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Teaching "Imaginary Objects" Symbolic Play to Young Children with Autism Spectrum Disorder

Gabrielle Lee
Western University, glee329@uwo.ca

Sheng Xu
Chongqing Normal University

Shufang Guo
Zhengzhou Preschool Education College

Lina Gilic
State University of New York College at Old Westbury

Yunhuan Pu
Sichuan University

See next page for additional authors

Authors
Gabrielle Lee, Sheng Xu, Shufang Guo, Lina Gilic, Yunhuan Pu, and Jiacheng Xu

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Abstract

Symbolic play skills are important in language acquisition and child development. Children with autism spectrum disorder (ASD) often have difficulties demonstrating such play behaviors. Imaginary objects symbolic play refers to play behavior in which children perform play actions without actual objects. Three boys with ASD (3-7 years) participated in this study. A multiple-probe across three participants and two settings design was employed to evaluate the effects of intraverbal training on the acquisition and generalization of imaginary objects symbolic play. Results indicated that all children acquired and maintained target imaginary objects play activities. Generalization to untaught activities occurred in one child. All three children' symbolic play emerged or increased in free play after the instruction.

Keywords: symbolic play, imaginary objects, intraverbal training, autism spectrum disorder; China

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Symbolic play, imaginary play, or pretend play are often used interchangeably to refer to a child's ability to use objects or perform actions in play situations in a way that is not consistent with facts or reality (McCune, 2010). It is suggested as one of the most important basic skills in child development (Copple, Bredekamp, & National Association for the Education of Young Children, 2009) as it is highly correlated to language development (McCune, 2010; McCune, 1995; Orr & Geva, 2015). Typically developing children usually demonstrate symbolic play during 2 to 3 years of age while such play behavior is weak or nearly absent in children with autism spectrum disorder (ASD; Baron-Cohen, 1987; Charman et al., 1997). The ability to demonstrate symbolic play is included in the test items (e.g., symbolic imitation, demonstration task, make-believe play) for the diagnosis of ASD (Lord et al., 2012). With the persistence of fad treatments appealing to the parents of children with ASD (e.g., Floortime, sensory integration), evidence-based interventions targeting play skills in early years is critically needed (Mets, Mulick, & Butter, 2016).

Evidence-based interventions aimed at improving symbolic play in children with ASD are limited because of the complexity in symbolic play (Kasari, Freeman, & Paparella, 2006). It is necessary to conduct an operational analysis of symbolic play and develop an intervention accordingly. Symbolic play refers to three types of play behaviors, namely, object substitutions, attributions of pretend properties, and imaginary objects (Barton, 2010; Leslie, 1987). Imaginary objects play is a type of symbolic play behavior in which a child performs play actions without the presence of the actual objects (e.g., pantomime). From the behavioral perspective, the process of imagination may involve conditioned seeing. As suggested by Skinner (Skinner, 1953, 1957),

conditioned seeing is a behavior that occurs in the absence of the actual stimulus as a result of the association with that stimulus in the learning history. The association with the stimulus can be the name, the sound, the smell or any stimulus being paired with the stimulus. In the case of a child's imaginary objects symbolic play demonstrated in conditioned seeing, for example, upon hearing the name of an object (e.g., a jump rope), a child may start jumping as if she/he is using a jump rope in hand. In other words, imaginary objects play behavior may be respondent responses of conditioned seeing, in which the visual stimuli are not present but may have the power to occasion responses that have been associated with the stimuli in the past.

Horne and Lowe (1996) postulated that responses evoked via conditioned seeing would be relevant to the acquisition and maintenance of the naming relation. For example, a child evoking the tact response of "mom" in her absence may still "see," "hear," "smell," and "feel" her (p, 203). Further, once a child acquired naming, the stimuli named would be free of real-time constraint, and therefore, the child would "visualize" or "imagine" them (p. 215). The naming process described above could be demonstrated in the form of imaginary objects play in the child's play activities, during which the child could tact his action (e.g., "I'm drawing") and simultaneously display the actions associated with drawing without real materials (e.g., a pencil and paper).

Shanman (2013) used drawing responses as an objective measure of conditioned seeing and found a correlation between one's drawing responses and the corresponding speaker's responses (e.g., naming the objects or events). He further demonstrated that conditioned seeing could be acquired via contact with reinforcement. Therefore, responses associated with conditioned seeing could be operant in nature. It is possible that imaginary objects symbolic play

observed in children's play activities, as a demonstration of conditioned seeing, would be related to the acquisition and maintenance of naming relations in children.

The above analysis suggests that the tact response of a stimulus may be acquired prior to or in tandem with the acquisition of conditioned seeing of the stimulus before a child can demonstrate imaginary objects symbolic play. Tact responses are often demonstrated in children's functional play activities involving the objects' conventional functions as opposed to novel uses in symbolic play (Lifter, Sulzer-Azaroff, Anderson, & Cowdery, 1993). In summary, the analysis of the skill acquisition process, the complexity of symbolic play, and the developmental sequence suggest that functional play is a required skill for symbolic play.

Functional play refers to play behaviors of using objects with their conventional function. Barton (2010) further distinguished functional play without pretense (e.g., rolling a ball) and functional play with pretense (e.g., pretending to drink juice from an empty cup; using a toy figure to hold a bottle and feed a baby doll). Research on improving appropriate toy play behaviors for children with ASD primarily involves functional play with or without pretense. Effective strategies to increase these appropriate play behaviors for children with ASD included stimulus-stimulus pairing (Nuzzolo-Gomez, Leonard, Ortiz, Rivera, & Greer, 2002), reciprocal imitation (Ingersoll & Schreibman, 2006), activity schedules (DiCarlo & Reid, 2004; Morrison, Sainato, Benchaaban, & Endo, 2002), and video modeling (D'Ateno, Mangiapanello, & Taylor, 2003; MacDonald, Clark, Garrigan, & Vangala, 2005; MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009; Paterson & Arco, 2007; Reagon, Higbee, & Endicott, 2006). Further, generalization to new toys, novel play actions, or unscripted verbal statements during play is facilitated by incorporating multiple exemplar training (Dupere, MacDonald, & Ahearn, 2013) or

matrix training (Dauphin, Kinney, Stromer, & Koegel, 2004; MacManus, MacDonald, & Ahearn, 2015) in instructional programs.

Research has demonstrated that children with ASD can acquire symbolic play skills through carefully planned intervention (Kasari et al., 2006; Lee, Feng, Xu, & Jin, 2019; Lydon, Healy, & Leader, 2011; Stahmer, 1995). Kasari et al (2006) combined discrete trials and natural teaching to engage children in play activities. Pivotal response training also effectively increased symbolic play in children with ASD through adult-child interactions (Lydon et al., 2011; Stahmer, 1995). Video modeling and matrix training was used to teach a series of complex play behavior (MacDonald et al., 2005). The above studies included symbolic play in general and therefore, it is not certain whether all three types of symbolic play behaviors are established in the children's repertoire. As each type of symbolic play requires a different set of skills, it is helpful to assess each child's symbolic play skills and focus the instruction on one type that is weak or non-existent in the child's repertoire.

One study was found that targeted a specific type of symbolic play. Lee et al. (2019) taught object-substitution symbolic play with systematic intraverbal training, which simulated child-mother interactions in the natural environment. Specifically, the instructor first asked the child to identify the name and function of an actual object before engaging in symbolic play activities. The instructor verbally guided the child to change the intended function of an object through a new name (e.g., "What can you pretend with this bowl?"). If the child did not respond, the instructor presented a picture of a substitute (e.g., a hat) and modeled the substitute's play action with the target object (e.g., a bowl). The child was required to provide a new name for the target object and display a corresponding play action (e.g., "This bowl is a hat" and putting the bowl on his/her own head). The instructor provided up to five different names and play actions

for each target item to increase response variability in symbolic play. The results of their study indicated that intraverbal training was effective in increasing object-substitution symbolic play in five children with ASD. Besides instructor-modeled play actions, all five children were able to provide novel responses to target objects along with corresponding play actions, suggesting the occurrences of response generalization through the intraverbal training with multiple exemplars. However, generalization to untaught objects or other settings was not evaluated in their study. It is not clear whether the acquired symbolic play skills were generalized to new stimuli or to free play settings. Additionally, instruction targeting other types of symbolic play (e.g., imaginary objects and attribution to absent properties) for children with ASD remains needed.

Given the importance of symbolic play in child development and the scarcity of intervention targeting symbolic play with children with ASD, it is necessary to develop instructional programs in order to address the symbolic play deficit in children with ASD in early intervention. In addition, evaluations of instructional effectiveness should include generalization of acquired skills outside of instructional settings. The purpose of this study was to evaluate the effects of an instructional program on the acquisition and generalization of imaginary objects symbolic play skills. The following research questions were addressed: (a) Did the percentage of accurate responses for target imaginary objects play activities increase after the instruction?, (b) Did the percentage of accurate responses for generalization activities increase after the instruction?, and (c) Did the percentage of symbolic play increase during free play after the instruction?

Method

Participants

The participants were recruited via the website of a university-affiliated autism research center and a WeChat (a Chinese social media mobile app) parent support group for parents of children with ASD in the local area. The inclusion criteria included that the child: (a) had an ASD diagnosis, (b) had generalized imitation skills, (c) had basic verbal communication skills, (d) followed verbal directions, and (e) needed improvements in play skills. After initial screening on the phone, the potential participants scheduled their first visits for the play skills assessments (described below). The children who scored a "2" in functional play and a "0" in imaginary objects symbolic play were invited to participate in this study.

Three children participated in this study. They were diagnosed with ASD in the category of mild to moderate autism using the Chinese version of the *Childhood Autism Rating Scale* (CARS; Lu, Yang, Shu, & Su, 2004; Schopler, Reichler, & Renner, 2002) and met the ASD diagnostic criteria of *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (American Psychiatric Association, 2013). The CARS is recommended as one of the ASD diagnostic tools for children age 2 and above (Centers for Disease Control and Prevention, 2019). The psychometric properties of the CARS-Chinese version, in Chinese samples, have a reliability coefficient of 0.74 and the predictive validity coefficient of 0.5 with the Chinese version of *Autism Behavior Checklist* (Lu et al., 2004). The CARS consists of 15 domains, and each domain of autism symptoms is rated with scores from 1 to 4 (normal, mildly abnormal, moderately abnormal, and severely abnormal). Higher scores are associated with a higher level of impairment in autism symptoms (Total score < 30: no autism symptoms; 30-36: mild to moderate, > 36 severe).

Liu was 7 years old at the time of the study. His IQ score was 66 measured by the Chinese version of the Wechsler Intelligence Scale for Children, 4th edition, (WISC-IV;

Wechsler, 2003; Zhang, 2008). He attended the first grade in a general education elementary school and did not receive any other intervention. He had very good attending skills and followed verbal directions. He could mand for his preferred items, tact more than 50 common items, answer at least 10 social questions (e.g., How are you? What's your name?), and ask WH questions (i.e., What, Who, Where, How, and Which). He also maintained brief conversations with others. During the play skills assessments, he showed interests in different toys and demonstrated appropriate toy play behavior. He scored a 2 in functional play, 1 in object-substitution symbolic play, and 0 in imaginary objects symbolic play. His parent reported that he usually had invariant patterns when engaging in play activities but liked to observe others and imitate them.

Chang was 4 years old at the time of the study. His IQ score was 88 assessed from the Chinese version of *Wechsler Preschool and Primary Scale of Intelligence-Revised* (WPPSI-R; (David Wechsler, 1989; Zhang, 2009). He was enrolled in a full-day, play-based preschool with typically developing children his age. Chang followed verbal directions and had appropriate toy play skills. He could mand for his preferred items, tact more than 50 common items, and respond to approximately 10 social questions. He scored a 2 in functional play, 1 in object-substitution symbolic play, and 0 in imaginary-object symbolic play. During the assessments, Chang sometimes displayed repetitive speech (i.e., "What's that?" and "Why?") but did not engage in other problem behaviors. His parent reported that Chang followed directions in a group and played with toys when other children were present. However, he was not observed to engage in interactions or conversations with others during play.

Xie was a 3-year-old boy who attended a half-day regular preschool in the morning and received 2.5 hours of behavioral intervention in the afternoon four days per week. His test score

measured by the Chinese version of *Peabody Picture Vocabulary Test-Revised* (PPVT-R; (Dunn & Dunn, 1981; Sang & Miao, 1990) was 123 at 94 percentile, indicating that his receptive vocabulary functioning is well above the average range of children at his age. The psychometric properties of the Chinese version of the PPVT-R, in Chinese samples, included a split-half reliability coefficient of 0.99, a test-retest reliability coefficient of 0.94, and the validity coefficient of 0.46 with the Chinese version of the *Combined Raven's Test* (Sang & Miao, 1990). He was able to follow at least 10 three-step verbal instructions, imitate more than 10 actions involving objects, mand for his preferred items, and tact more than 50 common objects. He answered approximately 10 social questions but did not engage in conversations with others. He also had appropriate toy play skills and did not display problem behaviors. He followed directions in a group but only had interactions with others when prompted to do so. His scored a 2 in functional play and a 0 in both object-substitution and imaginary objects symbolic play.

Settings

The study was conducted in the autism research center located in a major city of central China. The imaginary objects play activities related to table top work (e.g., drawing) took place in one of the individual tutoring rooms of the center. The room was 2.5m x 2.5m x 3m in size with a two-way mirror for observations. A child-sized table and two chairs were arranged adjacent to the two-way mirror with shelves to place instructional materials next to the table in the child's eye level. Both the child and the instructor sat on the chair during instruction. A book-toy area was located on another side of the room with books and toys placed on the open shelves at the child's eye level.

The second setting for instruction was in the gym of the center for imaginary activities involving gross motor skills. Both the child and the instructor stood during instruction in this

setting. The gym room was 5m x 5m x 3m in size containing toys on open shelves and big balls. It was typically used for group activities or free play. The instructional sessions were conducted in the one-to-one format with a child and an instructor in the room.

The free play sessions were conducted in the free play area of the center. The free play area was an open area connected to the hall way of the individual tutoring rooms and the waiting room of the center. All toys were placed on open shelves at the child's eye level on one side of the area. The child was engaged in solitary play activities with free access to all toys. The instructor sat next to the child. No other children were present during free play sessions. A video camera was set on a tripod in a study room to record all instructional and probe sessions.

Experimental Design

The study combined the designs of multiple-probe across three participants and across two settings (Ledford & Gast, 2018) to evaluate the effects of the instruction on children's imaginary objects play behavior. In a multiple-probe design, a functional relationship is demonstrated when the target behavior changes after the instruction is introduced, and the same effect is replicated across all tiers (Ledford & Gast, 2018). As a multiple-probe-across-participants design only allowed between-subject comparison, a multiple-probe-across-settings design was combined to strengthen within-subject comparison. Visual inspection was used as a means of data analysis.

The target activities in each setting were probed across conditions and counted toward criterion. The sequenced conditions included baseline, instruction (Phase 1: target activities 1-3; Phase 2: target activities 4-7), and follow-up conditions. In Phase 1, the three target activities undergoing the instruction were probed before each instructional session. Once these activities

reached criterion, all seven target activities were probed. The same sequence was repeated in Phase 2 of instruction.

Each child's performance on five generalization activities were assessed at baseline and after the instruction was completed in each setting. If criterion for generalization activities was not reached, the instruction was implemented. Additionally, free play sessions were conducted before and after the instruction to evaluate each child's play behaviors in the natural play setting.

Response Measure and Definition

Play skills assessments. The play skills assessments used in this study included functional play, object-substitution symbolic play, and imaginary objects symbolic play, which were based on the Developmentally-based Behavior Assessment for Children with Autism (DBACA; Feng & Sun, 2017). The DBACA is a semi-structured assessment consisting of five domains: cognitive/language, physical, adaptive/self-help, communication, and social/emotional. It has been field tested for children ages 3 to 12 years in Taiwan with a high level of inter-scorer agreement (M = 92%, range: 90-100%) and has demonstrated the content validity with two experts in developmental psychology.

The play skills assessments were conducted by a trained graduate student of special education in the play area of the center. The child was offered the toys specified in the assessment and did not play with other toys during the assessment. The assessment procedures of functional play and object-substitution symbolic play skills were conducted in the same manner as described in Lee et al. (2019).

During the assessment of imaginary objects symbolic play, no actual objects or materials were used by the assessor or offered to the child. First, the assessor pretended to hold an apple in her hands. She said, "Here is an apple. I'm eating the apple," and open her mouth to perform the

actions of eating an apple. The assessor then said, “Now it’s your turn.” The assessor waited 10 seconds for the child to respond. Next, the assessor provided a second opportunity and pretended to turn the pages of a book and read. The assessor said, “I’m reading a book.” The assessor would ask the child to respond and waited 10 seconds. The third opportunity consisted of the assessor pretended to turn a steering wheel and said, “I’m driving.” The assessment was complete after the child responded to the third opportunity or after 10 seconds of this opportunity, if the child did respond at all.

Response definitions. An instance of imaginary object symbolic play was defined as the child performing the actions of an activity along with verbal descriptions of the activity without using the actual object for that activity. If the child only described an activity (e.g., I’m drinking) without corresponding actions, the assessor would ask the child to perform the actions (e.g., “Can you show me?”). If the child only performed the actions without verbal descriptions, then the assessor would ask for a verbal description (e.g., “What are you doing?”). If the child provided a verbal description that matched the actions (or vice versa), then it was considered as a correct response for the imaginary objects activity. If the child displayed irrelevant responses or no response for all three opportunities, then this assessment item was scored as “0.” If the child had imaginary objects symbolic play for one or two presses, then this item was scored as “1.” If the child responded correctly for all three presses, then it was scored as “2.”

The primary dependent variables included (a) the percentage of correct responses for target imaginary objects activities and (b) the percentage of correct responses of generalization activities in probe sessions. One probe trial of a target imaginary objects play activity required four responses: a motor response of the play action (e.g., the action of stacking blocks), a verbal response naming the corresponding play action (e.g., “I’m playing with blocks”), another motor

response of the play action (e.g., the action of putting blocks together), and another verbal response naming the corresponding play action (e.g., “I’m making a house”). Each response accounted for 25% of the total percentage of accuracy for each target activity. Incorrect responses were defined as the child providing no response or an irrelevant response that did not match the given instruction (e.g., the child said, “Turning on water” when given a pencil and a paper in the instruction). When the child provided no response or an irrelevant response, both the verbal response and the corresponding action were counted as incorrect responses. When the child provided an accurate verbal response without a corresponding action (or vice versa), one response was coded as correct while another one was incorrect.

The secondary dependent variables consisted of: (a) the percentage of intervals engaging in functional play behaviors and (b) the percentage of intervals engaging in symbolic play behaviors in free play sessions. An instance of functional play behavior was defined as the child displaying a play action that was the intended use of the object (e.g., using a cup to drink). An instance of symbolic play behavior was defined as the child engaging in any of the following activities: (a) the child displayed a play action that was not the intended use of the object (e.g., moving a block in the air as if it were an airplane), (b) the child engaged in a play activity without the actual object (e.g., performing the action of drinking without a cup), (c) the child labeled an abstract property of an object when such a property was not present (e.g., performing the action of smelling a toy apple, and said, “It smells good”), or (d) the child alternated between two roles in play actions or talks (e.g., The child took the baby role by imitating baby crying and switched to the mother role by saying, “Baby, you’re hungry”). If the child engaged in both functional play and symbolic play at the same time, it was coded as both. For example, if the child held a baby doll and used a bottle to feed the baby and, at the same time, switching roles

between the baby and the mother, it was coded as both functional play and symbolic play for that interval. Data of free play observation were collected in the paper-and-pencil format via watching videos using 5-s partial interval recording by a trained graduate student of special education.

Procedure

Preference assessment. Preference assessments were administered by a trained graduate student according to the procedure described in DeLeon and Iwata (1996) to determine each child's preferred items and activities. The items and activities used in the assessments were collected via parental survey. The most preferred items and activities, determined by the assessments, were used as back-up reinforcers at the end of probe and instructional sessions.

Target selection. The target imaginary objects play activities were selected from the toys or activities the children had prior experiences with (e.g., presented by instructors or played with by children in the center's group activities). Each child was probed to name the items or activities. The assessor presented a picture with the item/activity on it for the child to name. Only the items or activities the children could label accurately were included as target activities and generalization activities in this study. Target activities consisted of seven activities in the table top setting and seven activities in the gym. Additionally, five activities were used to test generalization after the completion of the instruction in each setting. Examples of table top activities included drawing, bead stringing, block stacking, and assembling nuts and bolts; examples of gym activities included bubble blowing, basketball, driving a toy car, and bowling.

Probe sessions across conditions. Probe sessions for target activities in each setting were conducted across baseline, instruction, and follow-up conditions. A probe session for target activities was conducted before instructional sessions of the day. A probe trial was implemented

in the following steps. Step 1: Upon obtaining the child's attention, each trial began with the instructor's verbal instruction along with corresponding actions (e.g., "Let's play a pretend game. This is a pencil, and this is a paper. Here you go!"). While giving the verbal direction, the instructor also performed the action of holding a pencil with one hand and a paper with another hand as if a pencil and a paper were there. Step 2: The instructor waited 3 seconds for the child to respond. If the child did not respond with a corresponding play action or did not respond at all, the instructor ignored the child's response, but provided praise to reinforce the child's attending behavior (e.g., "Thank you for listening") to end this trial. If the child responded with a corresponding play action (e.g., drawing), the instructor provided specific praise (e.g., "Wow, I like the way you use the pencil and paper") and continued. Step 3: The instructor asked, "What are you doing" and waited 3 seconds for the child to respond. If the child provided an incorrect verbal response or did not respond, the instructor ignored the response but provided praise to reinforce the child's attending behavior to end this trial. If the child answered correctly (e.g., "I'm drawing/writing"), the instructor provided praise (e.g., "Wow, your drawing/writing is so interesting") and continued. Step 4: The instructor asked, "Can you tell me and show me how to draw" and waited 3 seconds for the child to respond. If the child did not respond with a verbal description and a corresponding play action, the instructor ignored the response but provided praise for the child's attending behavior to end the trial. If the child responded accurately with a verbal description (e.g., "I'm drawing an apple") and a corresponding play action, the instructor provided specific praise (e.g., "Your apple is beautiful. I like how you drew it") to end the trial. The instructor also delivered a token along with social praise when the child responded correctly in Step 2, 3, and 4. The child used the tokens to exchange for back-up reinforcers at the end of the probe session.

Probe sessions for generalization activities were conducted at baseline and follow-up probe sessions in each setting. If the child did not reach criterion on generalization activities, additional instruction was provided until mastery criterion was achieved. Chang and Xie required instruction for generalization activities because they did not achieve criterion performance. The probe trials for generalization activities were conducted in the identical manner as those for target activities described above. Follow-up sessions were conducted the next day after the completion of the instruction, as well as after 1 week, 3 weeks, and 7 weeks from the completion of the instruction. The instructor who conducted the probe and instructional sessions was a graduate student of special education in her second year and had received basic training in applied behavior analysis for one year.

Instruction. A total of three or four target activities were presented in a random order in each instructional session. Each activity was presented a total of five times, and therefore, a session contained 15 to 20 instructional trials. One instructional session was conducted per day.

The steps of implementation for each instructional trial were identical to a probe trial when the child provided accurate responses. When the child responded incorrectly or did not respond, the instructor followed the pre-determined prompt hierarchy described as follows. Step 1: The initial step was identical to that of the probe trial. Step 2: The prompt hierarchy for a correct corresponding play action consisted of instructor modeling, verbal instruction, and physical assistance. Specifically, the instructor first modeled the play action (e.g., the action of holding a pencil to draw on paper), and if the child imitated the action within 3 seconds, and instructor provided specific praise and continued. If not, the instructor provided verbal instruction (e.g., “Do what I just did, pretend to hold the pencil and draw on paper”). If the child followed the verbal direction, the instructor provided praise and continued. If not, the instructor

provided physical assistance by holding the child's hands to perform the action of holding a pencil and drawing on paper. The instructor also provided praise and continued. Step 3: The instructor asked, "What are you doing" and waited 3 seconds for the child to respond. If the child responded incorrectly or did not respond, the instructor used an echoic prompt (e.g., "I'm drawing") to prompt for the correct response. The instructor praised for a correct answer or provided a correction (e.g., "You have to say, 'I'm drawing'"). Step 4: The instructor asked, "Can you tell me and show me how to draw?," and waited 3 seconds for the child to respond. If the child did not respond correctly, the same prompt hierarchy described in Step 2 was implemented along with echoic prompts. The child was required to name and perform a play action following the instruction. The instructor provided specific praise to conclude the instructional trial. If the child independently provided accurate responses without any prompt in Step 2, 3, and 4, the instructor delivered a token along with social praise upon the completion of Step 4 to end the trial. The child could use the token to exchange for back-up reinforcers at the end of the instructional session.

In Step 4, the instructor used a different exemplar to prompt for a correct response in each instructional trial. For example, the instructor would say, "I'm drawing an apple with a stem", and modeled the corresponding actions at the same time in the first instructional trial for the drawing activity. The instructor would provide a different model (e.g., "I'm drawing a big fish with eyes") in the next instructional trial for drawing. The purpose of providing multiple exemplars was to promote response variability and response generalization.

Free Play Observation. Free play observations were conducted by the instructor before and after the instruction. The duration of each observation was 15 minutes, during which the child had free access to all toys in the play area. The toys included blocks, play dough, stuffed

animals, toys trucks, balls, a farm house with miniature figurines, a kitchen set, and puzzles. The instructor sat next to the child, responded to the child's requests, but did not initiate any interactions or provide any guidance to the child. No other individuals were present during this time.

Procedural Integrity and Interobserver Agreement

All sessions were videotaped. Another senior graduate student was trained to assess procedural integrity and interobserver agreement (IOA) by watching the videotapes of the recorded sessions. The assessor independently checked the accuracy of each implementation step in probe trials and instructional trials, including the delivery of the antecedents and the designated consequences for the correct and incorrect responses in each probe trial, as well as the accuracy of the implementations of the prompt hierarchy in each instructional trial. Meanwhile, the assessor recorded child responses to obtain trial-by-trial IOA data for the probe trials. Table 1 shows the table used for assessing procedural integrity and IOA.

Procedural integrity was assessed for 30% of the instructional sessions randomly selected from sessions conducted in each setting for each child and 30% of probe trials randomly selected from each condition (i.e., baseline, instruction, and follow-up) for each child in each setting. The percentage of procedural integrity was calculated using this formula: accurate steps of implementation ÷ total steps of implementation × 100. The average integrity was 92% (range: 81-100%) for the instructional sessions and 94.5% (range: 82-100%) for the probe sessions.

Trial-by-trial IOA was assessed for 30% of the probe sessions randomly selected from each condition in each setting for each child and 30% of the free play sessions randomly selected from each child. The percentage of IOA was calculated using the formula: the number of agreement ÷ total the number of agreement and disagreement × 100. The Kappa coefficient (*k*)

was obtained using IBM SSPS Statistics Version 19. The IOA for probe sessions averaged 97.4% (k = .94) with a range from 89.3% to 100% (k range: .75-1) for all sessions assessed. The IOA for free play sessions averaged 93.3% (range: 90-96.7%; k = 0.81, range: .76-.92) for functional play and 97.2% (range: 90-100%; k = 92, range: .76-1) for symbolic play.

Social Validity

We developed a questionnaire to assess the social validity regarding the acceptability, feasibility, and satisfaction of the instruction (Appendix 1). The questionnaire contained 12 items, including instruction acceptability (Items 1-4), feasibility (Items 5-7), satisfaction (Items 8-11), and an open-ended question. The acceptability questions solicited responses concerning the importance of the instruction, the appropriateness of the content, the adequacy of the one-on-one format, and the teacher qualifications. The feasibility questions solicited responses concerning the frequency, location, duration, and time of weekly sessions and whether they were reasonable to manage in the child's schedule. The satisfaction questions consisted of questions concerning parents' satisfaction with their child's overall progress in play skills, the results of the instruction, whether they would recommend this intervention to other parents, and whether they perceived their children liked the instruction. Each item was rated on a 5-point Likert scale (1 = strongly dissatisfied or disagree to 5 = strongly satisfied or agree). The last question on the survey was an open-ended question for parents to provide suggestions for the instruction or to share their child's progress in play skills, if any.

Results

Acquisition of Imaginary Objects Play Activities

Figure 1 depicts the percentage of correct responses for target activities in probe sessions across two settings in all conditions for the three children. At baseline (Probe 1), Liu had a stable

low level of correct responses (*M* = 25.6%, range: 21-32%) in the table top setting. His correct responses immediately increased with a rapid ascending trend to criterion performance for three target activities in six sessions in Teach 1 (range: 33-100%). At Probe 2, Liu maintained the three target activities at a high level (range: 92-100%) while the correct responses for the remaining four untaught activities were at a relatively low level (*M* = 25.3%, range: 13-38%) similar to baseline. His correct responses for the four target activities in Teach 2 started at a relatively low level and gradually ascended to a high level and reached criterion in six sessions (range: 19-100%). He maintained all target activities at 100% accuracy in follow-up probe sessions.

Liu also displayed a similar acquisition pattern for target activities taught in the gym. His baseline data started at a relatively low level but increased to a stable state at a slightly high level (range: 7-43%). His correct responses started to increase with a gradual ascending trend in the instruction condition and achieved criterion for three target activities in six sessions in Teach 1. At Probe 2, Liu maintained the three target activities at a high level (range: 92-100%) while untaught activities remained at a low level (*M* = 17, range: 13-25%). Once instruction was introduced to the four target activities, he achieved criterion rapidly in six sessions (range: 25-100%). He also maintained 100% accuracy for all target activities in follow-up probe sessions.

Similarly, Chang's correct responses were at a relatively low level at baseline in both settings (*M* = 19.9%, range: 14-25% at the table top; *M* = 25.8%, range: 14-32% in the gym). His correct responses displayed an ascending trend in the instruction condition (Teach 1, range: 33-100%; Teach 2, range: 19-100% at table top; Teach 1, range: 33-100%; Teach 2, range: 25-100% in the gym). At Probe 2, Chang maintained the taught activities at a high level (range: 92-100 at the table top; range: 92-100 in the gym) while the untaught activities remained at a low level

(range: 13-25% at the table top; range: 19-38% in the gym). After criterion was achieved for target activities, Chang also maintained these activities at a relatively high level in follow-up probe sessions (range: 100-100% at the table top; range: 82-100% in the gym).

Xie also had a low level of accuracy for the target activities at baseline (*M* = 22%, range: 14-25% at the table top; *M* = 19.2%, range: 14-29% in the gym) but gradually increased and reached criterion in the instruction condition across both settings. He mastered three target activities (Teach 1, range: 17-100%) and four target activities (Teach 2, range: 25-100%) in a total of 16 sessions in the table top setting. He mastered seven target activities (Teach 1, range: 8-100%; Teach 2, range: 6-100%) in 12 sessions in the gym setting. At Probe 2, he maintained target activities at a high level (range: 83-100% at the table top; range: 92-100% in the gym) while untaught activities remained at a low level (range: 13-13% at the table top; range: 13-25% in the gym). Xie maintained target activities at a relatively high level with a range from 79% to 100% in both settings in follow-up sessions.

Generalization of Imaginary Objects Play Activities

Figure 2 displays the percentage of correct responses for generalization activities before and after the instruction across two settings for all the children. Five generalization activities were used to assess generalization in each setting. Liu's correct responses for generalization activities were at a relatively low level at baseline (*M* = 24%, range: 20-30% at the table top; *M* = 29.4%, range: 20-35% in the gym). One generalization activity (i.e., jumping rope) reached criterion performance at 100% in the 8th session at baseline in the gym setting. After the completion of the instruction, correct responses of generalization activities increased to a high level and were maintained for 7 weeks (range: 90-100% at the table top; range: 90-100% in the gym). No data overlap occurred between baseline and follow-up conditions.

Chang had a low level of correct responses for generalization activities at baseline across both settings (*M* = 20.1%, range: 15-25% at the table top; *M* = 22.2%, range: 20-25% in the gym). His correct responses increased to a slightly high level (*M* = 46.7%, range: 45-50% at the table top; *M* = 55%, range: 50-60% in the gym) after mastering target activities in the instruction condition. Chang reached criterion performance (100% accuracy) on one generalization activity (i.e., reading a book) in the table top setting with no other generalization activities reaching criterion in the gym setting. As Chang did not reach criterion for the remaining generalization activities, instruction for these activities were implemented. He required seven sessions to acquire these activities in each setting. At follow-up, these activities were maintained at a relatively high level (range: 85-100% at the table top; range: 85-100% in the gym) for 7 weeks after the completion of additional instruction.

Xie had a similar pattern as Chang, with a low level of correct responses at baseline (*M* = 18.1%, range: 15-25% at the table top; *M* = 19.3%, range: 14-25% in the gym) and a slightly increased level of correct responses (*M* = 58.3%, range: 50-60% at the table top; *M* = 46.7%, range: 40-55% in the gym) after acquiring target activities across both settings. However, no generalization activities achieved criterion performance at this time. He also required additional seven instructional sessions to acquire these activities in the table top setting, and six sessions in the gym setting. He maintained these activities at a high level of accuracy for 7 weeks after additional instruction (range: 75-100% at the table top; range: 75-100% in the gym).

Free Play Observation

Figure 3 depicts the percentage of 5-second intervals engaging in functional play or symbolic play for three children in 15-min free play sessions before and after the instruction. Liu engaged in functional play at a high level (range: 82.2-87.8%) without symbolic play activities at

baseline. His functional play remained at a high level (range: 72.8-76.7%) while symbolic play emerged at a slightly high level after the instruction (range: 1.1-23.3%).

At baseline, Chang had a high level of functional play (range: 54.4-77.8%), and his symbolic play was at a very low level (range: 0-6.7%). His functional play remained at approximately the same level (range: 58.3-86.1%) as baseline, but his symbolic play increased to a slightly high level (range: 13.9-41.7%) after the instruction.

Xie also had a high level of functional play at baseline (range: 68.9-72.8%) and remained at a slightly high level after the instruction (range: 82.8-85.6%). He did not engage in any symbolic play at baseline, but his symbolic play emerged after the instruction (range: 0-16.7%). The symbolic play behaviors observed after instruction for the three children primarily involved object substitutions, such as pretending a Coke bottle was a bowling pin, using a piece of cardboard as a sports racket, or pretending a red round-shaped block as a red traffic light.

Social Validity

One parent for each child provided responses to the questionnaire. The average ratings were 4.68 (*SD* = 0.23) on the acceptability, 4.57 (*SD* = 0.19) on the feasibility, and 4.43 (*SD* = 0.29) on their satisfaction of the instruction. All three parents responded to the open-ended question. Liu's mother suggested that we should expand the instruction to teach different types of play activities and would like to continue the instruction. Chang's mother shared that Chang displayed many more varieties in his play activities. For example, he would use a stick as a phone to make phone calls and spontaneously asked his parents to join his imaginary play activity (e.g., pretending to hold a patient with a toy pillow). Chang also enjoyed pretend play in his daily activities. For example, his mother shared, "When he brushes his teeth, he likes to spray water to pretend he is a steam engine." "He tells me he needs 'gasoline' to indicate that he is

hungry.” Similarly, Xie’s mother reported that Xie also showed imagination in his play activities. For example, without actual objects, he would say, “This is a pool, and this is a fish. I am catching fish.”

Discussion

This study was one of the initial attempts to address imaginary objects symbolic play in young children with ASD. The instructional program simulated mother-child interactions and required the child to perform two to three steps of play actions along with corresponding verbal descriptions of these steps. The result indicated that the instruction was effective in increasing imaginary objects play behavior in all three children. Correct responses to generalization activities increased in all three children, but only one child achieved criterion performance for these activities without additional instruction. All three children’s overall symbolic play behaviors emerged or increased in free play sessions after the instruction.

Acquisition of Imaginary Objects Play Activities

Consistent with Lee et al (2019), intraverbal training effectively facilitated the acquisition and maintenance of imaginary objects play for all three children in this study. As discussed, each type of symbolic play behavior involved a different set of repertoires and needed to be targeted individually for children who lacked these play skills. For example, the intraverbal training procedure in Lee et al (2019) involved the use of picture prompts to form a stimulus equivalent relation among several objects, a necessary component for one to “pretend” an object as if it were another. With imaginary objects play, the emission of conditioned seeing responses would be required without forming a stimulus class. The conditioned seeing responses as in “pretense” were evident when the child labeled the activity and performed the action of imaginary objects play. The imaginary objects play demonstrated in the three children were acquired as operants

but not as respondents, which was consistent with Shanman (2013). In addition to developing the procedure based on the analysis of the target symbolic play skills, the play skills assessments were important in identifying strengths and weaknesses in specific play skills for each child, thus contributed to the success of the instruction. In practice, the benefits of this teaching procedure included feasibility and ease of implementation in many different settings or conditions.

Generalization of Imaginary Objects Play Activities

Generalization activities were used to assess generalization effects after the instruction for target activities. One of the three children (Liu) demonstrated imaginary objects play in all generalization activities across two settings without additional instruction after the completion of the instruction. Although the other two children did not reach criterion performance for generalization activities, their accurate responses of these activities increased to a relatively high level without overlaps to baseline, suggesting that generalization to untaught activities occurred but not to the criterion performance. However, further evaluation for generalization was not conducted following the additional instruction.

As suggested in previous research, it is necessary to incorporate strategies to promote generalization in the instruction of play skills for children with ASD (Dauphin et al., 2004; Dupere et al., 2013; MacManus et al., 2015). In this study, the instructor modeled three different possible actions for each target activity during instruction. For example, the instructor asked the child, “What are you drawing?,” after the child responded that he was drawing. The instructor then modeled a response (e.g., “I am drawing a red apple”). If the child did not respond to the same question in the subsequent trials, the instructor would model a different response (e.g., “I am drawing a person”). This element was added for the purpose of promoting generalization and increasing response variability.

Free Play

The result of free play observations indicated that the children's symbolic play behavior emerged or increased after the completion of the instruction. All three children maintained functional play behavior at a similar level with baseline. Interestingly, the symbolic play behavior observed in free play sessions involved object substitutions rather than imaginary objects. It is possible that the instruction of imaginary objects play activities facilitated generalized symbolic play, especially object substitutions. As each child was engaged in solitary play in free play sessions, object substitutions were more frequently observed, while imaginary objects play was more likely to occur in a social context. For example, the presence of an audience could be a discriminative stimulus to initiate or respond to an imaginary objects play activity (e.g., "Pretend this is a chair for you to sit" without an actual object as a chair; "Let my people sit too"). Despite that symbolic play occurred in free play sessions after the instruction, it remained at a relatively low level, suggesting that further instruction was necessary to improve generalized symbolic play for the children.

Limitation and Future Research Direction

The potential limitations of this study included the lack of measurement in response variability, the use of tangible reinforcers during instruction, partial play skills assessments, and insufficient diagnostic instruments to confirm the ASD diagnosis. As discussed, one of the key components in the procedure to promote generalization and response variability was that the instructor modeled varied responses during instruction. However, response variability was not measured in this study. It is important to consider measuring response variability within each target activity for future research. For the two children who required additional instruction to

achieve criterion for generalization activities, it would be necessary to add new activities to further evaluate generalization.

A procedural limitation in this study pertained to the use of tangible reinforcers. All three children required tangible reinforcers (e.g., tokens) to maintain participation and engagement in the instruction. Though social praise was delivered in conjunction with tangible reinforcers, merely providing praise was not sufficient for these children to maintain participation in instructional activities. It is possible that social praise did not function as a reinforcer for these children, and this may limit their generalization of symbolic play in the social context (Greer & Du, 2015). It will be interesting for future researchers to isolate the effect of social praise as a conditioned reinforcer, and compare children's play behavior in natural free play settings with the presence of peers and teachers.

The use of standardized assessments for play skills was an asset of this study. However, we only completed some but not all of the items in the DBACA. It would be helpful to conduct comprehensive play skills assessments before and after the instruction to evaluate acquisition effects in future studies. Finally, the children's ASD diagnosis was solely based on the CARS and the DSM-5 criteria. It is necessary to confirm the diagnosis with additional assessments by trained professionals or researchers.

Despite these limitations, the results of this study were promising. The instruction was effective in the acquisition and maintenance of imaginary objects symbolic play for the three children. All three children's correct responses to generalization activities increased and symbolic play emerged in the free play setting after the instruction. In addition, the instructional procedure requires minimal preparation and is easy to implement in various applied settings. The

instruction is appropriate for children with ASD but its efficacy needs to be further assessed in larger samples.

Compliance with Ethical Standards

Disclosure of Potential Conflict of Interest

All authors involved in this study do not have any interests that might be interpreted as influencing the research.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from the parents of the child participants included in the study.

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Table 1. *Procedural integrity and interobserver agreement data collection form*

	Antecedent (A), Behavior (B), Consequence (C)	Trials (+ correct; - incorrect)									
		1	2	3	4	5	6	7	8	9	10
Probe trial	A1：Let's play pretend. Name the materials and offer them to child. (3-s time delay) B1: motor response (play action) C1: (+: praise; -: ignore/praise good behavior)										
	A2: "What are you doing?" (3-s time delay) B2: verbal response C2:(same as C1)										
	A3: Tell and show me how you do it. B3: verbal response/motor response C3: (same as C1)*										
Instructional trial	A1: same as above B1: motor response (play action) C1: (+: praise; -: prompt hierarchy**)										
	A2: same as above B2: verbal response C2: (+: praise; -: echoic prompt)										
	A3: same as above B3: verbal response/motor response C3: (+: praise; -: prompt hierarchy**)*										
*Deliver a token along with praise when the child independently provided correct responses in B1, B2, and B3 without prompts. **Prompt hierarchy: (a) modeling, (b) verbal direction, (c) physical assistance.											

Note. The antecedent (A) and consequence (C) codes were used to calculate the percentage of accurate implementations (procedural integrity). The behavior (B) codes were used to calculate point-to-point interobserver agreement.

Appendix 1. *The social validity questionnaire*

1: Strongly Disagree/Dissatisfied; 2: Disagree/Dissatisfied; 3: Neutral/no opinion;
4: Agree/Satisfied, 5: Strongly Agree/Satisfied

	Item\Rating	1	2	3	4	5
1	The instruction is important to my child.					
2	The content is developmentally appropriate.					
3	The 1:1 teaching format is adequate.					
4	The instructor is qualified and experienced.					
5	The frequency of weekly sessions and the durations are arranged properly.					
6	The location is appropriate.					
7	The schedule of instruction is manageable.					
8	I am satisfied with the overall progress of my child's play skills.					
9	I am satisfied with the results of the instruction.					
10	I would recommend the instruction to other parents.					
11	My child likes to come for the instruction.					

12. Please share your comments/experiences about the instruction, or do you have any suggestions to improve the instruction?

_____