are used to calculate interobserver agreement. Only independent student responses were recorded as "+," all prompted student responses were recorded as "-."

Table 4. *Novel substitutes and play actions provided by Yu, Ray, and Cheng*

Target Objects	Novel Substitutes	Play Actions
Yu		
bowl	cake umbrella pot	put bowl upside down and sing birthday song hold bowl over head stir in bowl with fingers
chopsticks	rod straw needle	put two chopsticks in cross put in front of mouth put chopstick on elbow pit
towel	cracker SpongeBob paper	fold towel in rectangle fold towel in rectangle open towel flat
cracker	LEGO sun eraser	stack crackers hold up cracker in air move cracker back and forth on table
Ray		
bowl	turtle shell bun Teletubbie	put bowl upside down and move slowly hold bowl close to mouth and open mouth hold bowl in front of face and sing song
chopsticks	train glue tube telescope fishing rod	move chopsticks on table squeeze chopstick hold chopstick out in front of eye hold chopstick end over table
towel	hat curtain	put towel on head hold up towel flat
eraser	train track table house	lay eraser on table and move hand on top put eraser flat in front hold up eraser in front
Cheng		
bowl	coffee cup badminton	drinking from bowl hold bowl up and move back and forth
chopsticks	fishing rod	hold chopstick over table
towel	hat clothes	put towel on head put towel on body
Scotch tape	glasses donut	put tape in front of eye put tape in front of mouth and open mouth

Table 5. *Novel substitutes and play actions provided by Xuan and Yan*

Target Object	Novel Substitutes	Play Actions
Xuan		
clip	handbag	put clip on shoulder
block	boat	move block on table
	bed	lay doll on block
	train track	move hand on block
cup	car wheel	row cup on table
	steering wheel	hold up cup in front and turn
	hat	put cup on head
	party hat	put cup on head
	trap	drop doll into cup
bowl	steering wheel	hold bowl in front and turn back and forth
	moon cake	put bowl in front of mouth and open mouth
	magnifying glass	put bowl in front of eye
	telescope	put bowl in front of eye
	cup	drink with bowl
	water well	scoop with hand in bowl
	hill	put bowl upside down on table with hand moving down
pencil	airplane	move pencil in air
	toothpick	put pencil close to teeth
	hedgehog's quill	hold up pencil on table
Yan		
pencil	bridge	hold pencil's ends with two hands
	log	hold up pencil on table
	train track	lay pencil flat on table
	street road	lay pencil flat on table
bowl	car wheel	row bowl on table
	coconut	hold bowl up
cup	toilet	sit doll on cup
	clock	hold up cup and said, "It's time."
block	tunnel	move hand on block
	train track	move hand on block and said," Swoosh."
clip	chick	move clip up and down on table
	baby eagle	fly clip in air
	butterfly	fly clip in air
	bumblebee	fly clip in air and said, "Buzz."
	tunnel	put finger through clip
	train track	lay clip flat on table and move hand on top
	leaf	drop clip in air
	sparrow bird	fly clip in air